



Ultra
Commercial



Gas-fired water boilers

Featuring *UControl*[®]
Flexibility

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 *Ultra* COMMERCIAL gas-fired water boiler, Featuring *UControl* Flexibility

1 Cast aluminum sectional heat exchanger

2 Heat exchanger cleanout plate

3 Blower

Air enters the boiler enclosure through the air intake adapter (18), flows through the enclosure, enters the air inlet silencer (5), then enters the venturi (6). The blower pulls air and gas through the venturi and pushes the mixture into the burner. The advanced blower design and air inlet silencer yield very quiet operation.

3a Blower motor

4 Automatic gas valve

The automatic gas valve incorporates two solenoid-operated valve seats. The valve senses the vacuum in the venturi (item 6) caused by flowing air. Gas flows in proportion to air flow, so fuel/air ratio remains constant as blower speed/air flow changes.

5 Air inlet silencer

The horn-shaped air inlet silencer significantly reduces fan noise, providing exceptionally quiet operation.

6 Venturi

When air flows through the venturi, it creates a vacuum that is sensed by the gas valve to regulate gas flow (see item 4).

7 U-Control module

The *U-Control* Module responds to signals from the room thermostats, DHW aquastats (when used), boiler sensors (boiler return, boiler supply, heat exchanger, system return, system supply, flue temperature, and outdoor temperature, if used). The control module automatically adjusts blower speed (and gas flow rate) to match boiler output to space heating and/or DHW heating demand.

8 Expansion module

The expansion module operates the gas valve, monitors gas pressure switches and provides a dry contact for the boiler circulator (suitable for up to 10 amps).

9 Temperature and pressure gauge

10 Electronic display & buttons

The electronic display is used to configure boiler settings and monitor boiler operation. The buttons allow changing display mode, entering setting values, and resetting after lockout.

11 Flue pipe adapter (6-inch PVC size, female)

12 Premix gas burner (not shown)

Made with high-grade stainless steel and fiber mesh construction, the burner uses pre-mixed air and gas. The burner and control provide modulating firing.

13 Water outlet pipe (system supply)

14 Water return pipe (system return)

15 Gas connection pipe

16 Manual gas shut-off valve

17 Swing-away control panel assembly

The Ultra control panel is mounted to a hinged subpanel, allowing the panel to be swung forward and down for easy access to the electrical connections.

18 Air intake adapter (6-inch PVC size, female)

19 Electrical entrances knockouts

Knockouts are provided in the jacket top panel, allowing conduit entry directly behind the control panel or near the wall.

20 Air pressure switch

21 Low water cutoff

22 Flue adapter condensate collector drain tube

23 Heat exchanger flue gas condensate drain

24 Flue gas condensate drain field connection

25 Front door

The front door is sealed to the boiler assembly around its entire perimeter.

26 Jacket door latches

27 Ignition electrode/flame sensor

The burner flame is ignited by applying a high voltage to the ignition electrode. This causes a spark (from electrode to ground). After ignition, the electrode measures flame signal.

28 Flame inspection window

The quartz glass window provides a view of the burner surface and flame.

29 Line voltage terminal strip (120 volt power)

30 ON/OFF switch

31 High gas pressure switch

32 Low gas pressure switch

33 Transformer

34 Blower relay

35 U-Control temperature sensor well

36 P/T gauge pressure sensor tapping

37 P/T gauge temperature sensor well

38 Wire harness connector, line voltage

39 Wire harness connector, low voltage

40 Blower plate

A blower plate is used on Ultra-550 for both natural gas and propane applications. The Ultra-750 propane requires a blower plate, but does not use a blower plate on natural gas.

41 Propane gas orifice location

Boilers are shipped with no orifice installed (not required for natural gas). The propane orifice must be installed to operate on propane.

42 Boiler outlet temperature sensor well

43 T/P gauge temperature sensor well

44 Tapping plugged, not used

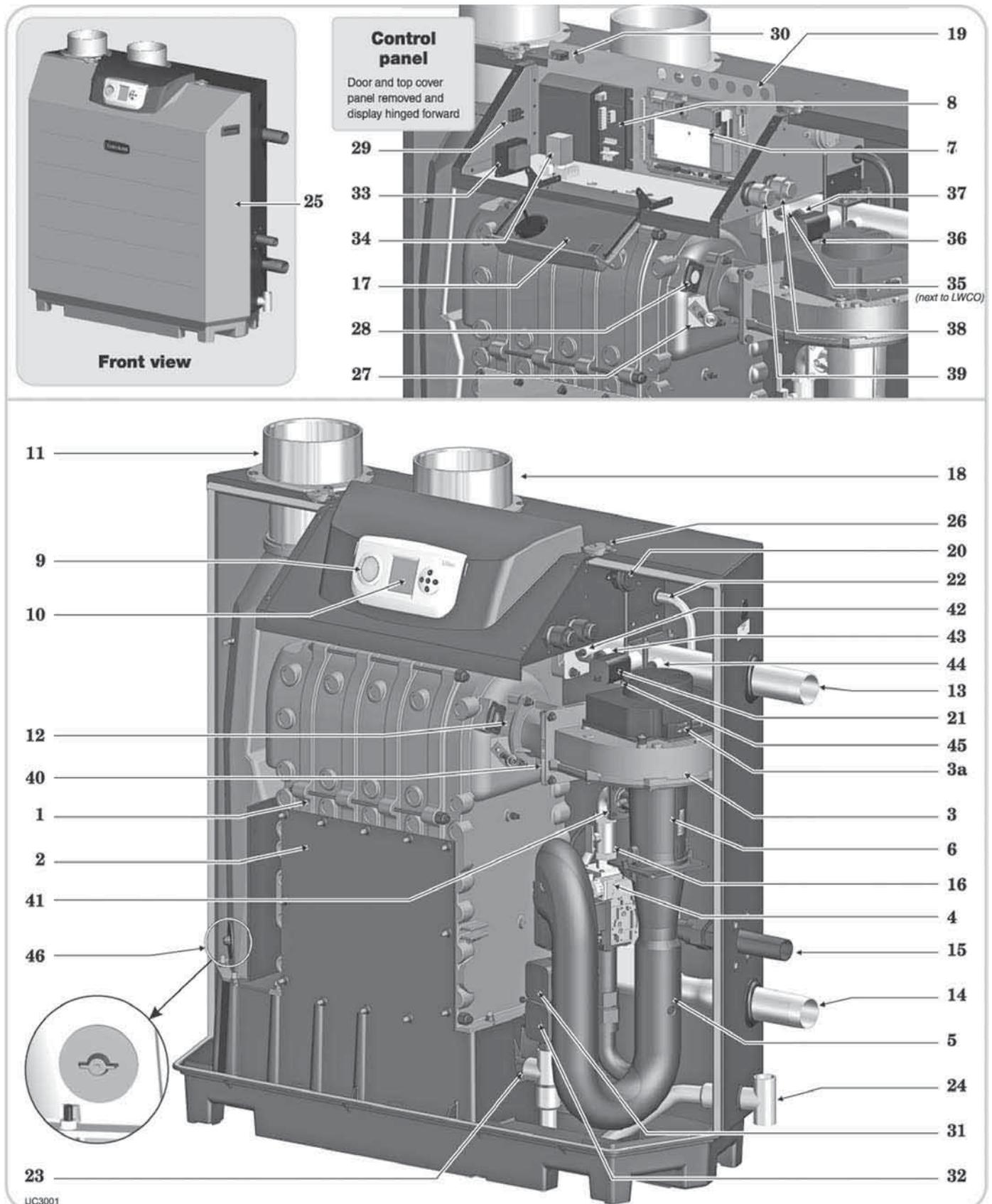
45 T/P gauge pressure sensor tapping

Located in bottom of supply manifold.

46 Flue inspection plug



The *Ultra* COMMERCIAL gas-fired water boiler, Featuring *UControl* Flexibility





Contents

Contents	4	Install vent/air piping — from termination to boiler .	46
Hazard definitions	4	Install condensate components	47
Please read before proceeding	5	Gas piping	49
Prepare boiler location	6	Field wiring (see Figure 57 & Figure 58)	51
Prepare boiler	9	U-Control operation and setup	58
Install water piping	13	Startup — fill the system	70
Multiple boiler water piping	21	Startup — final checks	72
Venting/combustion air — general	26	Check-out/startup verification	76
Venting/combustion air — options	27	Annual startup and general maintenance.	77
Appliances remaining on an existing vent system .	28	Annual startup.	78
Venting/air piping — Massachusetts installations .	29	Troubleshooting	83
DIRECT EXHAUST — Boiler room air openings . .	30	Maintenance.	93
DIRECT EXHAUST — Sidewall	32	Replacement parts	96
DIRECT EXHAUST — Vertical.	35	Dimensions	108
DIRECT VENT — Boiler room air openings	37	Ratings — Ultra boilers	109
DIRECT VENT — Sidewall	39	Ratings — multiple Ultra boilers	110
DIRECT VENT — Vertical.	43	Installation and Service Certificate	112

Hazard definitions

The following defined terms 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.
- ▲ WARNING** Indicates presence of hazards that can 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.
- NOTICE** Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.



Please read before proceeding

WARNING

Installer— Read all instructions, including this manual and all other information shipped with the boiler, before installing. Perform steps in the order given.

User — This manual is for use only by a qualified heating installer/service technician. Refer to User's Information Manual for your reference.

User — Have this boiler serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE

Write in the CP number in the space provided on the Installation certificate on page 112 if not already shown.

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.

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 or gas fitter.
- If antifreeze is used, a reduced pressure back-flow preventer device shall be used.
- Sidewall vent air installations — see instruction on page 29.

WARNING

Failure to adhere to the guidelines on this page can result in severe personal injury, death or substantial property damage.

When servicing boiler —

- To avoid electric shock, disconnect all electrical supplies to the boiler before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.
- This boiler contains ceramic fiber and fiberglass materials. Refer to the WARNING and instructions on page 78.

Boiler operation —

- Do not block flow of combustion or ventilation air to boiler.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control that has been under water.

Boiler water —

- The Ultra heat exchanger is made of aluminum, and requires that system pH always be between 7.0 and 8.5 and water chemistry be checked. Chemical treatment may be necessary. See page 70 for details.
- Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency 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.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in heat exchanger reduces heat transfer, overheats the aluminum heat exchanger, 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. Use this boiler ONLY in a closed-loop system.
- Do not add cold water to hot boiler. Thermal shock can cause heat exchanger to crack.

Freeze protection fluids —

NEVER use automotive or standard glycol antifreeze, even glycol made for hydronic systems. Use only freeze-protection fluids recommended in this manual (see page 70). Follow all guidelines given. Thoroughly clean and flush any replacement boiler system that has used glycol before installing the new Ultra boiler.



Prepare boiler location

Installations must comply with:

- Local, state, provincial, and national codes, laws, regulations and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
- National Electrical Code.
- For Canada only: B149.1 or B149.2 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Ultra boiler gas manifold and controls met safe lighting and other performance criteria when boiler underwent tests specified in ANSI Z21.13 — latest edition.

Before locating the boiler, check:

1. Check for nearby connection to:
 - System water piping
 - Venting connections
 - Gas supply piping
 - Electrical power
 - Location of drain for condensate
2. Check area around boiler. Remove any combustible materials, gasoline and other flammable liquids.

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.

3. The Ultra boiler must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
4. If new boiler will replace 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.

Provide clearances:

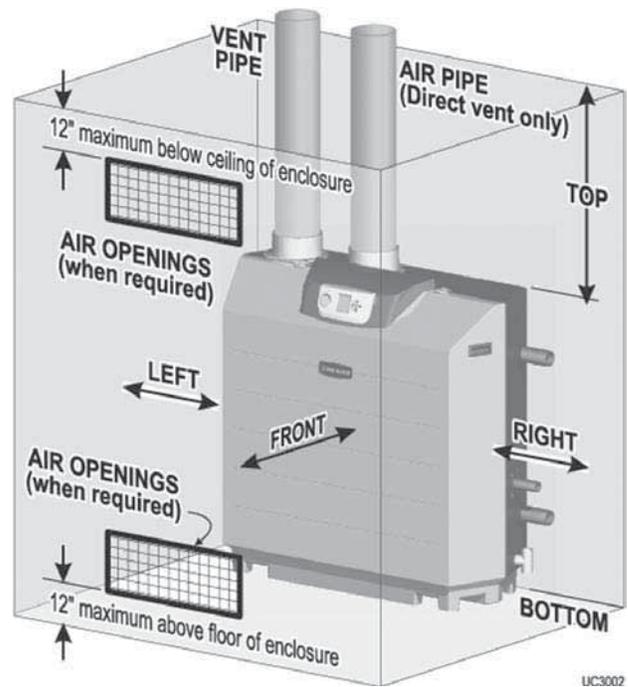
Clearances from combustible materials

1. Hot water pipes — at least 1/2" from combustible materials.
2. Vent pipe — at least 3/16" from combustible materials.
3. See Figure 1 for other clearance minimums.

Clearances for service access

1. See Figure 1 for recommended service clearances. If you do not provide minimum clearances shown, it might not be possible to service the boiler without removing it from the space.

Figure 1 Clearances



Clearance from	Minimum clearance to combustible surfaces (inches)	Recommended service access clearances (inches)
LEFT	0	0
RIGHT	0	12
TOP	20	20
BOTTOM (Floor)	0	0
FRONT	1/2	24
BACK	0	0
VENT PIPE	3/16 **	NA
HOT WATER PIPES	1/2	NA

** Openings in combustible floors, walls, ceilings or roofs must be 3/8" larger in diameter than the vent pipe and must be lined with steel thimbles and designed for fire stopping as required by applicable codes.

WARNING Provide air openings for combustion air and/or ventilation of the room as specified in this manual and as required by applicable codes.

Prepare boiler location *(continued)*

Placing multiple boilers

1. Locate multiple boilers in boiler room to provide the clearances shown in:
 - a. Figure 2 (side-to-side), or
 - b. Figure 3 (back-to-back).
2. Provide indicated clearances around boilers for access and servicing. If recommended dimensions are not possible, provide at least the minimum clearances given on page 6. Also follow local codes.
3. Construct boiler foundation if boiler room floor is uneven or if there is a danger of flooding. Size foundation to allow for clearance and spacing dimensions shown in either Figure 2 or Figure 3.
4. Chalkline boiler locations on foundation or boiler room floor.
5. Uncrate, assemble and mount boilers according to instructions in this manual.
6. Provide clearance for installation of venting, air piping, gas piping, condensate piping and components, expansion tank, boiler circulator and other accessories.

Figure 2 Side-to-side mounting of multiple Ultra boilers

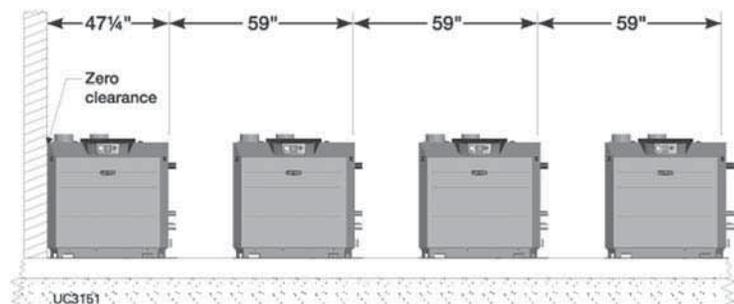
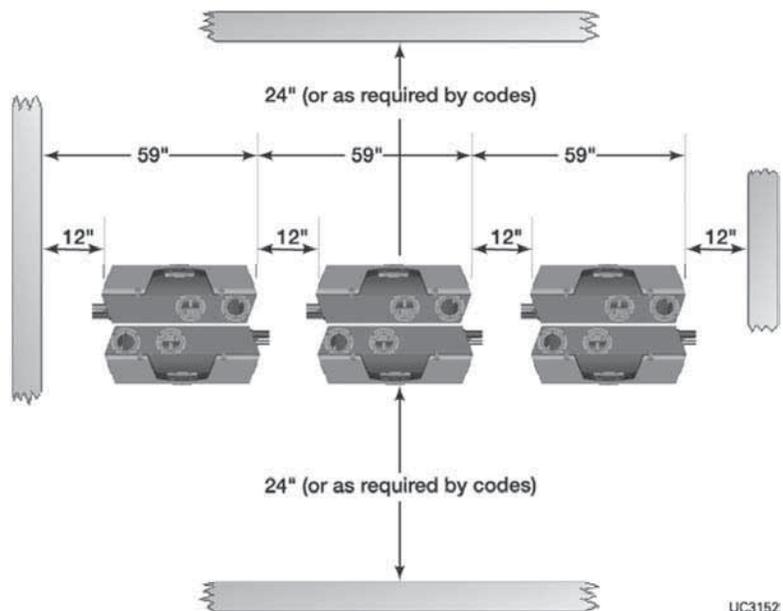


Figure 3 Back-to-back installation of multiple Ultra boilers





Prepare boiler location *(continued)*

Flooring and foundation

Flooring

1. The Ultra boiler is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠WARNING Do not install boiler on carpeting even if foundation is used. Fire can result, causing severe personal injury, death or substantial property damage.

Foundation

1. The boiler mounting surface must be level and suitable for the load.
2. Provide a solid foundation pad, at least 2 inches above the floor, if any of the following is true:
 - floor can become flooded.
 - the floor is dirt, sand, gravel or other loose material.
 - the boiler mounting area is severely uneven or sloped.
3. The minimum foundation size is:
 - 48 inches wide x 20 inches deep.
4. Foundation may be of wood, brick or concrete (minimum 2 inches thick) construction.
5. If flooding is possible, elevate boiler sufficiently to prevent water from reaching boiler.

Garage installation

Precautions

1. Take the following special precautions when installing the boiler in a garage. If the boiler is located in a garage:
 - Mount the boiler at a height above the floor as specified in the National Fuel Gas Code, ANSI Z223.1 for U. S. installations, or CSA B149.1 and B149.2 for Canadian installations.
 - Locate or protect the boiler so it cannot be damaged by a moving vehicle.
 - Ensure that the installation complies with all applicable codes.

Provide air openings to room

Air openings — General

Follow the National Fuel Gas Code (U. S.) or CSA B149.1 and B149.2 (Canada) and all applicable codes to size/verify size of the combustion/ventilation air openings into the space. See the venting instructions section of this manual for required air openings and sizing for either direct vent or direct exhaust installation.

Air openings — Ultra boiler alone in boiler room

1. **DIRECT VENT** — For direct vent installations (air piped to boiler), no air ventilation openings into boiler room are needed if clearances around the Ultra boiler are at least equal to the SERVICE clearances shown in Figure 1, page 6. For spaces that DO NOT supply the minimum service access clearances, see the direct vent venting instructions in this manual for required openings.
2. **DIRECT EXHAUST** — For direct exhaust installations (combustion air from inside), provide air openings as specified in the direct exhaust venting section of this manual.

Air openings — Ultra boiler in same room with other gas or oil-fired appliances

1. **DIRECT VENT** — For direct vent installations (combustion air piped to boiler), size openings only on the basis of the other appliances in the space. No additional air opening free area is needed for the Ultra boiler because it takes its combustion air from outside.

⚠WARNING For direct vent installations, when the Ultra boiler is located in the same room as other appliances, provide combustion air openings correctly sized for all appliances in the room except the Ultra boiler.

Reinstall the boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent the boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances.

Failure to comply with the above warnings could result in severe personal injury, death or substantial property damage.

2. **DIRECT EXHAUST** — For direct exhaust installations, combustion air openings into the room must be sized to handle the Ultra boiler and all other appliances. See the direct exhaust venting instructions in this manual for required openings.

⚠WARNING For direct exhaust installations, when the Ultra boiler is located in the same room as other appliances, provide combustion air openings correctly sized for all appliances, including the Ultra boiler.

Failure to comply with the above warnings could result in severe personal injury, death or substantial property damage.

Prepare boiler

Vent and air piping requirements (page 26)

- The Ultra boiler requires a special vent system, designed for pressurized venting.
 - Ultra boilers are rated ANSI Z21.13 Category IV (pressurized vent, likely to condense in the vent).
 - Ultra commercial boilers can be either **direct-exhaust** (vent to the outside, combustion air from inside) or **direct-vent** (vent and air piped outside).
 - See instructions beginning on page 26 for vent/air configuration options and installation requirements.
- Note “Prevention of combustion air contamination” on page 26 when considering vent/air terminations and boiler room conditions when using inside air (direct exhaust installation).
- Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated. The vent/air piping lengths, routing and termination method must all comply with the methods and limits in instructions beginning on page 26.

Remove boiler from crate

CAUTION Cold weather handling — If boiler has been stored in a very cold location (below 0°F) before installation, handle with care until the plastic components come to room temperature.

WARNING Do not lift or handle the boiler by the water or gas pipes.

- Leave boiler on crate base until ready to place in final location.
- Cut the retaining straps. Make sure the boiler is sitting securely.
- Remove outer shipping carton from boiler.

CAUTION Leave the plastic cover on the boiler vent outlet until ready to attach vent piping. This will prevent debris from falling into the vent adapter.



- After removing the packaging, lift boiler from the skid and place in position.

NOTICE Do not drop the boiler. Damage to boiler components can result.

WARNING **Inspect the boiler base for cracks or possible damage in handling.** The base must be in good condition and sealed tightly for proper operation of the boiler.

Placing the boiler

- Set the boiler in place and check level. Use shims if necessary to level the boiler (and condensate pump, if used).

Prepare boiler for propane (when required)

WARNING Ultra boilers must be converted for propane operation — all boilers are shipped ready for natural gas operation, and must be fitted with a propane orifice to be used on propane. Model 750 boilers also require installation of a propane blower orifice, supplied in the propane conversion kit.

High altitude installations

No orifice change is required for high-altitude installations. The U-control automatically adjusts boiler operation for altitude when set properly. Select “YES” in the U-Control setup for the **High Altitude** option (see Figure 65, page 63).

Verify orifice size

See Figure 4, page 11. Verify when installing the propane orifice that the orifice size marking matches boiler size.

Model 750 boilers also require installation of a blower orifice for propane operation. The orifice is supplied in the propane conversion kit.

Converting existing natural gas-fired boiler for propane

For a boiler already installed, you must turn off gas supply, turn off power and allow boiler to cool before proceeding.

Verify operation after conversion

You must completely test the boiler after conversion to verify performance. Start up the boiler following instructions in this manual.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.



Prepare boiler *(continued)*

Install propane orifice — Ultra-550 or -750

▲WARNING **If boiler is already installed** — You must turn off electrical supply to the boiler and close the external manual gas shut-off valve to isolate the boiler during conversion. Allow the boiler to cool if it has been operating. Following conversion of an installed boiler, follow all instructions in this manual to start up the boiler and verify operation of the boiler and all system components.

▲WARNING Ultra-550 boilers are shipped with a blower plate that is used for natural gas and propane. The blower plate must be left in place for propane applications.

1. Locate propane orifice disc from conversion kit bag shipped with the boiler.
2. Verify that the stamping on the orifice disk matches the model size (see Figure 4, page 11).
3. Remove jacket front door by rotating the two rotary latches.
4. Lift the door away from boiler.
5. See Figure 4, page 11.
6. Disconnect the gas train adapter flange (see item 12) from the venturi gas line flange (see item 7):
 - a. Use a 4 mm Allen wrench and 8 mm open-end or box wrench to loosen the four screws and nuts (items 10 and 11).
 - b. Remove the gasket (item 9).

▲WARNING Inspect the gasket between the gas train adapter flange (see item 12) and the venturi gas line flange (see item 7). The gasket must be in good condition and must be installed. Failure to comply could result in a gas leak, resulting in severe personal injury, death or substantial property damage.

- c. The gas train is connected with a flexible gas line. Pull the gas train forward and support it temporarily.
- d. Insert the propane orifice into the counterbore in the venturi flange.
- e. Reposition the gasket and gas train adapter against the venturi gas line flange.
- f. Secure with the four screws and nuts. Do not over-tighten, but make sure the joint is secure (torque to 1.5 N-m/13 in-lbs/1 ft-lb).

Ultra-750 propane only — Install the propane blower plate and gaskets

1. See Figure 4, page 11.
2. Disconnect the two wire harnesses connected to the blower.
3. Ultra-750 natural gas boilers do not use a blower plate. The boiler is shipped with a blower plate and gaskets that must be installed to operate the boiler on propane.
4. Obtain the two gaskets (item 3) and blower plate (item 4) shipped with the boiler.
5. Check the blower plate to ensure it says “750 LP.”
6. Turn off all power sources to the boiler.

Legend for Figure 4, page 11

(see Figure 93, page 104 for part numbers)

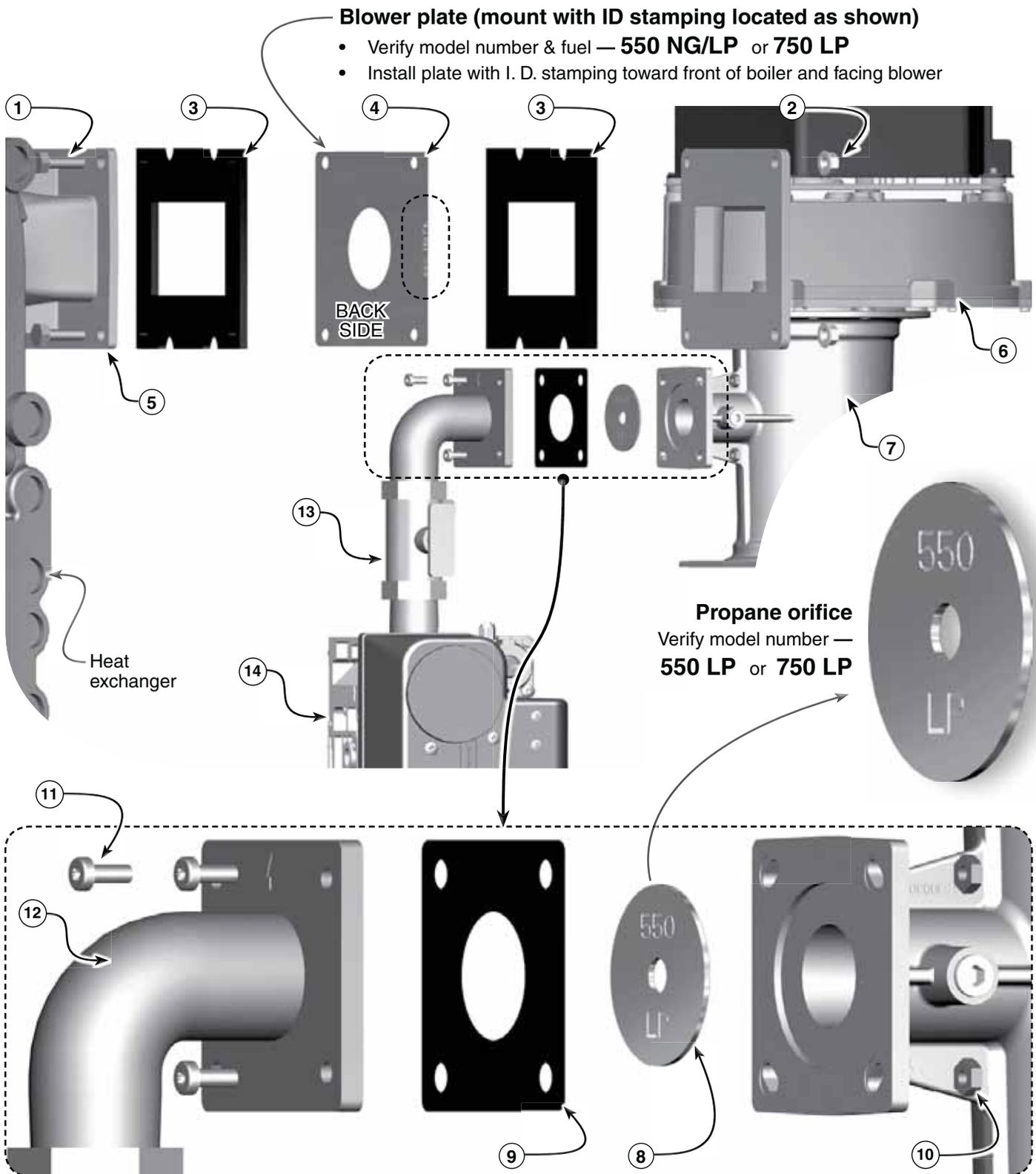
1. Hex bolts (4), M8 x 30 mm — requires 13 mm open-end wrench, box wrench or ratchet.
 2. Hex nuts (4), M8 keys — nylon lock nuts — requires 13 mm open-end wrench, box wrench or ratchet.
 3. Blower plate gasket (one on each side of blower plate). One gasket is used on Ultra-750 natural gas, because this unit does not use a blower plate — blower plate is only used for the Ultra-750 propane. Ultra-550 boilers use a plate for natural gas and propane (same plate is used for both fuels).
 4. Blower plate — used on all Ultra-550, natural gas and propane; used on Ultra-750 propane only (not on Ultra-750 natural gas).
 5. Mixing tube.
 6. Blower motor and blower.
 7. Venturi — with gas line flange and inlet air connection.
 8. Propane orifice — shipped with boiler — verify the model number stamped on the orifice.
 9. Gasket — venturi gas flange to gas line adapter flange.
 10. Hex nuts (4), M5 keys — requires 8 mm open-end or box wrench.
 11. Hex bolts (4), M 5 x 20 mm — requires 4 mm Allen wrench.
 12. Gas line adapter flange.
 13. Manual gas valve.
 14. Automatic gas valve.
7. Disconnect the two wiring connectors on the blower.
 8. Disconnect the blower flange (see item 6) from the mixing tube flange (see item 5) as shown.
 9. Use a 13 mm nut driver or ratchet for the screws and a 13 mm open-end wrench for the nuts.
 10. Support the weight of the blower and gas train temporarily.
 11. Insert the top two bolts through the mixing tube flange.
 12. Slide on the two gaskets and blower plate, with one gasket on each side as shown.
 13. Position the blower.
 14. Align all parts and start the nuts on the top two bolts.
 15. Insert the remaining two bolts and fasten with nuts. Be careful not to tear the gasket.
 16. Secure the flanges together with the bolts and nuts, being careful not to over-tighten (torque to 15 N-m/132 in-lbs/11 ft-lbs).
 17. Reconnect the two blower wiring harnesses.



Prepare boiler *(continued)*

See opposite page for legend

Figure 4 A **blower plate** is used on all Ultra-550 boilers, for both natural gas and propane.
 A **blower plate** is used on Ultra-750 propane, but NOT on natural gas.
 A **propane orifice** MUST be installed on both the Ultra-550 and Ultra-750 to operate on propane.



Prepare boiler *(continued)*

▲WARNING DO NOT install a relief valve with a pressure higher than 80 PSIG. This is the maximum allowable relief valve setting for the Ultra boiler. The boiler is shipped with a 30 PSIG relief valve. See Replacement parts in the back of this manual for alternate pressure setting relief valves.

Perform hydrostatic pressure test

Pressure test boiler before permanently attaching water or gas piping or electrical supply.

Prepare boiler for test

1. See Figure 5 for reference in following steps. Use pipe dope sparingly.
2. Remove 2" supply line tee, 2x $\frac{3}{4}$ " bushing and $\frac{3}{4}$ " nipple from accessory bag.
3. Pipe 2" tee, bushing and $\frac{3}{4}$ " nipple to boiler supply connection as shown.
4. Temporarily plug the end of the 2" supply tee.
5. Attach a $\frac{3}{4}$ " shut-off valve (by others) to the $\frac{3}{4}$ " nipple.
6. Attach a 2-inch tee (by others) to the boiler return pipe.
7. Install a bushing and a $\frac{3}{4}$ -inch boiler drain valve off of the tee as shown. Temporarily plug the end of the tee. (All fittings by others.)
8. Connect a hose to the boiler drain valve, with the other end connected to a fresh water supply. Make sure the hose can also be used to drain the boiler after test.
9. To avoid getting water on the boiler, you may want to pipe street elbows on top of shutoff valves and attach catch-buckets beneath.
10. If convenient, install any other piping compatible with Figure 5 that would still allow bleeding air from shutoff valves.

Fill and pressure test

1. Open the shutoff valves you installed on supply and return connections.
2. Slowly open boiler drain valve and fresh water supply to fill boiler with water. The boiler will fill quickly because of its low water content.
3. When water reaches the shutoff valve on top, allow water to flow long enough to ensure all air is out of the heat exchanger. Then close the boiler drain valve.
4. Close shutoff valve on top.
5. Increase test pressure until the pressure/temperature gauge reaches 120 psig, but no higher. DO NOT exceed 120 psig.
6. Hold at test pressure for 10 minutes.

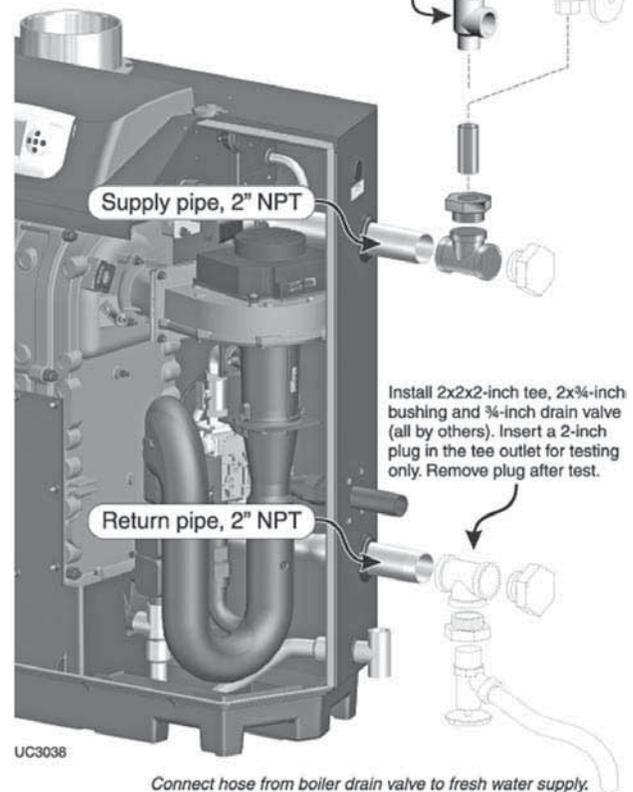
▲WARNING Do not leave boiler unattended. A cold water fill could expand and cause excessive pressure, resulting in severe personal injury, death or substantial property damage.

7. Make sure constant gauge pressure has been maintained throughout test. Check for leaks. Repair if found.

Figure 5 Hydrostatic test piping connections

Attach the 2x2x2-inch tee supplied with the boiler to the boiler supply pipe. Insert the 2x $\frac{3}{4}$ -inch bushing (supplied with the boiler) and $\frac{3}{4}$ -inch nipple (supplied with the boiler) into the branch side of the tee. Attach a temporary $\frac{3}{4}$ -inch shut-off valve (by others) to the nipple and temporarily plug the end of the 2-inch tee.

After testing, remove the temporary $\frac{3}{4}$ -inch shut-off valve. Replace with the relief valve. Remove the plug (by others) in the supply end of the 2-inch tee.



UC3038

Connect hose from boiler drain valve to fresh water supply.

▲WARNING Leaks must be repaired at once. Failure to do so can damage boiler, resulting in substantial property damage.

▲WARNING 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.

Drain and remove fittings

1. Disconnect fill water hose from water source.
2. Drain boiler through drain valve. Remove hose after draining.
3. Remove pipe fittings unless they will remain for use in the system piping.
4. Remove the $\frac{3}{4}$ " shut-off valve from the $\frac{3}{4}$ " relief valve nipple.
5. See page 13 to install relief valve on the $\frac{3}{4}$ " nipple.



Install water piping

⚠ WARNING Use two wrenches when tightening water piping at boiler, using one of the wrenches to prevent the boiler interior piping from turning. Failure to support the boiler piping connections to prevent them from turning could cause damage to boiler components.

General piping information

Additional controls, when required

NOTICE The U-Control module uses temperature sensors to provide both high limit protection and modulating temperature control, and is UL353 Limit Controls certified to meet ASME CSD-1 and Section IV requirements. The U-Control module also provides low water protection, both with a low water cut-off inside the boiler jacket and by sensing the temperature of the heat exchanger. Some codes/jurisdictions may require additional external controls.

Additional limit controls

1. Consult local requirements for other codes/standards to determine if additional limit devices are needed.

⚠ WARNING **Multi-temperature systems** — If the heating system includes circuits that require lower temperature water (radiant slab circuits, for example) as well as higher temperature circuits, it is recommended to protect low-temperature circuits with limit controls that are wired to a U-Control external limit circuit (P13 terminals 1 and 2 for manual reset, or P13 terminals 3 and 4 for automatic reset).

2. See instructions beginning on page 51 for wiring information.
 - a. Manual reset operation: If external limit controls are to cause **manual reset** of the U-control module, connect series-wired isolated contacts to P13 terminals 1 and 2 (see page 51 for wiring information).
 - b. Automatic reset operation: If external limit controls are to cause **automatic reset** of the U-control module, connect series-wired isolated contacts to P13 terminals 3 and 4 (see page 51 for wiring information).

Low water cutoff

1. A push-to-test low water cutoff is included with the boiler. The low water cutoff is mounted on the boiler supply manifold, and is available for test by removing the boiler jacket.
2. Operation of the low water cutoff is manual reset through the U-control.

Backflow preventer

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

Install relief valve

1. Install relief valve on the 3/4" nipple in the 2x3/4" bushing on the boiler supply piping tee (Figure 5, page 12). The relief valve must be piped with no smaller than 3/4" pipe and fittings.
2. Connect discharge piping to safe disposal location, following guidelines in the **WARNING** below.

⚠ WARNING **To avoid water damage or scalding due to relief valve operation, as per local or state codes:**

Discharge line must be connected to relief valve outlet and run to a safe place of disposal. Terminate the discharge line in a manner that will prevent possibility of severe burns or property damage 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.

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.

Failure to comply with the above guidelines could result in failure of the relief valve to operate, resulting in the possibility of severe personal injury, death or substantial property damage.



Install water piping *(continued)*

System water piping methods

NOTICE All piping methods shown in this manual use **primary/secondary connection to the boiler loop**. These designs ensure proper flow through the Ultra boiler, for the most efficient and reliable operation of the boiler and the heating system. For other piping methods, consult your local Weil-McLain representative or see separate Ultra boiler piping guides.

Recommended pipe sizing

Connect minimum 2” pipe to the supply and return connections Ultra-550 and Ultra-750 boilers.

Size the piping and the boiler circulator to provide the required temperature rise through the boiler loop. See Figure 6 for the head loss through the boiler and minimum/maximum flow rates.

CAUTION **DO NOT** design the piping and components for a boiler loop flow rate above or below the range given in Figure 6. Insufficient flow will cause nuisance outages due to limit operation. Excessive flow can damage to the boiler heat exchanger from erosion.

Circulators

The boiler circulator must be supplied by others. Locate the boiler circulator in the return piping, as shown in the appropriate piping diagram in this manual.

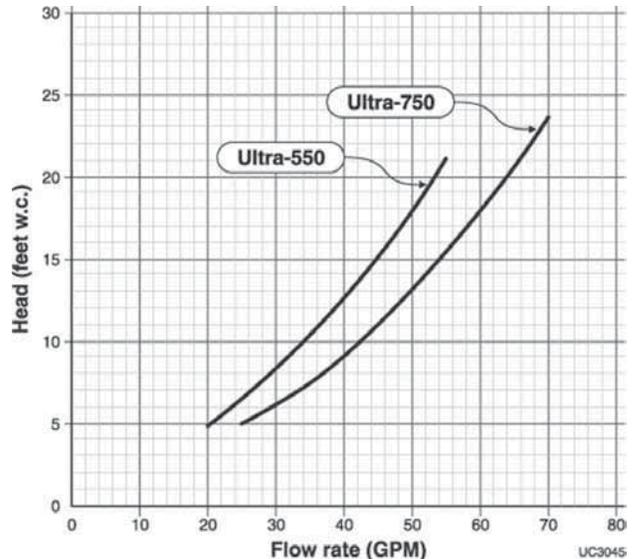
WARNING **DO NOT** use the boiler circulator in any location other than the ones shown in this manual. The boiler circulator must be selected to ensure adequate flow through the Ultra boiler.

Install the boiler circulator only on the boiler return piping. This ensures the pressure drop through the boiler will not cause low pressure in the circulator intake.

Failure to comply could result in unreliable performance and nuisance shutdowns from insufficient flow.

A Taco model 1400-50 (or 2400-50) or equivalent will work for most boiler loop circulator applications.

Figure 6 Boiler head loss vs flow rate for Ultra-550 & Ultra-750



Ultra-550			Ultra-750		
GPM	Temp. Rise °F	Boiler head loss Feet w.c.	GPM	Temp. Rise °F	Boiler head loss Feet w.c.
25	41.0	6.3	30	46.4	6.3
30	34.1	8.1	35	39.8	7.6
35*	29.3	10.2	40	34.8	9.2
40	25.6	12.5	45*	30.9	11.0
45	22.8	15.1	50	27.8	13.0
50	20.5	18.1	55	25.3	15.3
55	18.6	21.3	60	23.2	17.9
DO NOT design for flow rates above or below the range listed above.			65	21.4	20.7
			70	19.9	23.6
			DO NOT design for flow rates above or below the range listed above.		
* Suggested design flow rates (30°F temperature rise)					



Install water piping *(continued)*

Expansion tank and make-up water

1. Ensure expansion tank size will handle boiler and system water volume and temperature. Allow 7 gallons per boiler for the boiler and its piping.

CAUTION Undersized expansion tanks cause system water to be lost from relief valve and make-up water to be added through fill valve. Eventual boiler failure can result due to excessive make-up water addition.

2. Tank must be located as shown in this manual, or following recognized design methods. See tank manufacturer’s instructions for details.
3. Connect the expansion tank to the air separator only if the separator is on the suction side of the circulator. Always install the system fill connection at the same point as the expansion tank connection to the system.
4. Most piping drawings in this manual show diaphragm expansion tanks. See Figure 7 for piping from air separator to expansion tank and make-up water line using a closed-type expansion tank.
5. Most chilled water systems are piped using a closed-type tank, as shown in Figure 12, page 20.

Diaphragm (or bladder) expansion tank

1. (Figure 7) Always install an automatic air vent on top of the air separator to remove residual air from the system.

NOTICE When using diaphragm or bladder tanks only — when the boiler is installed above the system main piping, install an automatic air vent in the top of the outgoing boiler piping to prevent air pocketing.

Closed-type expansion tank

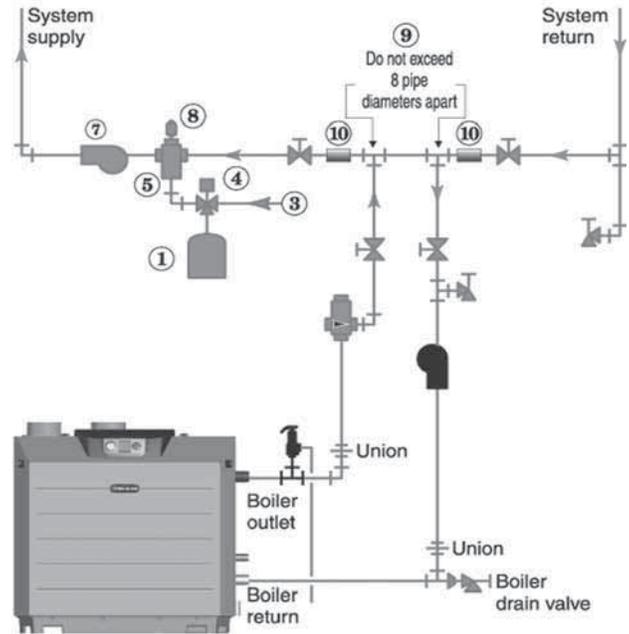
1. See Figure 7, Alternate, for piping connections when using a closed-type expansion tank.
2. Pitch any horizontal piping up towards tank 1 inch per 5 feet of piping. Connect to tank with at least 3/4” piping to allow room for air to rise.

CAUTION DO NOT install automatic air vents on closed-type expansion tank systems. Air must remain in the system and return to the tank to provide its air cushion. An automatic air vent would cause air to leave system, resulting in water-logging the expansion tank.

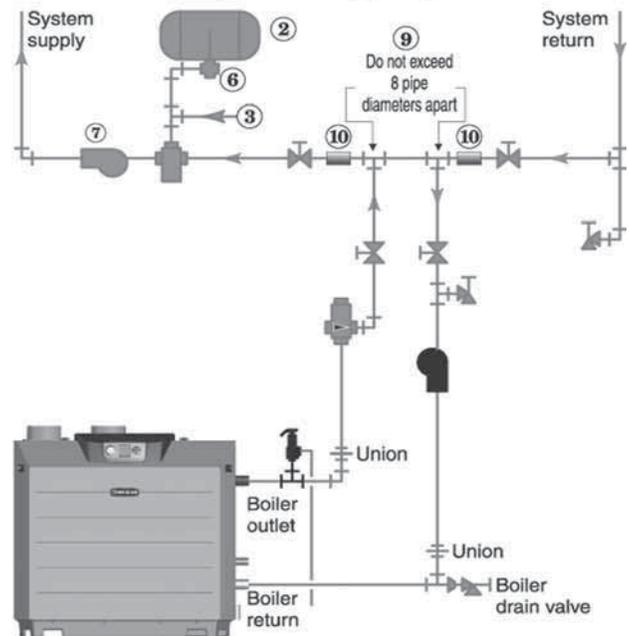
NOTICE Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required. See Figure 7.

Figure 7 Expansion tank piping

Piping to diaphragm (or bladder) expansion tank



Alternate — Piping to closed-type expansion tank



- | | |
|---------------------------------|--------------------------------|
| ① Diaphragm-type expansion tank | ⑥ Tank fitting |
| ② Closed-type expansion tank | ⑦ System circulator |
| ③ Make-up water supply | ⑧ Automatic air vent |
| ④ Fill valve, typical | ⑨ Primary/secondary connection |
| ⑤ Air separator | ⑩ System supply/return sensors |

U3039



Install water piping *(continued)*

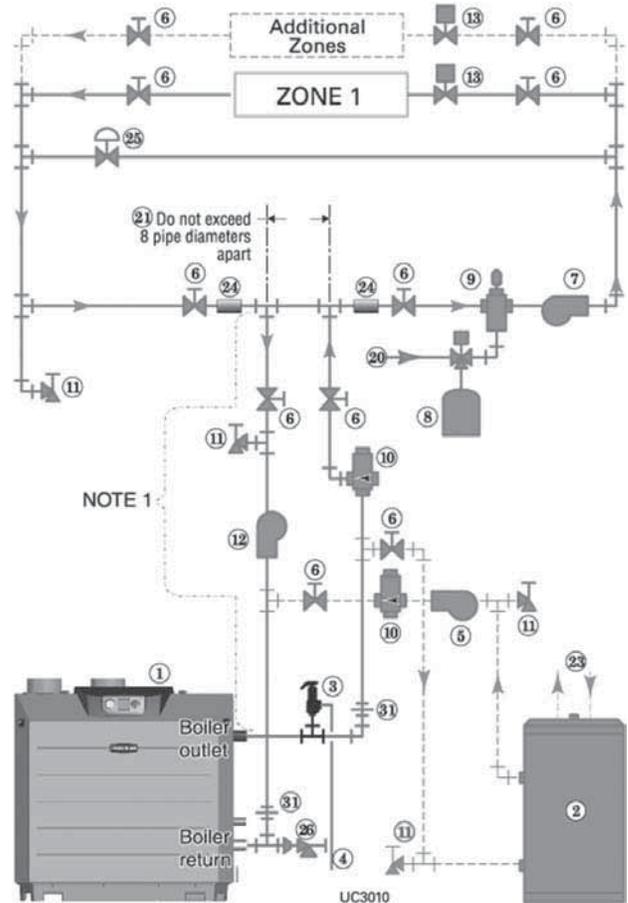
Zoning with zone valves

1. Connect boiler to system as shown in Figure 8 when zone valve zoning. The primary/secondary piping shown ensures the boiler loop will have sufficient flow. It also avoids applying the high head of the boiler circulator to the zone valves.
2. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 7, page 15.
3. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE If DHW input is priority 1: With factory default, on a call for DHW heating, the U-Control turns circulator 1 (DHW) and circulator 4 (boiler) ON and turns circulators 2 and 3 OFF (so there is no space heating during DHW operation). For the system shown in Figure 8, you can set the U-Control to turn the boiler circulator off during DHW heating. It is not needed. (The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop.)

4. Controlling the circulators
 - a. The U-Control can control up to four circulators (boiler circulator and three others). Refer to Field wiring, beginning on page 51, for instructions on wiring to circulators.
 - b. The factory default settings are: DHW circulator as Circulator 1, system circulator as Circulator 2, and boiler circulator as Circulator 4. See Field wiring instructions, beginning on page 51, for details. **(By default, circulator 4 is ON for all priorities.)**

Figure 8 Zone valve zoning plus optional DHW piping



Legend — Figure 8

<ol style="list-style-type: none"> 1 Ultra boiler 2 Indirect water heater (DHW), if used 3 Boiler relief valve (see page 13 for piping details) 4 Relief valve discharge piping (see page 13 for details) 5 DHW circulator) 6 Isolation valves 7 System circulator (see information above for wiring) 8 Diaphragm (or bladder) type expansion tank (see page 15 for piping of closed-type expansion tank, if used) 9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank] 10 Flow/check valves 11 Purge/drain valves 12 Boiler circulator 13 Zone valves, typical 20 Make-up water supply 21 Primary/secondary connection 	<ol style="list-style-type: none"> 24 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees. 25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves. 26 Boiler drain valve, 3/4" or larger 31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required. <p> Items supplied with boiler Items supplied by others </p> <p>NOTE 1: CAUTION Use at least the following pipe sizes on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). Pipe sizing is based on a temperature rise of 30°F, corresponding to the recommended maximum flow rate. Use only primary/secondary piping as shown. Failure to follow these guidelines could result in system problems.</p> <ul style="list-style-type: none"> • Ultra-550 — 2" or larger. • Ultra-750 — 2" or larger.
--	---



Install water piping *(continued)*

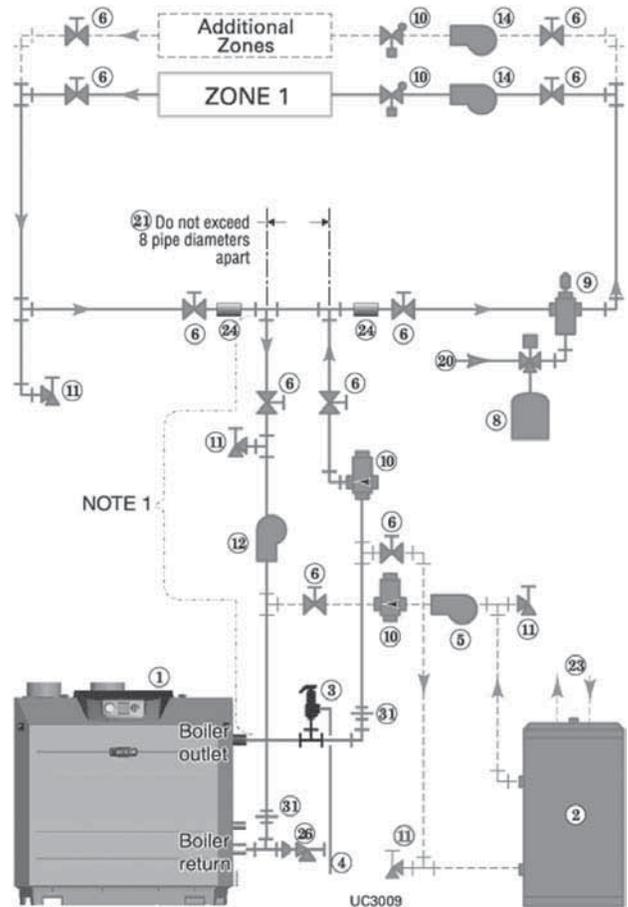
Zoning with circulators

1. Connect boiler to system as shown in Figure 10 when circulator zoning. The boiler circulator cannot be used for a zone. It must supply only the boiler loop.
2. Install a separate circulator for each zone.
3. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 7, page 15.
4. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE If DHW input is priority 1: With factory default, on a call for DHW heating, the U-Control turns circulator 1 (DHW) and circulator 4 (boiler) ON and turns circulators 2 and 3 OFF (so there is no space heating during DHW operation). For the system shown in Figure 8, you can set the U-Control to turn the boiler circulator off during DHW heating. It is not needed. (The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop.)

5. Controlling the circulators
 - a. The U-Control can control up to four circulators (boiler circulator and three others). Refer to Field wiring, beginning on page 51, for instructions on wiring to circulators.
 - b. The factory default settings are: DHW circulator as Circulator 1, system circulator as Circulator 2, and boiler circulator as Circulator 4. See Field wiring instructions, beginning on page 51, for details. **(By default, circulator 4 is ON for all priorities.)**
 - c. The zone circulators in Figure 10 must be controlled by circulator relays activated by the zone thermostats or zone controller.

Figure 10 Circulator zoning plus optional DHW piping



Legend — Figure 10

1 Ultra boiler	21 Primary/secondary connection (tees no more than 8 pipe diameters apart)
2 Indirect water heater (DHW), if used	24 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees.
3 Boiler relief valve (see page 13 for piping details)	26 Boiler drain valve, 3/4" or larger
4 Relief valve discharge piping (see page 13 for details)	31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required.
5 DHW circulator	■ Items supplied with boiler
6 Isolation valves	■ Items supplied by others
7 System circulator (see information above for wiring)	
8 Diaphragm (or bladder) type expansion tank (see page 15 for piping of closed-type expansion tank, if used)	
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	
10 Flow/check valves	
11 Purge/drain valves	
12 Boiler circulator	
14 Zone circulators, typical	
20 Make-up water supply	

NOTE 1: **CAUTION** Use at least the following pipe sizes on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). Pipe sizing is based on a temperature rise of 30°F, corresponding to the recommended maximum flow rate. Use only primary/secondary piping as shown. Failure to follow these guidelines could result in system problems.

- Ultra-550 — 2" or larger.
- Ultra-750 — 2" or larger.



Install water piping *(continued)*

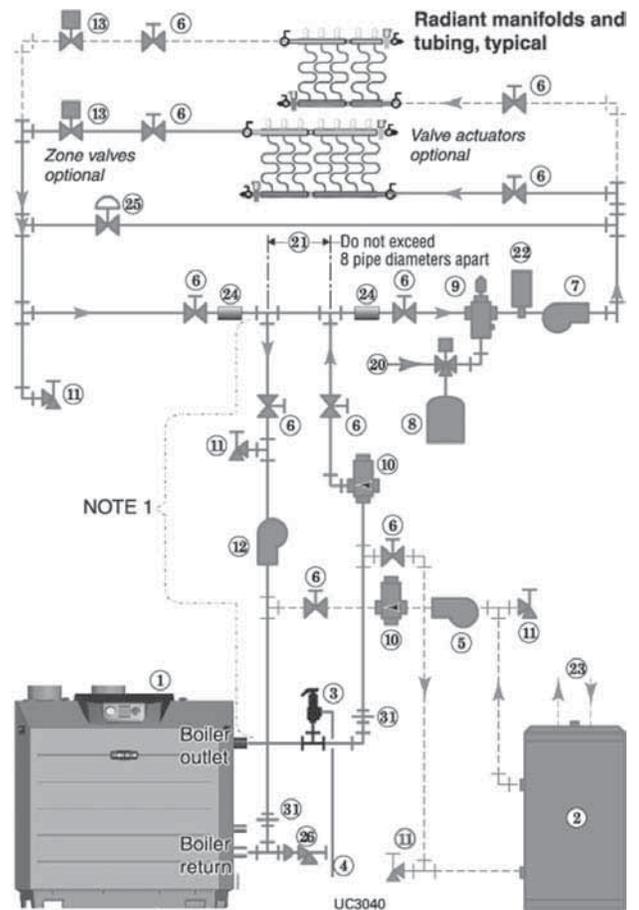
Radiant heating applications

1. The Ultra boiler is ideal for use in radiant heating. The Ultra boiler's unique heat exchanger design allows it to work well even in condensing mode. So there is no need to regulate boiler return water temperature in radiant heating applications.
2. Connect boiler to system as shown in Figure 11 for typical radiant heating applications. The primary/secondary piping shown ensures the boiler loop will have sufficient flow. Size the system piping and circulator to provide the flow and pressure drop needed for the radiant system.
3. Adding the recommended high limit control (Figure 11, item 22) can help ensure supply water temperature will not exceed the maximum allowable for the radiant system. Wire this limit control in either the manual reset or automatic reset external limit circuit of the U-Control.
4. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 7, page 15.
5. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE If DHW input is priority 1: With factory default, on a call for DHW heating, the U-Control turns circulator 1 (DHW) and circulator 4 (boiler) ON and turns circulators 2 and 3 OFF (so there is no space heating during DHW operation). For the system shown in Figure 8, you can set the U-Control to turn the boiler circulator off during DHW heating. It is not needed. (The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop.)

6. Controlling the circulators
 - a. The U-Control can control up to four circulators (boiler circulator and three others). Refer to Field wiring, beginning on page 51, for instructions on wiring to circulators.
 - b. The factory default settings are: DHW circulator as Circulator 1, system circulator as Circulator 2, and boiler circulator as Circulator 4. See Field wiring instructions, beginning on page 51, for details. **(By default, circulator 4 is ON for all priorities.)**

Figure 11 Typical radiant heating system piping plus optional DHW



Legend — Figure 11

1 Ultra boiler	21 Primary/secondary connection (tees no more than 8 pipe diameters apart)
2 Indirect water heater (DHW), if used	22 Optional high limit temperature control, set to protect radiant tubing
3 Boiler relief valve (see page 13 for piping details)	24 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees.
4 Relief valve discharge piping (see page 13 for details)	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
5 DHW circulator	26 Boiler drain valve, 3/4" or larger
6 Isolation valves	31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required.
7 System circulator (see information above for wiring)	■ Items supplied with boiler
8 Diaphragm (or bladder) type expansion tank (see page 15 for piping of closed-type expansion tank, if used)	■ Items supplied by others
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	
10 Flow/check valves	
11 Purge/drain valves	
12 Boiler circulator	
13 Zone valves, when used (zoning may also be done using manifold-mounted valve actuators)	
20 Make-up water supply	

NOTE 1: **CAUTION** Use at least the following pipe sizes on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). Pipe sizing is based on a temperature rise of 30°F, corresponding to the recommended maximum flow rate. Use only primary/secondary piping as shown. Failure to follow these guidelines could result in system problems.

- Ultra-550 — 2" or larger.
- Ultra-750 — 2" or larger.



Install water piping *(continued)*

Chilled water systems

1. Install boiler so that chilled medium is piped in parallel with the heating boiler. Use appropriate valves to prevent chilled medium from entering boiler. See Figure 12 for typical installation of balancing valve and check valve.
2. The space heating system may be zoned with circulators if a separate circulator is supplied for the chilled water loop.

NOTICE If antifreeze is used in the system, consider the effects of antifreeze on circulator sizing and DHW performance. Some local codes may require double-wall DHW heat exchanger design.

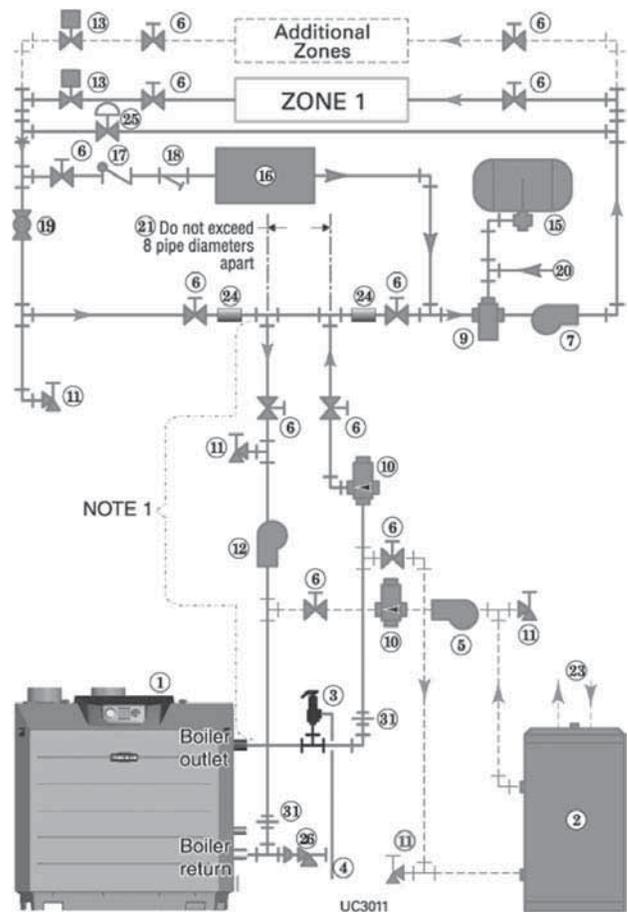
WARNING Chilled medium, if used, is piped in parallel with heating boiler as shown in Figure 12. Use appropriate valves to prevent chilled medium from entering boiler.

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.

NOTICE If DHW input is priority 1: With factory default, on a call for DHW heating, the U-Control turns circulator 1 (DHW) and circulator 4 (boiler) ON and turns circulators 2 and 3 OFF (so there is no space heating during DHW operation). For the system shown in Figure 8, you can set the U-Control to turn the boiler circulator off during DHW heating. It is not needed. (The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop.)

3. Controlling the circulators
 - a. The U-Control can control up to four circulators (boiler circulator and three others). Refer to Field wiring, beginning on page 51, for instructions on wiring to circulators.
 - b. The factory default settings are: DHW circulator as Circulator 1, system circulator as Circulator 2, and boiler circulator as Circulator 4. See Field wiring instructions, beginning on page 51, for details. (**By default, circulator 4 is ON for all priorities.**)

Figure 12 Chilled water system plus optional DHW piping



Legend — Figure 12

1 Ultra boiler	20 Make-up water supply
2 Indirect water heater (DHW), if used	21 Primary/secondary connection (tees no more than 8 pipe diameters apart)
3 Boiler relief valve (see page 13 for piping details)	24 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees.
4 Relief valve discharge piping (see page 13 for details)	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
5 DHW circulator	26 Boiler drain valve, 3/4" or larger
6 Isolation valves	31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required.
7 System circulator (see information above for wiring)	■ Items supplied with boiler
8 Diaphragm (or bladder) type expansion tank (see page 15 for piping of closed-type expansion tank, if used)	■ Items supplied by others
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	NOTE 1: CAUTION Use at least the following pipe sizes on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). Pipe sizing is based on a temperature rise of 30°F, corresponding to the recommended maximum flow rate. Use only primary/secondary piping as shown. Failure to follow these guidelines could result in system problems.
10 Flow/check valves	• Ultra-550 — 2" or larger.
11 Purge/drain valves	• Ultra-750 — 2" or larger.
12 Boiler circulator	
13 Zone valves, typical	
15 Closed-type expansion tank	
16 Water chiller	
17 Check valve	
18 Strainer	
19 Balancing valve	



Multiple boiler water piping

Easy-Fit® piping installation

1. Main header and Easy-Fit® Manifold pipe sizing.
 - a. New system — Size system piping as required for system flow. Use an Easy-Fit® Manifold equal to or larger than the system pipe size.
 - b. Replacing boilers in an existing system — Without reducing size, connect system supply and return lines. Install tees or crosses for Easy-Fit® manifolds as shown in Figure 13 or Figure 14. Size manifolds to handle total connected boiler output.
 - c. Only 4-inch manifolds are available from Weil-McLain. All others must be field assembled.
2. Provide connections in main header for Easy-Fit® manifolds as close as possible to the midpoint of multiple boilers.
 - a. Use tees for four or less boilers, as in Figure 13.
 - b. Use either tees (Figure 13) or crosses (Figure 14) for five or more boilers.
3. Manifold placement:
 - a. To alternate spacing for supply and return lines to boilers, reverse the short-end and long-end of the manifolds as shown in Figure 13 and Figure 14.
 - b. Return manifold must be on the return side of the main and supply manifold must be on the supply side of the main.
4. Connect from Easy-Fit® manifold branches to boiler supply and return connections using 2" or larger copper or steel pipe, suitable for the recommended temperature rise of 30°F.
5. Provide a flow/check valve in the supply piping of each boiler as shown in piping diagrams in this manual. Install an isolation valve on the supply and return of each boiler as shown. Each boiler is equipped with an internal low water cutoff and limit control. Check local codes to see if additional controls may be needed.
6. Install main system air eliminator and primary circulator in supply piping as shown in piping diagrams. Place expansion tank on suction side of system circulator as shown.
7. Install system accessories as shown in drawings.
8. Piping recommendation drawings:
 - a. Figure 13 and Figure 14 show details of Easy-Fit® manifolds.
 - b. Figure 15, page 22 is a schematic piping drawing showing the locations of typical boiler piping and system piping, including limits and other devices often required by local codes.
 - c. Figure 16, page 23 and Figure 17, page 24 are three-dimensional piping drawings of typical multiple boiler installation.
 - d. Figure 18, page 25 shows recommended piping when an isolating heat exchanger is needed.
9. If desired, other primary/secondary piping arrangements can be used.

NOTICE When using isolation valves on each boiler, some codes may require additional controls. The U-Control module uses temperature sensors to provide both high limit protection and modulating temperature control, and is UL353 Limit Controls certified to meet ASME CSD-1 and Section IV requirements. The U-Control module also provides low water protection, both with a low water cut-off inside the boiler jacket and by sensing the temperature of the heat exchanger. Some codes/jurisdictions may require additional external controls.

Maximum connected load per manifold:
 3-inch manifold — 1400 MBH
 4-inch manifold — 2900 MBH
 (Do not use manifolds smaller than 3 inch for Ultra-550 or Ultra-750 MBS applications.)

Figure 13 Single-sided EZ-Fit Header connection

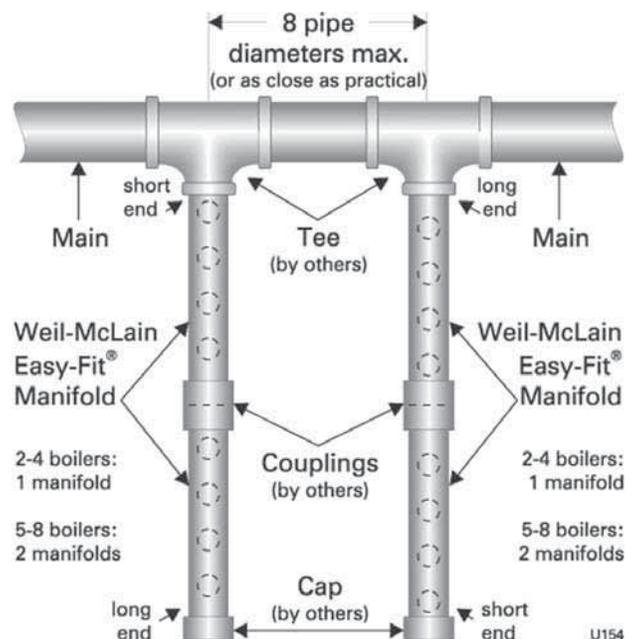
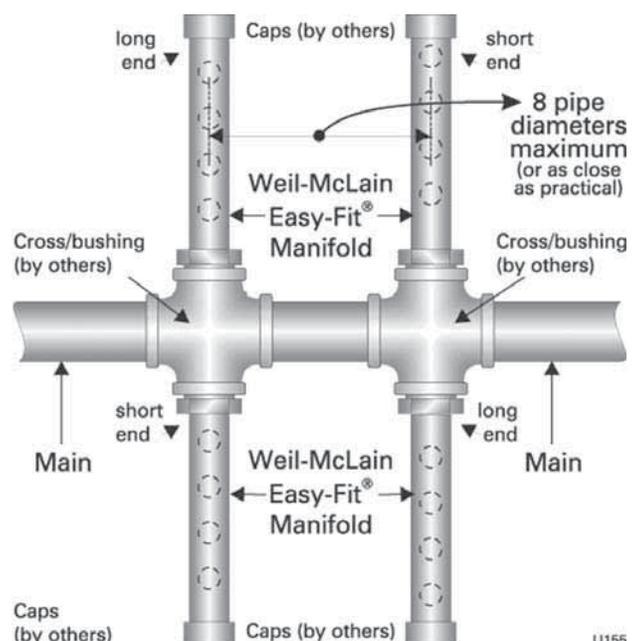


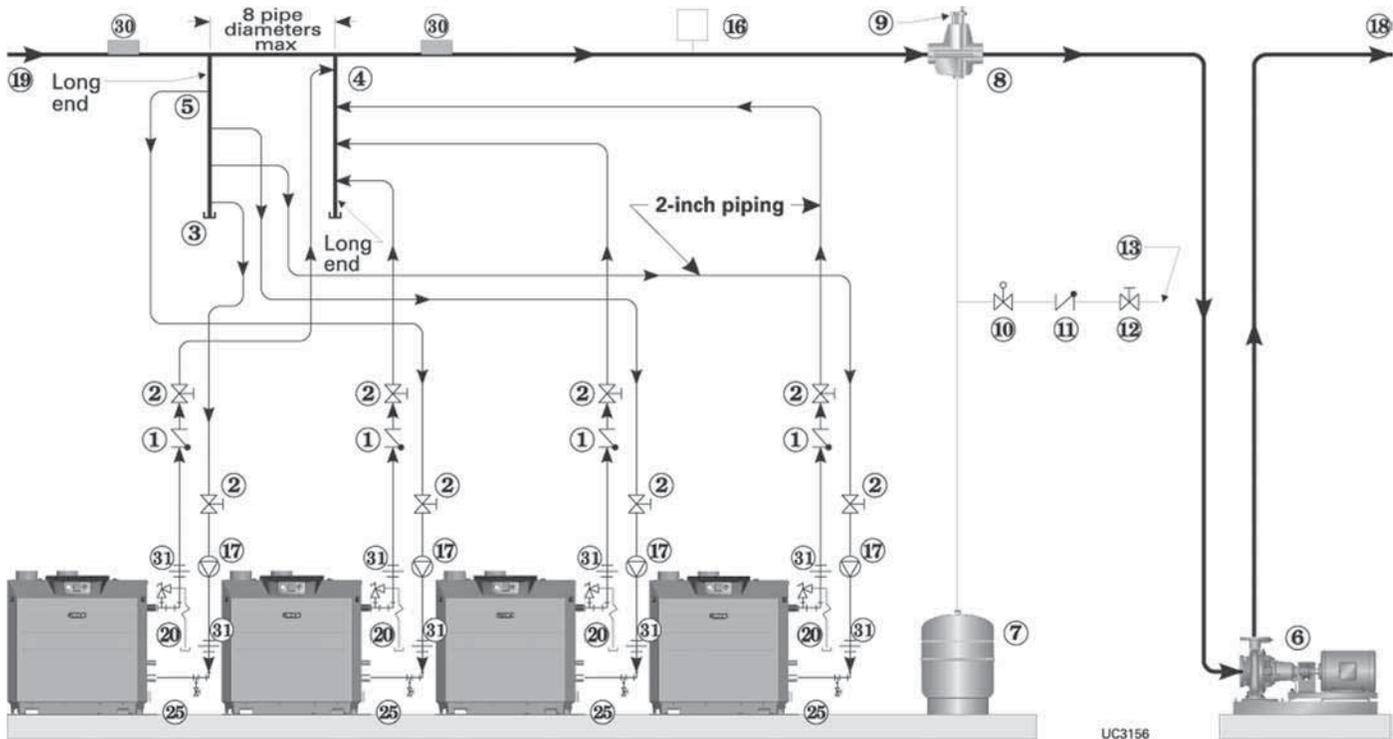
Figure 14 Double-sided EZ-Fit Header connection





Multiple boiler water piping *(continued)*

Figure 15 Piping schematic — typical piping for multiple Ultra boilers, using Weil-McLain Easy-Fit manifolds

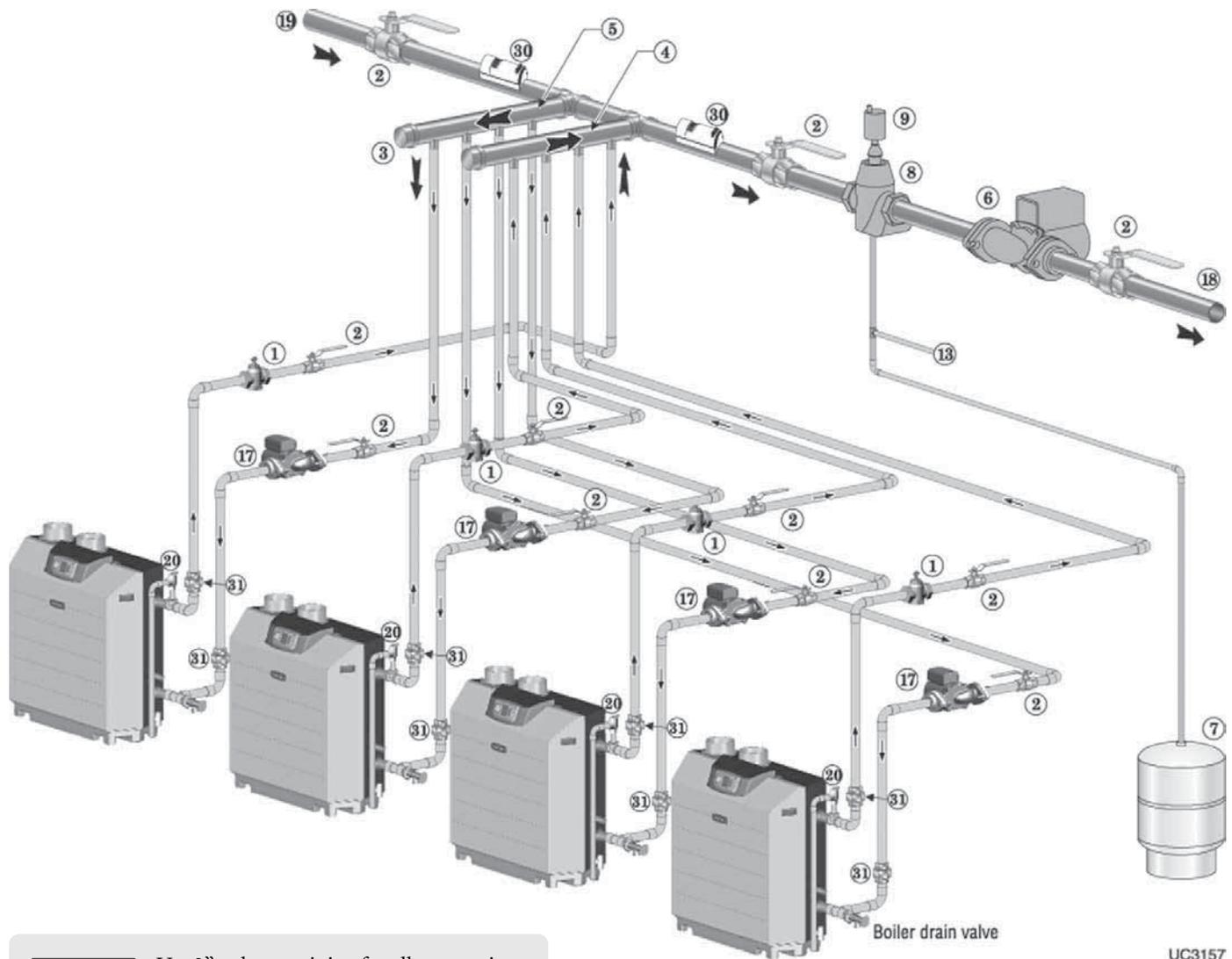


Legend — Figure 15

- | | |
|---|---|
| 1 Flow/check valve (each boiler) | 12 Isolation valve |
| 2 Isolation valves (when used) | 13 Cold water supply |
| 3 Cap | 16 Water flow switch (when used) |
| 4 Easy-Fit® Manifold (supply) — layout and size per page 21 | 17 Boiler circulator (each boiler) |
| 5 Easy-Fit® Manifold (return) — layout and size per page 21 | 18 System supply |
| 6 Primary circulator | 19 System return |
| 7 Expansion tank (diaphragm type) | 20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual |
| 8 System air eliminator | 25 Boiler drain valve, 3/4" NPT or larger |
| 9 System automatic air vent | 30 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees. |
| 10 Pressure reducing valve | 31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required. |
| 11 Check valve or backflow preventer, as required by applicable codes | |

Multiple boiler water piping *(continued)*

Figure 16 Piping layout — typical piping for multiple Ultra boilers, using Weil-McLain Easy-Fit manifolds



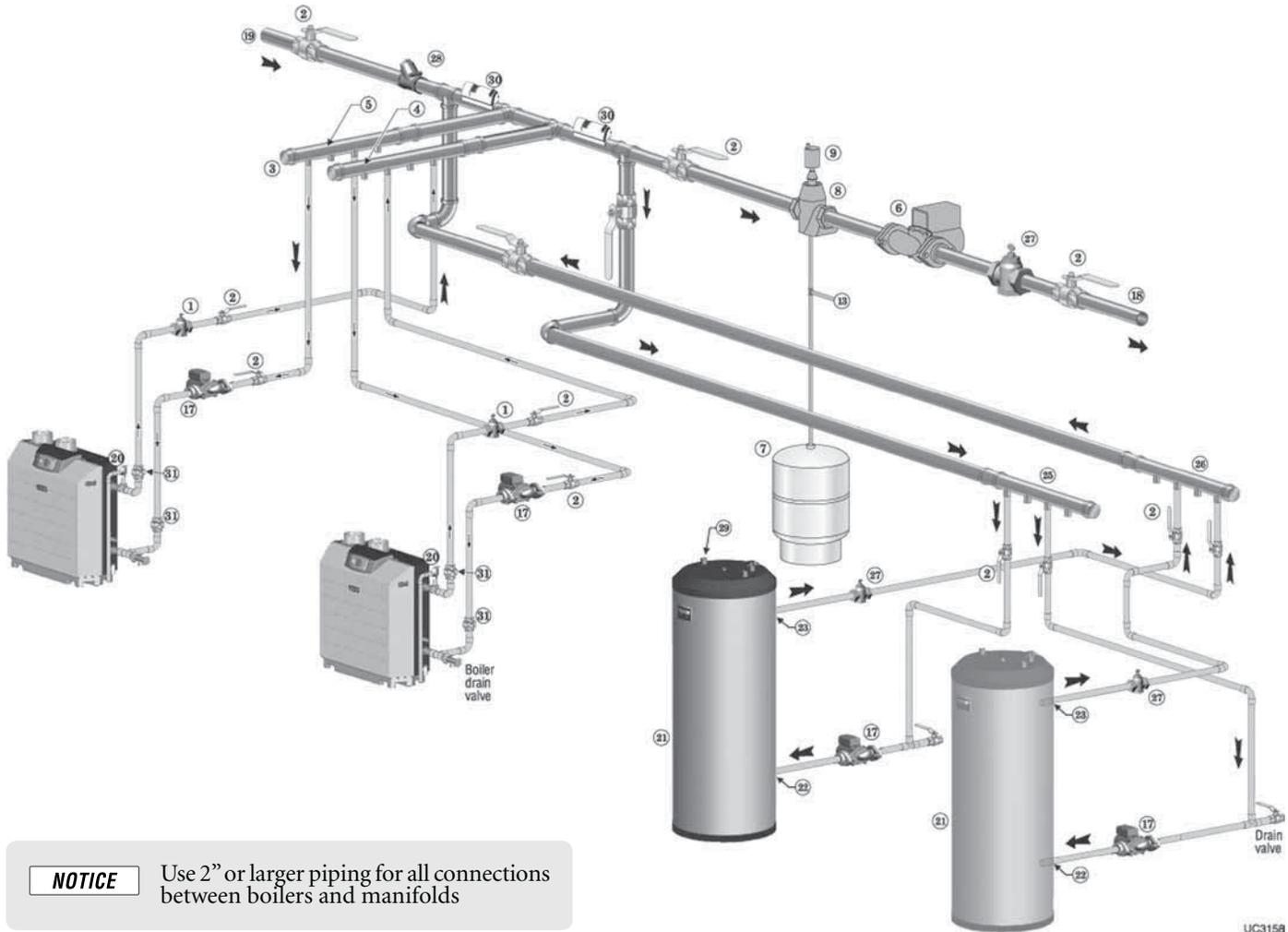
NOTICE Use 2" or larger piping for all connections between boilers and manifolds

Legend — Figure 16	
1 Flow/check valve (each boiler)	13 Cold water supply (requires items 10, 11 and 12 as shown in Figure 15, page 22)
2 Isolation valves (when used)	17 Boiler circulator (each boiler)
3 Caps	18 System supply
4 Easy-Fit® Manifold (supply) — layout and size per page 21	19 System return
5 Easy-Fit® Manifold (return) — layout and size per page 21	20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual
6 Primary circulator	30 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees.
7 Expansion tank (diaphragm type)	31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required.
8 System air eliminator	
9 System automatic air vent	



Multiple boiler water piping *(continued)*

Figure 17 Piping layout — typical piping for multiple Ultra boilers, with DHW storage heaters



UC3158

NOTICE Use 2" or larger piping for all connections between boilers and manifolds

Legend — Figure 17

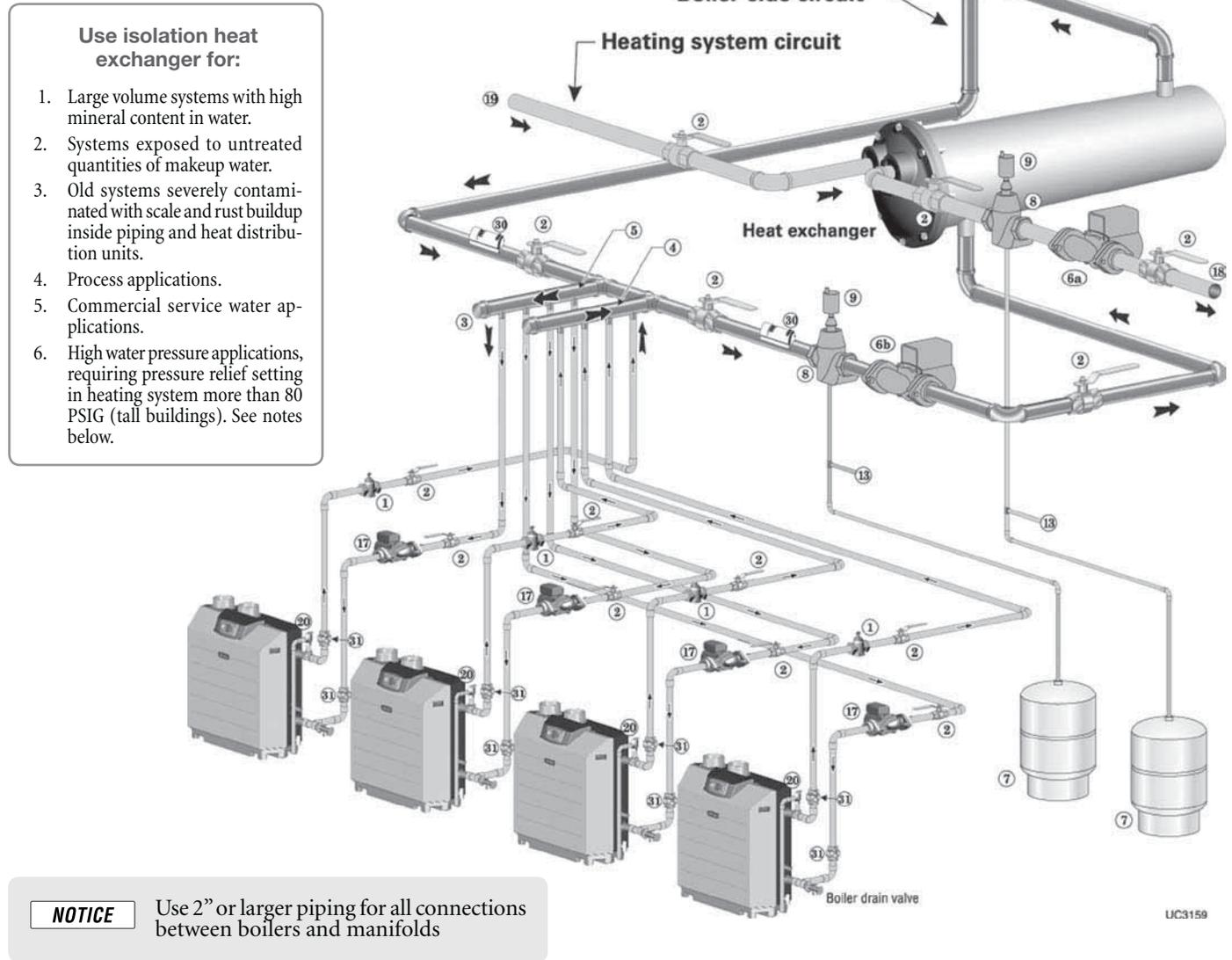
1 Flow/check valve (each boiler)	21 Indirect-fired storage water heaters (Weil-McLain PLUS Line shown) — Example is shown with reverse-return boiler-side piping using a single circulator. Alternate: each water heater could have its own circulator.
2 Isolation valves (when used)	22 Boiler water inlet
3 Caps	23 Boiler water outlet
4 Easy-Fit® Manifold (supply) — layout and size per page 21	24 DHW boiler-side supply Easy-Fit® Manifold
5 Easy-Fit® Manifold (return) — layout and size per page 21	25 DHW boiler-side return Easy-Fit® Manifold
6 Primary circulator	26 Flow/check valves (to prevent induced or gravity flow in heating system or DHW piping)
7 Expansion tank (diaphragm type)	27 Check valve to prevent heat migration in heating system
8 System air eliminator	28 See water heater manual for DHW piping — The DHW piping must also be manifolded together since the boiler-side piping is manifolded. If DHW heaters supply separate DHW circuits, provide an individual circulator for each water heater, and control each circulator by its water heater's aquastat.
9 System automatic air vent	29 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees.
13 Cold water supply (requires items 10, 11 and 12 as shown in Figure 15, page 22)	30 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required.
17 Boiler circulator or DHW circulator (one for each boiler and DHW tank)	
18 System supply	
19 System return	
20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual	

NOTICE
This piping is suggested only. Set the U-Controls so the boiler circulators, item 17, operate on any call for heat, whether heating system or DHW. Offset the DHW boiler-side supply and return manifolds as shown so the total run of pipe and fittings to each of the water heaters is approximately equal.



Multiple boiler water piping *(continued)*

Figure 18 Piping layout — typical piping for multiple Ultra boilers, using isolation exchanger



NOTICE Use 2" or larger piping for all connections between boilers and manifolds

Legend — Figure 18

<ol style="list-style-type: none"> 1 Flow/check valve (each boiler) 2 Isolation valves (when used) 3 Cap 4 Easy-Fit® Manifold (supply) — layout and size per page 21 5 Easy-Fit® Manifold (return) — layout and size per page 21 6a Heating system circulator (exchanger tube-side) 6b Heat exchanger shell-side circulator 7 Expansion tanks (diaphragm type) 8 System air eliminator 9 System automatic air vent 	<ol style="list-style-type: none"> 13 Cold water supply connections (requires items 10, 11 and 12 as shown in Figure 15, page 22) 17 Boiler circulator (each boiler) 18 Heating system supply 19 Heating system return 20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual 30 Strap system supply and return sensors to lines as shown, at least 6 pipe diameters (but no more than 3 feet) from boiler connection tees. For pipe sizes larger than 3-inch, contact Weil-McLain for well-mounted sensors. 31 Install a union on the boiler supply and return connections as close as possible to the boiler to allow disconnection for service when required. 	<p>Notes:</p> <ol style="list-style-type: none"> 1. Contact heat exchanger manufacturer for heat exchanger shell-side and tube-side piping and circulator requirements. Tube-side flow and temperatures must meet heating system requirements. 2. Contact heat exchanger manufacturer for sizing heat exchanger. 3. Heat exchanger shell-side circuit requires its own expansion tank as shown. 4. Heating system circuit requires its own expansion tank, as shown, plus its own relief valve set to protect heating system and heat exchanger piping and components.
--	---	--



Venting/combustion air — general

⚠ DANGER Ultra Boilers must be vented and supplied with combustion and ventilation air using piping and methods described in this manual.

DO NOT COMMON VENT

Every boiler must have its own vent. DO NOT common vent with any other appliance. See page 28 for checking appliances remaining on a common vent.

INSPECT VENT/AIR COMPONENTS

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes. Verify all air openings are correctly sized, unobstructed, and free of airborne contaminants.

Failure to provide a properly-installed vent and air system will cause severe personal injury or death.

Code compliance

⚠ WARNING Installations must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 or B149.2 for Canadian installations.

Vent and air piping materials

⚠ WARNING Use only the materials listed in this manual (Figure 20, page 27) for vent and air pipe and fittings.

A masonry chimney can ONLY be used as a chase for vent and air piping

⚠ WARNING If used, a masonry chimney can ONLY be used as a PIPE CHASE for vent and air pipes — The vent and air piping must be installed as instructed in this manual and all joints must be sealed. The chimney must be used only as a chase for the Ultra boiler vent/air piping. NO OTHER appliance or fireplace can be connected to the chimney.

The chimney must be straight, with no offsets, and the vent and air piping materials must comply with this instruction manual.

The chimney must be fitted with a sealed access opening, through which the interior of the chimney can be inspected.

The chimney and liner must be inspected at least once annually to verify condition.

Failure to comply could result in severe personal injury, death or substantial property damage.

Combustion air contamination

1. **Direct exhaust** (combustion air from boiler room):
 - a. Provide combustion air openings to boiler room as described in this manual.
 - b. Ensure the boiler room and combustion air source areas are free of contaminants.
2. **Direct vent** (piped combustion air):
 - a. Install air inlet piping for the Ultra boiler as described in this manual.
 - b. Do not terminate air piping in locations that can allow contamination of combustion air.
3. See Figure 19 for products and areas which may cause contaminated combustion air.

Figure 19 Corrosive contaminants and sources

Products to avoid
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Excessive dust and dirt

Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops



Venting/combustion air — options

Vent and air piping materials

- See Figure 20 for approved vent and air piping materials, for both **direct exhaust** and **direct vent**.

WARNING Use the same vent or air piping material throughout. — Do not connect different types of piping together.

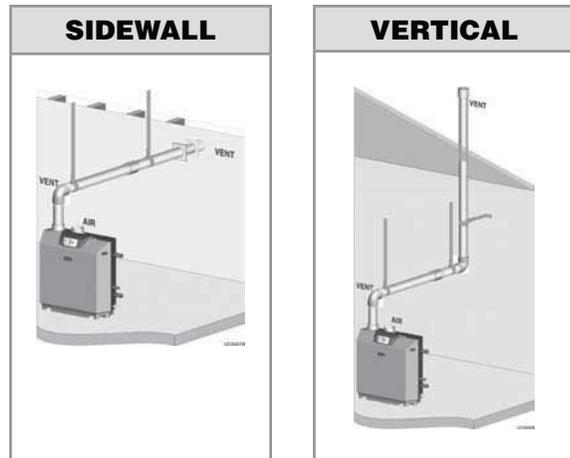
Vent piping

- Boiler flue gases must be piped from the boiler to outside, following the instructions in this manual, and compliant with all applicable codes. The vent pipe must terminate either through the sidewall or through the roof, located with the correct separation from the air termination. See the associated instructions in the following pages.
- Each Ultra boiler requires a separate vent. **DO NOT** common vent.

Figure 20 Use only the materials listed below, ensuring that all materials meet local codes

Item	Material	Standards for installations in:	
		United States	Canada
Vent or air pipe & fittings	PVC schedule 40	ANSI/ASTM D1785	Plastic vent pipe must be certified to UL S636 when required.
	PVC-DWV	ANSI/ASTM D2665	
	CPVC schedule 40	ANSI/ASTM F441	
	ABS-DWV schedule 40	ANSI/ASTM D2661	
PVC & ABS pipe cement & primer	PVC	ANSI/ASTM D2564	Air pipe can be any of those listed at left if acceptable for local codes.
	CPVC	ANSI/ASTM F493	
	ABS	ANSI/ASTM D2235	
NOTICE Do not use cellular core pipe for either vent or air.			

DIRECT EXHAUST OPTIONS



Combustion air openings for direct exhaust

- Combustion air must be supplied through openings into the boiler room, following the instructions in this manual, and compliant with all applicable codes. Read the warning in Figure 19, page 26, and ensure the air and boiler room will not contain contaminated air.
- Where the Ultra boiler shares a space with other appliances, the combustion air openings must be sized to handle the combined requirements of all appliances in the space.

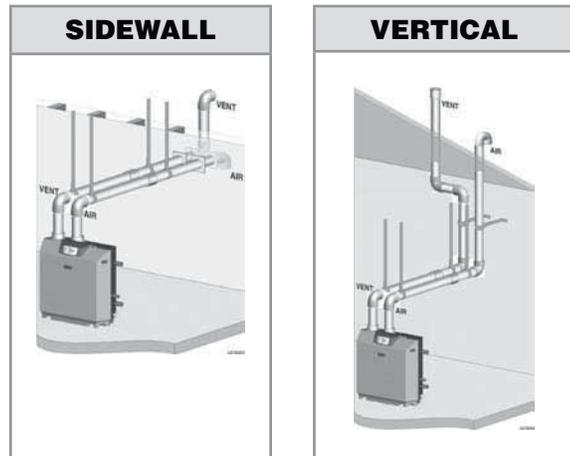
SIDEWALL direct exhaust option

- Read page 28 through page 31. Then go to page 32.

VERTICAL direct exhaust option

- Read page 28 through page 31. Then go to page 35.

DIRECT VENT OPTIONS



Combustion air piping for direct vent

- Combustion air must be piped from outside to the boiler, following the instructions in this manual, and compliant with all applicable codes. Read the warning in Figure 19, page 26, and ensure the air intake will not be likely to draw in contaminated air.
- Combustion air can be piped individually for each boiler, or it can be manifolded as shown in Figure 31, page 37. Combustion/ventilation openings may also be required in boiler room walls, per instructions in this manual and applicable codes.

SIDEWALL direct vent option

- Read page 28, page 29 and page 37. Then go to page 39.

VERTICAL direct vent option

- Read page 28, page 29 and page 37. Then go to page 43.



Appliances remaining on an existing vent system

⚠ DANGER Do not install the Ultra boiler into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death or substantial property damage.

⚠ WARNING Existing common vent systems may be too large for the appliances remaining connected after the existing boiler is removed.

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing a boiler from an existing common vent system

The Ultra boiler cannot be common vented with any other appliance. When an existing boiler is replaced with an Ultra boiler, the Ultra boiler CANNOT use the existing common vent. The Ultra boiler requires its own vent and air piping, as specified in this manual. This may cause a problem for the appliances that remain on the old common vent, because the vent may be too large. The following test is intended to check for proper operation of the appliances remaining on the old common vent system.

Vent system verification

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation. Seal any unused openings in the common venting system.

Existing vent test procedure

(The following is intended to test whether the appliances remaining on an existing vent system will operate satisfactorily.)

1. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
2. Test vent system — Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
3. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
4. Test for spillage at draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
5. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

Any improper operation of common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1 — latest edition. Correct by re-sizing to approach the minimum size as determined using the appropriate tables in Part 11 of that code. Canadian installations must comply with B149.1 or B149.2 Installation Code.

Venting/air piping — Massachusetts installations

Venting instructions for the installations in the Commonwealth of Massachusetts

- (a) For all sidewall horizontally-vented gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:
- 1. INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors
 - a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
 - b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
 - 2. APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
 - 3. SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS."
 - 4. INSPECTION.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1 through 4.
- (b) **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:
1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
 2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
- (c) **MANUFACTURER REQUIREMENTS — GAS EQUIPMENT VENTING SYSTEM PROVIDED.** When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:
1. Detailed instructions for the installation of the venting system design or the venting system components; and
 2. A complete parts list for the venting system design or venting system.
- (d) **MANUFACTURER REQUIREMENTS — GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.** When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:
1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
 2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.
- (e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.



DIRECT EXHAUST — Boiler room air openings

Combustion air provision

The Ultra Commercial boiler can use inside air if no contaminants are present in the boiler space. (If contaminants are likely to be present, install the boiler as a direct vent appliance, using the appropriate vent instructions in this manual.)

The boiler room must be fitted with combustion air openings large enough to provide air for all appliances in the room. Use the following information to size the openings. Ensure the installation complies with all applicable codes and standards.

Sizing combustion air openings

Air openings provide for ventilation (as well as combustion air) to prevent overheating of the boiler controls and boiler space. Air is also needed for other appliances located in the same space.

Use Figure 21, page 31, selecting the appropriate installation conditions.

WARNING Air openings must be sized to handle all appliances and air movers (exhaust fans, etc.) using the air supply.

The sizing given in Figure 21, page 31 is based on the National Fuel Gas Code, ANSI Z223.1, allowing adequate air openings for gravity-vented gas appliances (Category I) in addition to that needed for the Ultra boiler.

The Ultra Commercial boiler is rated Category IV (pressurized vent), and has varying requirements for combustion and ventilation air, reflected by the special sizing instructions given in in this manual.

The air openings recommended in Figure 21, page 31 will allow adequate ventilation and combustion air provided the boiler room is not subjected to negative pressure due to exhaust fans or other mechanical ventilation devices.

Refer to the National Fuel Gas Code for dealing with other conditions.

Free area — louver allowance

The free area of openings means the area **after reduction for any installed louvers or grilles**. Be sure to consider this reduction when sizing the air openings.

Special considerations

Tight construction

ANSI Z223.1 defines unusually tight construction where:

1. Walls and ceilings exposed to the outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed, and . . .
2. Weather-stripping has been added on openable windows and doors, and . . .
3. Caulking or sealants are applied to areas such as joints around windows and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and in other openings.

For buildings with such construction, provide air openings into the building from outside, sized per the appropriate case in Figure 21, page 31 if appliances are to use inside air for combustion and ventilation.

Exhaust fans and air movers

The appliance space must never be under a negative pressure unless all appliances are installed as direct vent. Always provide air openings sized not only to the dimensions required for the firing rate of all appliances, but also to handle the air movement rate of the exhaust fans or air movers using air from the building or space.

Motorized air dampers

If the air openings are fitted with motorized dampers, electrically interlock the damper to:

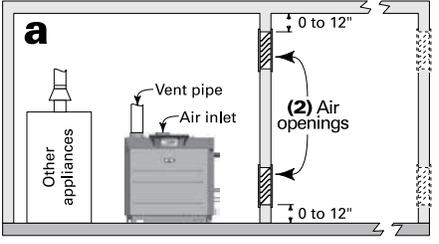
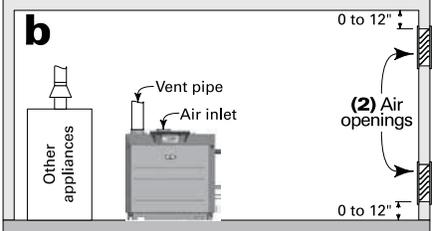
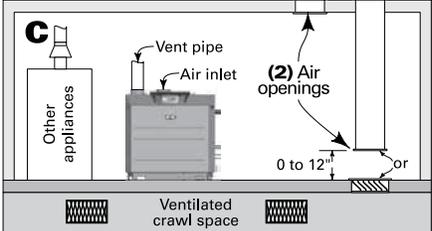
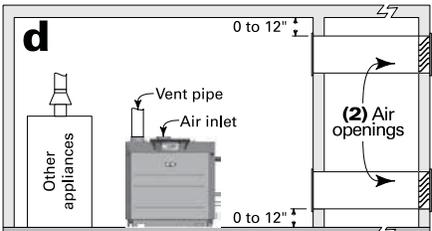
- Prevent the boiler from firing if the damper is not fully open.
- Shut the boiler down should the damper close during boiler operation.

To accomplish this interlock, wire an **isolated contact** (proving the damper open) in series with the thermostat input to the boiler. The boiler will not start if this contact is open, and will shut down should it open during operation.



DIRECT EXHAUST — Boiler room air openings *(continued)*

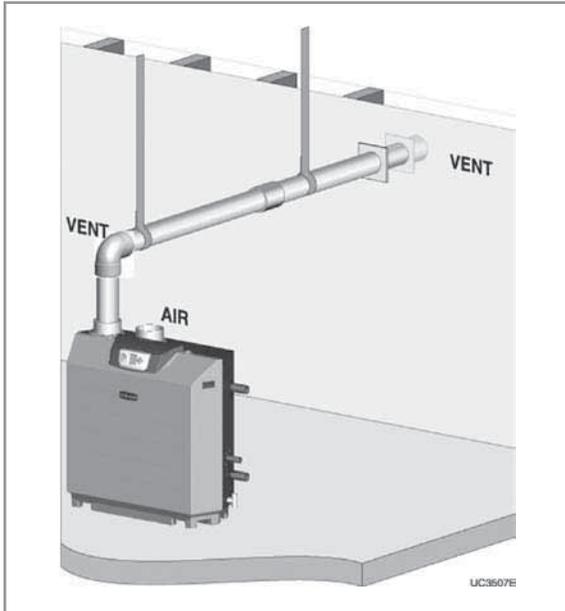
Figure 21 MINIMUM combustion air openings for direct exhaust applications — ALL OPENING SIZES ARE FREE AREA

<p style="text-align: center;">Air openings</p> <p>The required air opening sizes below are FREE AREA, after reduction for louver obstruction. Note the exception below for large spaces.</p>	<p style="text-align: center;">Ultra boiler WITH other appliances in room</p>	<p style="text-align: center;">Ultra boiler WITHOUT other appliances in room</p>
	<p>TWO openings, each at least: 1 square inch per 1,000 Btuh of all appliances in the room</p>	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room</p>
	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
<p style="text-align: center;">Outside or ventilated attic</p> 	<p>TWO openings, each at least: 1 square inch per 2,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
<p>** NOTICE: Requirements for using the SINGLE air opening option.</p>	<p>A single combustion air opening can be used for cases b, c or d above, sized as listed, provided that:</p> <ul style="list-style-type: none"> • The single opening must communicate directly to the outdoors or to a space that communicates directly with outdoors (NOT to an interior space). • The top of the opening must be within 12 inches of the ceiling. • The free area of the opening must be at least equal to the sum of the areas of all equipment vent connectors in the space. 	
<p>SPECIAL EXCEPTION FOR LARGE SPACES:</p>	<p>NO combustion air openings are needed when the boiler (and other appliances) are installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btuh of all appliances in the space. That is, total the input of all appliances in MBH (1,000's of Btuh), then multiply this total times 50. The building MUST NOT be of tight construction.</p> <p>Example: For a total input of 1500 MBH (1,500,000 Btuh) and an 8-foot ceiling height, the minimum volume would be 50 x 1500 x 8 = 60,000 cubic feet.</p>	



DIRECT EXHAUST — Sidewall

Figure 22 DIRECT EXHAUST — Sidewall termination



DIRECT EXHAUST — Sidewall termination — installation sequence

- Step 1** Install the boiler.
- Step 2** Determine the proper location for wall penetration for each termination.
 - Prepare wall penetrations before installing vent piping.
 - Finish by attaching external pipe and fittings as shown in the termination instructions.
 - Support vertical runs on the outside of the building with brackets as shown in the termination instructions.
- Step 3** Install vent piping from boiler to termination.
 - Install a hanger support within 6 inches of any upturn in the piping.
 - Slope horizontal piping downward toward the boiler at least 1/4 inch per foot.
- Step 4** Connect the vent piping at the boiler per manual instructions.

Allowable vent pipe materials

1. Use only the materials listed in Figure 20, page 27.
2. Install a bird screen in each vent pipe termination (coupling or elbow). Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.

Maximum piping length

1. Locate the termination such that the total vent piping from the boiler to the termination will not exceed the maximum length given in Figure 23.
2. Maximum lengths listed in Figure 23 allow for 2 elbows. Additional elbows require a reduction in maximum length as explained in the table notes.

Connecting from termination to boiler

1. Install the terminations as instructed in the following. Then proceed to page 46 to complete the vent piping between the termination and the boiler.

Figure 23 Maximum piping lengths for DIRECT EXHAUST sidewall termination

Boiler Ultra–	Maximum piping 6-inch diameter		Maximum piping 8-inch diameter *	
	Feet	Elbows **	Feet	Elbows **
550	100	2	Not allowed	
750	30	2	100	2

* Install a pipe reducer to adapt from 6" PVC to the 8" PVC pipe size required at the boiler. You do not have to reduce allowable pipe length for the reducer. Install reducer directly at the boiler, oriented vertically.

** For piping using more than 2 elbows, reduce maximum allowable length:
 • 7 feet for each additional 6-inch or 8-inch elbow (90° or 45°)

Determine location for sidewall termination

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below building extensions such as eaves, parapets, balconies or decks, except as otherwise instructed in this manual or local codes. Failure to comply could result in severe personal injury, death or substantial property damage.

Place the vent terminations using the following guidelines.

1. Terminate the vent piping with a coupling as shown in Figure 24, page 33. The coupling must butt against the outside wall plate. If vent piping is extended outside, install a coupling at the outer plate and continue vent piping from the coupling (or elbow when snorkeling as in Figure 24, page 33 right side).
 - a. Apply the configuration on the left side of Figure 24 unless the termination would fail to meet minimum clearance to grade or snow line.

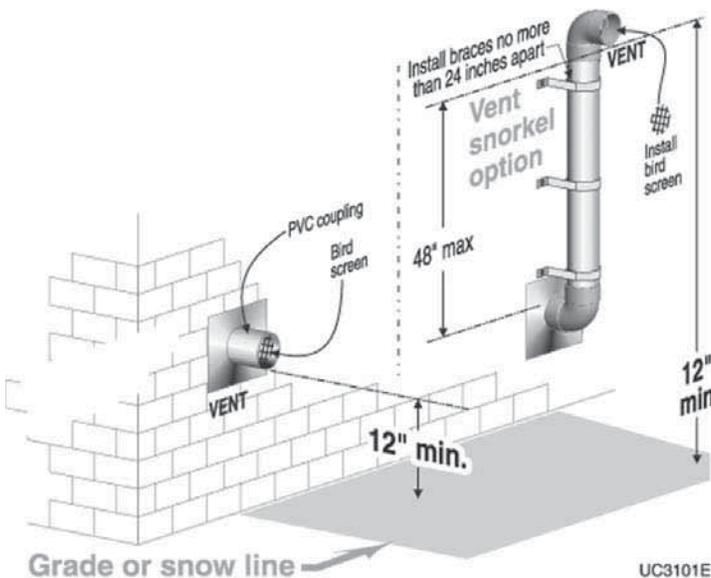


DIRECT EXHAUST — Sidewall *(continued)*

- b. Apply the configuration on the right side of Figure 24 when the termination needs to be raised higher to meet clearance to grade or snow line.
- c. The vent pipe may run up as high as 4 feet, as shown in Figure 24 right side, with no enclosure. The vent pipe must be secured with braces, and maintain all required clearances.
- d. Space braces no further than 24 inches apart. (See WARNING below for extremely cold climates.)
- e. External venting greater than 4 feet requires an enclosure around the vent pipe. The vent termination must exit through the enclosure as shown in Figure 24, maintaining all required clearances.

WARNING Do not exceed the maximum length of the outside vent piping shown in Figure 24. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown. In extremely cold climates, install an insulated chase around the vent piping, particularly when using longer lengths. The chase must allow for inspection of the vent pipe, and insulation must be protected from water.

Figure 24 DIRECT EXHAUST — Sidewall — configuration options and minimum clearances



2. Consider the surroundings when terminating the vent:
 - a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
 - b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
 - c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
 - d. Avoid possibility of accidental contact of flue products with people or pets.

Figure 25 DIRECT EXHAUST — Sidewall — clearances to openings

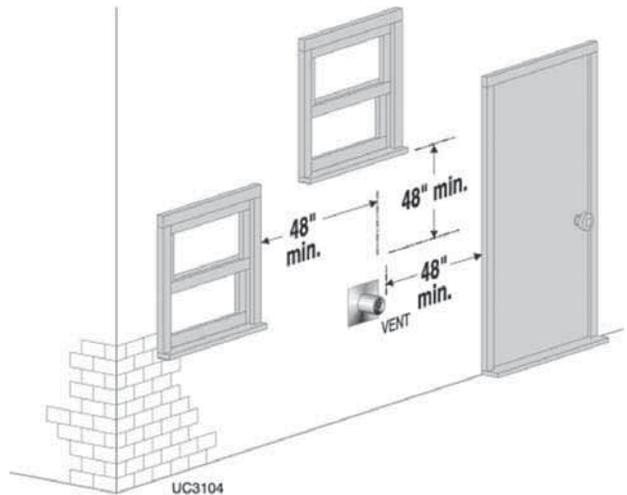
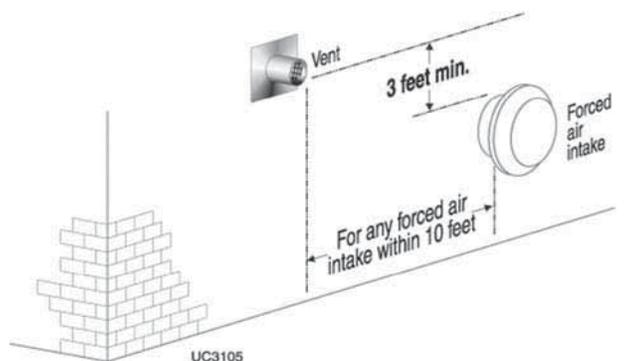


Figure 26 DIRECT EXHAUST — Sidewall — clearances from vent exit to forced air intake



- e. Do not locate the terminations where wind eddies could affect performance, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards or other recessed areas.
- f. Do not terminate above any door or window or under a deck. Condensate can freeze, causing ice formations.
- g. Locate or guard vent to prevent condensate damage to exterior finishes.



DIRECT EXHAUST — Sidewall *(continued)*

3. Maintain clearances as shown in the illustrations in this manual section. Also maintain the following:
 - a. Vent must terminate:
 - At least 6 feet from adjacent walls.
 - No closer than 5 feet below roof overhang.
 - At least 3 feet above any forced air intake within 10 feet.
 - No closer than 48 inches below or horizontally from any door or window or any other gravity air inlet.
 - b. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment.
4. Because the Ultra-550 and Ultra-750 are Category IV appliances, the National Fuel Gas Code, ANSI Z223.1, requires that the vent must not terminate over a public walkway or over an area where condensate or vapor could create a nuisance or hazard, or could be detrimental to the operation of regulators, relief valves, or other equipment.
5. Where the vent penetrates an outside wall, the annular space around the penetration must be permanently sealed using approved materials to prevent entry of combustion products into the building.
6. Locate termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.
7. Do not connect any other appliance to the vent pipe. Do not connect multiple boilers to a common vent pipe.

Completing the vent piping

1. Install vent penetrations as explained in the following pages before installing vent piping from the boiler to the terminations.
2. Insert piping from boiler vent connections, then attach exterior termination piping.
3. Follow instructions beginning on page 46 to complete piping from boiler to termination.

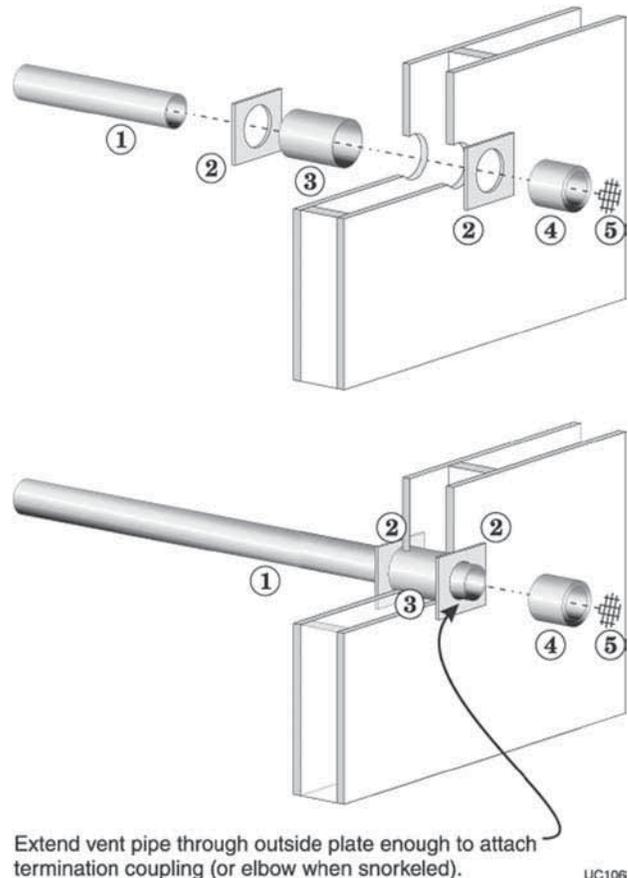
Multiple vent terminations

1. When terminating multiple direct exhaust Ultra boilers, terminate each vent connection as described in this manual for individual vents. Space terminations as required for best installation practices and required maintenance.

Prepare wall penetrations

1. Vent pipe penetration:
 - a. Cut a hole for the vent pipe. For either combustible or non-combustible construction, size the vent pipe hole at least 0.4" larger than the vent pipe diameter:
 - 7" hole for 6" PVC
 - 9" hole for 8" PVC
 - b. Insert a galvanized metal thimble in the vent pipe hole as shown in Figure 40.
2. Use metal cover plates at wall penetrations.
3. Follow all local codes for isolation of vent pipe when passing through floors or walls.
4. Seal exterior openings thoroughly with exterior caulk.

Figure 27 DIRECT EXHAUST — Sidewall — termination assembly — all parts by installer



1 Vent piping	4 Vent elbow
2 Cover plates	5 Bird screen
3 Galvanized thimble	

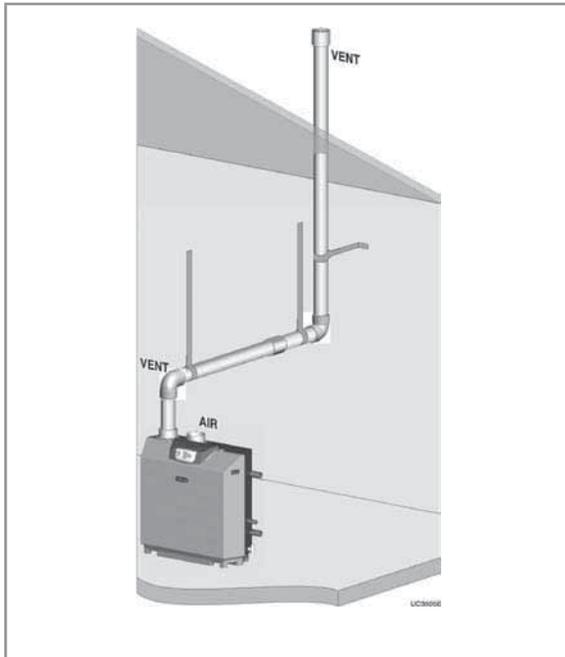
Termination and fittings

1. Prepare the vent termination elbow (Figure 24, page 33) by inserting a bird screen. Bird screens are supplied with the boiler, and may have to be trimmed to size for smaller vents.
2. You can install the vent termination using either of the configurations shown in Figure 24, page 33.
3. Maintain the required dimensions of the finished termination piping as shown in Figure 24, page 33.
4. Do not extend exposed vent pipe outside of the building more than shown in this document. Condensate could freeze and block vent pipe.



DIRECT EXHAUST — Vertical

Figure 28 DIRECT EXHAUST vertical termination



DIRECT EXHAUST — Vertical termination — installation sequence

- Step 1** Install the boiler.
- Step 2** Determine the proper location for wall penetration for each termination.
 - Prepare roof penetrations before installing vent piping.
 - Finish by attaching external pipe and fittings as shown in the termination instructions.
 - Install terminations as described in this manual.
 - Support vertical runs on the outside of the building with brackets as shown in the termination instructions.
- Step 3** Install vent piping from boiler to termination.
 - Install a hanger support within 6 inches of any upturn in the piping.
 - Slope horizontal piping downward toward the boiler at least 1/4 inch per foot.
- Step 4** Connect the vent piping at the boiler per manual instructions.

Allowable vent pipe materials

1. Use only the materials listed in Figure 20, page 27.
2. Install a bird screen in each vent termination (coupling or elbow). Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.

Maximum piping length

1. Locate the terminations such that the total vent piping from the boiler to the termination will not exceed the maximum length given in Figure 29.
2. Maximum lengths listed in Figure 29 allow for 2 elbows. Additional elbows require a reduction in maximum length as explained in the table notes.

Connecting from termination to boiler

1. Install the termination as instructed in the following. Then proceed to page 46 to complete the vent piping between the termination and the boiler.

Figure 29 Maximum piping lengths for DIRECT EXHAUST vertical termination

Boiler Ultra—	Maximum piping 6-inch diameter		Maximum piping 8-inch diameter *	
	Feet	Elbows **	Feet	Elbows **
550	100	2	Not allowed	
750	30	2	100	2

* Install a pipe reducer to adapt from 6" PVC to the 8" PVC pipe size required at the boiler. You do not have to reduce allowable pipe length for the reducer. Install reducer directly at the boiler, oriented vertically.

** For piping using more than 2 elbows, reduce maximum allowable length:

- 7 feet for each additional 6-inch or 8-inch elbow (90° or 45°)

Determine location for vertical termination

1. Locate the vent termination using the following guidelines:
2. The vent piping must terminate in a coupling as shown in Figure 30, page 36.
3. Consider the surroundings when terminating the vent:
 - a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
 - b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
 - c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
 - d. Avoid possibility of accidental contact of flue products with people or pets.
 - e. Do not locate the termination where wind eddies could affect performance or cause recirculation, such as inside building corners,

DIRECT EXHAUST — Vertical *(continued)*

near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards or other recessed areas.

- f. Locate or guard vent to prevent condensate damage to exterior finishes.
4. Maintain clearances as shown in the illustrations in this manual section. Also maintain the following:
 - a. Vent must terminate:
 - At least 12 inches above roof or snow line as shown in Figure 30.
 - At least 6 feet from adjacent walls.
 - No closer than 5 feet below roof overhang.
 - At least 3 feet above any forced air intake within 10 feet.
 - No closer than 48 inches below or horizontally from any door or window or any other gravity air inlet.
 - b. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment.
5. Where the vent penetrates the roof, the annular space around the penetration must be permanently sealed using approved materials to prevent entry of combustion products into the building.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.
7. Do not connect any other appliance to the vent pipe. Do not connect multiple boilers to a common vent pipe.

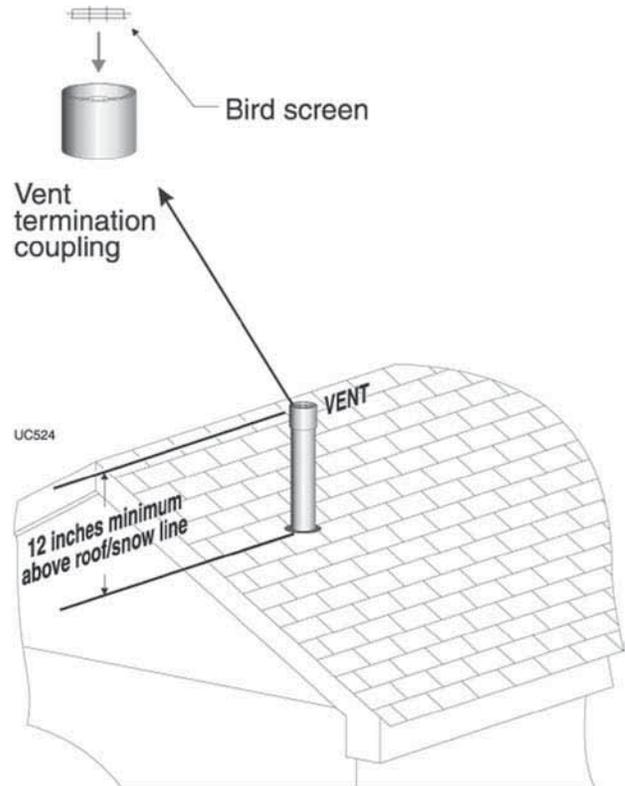
Prepare roof penetrations

1. Vent pipe penetration:
 - a. Cut a hole for the vent pipe. For either combustible or non-combustible construction, size the vent pipe hole at least 0.5" larger than the vent pipe diameter:
 - 7" hole for 6" PVC.
 - 9" hole for 8" PVC.
 - b. Insert a galvanized metal thimble in the vent pipe hole.
2. Follow all local codes for isolation of vent pipe when passing through floors, ceilings and roofs.
3. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Termination and fittings

1. Prepare the vent termination coupling (Figure 30) by inserting a bird screen. Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.

Figure 30 DIRECT EXHAUST — Vertical termination



2. The vent piping must terminate in a coupling as shown in Figure 30.
3. Maintain the required dimensions of the finished termination piping as shown in Figure 30.
4. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

Multiple vent terminations

1. When terminating multiple Ultra boilers, terminate each vent connection as described in this section. Space terminations as required for best installation practices and required maintenance.

DIRECT VENT — Boiler room air openings

Combustion/ventilation air provision

For direct vent installations, combustion air must be ducted directly from outside to the Ultra boiler air intake fitting. Two options are available: side-wall or vertical direct vent. Though combustion air is ducted to the Ultra boiler, the boiler room will still require air openings, either for ventilation or for combustion air for other appliances plus ventilation.

Sizing air openings

Air openings provide for ventilation (as well as combustion air) to prevent overheating of the boiler controls and boiler space. Air is also needed for other appliances located in the same space.

Use Figure 32, page 38, selecting the appropriate installation conditions.

⚠ WARNING Air openings must be sized to handle all appliances and air movers (exhaust fans, etc.) using the air supply.

The sizing given in Figure 32, page 38 is based on the National Fuel Gas Code, ANSI Z223.1, allowing adequate air opening for gravity-vented gas appliances (Category I) when located in the same space as the Ultra boiler.

When outside air is ducted as directed in this manual, the Ultra boiler is rated as direct vent (pressurized vent), and has varying requirements for combustion and ventilation air, reflected by the special sizing instructions given in Figure 32, page 38.

The air openings recommended in Figure 32, page 38 will allow adequate ventilation and combustion air provided the boiler room is not subjected to negative pressure due to exhaust fans or other mechanical ventilation devices. Refer to the National Fuel Gas Code for dealing with other conditions.

Louver allowance

The free area of openings means the area **after reduction for any installed louvers or grilles**. Be sure to consider this reduction when sizing the air openings.

Special considerations

Tight construction

ANSI Z223.1 defines unusually tight construction where:

1. Walls and ceilings exposed to the outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed, and . . .
2. Weather-stripping has been added on openable windows and doors, and . . .
3. Caulking or sealants are applied to areas such as joints around windows and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and in other openings.

For buildings with such construction, provide air openings into the building from outside, sized per the appropriate case in Figure 32, page 38 if appliances are to use inside air for combustion and ventilation.

Exhaust fans and air movers

The appliance space must never be under a negative pressure unless all appliances are installed as direct vent. Always provide air openings sized not only to the dimensions required for the firing rate of all appliances,

but also to handle the air movement rate of the exhaust fans or air movers using air from the building or space.

Motorized air dampers

If the air openings are fitted with motorized dampers, electrically interlock the damper to:

- Prevent the boiler from firing if the damper is not fully open.
- Shut the boiler down should the damper close during boiler operation.

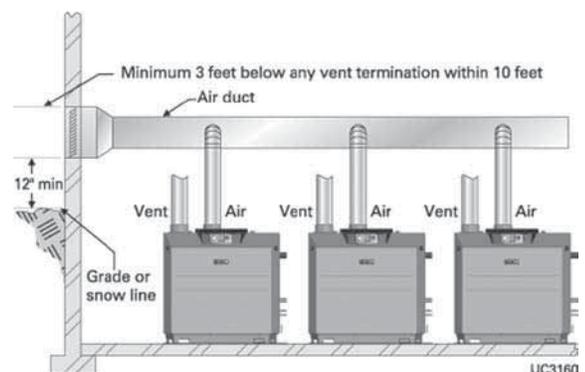
To accomplish this interlock, wire an **isolated contact** (proving the damper open) in series with the thermostat input to the boiler. The boiler will not start if this contact is open, and will shut down should it open during operation.

Manifolded combustion air option

1. Multiple Ultra boilers can use a common combustion air manifold.
 - a. See Figure 99, page 110 for minimum cross sectional area of combined air ducts.
 - b. Provide minimum clearance to adjacent vents and grade/snow line as shown in Figure 31.
 - c. Provide minimum free area in duct (adjusted for louver restriction) of **1 square inch per 2,000 Btuh** total boiler input, or divide the total MBH (1000's Btuh) by 2.
 - d. Example: For an MBS system with total input of 3,000,000 Btuh, or 3,000 MBH: Divide 3,000 by 2 = 1500 square inches minimum for a combined air duct.
 - e. If combustion air damper is used, wire to boilers to prevent operation except after damper has opened (see Motorized air dampers, above).

⚠ WARNING ONLY air piping can be combined. DO NOT use combined vent piping. Flue gas leakage and boiler component damage can occur. Failure to comply could result in severe personal injury, death or substantial property damage.

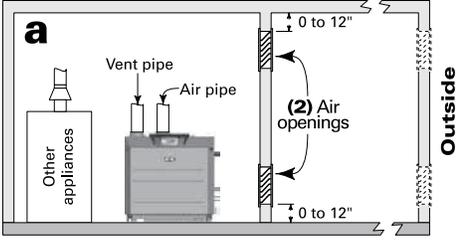
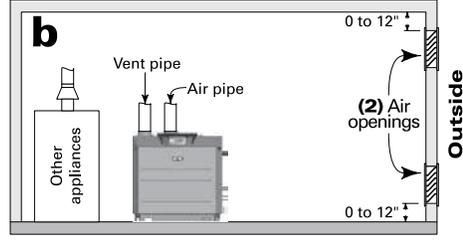
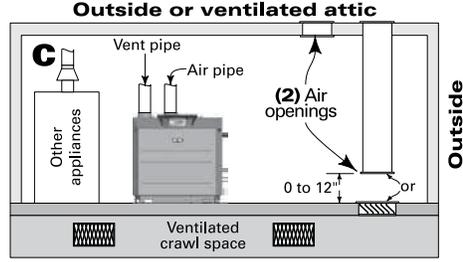
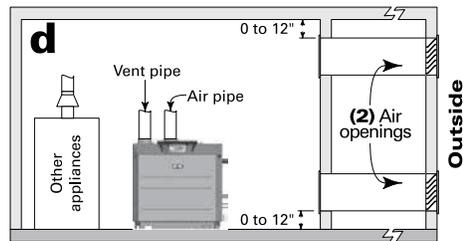
Figure 31 Manifolded combustion air option





DIRECT VENT — Boiler room air openings *(continued)*

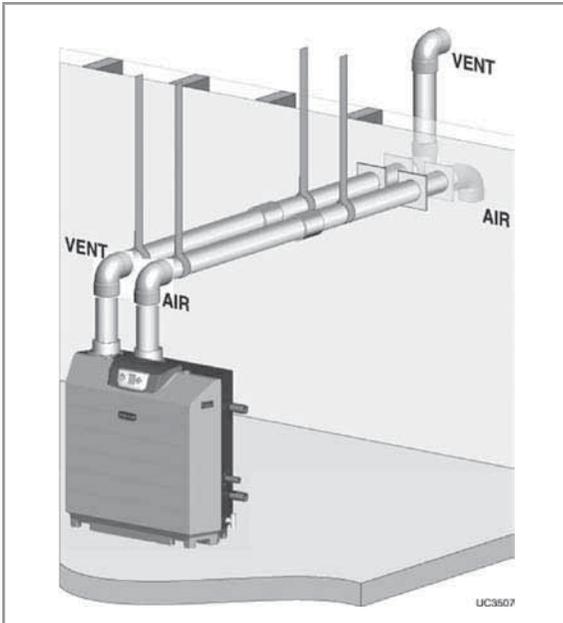
Figure 32 MINIMUM combustion air openings for direct vent applications — ALL OPENING SIZES ARE FREE AREA

<p>Air openings</p> <p>The required air opening sizes below are FREE AREA, after reduction for louver obstruction. Note the exception below for large spaces.</p>	<p>Ultra boiler WITH other appliances in room</p>	<p>Ultra boiler WITHOUT other appliances in room</p>
	<p>TWO openings, each at least: 1 square inch per 1,000 Btuh of all other appliances in the room</p>	<p>NO openings are required if the boiler installation provides at least the Recommended service clearances shown on page 6.</p> <p>If the space is smaller, provide ONE opening to a larger room with at least 1 square inch per 3,000 Btuh of Ultra boiler input.</p>
	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all other appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all other appliances in the room</p>	<p>NO openings are required if the boiler installation provides at least the Recommended service clearances shown on page 6.</p> <p>If the space is smaller, provide ONE opening to a larger room with at least 1 square inch per 3,000 Btuh of Ultra boiler input.</p>
<p>Outside or ventilated attic</p> 	<p>TWO openings, each at least: 1 square inch per 2,000 Btuh of all other appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all other appliances in the room</p>	<p>NO openings are required if the boiler installation provides at least the Recommended service clearances shown on page 6.</p> <p>If the space is smaller, provide ONE opening to a larger room with at least 1 square inch per 3,000 Btuh of Ultra boiler input.</p>
	<p>TWO openings, each at least: 1 square inch per 4,000 Btuh of all other appliances in the room — OR — ONE opening **, each at least: 1 square inch per 3,000 Btuh of all other appliances in the room</p>	<p>NO openings are required if the boiler installation provides at least the Recommended service clearances shown on page 6.</p> <p>If the space is smaller, provide ONE opening to a larger room with at least 1 square inch per 3,000 Btuh of Ultra boiler input.</p>
<p>** NOTICE: Requirements for using the SINGLE air opening option.</p>	<p>A single combustion air opening can be used for cases b, c or d above, sized as listed, provided that:</p> <ul style="list-style-type: none"> • The single opening must communicate directly to the outdoors or to a space that communicates directly with outdoors (NOT to an interior space). • The top of the opening must be within 12 inches of the ceiling. • The free area of the opening must be at least equal to the sum of the areas of all equipment vent connectors in the space. 	
<p>SPECIAL EXCEPTION FOR LARGE SPACES:</p>	<p>NO combustion air openings are needed when the boiler (and other appliances) are installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btuh of all appliances in the space. That is, total the input of all appliances in MBH (1,000's of Btuh), then multiply this total times 50. The building MUST NOT be of tight construction.</p> <p>Example: For a total input of 1500 MBH (1,500,000 Btuh) and an 8-foot ceiling height, the minimum volume would be 50 x 1500 x 8 = 60,000 cubic feet.</p>	



DIRECT VENT — Sidewall

Figure 33 DIRECT VENT sidewall termination



DIRECT VENT — Sidewall termination with separate vent and air pipes — installation sequence

- Step 1** Install the boiler.
- Step 2** Determine the proper location for wall penetration for each termination.
 - Prepare wall penetrations before installing vent and air piping.
 - Finish by attaching external pipe and fittings as shown in the termination instructions.
 - Install termination assembly as described in this manual.
 - Support vertical runs on the outside of the building with brackets as shown in the termination instructions.
- Step 3** Install air and vent piping from boiler to termination.
 - Install a hanger support within 6 inches of any upturn in the piping.
 - Slope horizontal piping downward toward the boiler at least 1/4 inch per foot.
- Step 4** Connect the vent and air piping at the boiler per manual instructions.

Allowable vent/air pipe materials

1. Use only the materials listed in Figure 20, page 27.
2. Install a bird screen in each vent and air pipe termination. Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.

Maximum piping length

1. Locate the terminations such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 34.
2. Maximum lengths listed in Figure 34 allow for 2 elbows. Additional elbows require a reduction in maximum length as explained in the table notes.

Connecting from termination to boiler

1. Install the terminations as instructed in the following. Then proceed to page 46 to complete the air and vent piping between the termination and the boiler.

Figure 34 Maximum piping lengths for DIRECT VENT sidewall termination

Boiler Ultra—	Maximum piping 6-inch diameter		Maximum piping 8-inch diameter *	
	Feet	Elbows **	Feet	Elbows **
550	100	2	Not allowed	
750	30	2	100	2

* Install pipe reducers to adapt from 6" PVC to the 8-inch PVC pipe size required at the boiler for both air and vent connections. You do not have to reduce allowable pipe length for the reducers. Install reducers directly at the boiler, oriented vertically.

** For piping using more than 2 elbows, reduce maximum allowable length:
 • 7 feet for each additional 6-inch or 8-inch elbow (90° or 45°)

Determine location for termination

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below building extensions such as eaves, parapets, balconies or decks, except as otherwise instructed in this manual or local codes. Failure to comply could result in severe personal injury, death or substantial property damage.

1. Place the vent/air terminations using the following guidelines.
2. The vent and air piping must terminate as shown in Figure 35, page 40. (The elbow at the exit opening must butt against the outside wall plate.) This arrangement avoids recirculation of flue products into the combustion air stream.
 - a. Apply the configuration on the left side of Figure 35 unless the terminations would fail to meet minimum clearance to grade or snow line.

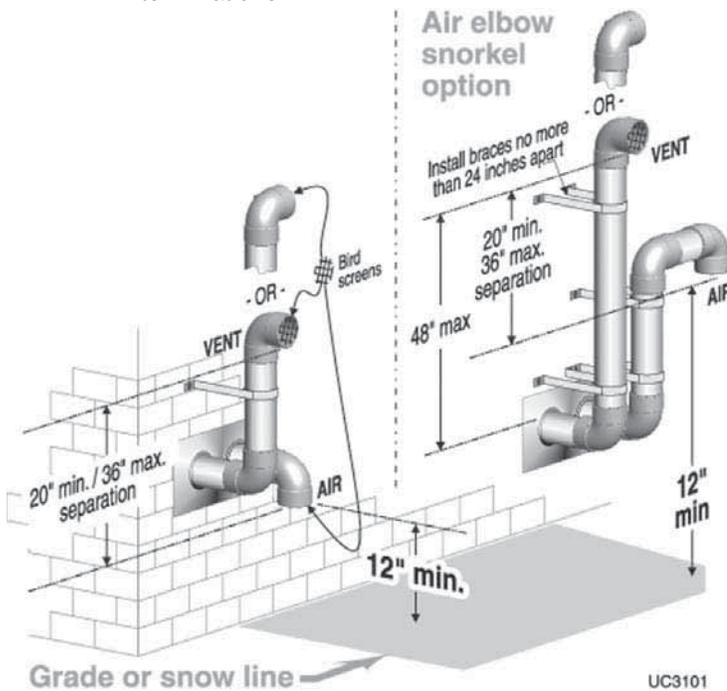


DIRECT VENT — Sidewall *(continued)*

- b. Apply the configuration on the right side of Figure 35 when the terminations need to be raised higher to meet clearance to grade or snow line.
 - c. The vent and air pipes may run up as high as 4 feet, as shown in Figure 35 right side with no enclosure. The vent and air pipes must be secured with braces, and all clearances and lengths must be maintained. Space braces no further than 24 inches apart. (See WARNING below for extremely cold climates.)
 - d. External venting greater than 4 feet requires an enclosure around the vent and air pipes. The vent and air terminations must exit through the enclosure as shown in Figure 35, maintaining all required clearances.
3. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in Figure 35.

WARNING Do not exceed the maximum lengths of the outside vent piping shown in Figure 35. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown. In extremely cold climates, install an insulated chase around the vent piping, particularly when using longer lengths. The chase must allow for inspection of the vent pipe, and insulation must be protected from water.

Figure 35 DIRECT VENT — Sidewall — configuration options and minimum clearances from vent to air terminations



4. Consider the surroundings when terminating the vent and air:
- a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
 - b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.

Figure 36 Sidewall termination with separate pipes — clearances to openings

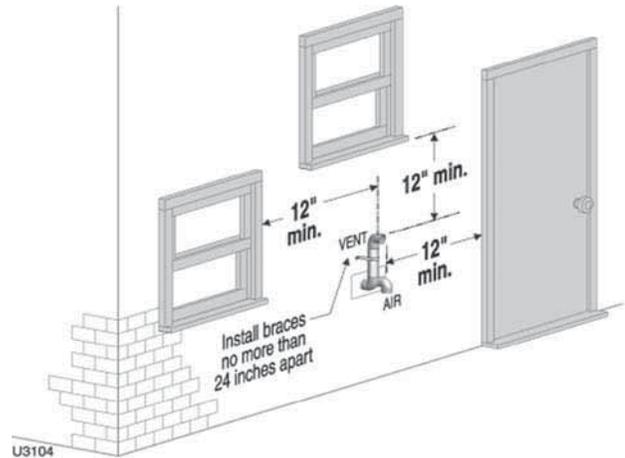
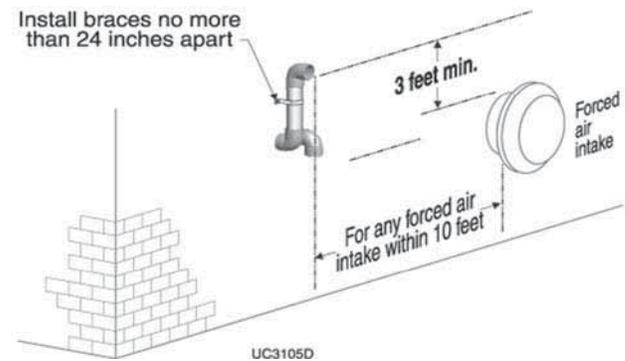


Figure 37 Sidewall termination with separate pipes — clearances from vent exit to forced air intake



CAUTION Terminating with the vent elbow sideways instead of pointed away from the building can result in the possibility of ice build-up on the side of the building.

NOTICE If the vent/air pipes are extended out beyond the wall, install a coupling at the exit opening, with the coupling butted against the outside plate. Then continue vent/air piping from the coupling.

DIRECT VENT — Sidewall *(continued)*

- c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
 - d. Avoid possibility of accidental contact of flue products with people or pets.
 - e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards or other recessed areas.
 - f. Do not terminate above any door or window or under a deck. Condensate can freeze, causing ice formations.
 - g. Locate or guard vent to prevent condensate damage to exterior finishes.
5. Maintain clearances as shown in the illustrations in this manual section. Also maintain the following:
 - a. Vent must terminate:
 - At least 6 feet from adjacent walls.
 - No closer than 5 feet below roof overhang.
 - At least 3 feet above any forced air intake within 10 feet.
 - b. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment.
 6. Because the Ultra-550 and Ultra-750 are condensing appliances, the National Fuel Gas Code, ANSI Z223.1, requires that the vent must not terminate over a public walkway or over an area where condensate or vapor could create a nuisance or hazard, or could be detrimental to the operation of regulators, relief valves, or other equipment.
 7. Where the vent or air pipe penetrates an outside wall, the annular space around the penetration must be permanently sealed using approved materials to prevent entry of combustion products into the building.
 8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.
 9. Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe.

Completing the vent/air piping

1. Install vent/air penetrations as explained in the following pages before installing vent and air piping from the boiler to the terminations. Insert piping from boiler air and vent connections, then attach exterior termination piping.
2. Follow instructions beginning on page 46 to complete piping from boiler to termination.

Multiple vent/air terminations

1. When terminating multiple Ultra boilers, terminate each vent/air connection as described in this manual.

- WARNING** All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death or substantial property damage.
2. Place wall penetrations to obtain minimum clearance of 12 inches between vent pipe and adjacent air inlet elbow, as shown in Figure 38, page 41 for U. S. installations.
 3. For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code.

Figure 38 Multiple terminations — separate pipes — clearance from vent of one to air intake of the next

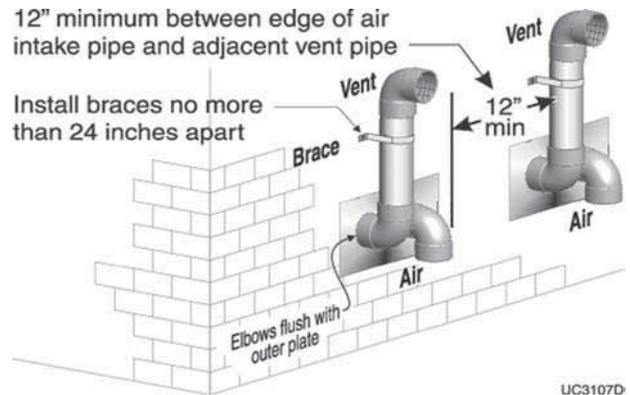
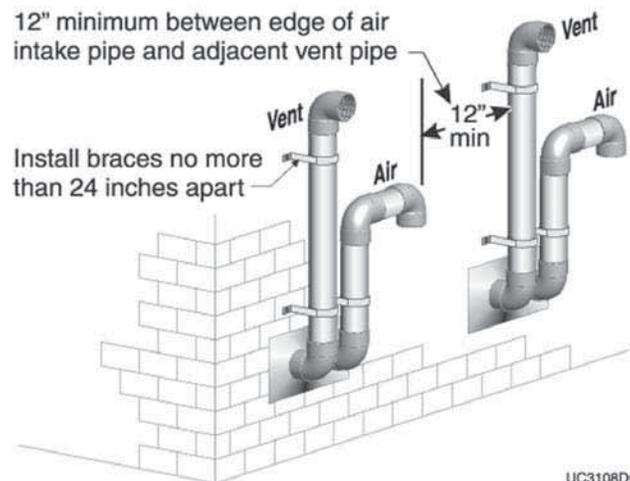


Figure 39 Multiple terminations — separate pipes — clearance from vent of one to air intake of the next — alternate configuration of air and vent terminations



NOTICE If the vent/air pipes are extended out beyond the wall, install a coupling at the exit opening, with the coupling butted against the outside plate. Then continue vent/air piping from the coupling.



DIRECT VENT — Sidewall *(continued)*

4. The air inlet of an Ultra boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.
5. Combustion air (NOT vent piping) can be manifolded as shown in Figure 31, page 37.

Prepare wall penetrations

1. Air pipe penetration:
 - a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
 - a. Cut a hole for the vent pipe. For either combustible or non-combustible construction, size the vent pipe hole at least 0.4" larger than the vent pipe diameter:
 - 7" hole for 6" PVC
 - 9" hole for 8" PVC
 - b. Insert a galvanized metal thimble in the vent pipe hole as shown in Figure 40.
3. Sidewall termination plates must be provided by the installer.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

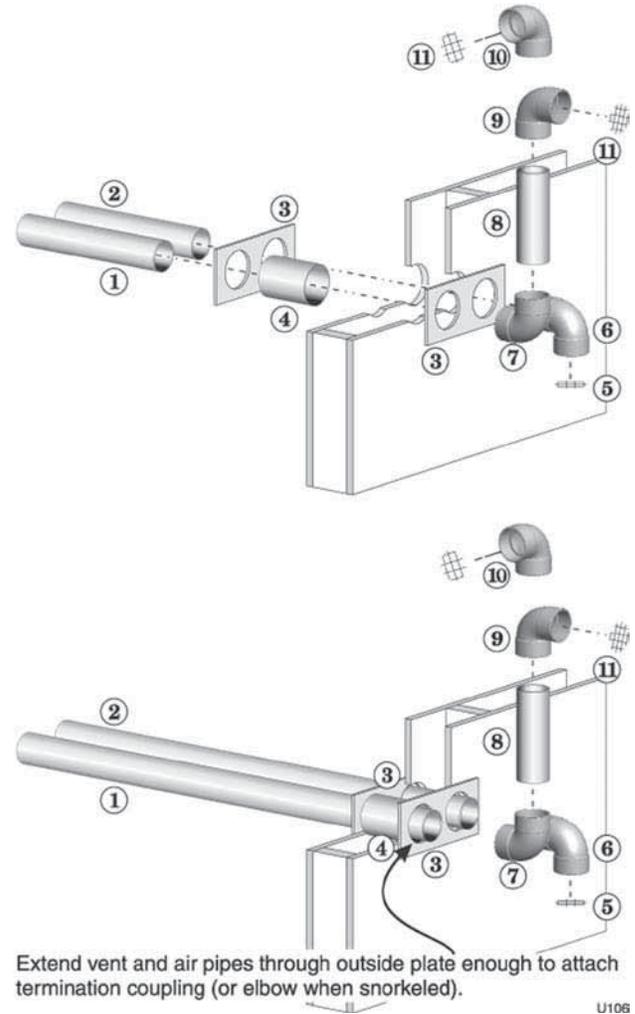
Termination and fittings

1. Prepare the vent termination elbow and the air termination elbow (Figure 40, page 42) by inserting a bird screen in each. Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.
2. When completed, the air termination elbow must be oriented at least 20 inches (and no more than 36 inches) below the vent termination, and at least 12 inches above grade or snow line as shown in Figure 35, page 40.
3. You can orient the vent termination elbow either directly outward or 90 degrees away from the air inlet elbow as shown in Figure 35, page 40.
4. Maintain the required dimensions of the finished termination piping as shown in Figure 35, page 40.
5. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

NOTICE If the vent/air pipes are extended out beyond the wall, install a coupling at the exit opening, with the coupling butted against the outside plate. Then continue vent/air piping from the coupling.

WARNING Do not exceed the maximum lengths of the outside vent piping shown in Figure 35, page 40. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown. In extremely cold climates, install an insulated chase around the vent piping, particularly when using longer lengths. The chase must allow for inspection of the vent pipe, and insulation must be protected from water.

Figure 40 DIRECT VENT — Sidewall — termination assembly (all parts by installer, except the bird screens)



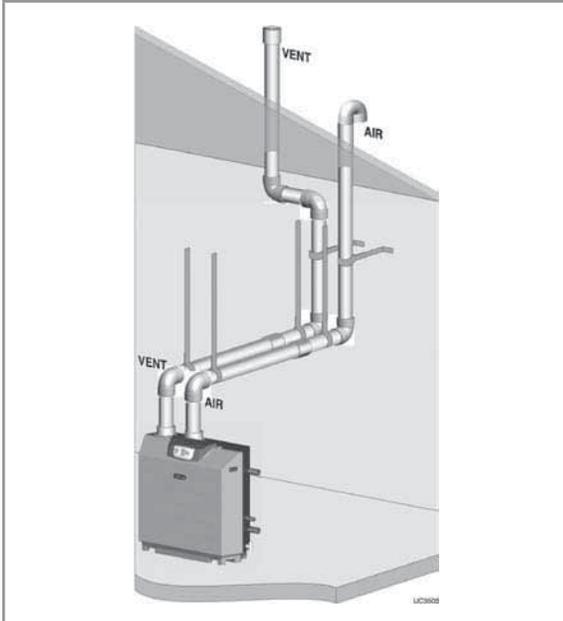
Extend vent and air pipes through outside plate enough to attach termination coupling (or elbow when snorkeled).

1 Vent piping	7 Elbow
2 Air piping	8 Nipple
3 Cover plates	9 Elbow (vent termination)
4 Galvanized thimbles	10 Alternate elbow orientation
5 Bird screen (air)	11 Bird screen (vent termination)
6 Air inlet elbow	



DIRECT VENT — Vertical

Figure 41 DIRECT VENT vertical termination



DIRECT VENT — Vertical termination with separate vent and air pipes — installation sequence

- Step 1** Install the boiler.
- Step 2** Determine the proper location for wall penetration for each termination.
 - Prepare roof penetrations before installing vent and air piping.
 - Finish by attaching external pipe and fittings as shown in the termination instructions.
 - Install terminations as described in this manual.
 - Support vertical runs on the outside of the building with brackets as shown in the termination instructions.
- Step 3** Install air and vent piping from boiler to termination.
 - Install a hanger support within 6 inches of any upturn in the piping.
 - Slope horizontal piping downward toward the boiler at least 1/4 inch per foot.
- Step 4** Connect the vent and air piping at the boiler per manual instructions.

Allowable vent/air pipe materials

1. Use only the materials listed in Figure 20, page 27.
2. Install a bird screen in each vent and air pipe termination. Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.

Maximum piping length

1. Locate the terminations such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 42.
2. Maximum lengths listed in Figure 42 allow for 2 elbows. Additional elbows require a reduction in maximum length as explained in the table notes.

Connecting from termination to boiler

1. Install the terminations as instructed in the following. Then proceed to page 46 to complete the air and vent piping between the termination and the boiler.

Figure 42 Maximum piping lengths for DIRECT VENT vertical termination

Boiler Ultra—	Maximum piping 6-inch diameter		Maximum piping 8-inch diameter *	
	Feet	Elbows **	Feet	Elbows **
550	100	2	Not allowed	
750	30	2	100	2

* Install pipe reducers to adapt from 6" PVC to the 8-inch PVC pipe size required at the boiler for both air and vent connections. You do not have to reduce allowable pipe length for the reducers. Install reducers directly at the boiler, oriented vertically.

** For piping using more than 2 elbows, reduce maximum allowable length:
 • 7 feet for each additional 6-inch or 8-inch elbow (90° or 45°)

Determine location for vertical terminations

1. Locate the vent/air terminations using the following guidelines:
2. The air piping must terminate in a down-turned 180-degree return bend as shown in Figure 43, page 44. Locate the air inlet pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
3. The vent piping must terminate in an up-turned coupling as shown in Figure 43, page 44. The top of the coupling must be at least 1 foot above the air intake. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet apart and with the vent termination at least 1 foot above the air intake.

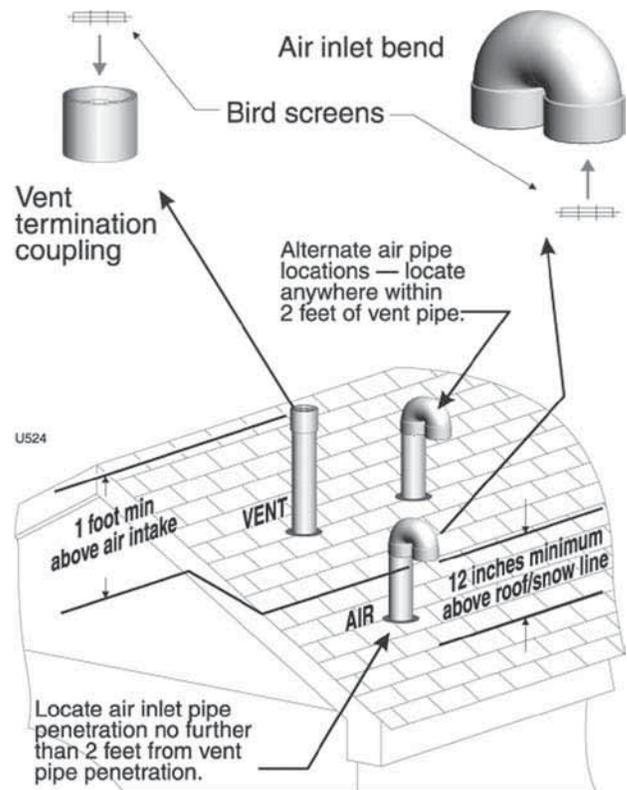
DIRECT VENT — Vertical *(continued)*

4. Consider the surroundings when terminating the vent and air:
 - a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
 - b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
 - c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
 - d. Avoid possibility of accidental contact of flue products with people or pets.
 - e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards or other recessed areas.
 - f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
 - g. Locate or guard vent to prevent condensate damage to exterior finishes.
 - h. Maintain clearances to vent termination as given below:
 - i. Vent must terminate:
 - At least 6 feet from adjacent walls.
 - No closer than 5 feet below roof overhang.
 - At least 3 feet above any forced air intake within 10 feet.
 - No closer than 12 inches below or horizontally from any door or window or any other gravity air inlet.
 - j. Air inlet must terminate at least 12 inches above the roof or snow line and at least 12 inches below the vent termination as shown in Figure 43.
 - k. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment.
5. Where the vent or air pipe penetrates the roof, the annular space around the penetration must be permanently sealed using approved materials to prevent entry of combustion products into the building.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.
7. Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe.

Prepare roof penetrations

1. Air pipe penetration:
 - a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
 - a. Cut a hole for the vent pipe. For either combustible or non-combustible construction, size the vent pipe hole at least $\frac{1}{2}$ " larger than the vent pipe diameter:
 - 7" hole for 6" PVC or 9" for 8" PVC.
 - b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes to provide the minimum spacings shown in Figure 43, page 44.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Figure 43 Vertical termination — separate pipes



DIRECT VENT — Vertical *(continued)*

Termination and fittings

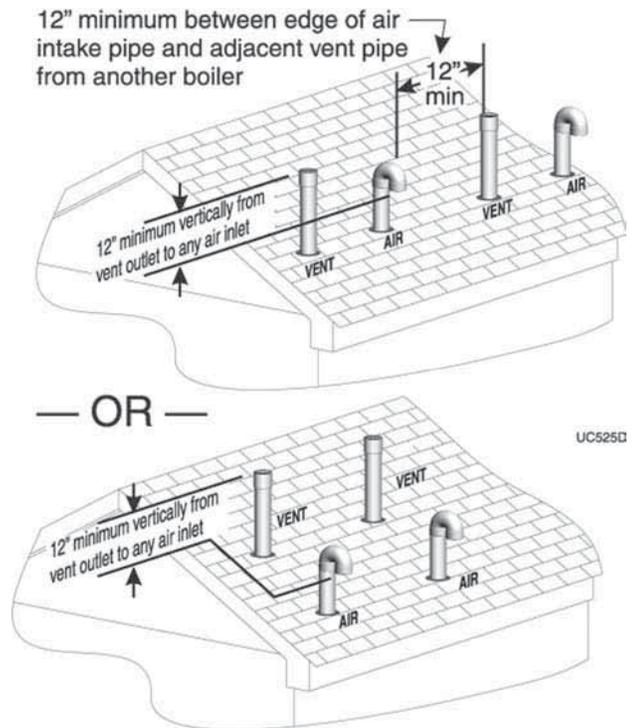
1. Prepare the vent termination coupling and the air termination return bend (Figure 43, page 44) by inserting a bird screen in each. Bird screens are supplied with the boiler. Cut to size if necessary to fit vent pipe size used.
2. The air piping must terminate in a down-turned 180-degree return bend as shown in Figure 43, page 44. Locate the air inlet pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
3. The vent piping must terminate in an up-turned coupling as shown in Figure 43, page 44.
 - a. Vent must terminate:
 - At least 6 feet from adjacent walls.
 - No closer than 5 feet below roof overhang.
 - At least 3 feet above any forced air intake within 10 feet.
 - No closer than 12 inches below or horizontally from any door or window or any other gravity air inlet.
4. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet apart and with the vent termination at least 1 foot above the air intake.
5. Maintain the required dimensions of the finished termination piping as shown in Figure 43, page 44.
6. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

Multiple vent/air terminations (Figure 44)

1. When terminating multiple Ultra boilers, terminate each vent/air connection as described in this section.

- WARNING** Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death or substantial property damage.
2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another boiler for U. S. installations (see Figure 2). For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code.
 3. The air inlet of an Ultra boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 44 Termination location — separate pipes — terminations for multiple boilers



Install vent/air piping — from termination to boiler

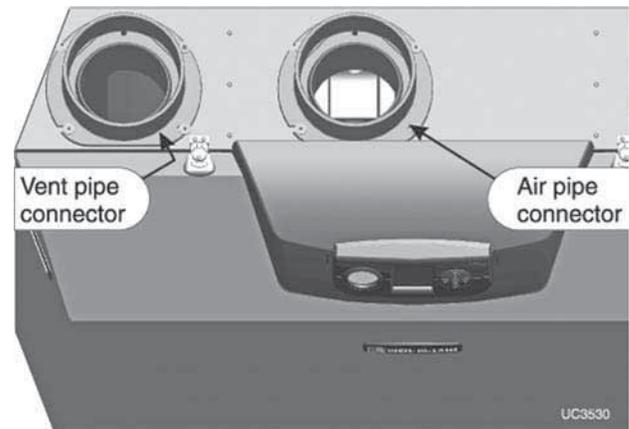
Complete termination preparation

1. Install vent and air terminations before proceeding. See previous pages for instructions.

Installing vent and air piping

1. For reference in the following see:
 - a. DIRECT EXHAUST — Sidewall terminations: see Figure 22, page 32.
 - b. DIRECT EXHAUST — Vertical terminations: see Figure 30, page 36.
 - c. DIRECT VENT — Sidewall terminations: see Figure 33, page 39.
 - d. DIRECT VENT — Vertical terminations: see Figure 41, page 43.
2. Work from the boiler to vent or air termination. Do not exceed the lengths given in the previous pages for either the air or vent piping.
 - a. As shown in the maximum length tables, the Ultra-550 must be installed with only 6-inch vent and air piping.
 - b. As shown in the maximum length tables, the Ultra-750 may be installed with either 6-inch or 8-inch vent and air piping.
 - c. Ultra-750 only — Install appropriate pipe reducers, when required, at both the boiler vent and air connections. Install directly at the boiler, with reducer in the vertical orientation.
3. See Figure 45 for attaching vent and air pipes at the boiler.
4. Cut pipe to required lengths.
5. Deburr inside and outside of pipe ends.
6. Chamfer outside of each pipe end to ensure even cement distribution when joining.
7. Clean all pipe ends and fittings. Dry thoroughly.
8. Dry assemble entire vent or air piping to ensure proper fit before assembling any joint.
9. For each joint:
 - a. Handle fittings and pipes carefully to prevent contamination of surfaces.
 - b. Apply primer liberally to both joint surfaces — pipe end and fitting socket.
 - c. While primer is still damp, lightly apply approved cement to both surfaces in a uniform coating.
 - d. Apply a second coat to both surfaces. Avoid using too much cement on sockets to prevent cement buildup inside.
 - e. With cement still wet, insert pipe into fitting, twisting $\frac{1}{4}$ turn. Make sure pipe is fully inserted.
 - f. Wipe excess cement from joint. Check joint to be sure a smooth bead of cement shows around the entire joint.
10. Install pipe supports as shown in Figure 33, page 39 or Figure 41, page 43.
11. Slope vent and air piping continuously toward boiler, with at least $\frac{1}{4}$ inch drop per foot of run. Do not allow sags at any point.
12. Maintain minimum clearance of $\frac{3}{16}$ inch between vent pipe and any combustible wall or material.
13. Seal wall or floor penetration openings following local code requirements.

Figure 45 Boiler vent and air connections



Inserting/securing vent or air pipe into boiler connectors

1. Clean and chamfer insertion end of pipe. Deburr inside of insertion end.
2. Inspect boiler vent or air adapter (above) — verify no obstructions or foreign objects inside.
3. Measure $3\frac{1}{2}$ inches from end of pipe and make a mark with felt-tip pen.
4. For each joint:
 - a. Handle fittings and pipes carefully to prevent contamination of surfaces.
 - b. Apply primer liberally to both joint surfaces — pipe end and fitting socket.
 - c. While primer is still damp, lightly apply approved cement to both surfaces in a uniform coating.
 - d. Apply a second coat to both surfaces. Avoid using too much cement on sockets to prevent cement buildup inside.
 - e. With cement still wet, insert pipe into adapter, twisting $\frac{1}{4}$ turn. Make sure pipe is fully inserted.
 - f. Slide pipe down until the $3\frac{1}{2}$ -inch mark is reached.
 - g. Wipe excess cement from joint. Check joint to be sure a smooth bead of cement shows around the entire joint.



Use cement sparingly. Excessive cement can cause blockage of the condensate opening.



Do not apply excessive force or bend the adapter or flue/air pipe when inserting. The adapter could be damaged.

Install condensate components

Install condensate drain tee

1. See Figure 46.
2. Remove PVC fittings and gasket from the accessories bag.
3. Deburr and chamfer outside and inside of 1" PVC nipple (item 1) to ensure even cement distribution when joining.
4. Clean nipple ends and all fittings. Dry thoroughly.
5. For each joint in the condensate line, apply the following. Assemble parts ONLY in the order given.
 - a. Apply primer liberally to both joint surfaces — pipe end and fitting socket.
 - b. While primer is still damp, lightly apply approved cement to both surfaces in a uniform coating.
 - c. Apply a second coat of cement to both surfaces. Avoid using too much cement on sockets to prevent cement buildup inside.
 - d. With cement still wet, insert pipe into fitting, twisting $\frac{1}{4}$ turn. Make sure pipe is fully inserted.
 - e. Wipe excess cement from joint. Check joint to be sure a smooth bead of cement shows around the entire joint.
6. Assemble the 1" PVC nipple to the PVC condensate drain tee (item 2). Insert the nipple completely into the tee socket.
7. Allow joint to dry completely.
8. Slide the finished nipple/tee assembly into the condensate drain hole.
9. Slide the gasket (item 3) over the nipple.
10. Cement the 1" coupling (item 4) to the protruding 1" nipple. Press together FIRMLY to ensure the gasket is compressed for an air-tight seal. Hold in place long enough for the PVC cement to set.
11. See Figure 47 for completed assembly.

CAUTION Firmly press the coupling and the tee together while the cement sets to ensure the gasket is securely compressed. The gasket ensures the jacket enclosure is airtight at this location.

Figure 46 Condensate drain tee assembly

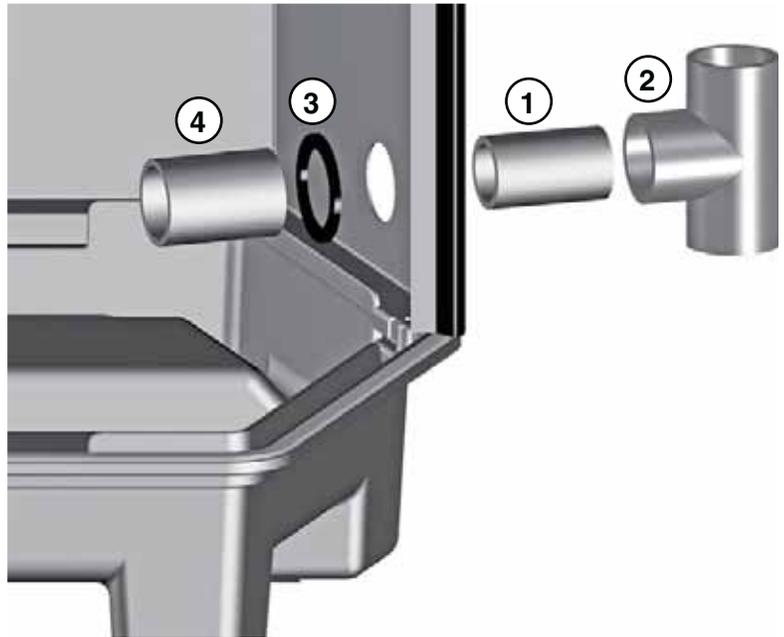
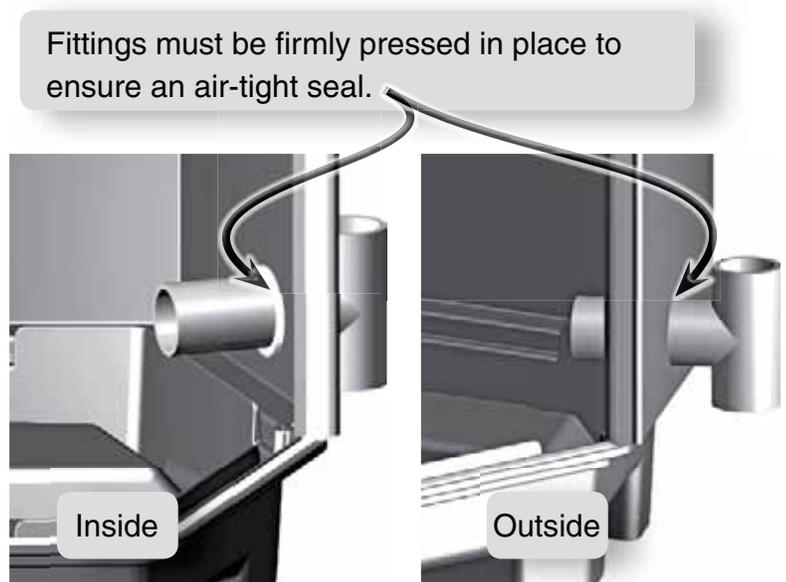


Figure 47 Condensate drain tee, completed





Install condensate components *(continued)*

Connect condensate trap

1. See Figure 49.
2. Remove the protector cap from the bottom of the PVC tee at the heat exchanger condensate connection (location 2).
3. Slide a hose clamp over each end of the condensate trap line.
4. Slide the ends of the line onto the bottom of the PVC tee at the heat exchanger condensate connection (location 2) and onto the PVC coupling on the right (location 1).
5. Slide the hose clamps into position and tighten securely.

Connect condensate line

1. Connect condensate drain tubing to the 1” PVC condensate tee and run to floor drain or condensate pump (see Figure 50). Use 1” PVC or CPVC pipe; or install a hose barb fitting and connect tubing.

NOTICE Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785, F441 or D2665. Cement and primer must comply with ASTM D2564 or F493. For Canada, use CSA or ULC certified PVC or CPVC pipe, fittings and cement.

2. Leave the top of the 1” tee OPEN. This is needed as a vacuum break.
3. When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. See Figure 48 for required flow capacity.
4. When sizing condensate pumps, make sure to include the total load of all Ultra boilers connected to it.

CAUTION The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manor, condensate can exit from the boiler tee, resulting in potential water damage to property.

NOTICE Condensate from the Ultra boiler will be slightly acidic (typically with a pH from 3.2 to 4.5). Install a neutralizing filter if required by local codes. See Replacement parts section at the end of this manual for the Weil-McLain kit.

Figure 49 Condensate trap installed (shown with inlet air silencer hidden)

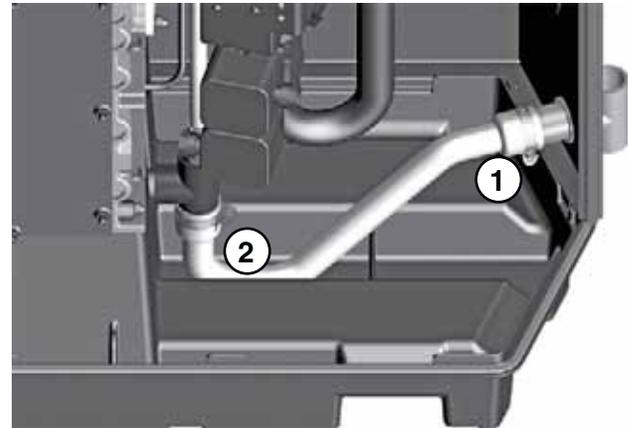


Figure 50 Condensate pump (by others), typical

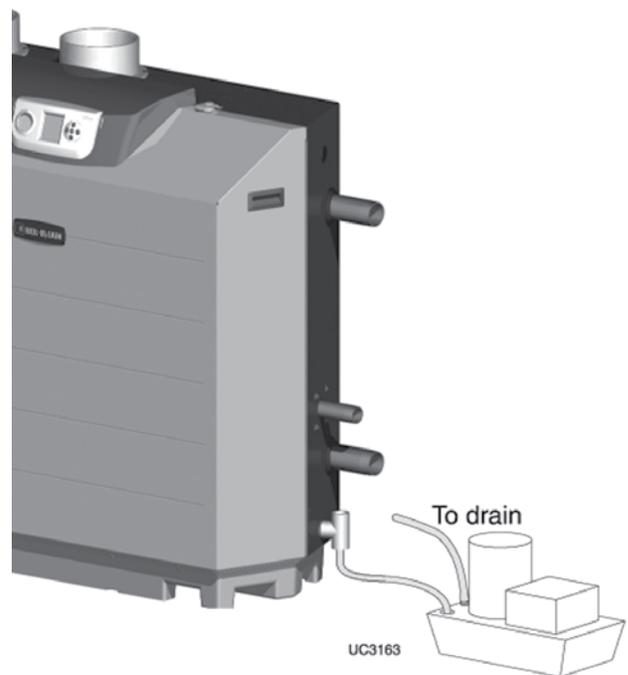


Figure 48 Condensate pump capacity, GPH

Minimum recommended condensate pump capacity per boiler, GPH			
Ultra-550	14	Ultra-750	20

NOTICE For a condensate pump equipped with an overflow switch, the switch can be connected to the external manual reset or automatic reset limit terminals of the U-Control. This would shut down the boiler in the event of a condensate overflow. See the wiring diagram for location of the wiring terminals.



Gas piping

Connecting gas supply piping

1. Remove jacket front panel. See Figure 51 to connect gas supply pipe to the boiler.
 - a. Install a union for servicing, when required.
 - b. Install a manual shutoff valve in the gas supply piping, within 6 feet of the boiler.
 - c. In Canada, the manual gas valve must be identified by the installer.
2. Support piping with hangers, not by the boiler or its accessories.
3. Purge all air from the gas supply piping.
4. Before placing the boiler in operation, check the boiler and its gas connection for leaks.
 - a. Close manual main shutoff valve during any pressure testing at less than 20" w.c.
 - b. Disconnect the boiler gas connection from the gas supply piping during any pressure testing greater than 20" w.c.

WARNING Do not check for gas leaks with an open flame — use a soapy water bubble test. Failure to eliminate gas leaks can cause severe personal injury, death or substantial property damage.

5. Use pipe dope compatible with propane gases. Apply sparingly only to male threads of pipe joints so that pipe dope does not block gas flow.

WARNING Failure to apply pipe dope as detailed above can result in severe personal injury, death or substantial property damage.

WARNING Ultra boilers are shipped ready to fire natural gas ONLY. You must install the propane conversion kit if the boiler will be connected to propane. See page 9 through page 11 for instructions. Failure to comply could result in severe personal injury, death or substantial property damage.

WARNING Install a 100% lockup gas pressure regulator in the gas supply line if inlet pressure can exceed 14" w.c. at any time. Adjust the lockup regulator for 7 to 10" w.c. inlet pressure. This setting provides a cushion below the setting of the high gas pressure switch. Failure to comply could result in shutdown by the high gas pressure switch, resulting in possible serious property damage due to freeze-up.

Natural Gas:

Pipe sizing for natural gas

1. Size gas supply piping from meter outlet to entrance of boiler in accordance with Figure 54 and Figure 55.
2. Use the total input of all boilers. Divide the total input in Btuh by 1,000 to obtain cubic feet per hour of natural gas.
 - a. Pipe lengths in Figure 54 are equivalent lengths of straight pipe. Use Figure 55 to determine equivalent length of fittings.
 - b. Figure 54 is only for natural gas with specific gravity 0.60, with a pressure drop through the gas piping of 0.30" w.c.
 - c. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 or B149.2 for Canadian installations).

WARNING

Use two wrenches when tightening gas piping at boiler, using one wrench to prevent the boiler gas line connection from turning. Failure to support the boiler gas connection pipe to prevent it from turning could damage gas line components.

Figure 51 Connect gas supply piping

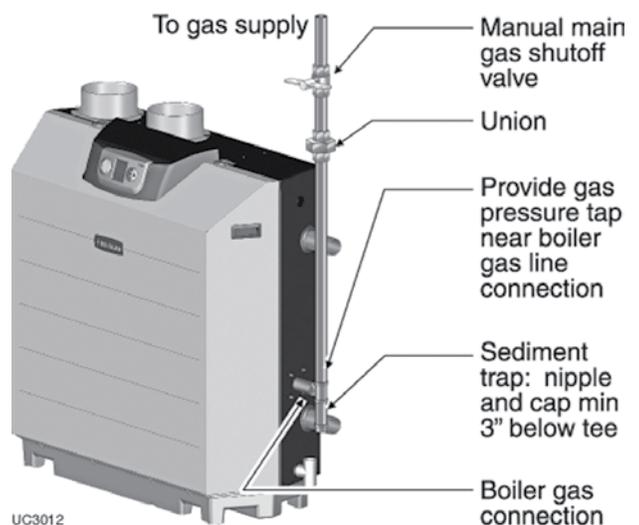
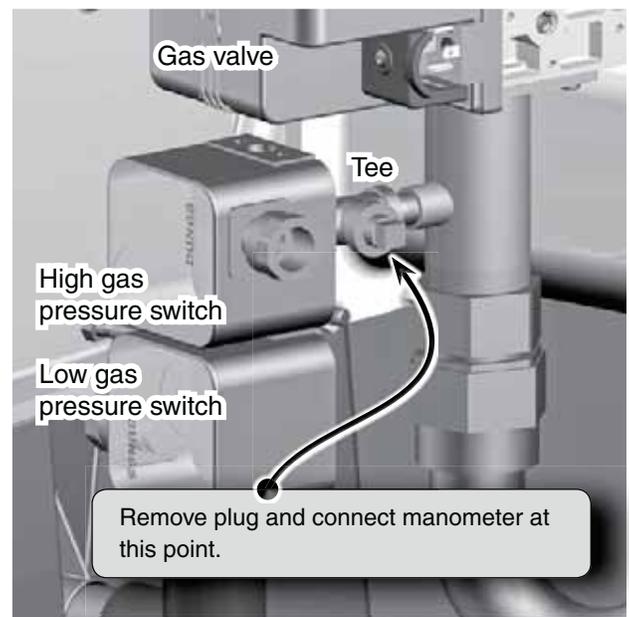


Figure 52 Location of gas train inlet pressure tap





Gas piping *(continued)*

Natural gas supply pressure

1. Pressure required at gas pressure tap near boiler gas connection (see Figure 51, page 49):
 - a. Maximum: 14" w.c. with no flow (lockup) or with boiler on.
 - b. Minimum: 3.5" w.c. with gas flowing (verify during boiler startup, while boiler is at high fire).
 - c. If no external pressure tap is available, connect manometer to the gas pressure switch tee (Figure 52). At this point, the minimum gas pressure required is 3.0" w.c.

Propane Gas:

⚠WARNING You must follow the instructions in this manual, beginning on page 9, to operate the boiler on propane. Failure to comply could result in severe personal injury, death or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks and 100% lockup gas pressure regulator.

Propane supply pressure

1. Pressure required at gas pressure tap near boiler gas connection (see Figure 51, page 49):
 - a. Maximum: 14" w.c. with no flow (lockup) or with boiler on.
 - b. Minimum: 3.5" w.c. with gas flowing (verify during boiler startup, while boiler is at high fire).
 - c. If no external pressure tap is available, connect manometer to the gas pressure switch tee (Figure 52, page 49). At this point, the minimum gas pressure required is 3.0" w.c.

Manifolded gas supply lines

1. Construct gas header for multiple boilers using Figure 53 and the sizing tables below. Refer to the National Fuel Gas Code for other conditions.
2. Provide manual shutoff gas valve, union and sediment trap (minimum 3 inches below tee) as shown in Figure 51, page 49 and Figure 53 for each boiler.
3. A 1¼" NPT gas piping riser from header to boiler will be large enough for most jobs. Ensure the piping is large enough so that the minimum pressure at the boiler, with all connected appliances firing, will be as specified on page 50 (natural gas) or page 50 (propane).

Gas pressure switches

1. Ultra Commercial boilers are equipped with manual reset high gas pressure and low gas pressure switches (see items 31 and 32, page 3).

Figure 53 Common gas line for multiple boilers

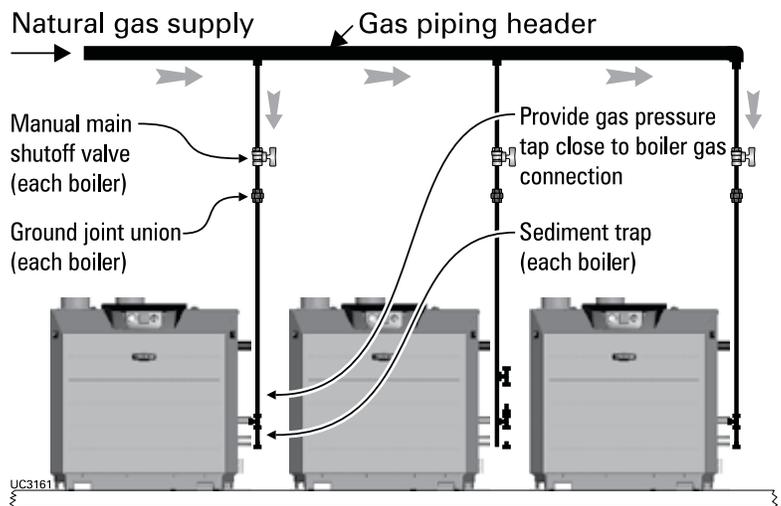


Figure 54 Pipe capacity for natural gas

Gas pipe total length (feet)	Gas supply pipe capacity (cubic feet per hour) @ 0.30" w.c. pressure drop (cubic feet per hour, 0.60 specific gravity)			
	1¼"	1½"	2"	2½"
10	1050	1600	3050	4800
20	730	1100	2100	3300
30	590	890	1650	2700
40	500	760	1450	2300
50	440	670	1270	2000
75	360	545	1020	1650
100	305	460	870	1400
150	250	380	710	1130

Figure 55 Equivalent lengths of straight pipe for gas line fittings

Pipe size inches	Equivalent length, feet	
	90° Elbow	Tee
1¼	3.45	6.90
1½	4.02	8.04
2	5.17	10.3
2½	6.16	12.3

2. These switches are factory set and should remain at the following settings:
 - a. High gas pressure: 14 inches w.c.
 - b. Low gas pressure: 2 inches w.c.
3. Note that the low gas pressure switch must be manually reset (button on front of switch) on initial start-up or any time the gas supply is turned off.



Field wiring (see Figure 57 & Figure 58)

⚠ WARNING ELECTRICAL SHOCK HAZARD — For your safety, turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1. If original wiring as supplied with boiler must be replaced, use only type 105°C wire or equivalent. Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial or local codes or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

Wiring — general

1. The U-Control provides plug-in, color-coded, non-interchangeable terminal strips for all field wiring. See the schematic diagram (Figure 57, page 52) & ladder diagram (Figure 58, page 54).
2. The U-Control provides programmable flexibility in system operation, allowing control of the heat supply for up to three different heating systems. Read this manual thoroughly before connecting the wiring to ensure trouble-free start-up and operation.

Wiring — overview

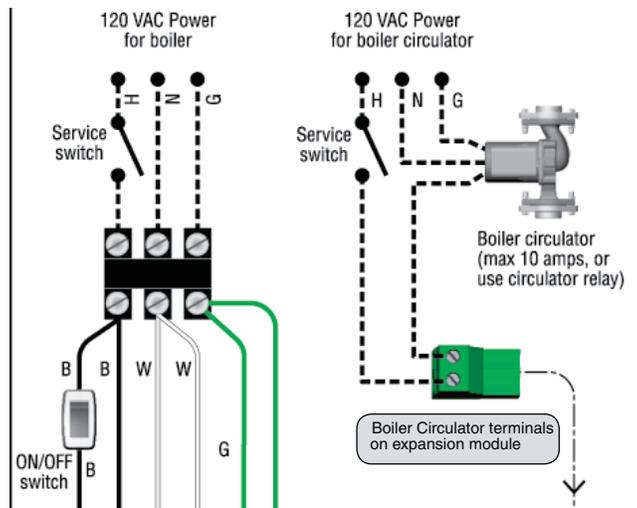
You will need to make the following connections, some of which depend on your system and how the U-Control will be programmed. (See this and following pages for more information.)

- ❑ **Connect 120VAC power for boiler and boiler circulator**
- ❑ **Connect wiring for up to three additional circulators**
- ❑ **Connect external limits, if used**
 - Two different circuits are available — The U-Control will require manual reset for one of these circuits. The U-Control will automatically reset after limit operation and re-closure for limits in the other circuit.
- ❑ **Connect thermostats and/or heat demand contacts**
 - The U-Control can regulate the boiler for up to three different heating systems.
- ❑ **Connect remote operation input, if used**
 - The U-Control will operate and modulate the boiler based on a 0–10 VDC control signal from a remote controller, when desired.

- ❑ **Connect the “additional heat demand” circuit to a second heating source, when used**
 - The U-Control allows the boiler to act as the primary or secondary heat source when another heat source, such as a heat pump or another boiler is available.
- ❑ **Connect to remote alarm, when used**
- ❑ **Connect wiring for multiple boiler operation**
 - The U-Control provides the flexibility for control of multiple Ultra boilers.
 - You will need to program the boilers’ U-Controls based on the interconnection method you choose.
- ❑ **Install system & outdoor sensors, when used**
 - The boiler is shipped with an outdoor sensor, a system supply sensor and a system return sensor. The system supply sensor will be required for most space heating applications. The system return sensor must also be installed when using the system supply sensor. Use of the outdoor sensor is optional.

Line voltage power input

Figure 56 Line voltage and boiler circulator connections



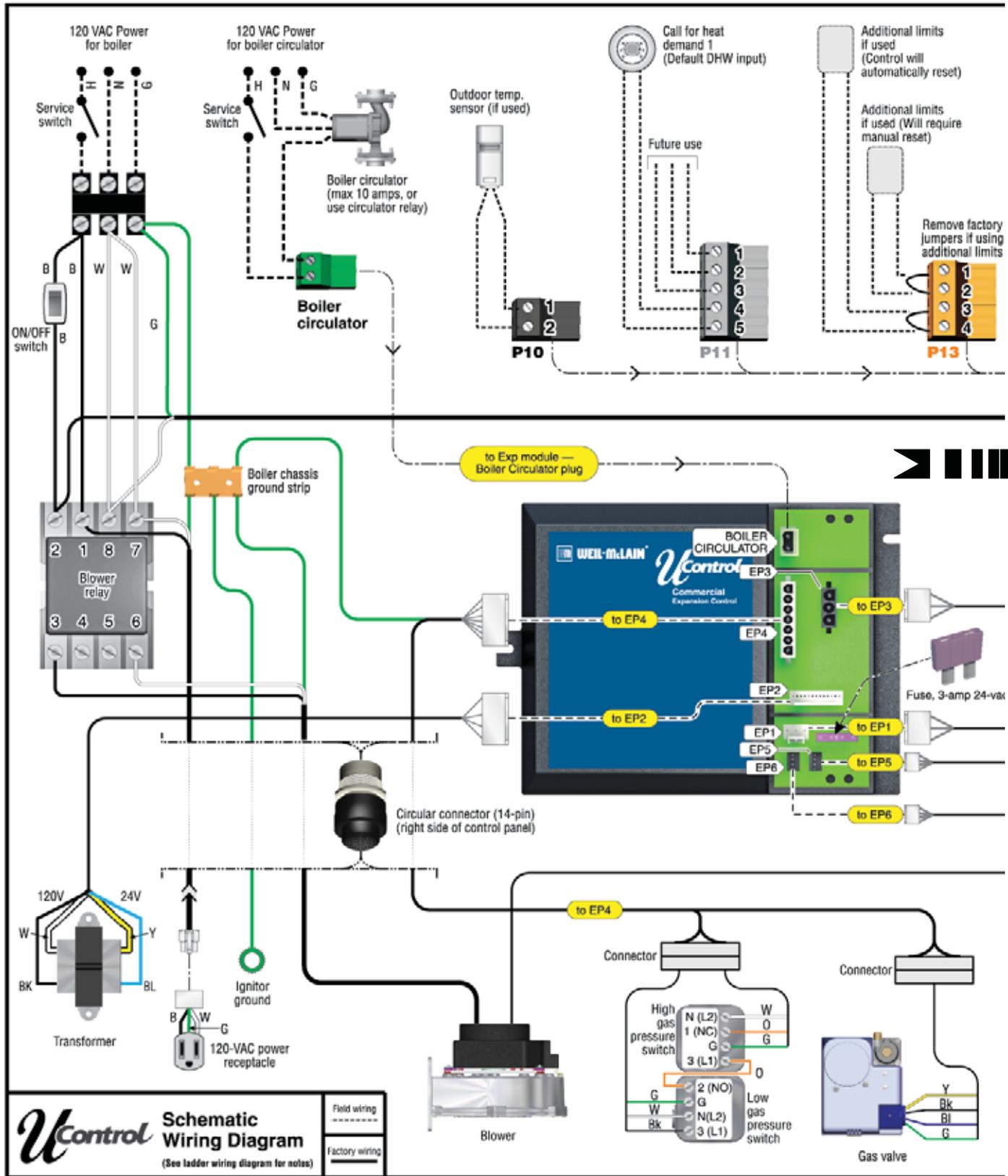
1. Boiler line voltage power — Boiler load is 18 amps. Provide and install a fused disconnect or service switch (25- or 30-ampere rated recommended) as required by applicable codes.
2. Boiler circulator line voltage power — Provide and install a fused disconnect or service switch (15-ampere rated recommended) as required by applicable codes for circulator with maximum load of 10 amps.

Continued after page 54



Field wiring (see Figure 57 & Figure 58) (continued)

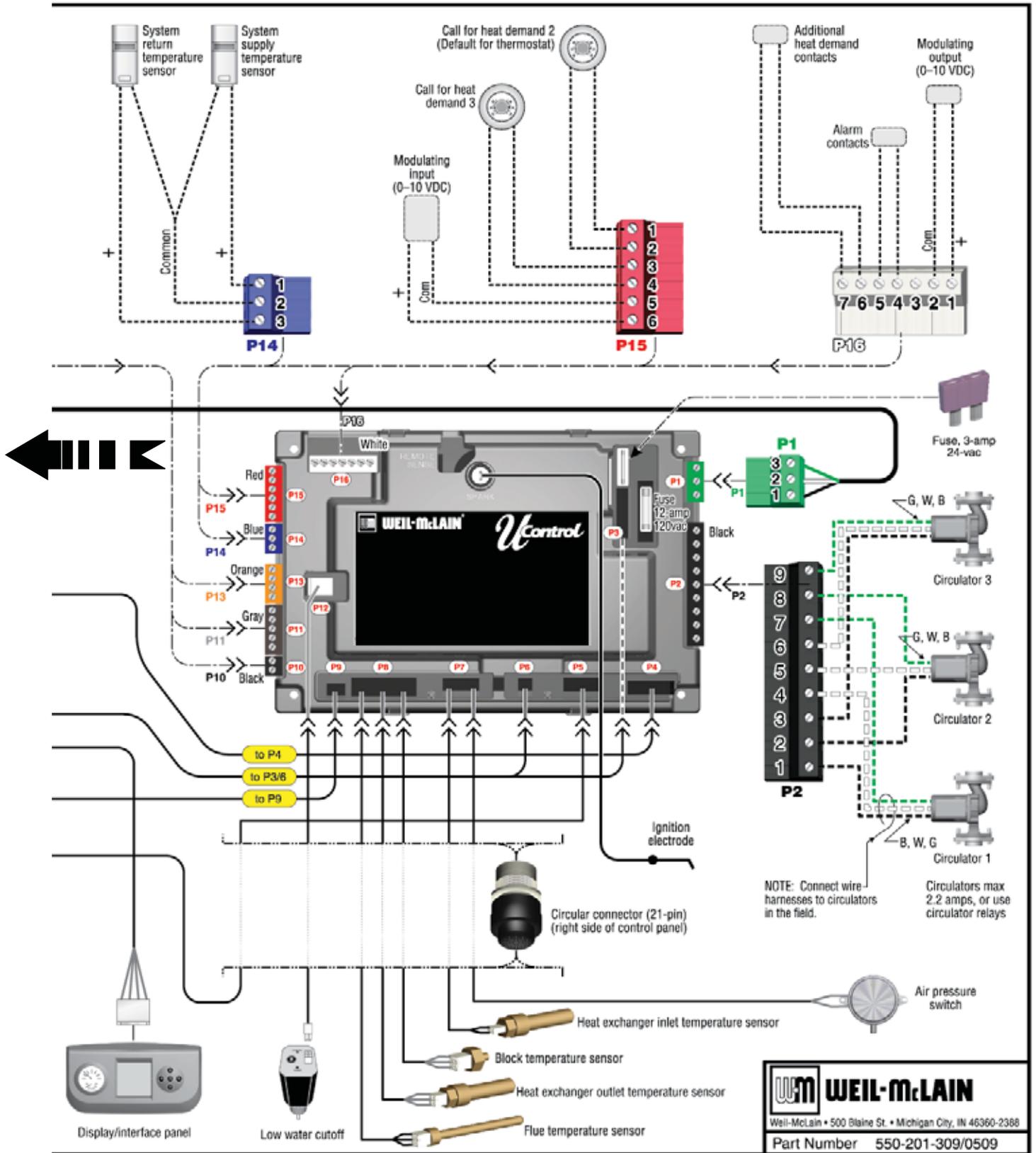
Figure 57 Schematic wiring diagram — Ultra-550 & Ultra-750 (continued on next page)





Field wiring (see Figure 57 & Figure 58) (continued)

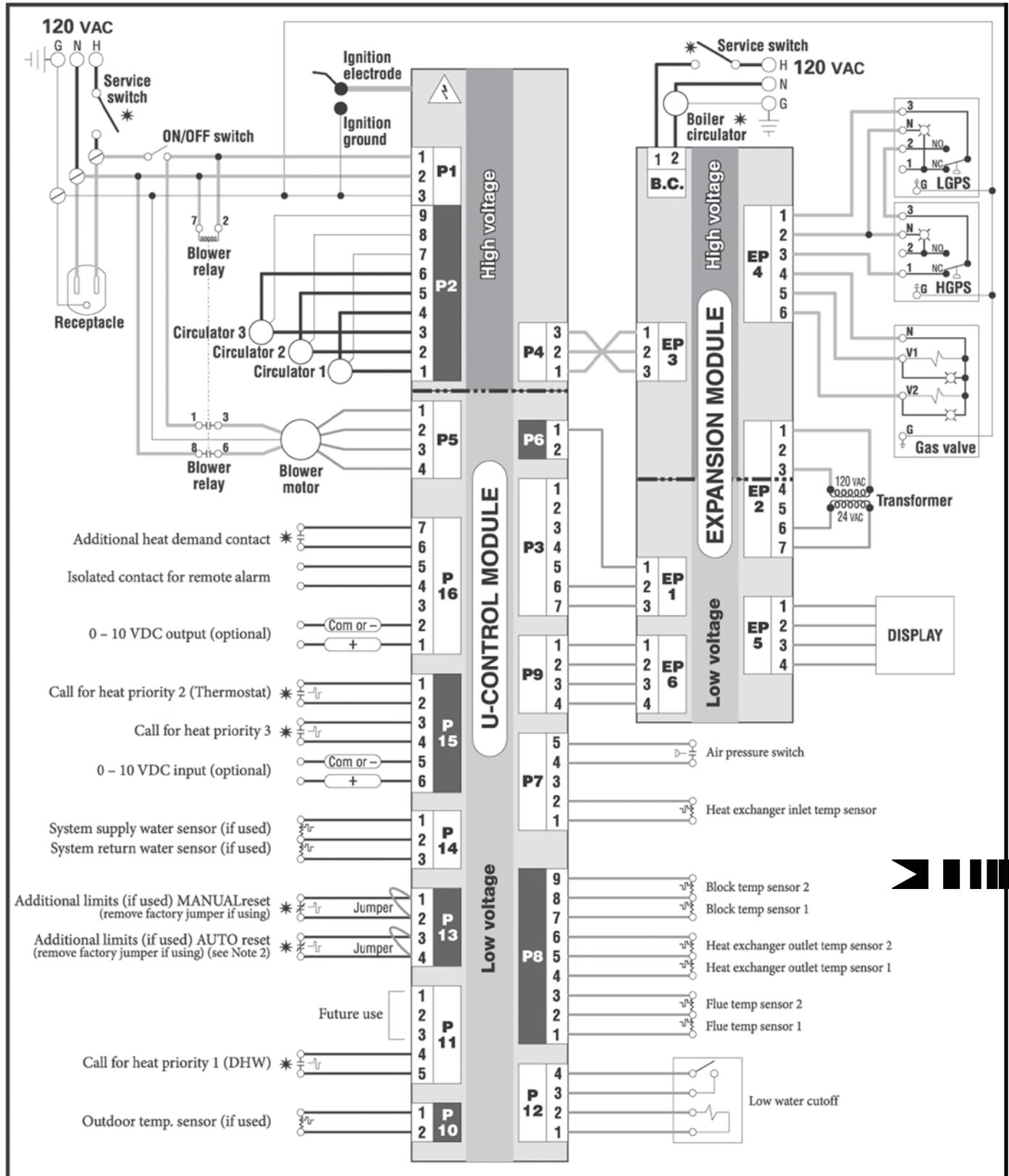
Figure 57 (continued from previous page) Schematic wiring diagram — Ultra-550 & Ultra-750





Field wiring (see Figure 57 & Figure 58) (continued)

Figure 58 Ladder wiring diagram — Ultra-550 & Ultra-750 (continued on next page)





Field wiring (see Figure 57 & Figure 58) *(continued)*

Figure 58 (continued from previous page) Ladder wiring diagram — Ultra-550 & Ultra-750

Ladder Wiring Diagram

⚠ WARNING

Electrical shock hazard — can cause severe injury or death. Disconnect power before

NOTICE

All contacts shown without power applied.

✳ Indicates items not provided

Legend for ladder wiring diagram only

	120 vac field wiring
	Low voltage field wiring
	120 vac factory wiring
	Low voltage factory wiring
	High voltage spark ignition wiring
	Ground connectors

Notes for Schematic and Ladder Diagrams

1. All wiring must be installed in accordance with:
 - U.S.A. — N.E.C. And any other national, state, or local code requirements.
 - Canada — C.S.A. C22.1 C.E.C. Part 1 and any other national, provincial, or local code requirements.
2. Connect additional limits (if used) between terminals P13-1 and P13-2 if the boiler control module is to manual reset on limit action. Connect between terminals P13-3 and P13-4 for automatic reset. Remove jumper across terminals used.
3. If any of the original wire as supplied with the appliance must be replaced, use minimum 105 °C wire or equivalent. Exceptions: Ignition lead wire must be obtained from Weil-McLain only.
4. Thermostat anticipator setting (single zone) — set anticipator for 0.1 amps.
5. For multiple zoning, use either zone valves or circulators. Refer to the component manufacturer's instructions and this manual for application and wiring suggestions. Boiler circulator must remain with boiler, and cannot be used for system circulation in any way.
6. Refer to control component instructions packed with the boiler for application information.

Weil-McLain • 500 Blaine St. • Michigan City, IN 46360-2388

Part Number 550-201-308/0509



Field wiring (see Figure 57 & Figure 58) (continued)

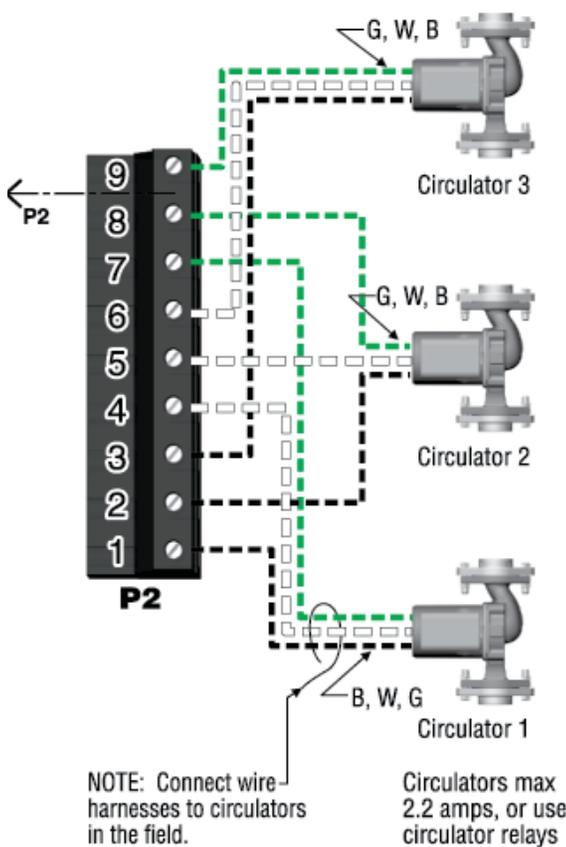
Wiring circulators

1. The U-Control provides for connection of up to four circulators. Circulator 4 (default boiler circulator) requires a separate power supply connection from a fused disconnect or service switch. See Figure 56, page 51 and Figure 57, page 52. In addition, you can connect a system circulators and a DHW circulator, for examples.

WARNING Circulators 1, 2 and 3 — **The maximum allowable current for each circulator is 2.2 amps at 120 VAC.** For circulators with higher amp ratings, you must install a circulator relay or starter to provide line voltage to the circulator. For circulators rated over 2.2 amps, connect only the circulator relay or starter coil to the Ultra circulator terminals.

Circulator 4 — Default setup as boiler circulator. A separate power supply is required for this circulator, as shown in the wiring diagrams. **The maximum allowable current for this circuit is 10 amps.** For a circulator with higher amperage, use an isolating relay.

Figure 59 Connections for circulators 1, 2 and 3



2. You can connect any of the circulators you use to any of the three circulator activation terminals. The U-Control setup allows you to assign which circulators activate on a call for

heat (this can be customized for each of the heating systems supplied by the boiler).

3. The U-Control **factory default** assignment for DHW heating is Circulator 1. The default setting operates the boiler circulator (circulator 4) during DHW call for heat (change this setting if the boiler circulator is to be OFF during DHW heating). To use factory default settings for the DHW circulator, connect the DHW circulator to terminals 1, 4 and 7 on connector P2 (see Figure 59). Connect the boiler circulator per Figure 56, page 51 (Circulator 4 requires a separate power supply as shown.).
4. The **factory default** for space heating is designed for finned-tube baseboard, and set up to activate Circulators 2, 3 and 4 on a call for heat. To use these default settings, connect these circulators as follows:
 - a. Circulator 2 — terminals 2, 5 and 8 (see Figure 59).
 - b. Circulator 3 — terminals 3, 6 and 9 (see Figure 59).
 - c. Circulator 4 — connect per Figure 56, page 51 (requires a separate power supply as shown).
5. Make sure the U-Control is programmed to activate the system circulator when it is required (during space heating, for instance).

Thermostats & DHW tank temperature control connections

1. The U-Control allows operation by up to three different heating systems.
2. The factory default configuration is for “heat demand 1” to be DHW and “heat demand 2” to be space heating. For factory default operation:
 - a. Connect the DHW tank temperature control across terminal strip P11, terminals 4 and 5 to use the default setup.
 - b. Connect the space heating thermostat to terminal strip P15, terminals 1 and 2 to use the default setup.
3. Install thermostats on inside walls away from the influences of drafts, hot or cold water pipes, lighting fixtures, television, sun rays, or fireplaces.
4. Thermostat anticipator (if applicable):
 - If connected directly to the boiler, set anticipator for 0.1 amps.
 - If connected to relays or other devices, set to match total electrical power requirements of connected devices. See device manufacturers’ specifications and the thermostat instructions for details.

Low water cutoff

1. Ultra Commercial boilers are equipped with a low water cutoff, mounted on the boiler supply header. See item 21, page 3.
2. The low water cutoff is wired to the U-Control and requires a manual reset if tripped, wired as shown in Figure 57, page 52.

Field wiring (see Figure 57 & Figure 58) (continued)

Additional limits

1. The U-Control allows connection of external limit controls, both for manual reset and for automatic reset operation of the U-Control.
2. **Manual reset of the U-Control on limit action** — Connect external limits across P13, terminals 1 and 2 if the U-Control is to require manual reset when a limit opens, even if the limit re-closes. (Remove the factory jumper when using these terminals.)

NOTICE

The U-Control will lockout when a limit in its manual reset circuit opens. The U-Control activates its alarm terminals and shuts the boiler down until an operator manually resets the U-Control (as explained in this manual). Reset will occur if the condition is corrected. This reset function can be done by a homeowner or a service technician.

3. **Automatic reset of the U-Control on limit action** — Connect external limits across P13, terminals 3 and 4 if the U-Control is to reset automatically when the limit circuit closes after a limit condition. Reset occurs after a 2½-minute delay. (Remove the factory jumper when using these terminals.)

Remote operation/modulation

1. The U-Control module provides terminals to input a remote 0–10 VDC operating signal. This can be provided by a separate controller if the boiler is configured as Type 4 (SHADOW boiler mode).
2. Connect the 0–10 VDC signal positive terminal to P15 terminal 6, and the signal common to terminal 5.
3. When receiving a remote operating signal, the boiler starts when the signal exceeds 1.0 VDC (and shuts off if the signal drops below 0.5 VDC). The boiler remains at low fire until the signal exceeds 2.0 VDC. Between 2.0 and 10.0 VDC, the boiler firing rate increases with the signal value, reaching full input at 10.0 VDC.
4. The U-Control continues to monitor boiler temperatures, based on the values set up under Priority 1 operation. See the following section for details.

Additional heat demand option

1. The U-Control module can be set up to activate another heat source using its additional heat demand dry contacts (P16, terminals 6 and 7).
2. Connect these terminals to call for heat from the other heat source. (See ADVANCED SETUP instructions beginning on page 60.)

Alarm contacts

1. The U-Control's alarm dry contact (P16, terminals 4 and 5) closes when the boiler enters lockout.
2. Connect these terminals for remote alarm notification.

Multiple boiler wiring options

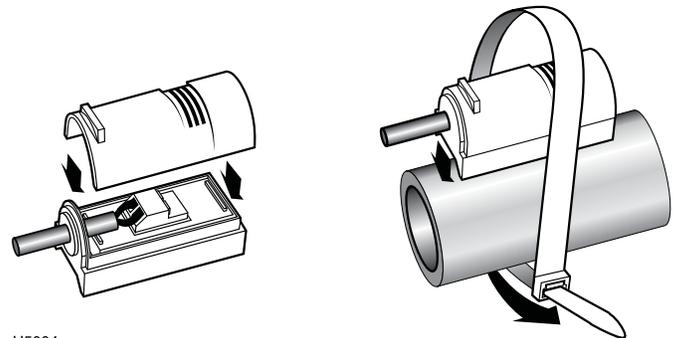
1. The U-Control can be programmed to sequence multiple boilers or operate/modulate in tandem from a 0–10 VDC source generated by the lead boiler or from a remote controller.
2. See the following section for recommended wiring.

Outdoor temperature sensor

1. The U-Control provides programmable options when using an outdoor temperature sensor. This sensor is supplied with the boiler, and can be used if desired (not required). See the following section for outdoor temperature options.
2. Mount the outdoor sensor on an exterior wall, shielded from direct sunlight or flow of heat or cooling from other sources.
3. Connect the sensor leads to P10, terminals 1 and 2, as shown in the wiring diagrams. Thermostat wire can be used to connect the sensor.

System supply & return sensors

1. The boiler is also shipped with two strap-on temperature sensors, intended for system supply and return.
2. Thermostat wire can be used to connect these sensors.



U5004

3. The system supply temperature sensor allows the U-Control to regulate temperature in the system main piping.
4. Locate the supply sensor at least six pipe diameters, but no further than 3 feet, downstream from the boiler connection to the main to ensure adequate mixing.
5. The system return sensor allows the U-Control to monitor and display system return temperature.
6. For multiple boiler applications, install the system supply temperature sensor and system return sensor wired to the LEAD boiler. Otherwise, Type 3 LEAD will not pass on the additional heat demand. (Optionally, connect supply and return sensors to each of the SHADOW boilers so they can monitor system supply temperature and temperature drop.)
7. The U-Control also compares the system return temperature with the system supply temperature. Should the return temperature ever exceed the supply temperature, the U-Control knows there is likely a sensor failure and will report this problem on the display. Refer to the Troubleshooting section of this manual for more information.



U-Control operation and setup

⚠️ WARNING **Temperature settings** — You must ensure that the U-Control is set for the proper water temperatures for the system. Excessive water temperature can cause significant property damage in some applications.

Multi-temperature systems — If the heating system includes circuits that require lower temperature water (radiant slab circuits, for example) as well as higher temperature circuits (DHW, finned tube baseboard, etc.), it is recommended to protect low-temperature circuits with limit controls that are wired to a U-Control external limit circuit. Failure to provide regulation can result in substantial property damage.

U-Control overview

The U-Control is fully programmable to meet system requirements, allowing supply water regulation for up to three different systems.

U-Control features include:

- ❑ Blower speed modulation to control the Ultra boiler’s firing rate.
- ❑ Advanced PID response to anticipate system needs based on response to heat input.
- ❑ Graphic and robust text display for ease of operation monitoring and troubleshooting.
- ❑ Preset operating parameters for typical heating systems (finned tube baseboard, radiant floor, DHW, and others), including target temperatures, reset curves and circulator assignments.
- ❑ Control of up to four circulators (boiler circulator plus three others), assignable for each of the three possible inputs.
- ❑ Programmable priority assignments for the three heat inputs.
- ❑ Integral outdoor reset option, with reset curves matched to the system type selected.
- ❑ Multiple boiler/heat source sequencing or modulation.
- ❑ Built-in 0–10 VDC signal generator to allow parallel modulation of multiple boilers; also capable of accepting 0–10 VDC input.
- ❑ Factory-installed temperature sensors for boiler in, heat exchanger, boiler out and flue.
- ❑ The boiler is equipped with a low water cutoff, factory wired to the U-Control, manually reset through the U-Control.
- ❑ The boiler is shipped with an outdoor sensor and strap-on system supply and return sensors for field installation.

Sequence of operation

1. Figure 60 is a summary of the operating sequence for the U-Control.
2. The symbols shown appear in the display as the U-Control cycles the boiler.
3. The wrench symbol appears when a scheduled maintenance date arrives. This informs the homeowner to call the contractor for service.
4. The exclamation mark symbol appears when a problem has been detected.

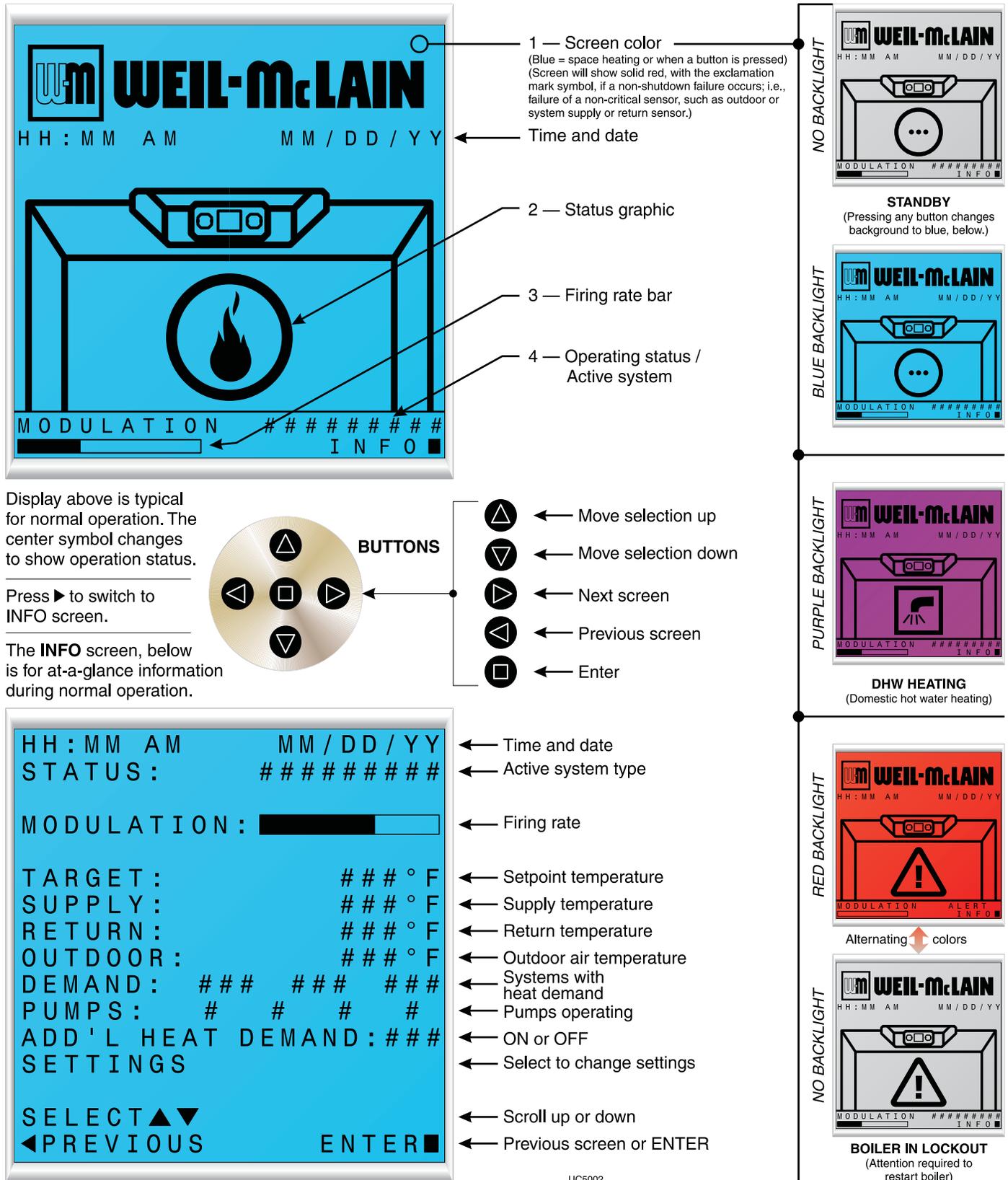
Figure 60 U-Control sequence of operation

Display	Control action <i>(also see Figure 61, page 59)</i>
POWER UP	<ul style="list-style-type: none"> • Check the boiler model listed on the power-up screen. See Figure 65, page 63 to change setting before firing boiler if boiler model is incorrect. • When power is turned on, the screen lists sensors that are detected. If any sensor is not listed, make sure it is connected correctly. Turn off power and restart.
Standby	<ul style="list-style-type: none"> • Standby — no calls for heat • Toggles through no dots, 1 dot, 2 dots, then 3 dots while in standby (wrench symbol will show instead if maintenance is needed)
Blower on	<ul style="list-style-type: none"> • Call for heat detected • Display on with BLUE light (space heating) or PURPLE light (DHW) • Start min/max on timers if more than one system is calling — highest priority starts first • Start circulators for this priority setup • Calculate target temp — If sensor temp is below target temp, begin firing sequence • Blower to ignition speed for prepurge • Multiple boilers/heat sources only — Start additional-heat timer — type 1 boiler starts immediately; type 2 activates other heat source immediately, but doesn’t start unless the timer times out; type 3 (LEAD boiler) starts immediately and sends 0–10 VDC signal to others after timer times out; type 4 receives signal from LEAD boiler and starts immediately (and starts timer for the next boiler, if programmed)
Ignition on	<ul style="list-style-type: none"> • After prepurge times out, begin ignition cycle • Activate gas valve and ignition spark • Continue ignition spark for ignition period • Turn off spark and use electrode to check for flame signal
Space heating	<ul style="list-style-type: none"> • Flame detected • Hold boiler at low fire for 1 minute • Release boiler to modulation • NOTE: If flame is not detected, the gas valve is turned off, blower turns on (postpurge), and control starts cycle again. Control tries one more time, then goes to manual reset lockout. • If priority timer times out, switch to next priority and start priority timer • If demand satisfied, go to postpurge
DHW heating	<ul style="list-style-type: none"> • Flame detected • Release boiler to modulation immediately • NOTE: If flame is not detected, the gas valve is turned off, blower turns on (postpurge), and control starts cycle again. Control tries one more time, then goes to manual reset lockout. • If priority timer times out, switch to next priority and start priority timer • If demand satisfied, go to postpurge
Blower on	<ul style="list-style-type: none"> • Demand satisfied (temperature reaches target temperature or limit setting) • Gas valve off • Blower to ignition speed for postpurge • Return to standby after purge
Maintenance	<ul style="list-style-type: none"> • Display turns RED, toggling between graphic screen and maintenance screen (occurs when maintenance schedule timer times out) • Will show during standby only • Boiler operates as normal
Error/fault	<ul style="list-style-type: none"> • Display turns RED due to error or limit event • Flashing display means lockout condition — display toggles between three screens as in Figure 79, page 85.
WWSD	<ul style="list-style-type: none"> • Warm weather shutdown — the boiler will not be allowed to fire on space heating if the outside temperature is greater than the WWSD setting.



U-Control operation and setup *(continued)*

Figure 61 U-Control display and navigation



UC5002



U-Control operation and setup *(continued)*

EXPRESS SETUP — Using default settings

1. The U-Control is factory programmed to supply a DHW circuit (control priority 1) and finned tube baseboard space heating (control priority 2). Control priority 3 is also available to be programmed to meet the desired system type.

Figure 62 Factory default settings

Priority	For	Target temperature	Circulators enabled
1	DHW	190°F	#1 and #4
2	Finned tube BB	180°F fixed (if no outdoor sensor) or 180°F at 0°F outside / 130°F at 70°F outside	#2, #3 & #4
3	Custom	180°F fixed (if no outdoor sensor) or 180°F at 0°F outside / 130°F at 70°F outside	#1, #2, #3 & #4

2. You can use the factory default settings for most systems supplying space heating with finned-tube baseboard and with or without a DHW tank, provided:
 - a. A DHW tank, if used, must be piped directly to the boiler, as in the piping shown in Figure 8, page 16 or Figure 10, page 18. If the DHW tank is a separate zone off of the system main, or if it is piped as in Figure 9, page 17, you will need to enable additional circulators for DHW operation. The U-Control is factory programmed to operate the DHW circulator (Circulator 1) and Circulator #4 (boiler circulator usually) during DHW heating. The boiler circulator may not be needed during DHW, and can be set to turn OFF if desired.
 - b. The heat emitters in the system must be finned tube baseboard only. Other heat emitters require changes in the U-Control setup.
3. To use the factory default settings:
 - a. Wire the DHW tank aquastat to the U-Control “heat demand 1” input, terminals P11 #4 and #5.
 - b. Wire the space heating thermostat (or zone controller or zone valve end switches) across the U-Control “heat demand 2” input, terminals P15 #1 and #2.
 - c. Attach a sensor (supplied with boiler) to the system supply pipe and wire to terminals P14 #1 and #2.
 - d. Attach a sensor (supplied with boiler) to the system return pipe and wire to terminals P14 #2 and #3.
 - e. If you want to use outdoor reset for the space heating circuits, install the outdoor temperature sensor (supplied with boiler) and wire to terminals P10 #1 and #2.
 - f. Wire the boiler circulator (supplied by the installer) as circulator 4.
 - g. Wire the DHW circulator (supplied by installer) as circulator 1.
 - h. Wire the system circulator (supplied by installer) as circulator 2 or circulator 3.

ADVANCED SETUP – OVERVIEW

1. **Access contractor menus by pressing and holding the UP and DOWN arrow keys for 5 seconds.**
2. The contractor screen will show:
 - a. BOILER SETTINGS
 - b. SYSTEM SETTINGS
 - c. DIAGNOSTICS
 - d. MAINTENANCE INFO
 - e. SET DATE AND TIME
 - f. GAS VALVE TEST
3. Navigate through the menus as shown in Figure 65, page 63. For a description of each of the menu options, see Figure 66, page 65.
4. You will need to adjust settings as required for the systems supplied by the boiler and connect the wiring accordingly.

ADVANCED SETUP — Boiler settings

BOILER MODEL

WARNING Check the **boiler model** against the model listed on the boiler’s rating plate. Change the selection to the correct model if not. Also verify the model number on the U-Control display at power-up. Failure to correct could result in severe personal injury, death or substantial property damage.

HIGH ALTITUDE

WARNING If the boiler is installed at an altitude above 5,500 feet, select YES for high altitude. The U-Control will automatically adjust firing rates (blower speeds) to compensate for altitude.

WWSD

1. WWSD stands for “warm weather shutdown.” It means the boiler will not be allowed to fire if the outside temperature is greater than the WWSD setting.
2. When the boiler is kept off because the outside temperature is above WWSD, the graphic display will show “WWSD,” and the boiler will remain in standby until the outside temperature drops below WWSD temperature.
3. WWSD does not apply to DHW systems.
4. The outdoor sensor must be installed to use this function.

ADJUST OUTDOOR

1. Use this setting to adjust the outdoor sensor temperature to account for solar or other effects that would cause the sensor to read incorrectly.



U-Control operation and setup *(continued)*

ADDITIONAL HEAT DEMAND

1. This setting is for multiple boilers or multiple heating sources (an Ultra boiler collaborating with a heat pump or a different boiler, for examples). (NOTE: Additional heat demand does not pass on if the system type is DHW Direct or custom.)
2. OFF — Function disabled.
3. Type 1 — This means the Ultra boiler is the primary heat source.
 - a. When the Ultra boiler receives a call for heat, it begins its startup sequence and also starts a delay timer (set as ADD'L HEAT DEMAND TIME).
 - b. When the delay timing is reached, the U-Control closes the the “Additional heat demand contact,” terminals P16 #6 and #7. Use this contact to start the next heat source.
 - c. If the next heat source is an Ultra boiler, connect this contact to the boiler’s “heat demand 1” terminals (P11 #4 and #5). Program the second boiler’s delay timer to start a third boiler the same way, and so on to sequentially fire multiple boilers.
4. Type 2 — This means the boiler is the secondary heat source.
 - a. When the U-Control receives a call for heat, it immediately activates the “Additional heat demand contact,” terminals P16 #6 and #7. This contact is used to start the next heat source immediately.
 - b. When the delay timing is reached, the Ultra boiler begins its startup sequence and continues to heat until the demand is satisfied.
 - c. Type 2 assignment would generally only be used if the other heat source is a different boiler or a heat pump, for example.
5. Type 3 — This assigns the boiler as the LEAD boiler in a multiple boiler system.
 - a. This LEAD boiler must have system supply and return sensors mounted on the system supply and return pipes and wired to the boiler.
 - b. When the U-Control receives a call for heat, it begins its heating sequence and starts the additional heat demand delay timer.
 - c. When the delay timing is reached, the U-Control sends a 0–10 VDC proportional signal out its 0–10 VDC output terminals, P16 #1 and #2.
 - d. Connect these output terminals to the SHADOW boilers’ 0–10 VDC input terminals, P15 #5 and #6. The SHADOW boilers will startup and modulate based on the signal strength. The SHADOW boilers must be set up as Type 4 (see below). They do not need their additional heat timers to be setup.
 - e. An alternate method is to daisy chain the other boilers. That is, connect the output of each to the input of the next. Each of these boilers would be set up as a Type 4 (see below), and each needs its additional heat timer set for the desired delay between boilers.
6. Type 4 — This assigns the boiler as a SHADOW boiler in a multiple boiler system.
 - a. For Type 4 boilers, the ADDITIONAL HEAT DEMAND function only applies to the Priority 1 system.
 - b. The boiler can be wired and setup to run in parallel with the other SHADOW boilers as in 5d, above. Or they can be set up for sequential operation following 5e, above.
 - c. When the boiler receives a 0–10 VDC input on terminals P15 #5 and #6, it starts up and modulates firing rate according to the signal.
 - d. If wired and setup per 5e above, it also starts its additional heat delay timer immediately. When the delay timing is reached, the U-Control sends out a 0–10 VDC signal (on terminals P16 #1 and #2) for the next boiler.
 - e. The boiler uses the settings for Priority 1 while receiving the 0–10 VDC signal.

ADVANCED SETUP — Priority 1, 2, 3

1. Priority 1, 2 and 3 refer to the three possible heating inputs that can be handled by the U-Control.
2. Select the priority level desired for the application. Priority 1 is usually assigned to domestic water heating, because of the need for quick response. Priority 2 and 3 are usually used for space heating circuits.
3. Each of the three inputs has its own set of operating parameters, programmed using the menus shown in Figure 65, page 63.
4. The inputs to the U-Control are:
 - a. Priority 1 — P11 #4 and #5, “heat demand 1”
 - b. Priority 2 — P15 #1 and #2, “heat demand 2”
 - c. Priority 3 — P15 #3 and #4, “heat demand 3”

ADVANCED SETUP — System type

1. For each priority being used, select the appropriate system type. See Figure 63, page 62 for system options and preset temperatures.
2. The temperature presets are chosen based on normal best setting for these systems. The temperature values can be changed, if desired, under “TEMPERATURES.”

ADVANCED SETUP — Temperatures

1. Setup desired temperatures for each of the priorities used.
2. For an explanation of the target temperatures and associated outdoor temperatures, see Figure 64, page 62.
 - a. Outdoor temp for max target means the outdoor temperature at which the target temperature reaches its maximum value. In the example of Figure 64, page 62, this occurs at 25 °F outside.
 - b. Outdoor temp for min target means the outdoor temperature at which the target temperature reaches its minimum. In the example of Figure 64, page 62, this occurs at 70 °F.
 - c. Note that the reset lines are curved. The shape of this curve is matched (or characterized) to the response of the system type chosen to ensure the most effective reset operation.

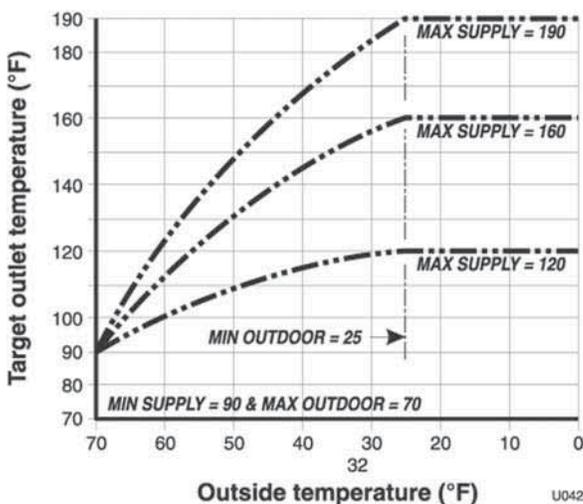


U-Control operation and setup *(continued)*

Figure 63 U-Control system types and preset parameters

System type	Display		Preset temperatures				Note
	8-character	3-char	Max Target Temp	Outdoor Temp for Max Target	Min Target Temp	Outdoor Temp for Min Target	
Fan-coil	FAN-COIL	FCL	190	0	140	70	
Finned tube baseboard	FIN BASE	FTB	180	0	130	70	
Cast iron baseboard	IRN BASE	CIB	180	0	120	70	
Cast iron radiators	RADIATOR	CIR	180	0	120	70	
Radiant – slab on grade	RAD SLAB	RSG	120	0	80	70	
Radiant – thin slab	RAD SLAB	RTS	140	0	80	70	
Radiant – below floor (staple up)	RADFLOOR	RSU	160	0	90	70	
Radiant – above floor (sleeper system)	RADFLOOR	RAF	140	0	90	70	
Custom	CUSTOM	CUS	190	0	70	70	<ul style="list-style-type: none"> • Does not pass along Add'l Heat Demand
DHW – system	DOMESTIC	DHW	190	DHW heating ignores outdoor reset and warm weather shutdown			<ul style="list-style-type: none"> • U-Control modulates to system temperature sensors.
DHW – direct	DOMESTIC	DHW	190		<ul style="list-style-type: none"> • U-Control modulates to boiler temperature sensors. • Does not pass along Add'l Heat Demand 		

Figure 64 Typical outdoor reset curves



3. **Modulate on differential** — The temperature must drop this many degrees below target temperature for the boiler to come on.
4. **Modulate off differential** — While the boiler is firing, as the temperature increases above the target temperature, the boiler firing rate is reduced. At this many degrees above the target temperature, the boiler shuts down.

ADVANCED SETUP — Circulator exercising

1. For each circulator, select whether you want the U-Control to automatically start the circulator and run for 10 seconds for each 72-hour period of inactivity.

ADVANCED SETUP — Freeze protection circulators

1. This function automatically fires the boiler at low fire and starts the circulators chosen if the heat exchanger sensor detects a temperature less than 40 °F. The circulators and boiler turn off when the temperature rises above 45 °F.

ADVANCED SETUP — Maintenance info

1. Use this section to enter contractor’s information and to enter an automatic notice for maintenance (default is 12 months). Because this shows on the display, it is an automatic means of notifying the homeowner of the need for scheduled maintenance by the technician. Update the screen reminder to reset for the next maintenance date after completing required maintenance.



U-Control operation and setup *(continued)*

Figure 65 U-Control menus *(press and hold the UP and DOWN arrow keys for 5 seconds to enter contractor menus)*

Menus	Next screen	Next screen	Next screen	Next screen	
<i>Follow information at the bottom of each screen to navigate to next/previous screen or enter/save data</i>					
BOILER SETTINGS	BOILER MODEL #####	80 105 155	230 299 310	399 550 750	
	HIGH ALTITUDE ###	NO YES			⚠ WARNING Carefully verify that the boiler model number on the display now agrees with the boiler rating plate. Setting these incorrectly could result in severe personal injury, death or substantial property damage.
	HIGH TEMP LIMIT	###			
	WSD TEMP °F ###	###			
	ADJUST OUTDOOR °F ###	###			
	ADD'L HEAT DEMAND TYPE: #####	OFF TYPE 1 – ULTRA = PRIMARY HEAT SOURCE TYPE 2 – ULTRA = BACKUP HEAT SOURCE TYPE 3 – ULTRA = LEAD (0–10V OUTPUT) TYPE 4 – ULTRA = SHADOW (0–10V INPUT)			
	ADD'L HEAT DEMAND TIME: ### MINUTES	## MINUTES			
SYSTEM SETTINGS	BOILER PRIORITY 1	SYSTEM TYPE: ###		OFF FAN COIL FINNED TUBE BASEBOARD CAST IRON BASEBOARD CAST IRON RADIATOR RADIANT – SLAB ON GRADE RADIANT – THIN SLAB RADIANT – BELOW FLOOR RADIANT – ABOVE FLOOR CUSTOM DHW – DIRECT DHW – SYSTEM	
		TEMPERATURES		MAX SUPPLY: ### °F MIN SUPPLY: ### °F MAX OUTDOOR: ### °F MIN OUTDOOR: ### °F MODULATE ON DIFF: ### °F MODULATE OFF DIFF: ### °F	
		TIMES		MAX ON TIME: ### MIN MIN ON TIME: ### MIN BOOST INTERVAL: ### MIN PRE PUMP TIME: ### SEC POST PUMP TIME: ### SEC	
		CIRCULATORS: # # #		CIRCULATOR 1: ### ON/OFF CIRCULATOR 2: ### ON/OFF CIRCULATOR 3: ### ON/OFF CIRCULATOR 4: ### ON/OFF	
		MAXIMUM RATE: ___% MINIMUM RATE: ___%		### % ### %	
	BOILER PRIORITY 2	SAME MENU AS FOR PRIORITY 1			
	BOILER PRIORITY 3	SAME MENU AS FOR PRIORITY 1			
	CIRCULATOR EXERCISING	CIRCULATOR 1: ### CIRCULATOR 2: ### CIRCULATOR 3: ### CIRCULATOR 4: ###		ON/OFF ON/OFF ON/OFF ON/OFF	
	FREEZE PROTECT CIRCS	CIRCULATOR 1: ### CIRCULATOR 2: ### CIRCULATOR 3: ### CIRCULATOR 4: ###		ON/OFF ON/OFF ON/OFF ON/OFF	
	DIAGNOSTICS <i>(continued on next page)</i>	TEMPERATURES	STATUS: ##### SYSTEM SUPPLY: ###°F SYSTEM RETURN: ###°F BOILER OUT1: ###°F BOILER OUT2: ###°F BOILER IN: ###°F HEAT XCHR 1: ###°F HEAT XCHR 2: ###°F FLUE 1: ###°F FLUE 2: ###°F OUTDOOR: ###°F		



U-Control operation and setup *(continued)*

Figure 65 U-Control menus, continued *(press and hold the UP and DOWN arrow keys for 5 seconds to enter contractor menus)*

Menus	Next screen	Next screen	Next screen	Next screen	
Follow information at the bottom of each screen to navigate to next/previous screen or enter/save data					
DIAGNOSTICS <i>(continued from previous page)</i>	INPUTS	STATUS: ##### PRIORITY 1: ### PRIORITY 2: ### PRIORITY 3: ### ANALOG IN: #### MANUAL LIMIT: ##### AUTO LIMIT: ##### AIR PR SWITCH: ##### GAS PR SWITCH: ##### LOW WTR CUTOFF: ##### BLOWER TACH: #####RPM FLAME SIGNAL: ###			
	OUTPUTS	STATUS: ##### GAS VALVE: ### CIRCULATOR 1: ### CIRCULATOR 2: ### CIRCULATOR 3: ### CIRCULATOR 4: ### BLOWER SIGNAL: ###% ADD'L HEAT DEMAND: ### ALARM: ### ANALOG OUT: #####			
	ERRORS	CONTROL FAULT	###		
		IGNITION RETRIES	###		
		MANUAL RESET CNT	###		
		AUTO RESET CNT	###		
	LOCKOUT HISTORY 1		LOCKOUT HISTORY # HH:MM AM MM/DD/YY STATUS: ##### MANUAL RESET AUTO RESET INPUTS OUTPUTS TEMPERATURES	LIST OF LOCKOUTS LIST OF LOCKOUTS INPUT STATUS OUTPUT STATUS TEMPERATURES	
	LOCKOUT HISTORY 2		. . . SAME AS HISTORY 1		
LOCKOUT HISTORY 3		. . . SAME AS HISTORY 1			
SOFTWARE VERSIONS	DISPLAY C#.## MAIN MICRO C#.## SECOND MICRO C#.##				
MANUAL TEST MODE	STATUS: ##### TARGET: ###°F MODULATION: ###°F SYSTEM SUPPLY: ###°F SYSTEM RETURN: ###°F BOILER OUT: ###°F BOILER IN: ###°F HEAT XCHR: ###°F FLAME SIGNAL: ### BLOWER SIGNAL: ###% BLOWER TACH: #####RPM FORCE RATE AUTO				
MANUAL RESET	PRESS ENTER TO RESET THE FOLLOWING ERROR (SCREEN SHOWS A LIST OF ERRORS)				
MAINTENANCE INFO	NAME ##### PHONE ###-###-#### MODEL ULTRA ##### CP# ##### INSTALLED MM/DD/YY LAST DATE MM/DD/YY NEXT DATE MM/DD/YY INTERVAL SETTINGS ## MONTHS RESET REMINDER PRESS ENTER TO RESET				
SET DATE AND TIME	SET YR/MN/DAY/HR/MIN				
GAS VALVE TEST	OPEN GAS VALVE 1				
	OPEN GAS VALVE 2				



U-Control operation and setup *(continued)*

Figure 66 U-Control setup options (see Figure 65, page 63 for location in menu sequence)

Menu/Item	Units	Low Value	High Value	Default	Comment
Boiler Settings					
Boiler Model	80, 105, 155, 230, 299, 310, 399, 550, 750			factory	THIS MUST BE SET CORRECTLY FOR SAFE OPERATION. Adjusts blower speeds and flame sense (Display will show "HA" after the model number if high altitude has been selected, below.) NOTE: Ultra-80 through Ultra-399 are residential models.
High Altitude	yes or no			no	Adjusts ignition and low fire fan speed (for altitudes above 5, 500 feet only)
High Limit	°F	50	200	200	If any boiler temperature sensor reaches this temperature, the boiler will lockout, requiring manual reset.
WWSD Temp	°F	Off, 50	100	70	Boiler will not respond to heating calls above this outdoor temp
Adjust Outdoor	°F (difference)	-10	+10	0	This value plus outdoor sensor reading equals outdoor temp (Use this setting to compensate for solar gain or other factors that cause a shift in sensor temperature.)
Add'l Heat Demand Type	Types	Off	Type 4	Off	Type 1 — Ultra is primary source, starts secondary after delay (requires system sensors) Type 2 — Ultra is secondary source, starts primary immediately Type 3 — Boilers operate in parallel, Ultra boiler is LEAD, outputs 0–10 VDC to others Type 4 — Boilers operate in parallel, Ultra boiler is SHADOW, receives 0–10 VDC input
Add'l Heat Demand Time	minutes	0	240	0	Delay before bringing on additional heating appliances

System Settings					
Boiler Priority 1					
System Type	Types	Off	Custom	DHW - direct	DHW-direct doesn't use ODR, boost, or Add'l heat demand output
Max Supply	°F	60	190	190	Boiler enters manual reset lockout at 200°F
Min Supply	°F	60	190	N/A	N/A - DHW does not use reset
Max OD Reset	°F	50	100	N/A	N/A - DHW does not use reset
Min OD Reset	°F	-20	50	N/A	N/A - DHW does not use reset
Modulate On Diff	°F	2	10	5	Boiler turns on if temperature drops below target minus differential on
Modulate Off Diff	°F	2	10	5	Boiler shuts down if modulates past target plus differential off
Max On Time	minutes	off	240	30	Longest time boiler will satisfy this system before switching to an active lower priority
Min On Time	—	—	—	—	Priority 1 does not have this setting
Boost Interval	minutes	off	240	N/A (not used)	When operating on ODR increases target 10F when this time expires until reaching MAX
Prepump Time: ### SEC	seconds	0	240	20	Additional time to run circulators longer than standard 10 second time
Postpump Time: ### SEC	seconds	off	240	30	Circulator run time after call for heat ends
Circulator 1	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 2	on-off	off	on	off	Circulator activates on this call for heat if on
Circulator 3	on-off	off	on	off	Circulator activates on this call for heat if on
Circulator 4	on-off	off	on	on	Circulator activates on this call for heat if on
Maximum Rate	%Rate	21%	100%	96%	Boiler Model and altitude specific (derated to 96% from factory)
Minimum Rate	%Rate	20%	99%	20%	Boiler Model and altitude specific

Boiler Priority 2					
System Type	Types			FTB	Finned-Tube Baseboard
Max Supply	°F	60	190	180	Highest target the control will calculate based on outdoor temperature Target temperature if outdoor sensor is not detected (manual reset lockout at 200°F)
Min Supply	°F	60	190	130	Lowest target the control will calculate based on outdoor air temperature
Max OD Reset	°F	50	100	70	Outdoor air temperature that forces the minimum supply water to be target temperature
Min OD Reset	°F	-20	50	0	Outdoor air temperature that forces the maximum supply water to be target temperature
Modulate On Diff	°F	2	10	5	Boiler turns on if temperature drops below target minus differential on
Modulate Off Diff	°F	2	10	5	Boiler shuts down if modulates past target plus differential off



U-Control operation and setup *(continued)*

Figure 66 U-Control setup options (see Figure 65, page 63 for location in menu sequence), continued

Menu/Item	Units	Low Value	High Value	Default	Comment
Max On Time	minutes	off	240	30	Longest time boiler will satisfy this system before switching to an active lower priority
Min On Time	minutes	off	240	15	Time boiler will satisfy this system before switching to the next active priority
Boost Interval	minutes	off	240	off	When operating on ODR increase target 10F when this time expires until reaching MAX
Prepump Time: ### SEC	seconds	0	240	20	Additional time to run circulators longer than standard 10 second time
Postpump Time: ### SEC	seconds	off	240	30	Circulator run time after call for heat ends
Circulator 1	on-off	off	on	off	Circulator activates on this call for heat if on
Circulator 2	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 3	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 4	on-off	off	on	on	Circulator activates on this call for heat if on
Maximum Rate	%Rate	21%	100%	96%	Boiler Model and altitude specific (derated to 96% from factory)
Minimum Rate	%Rate	20%	99%	20%	Boiler Model and altitude specific
Boiler Priority 3					
System Type	Types			Custom	
Max Supply	°F	60	190	190	Highest target the control will calculate based on outdoor temperature Target temperature if outdoor sensor is not detected (manual reset lockout at 200°F)
Min Supply	°F	60	190	70	Lowest target the control will calculate based on outdoor air temperature
Max OD Reset	°F	50	100	70	Outdoor air temperature that forces the minimum supply water to be target temperature
Min OD Reset	°F	-20	50	0	Outdoor air temperature that forces the maximum supply water to be target temperature
Modulate On Diff	°F	2	10	5	Boiler turns on if temperature drops below target minus differential on
Modulate Off Diff	°F	2	10	5	Boiler shuts down if modulates past target plus differential off
Max On Time	—	—	—	—	Priority 3 does not have this setting
Min On Time	minutes	off	240	15	Time boiler will satisfy this system before switching to the next active priority
Boost Interval	minutes	off	240	off	When operating on ODR increase target 10F when this time expires until reaching MAX
Prepump Time: ### SEC	seconds	0	240	20	Additional time to run circulators longer than standard 10 second time
Postpump Time: ### SEC	seconds	off	240	30	Circulator run time after call for heat ends
Circulator 1	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 2	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 3	on-off	off	on	on	Circulator activates on this call for heat if on
Circulator 4	on-off	off	on	on	Circulator activates on this call for heat if on
Maximum Rate	%Rate	21%	100%	96%	Boiler Model and altitude specific (derated to 96% from factory)
Minimum Rate	%Rate	20%	99%	20%	Boiler Model and altitude specific
Circulator Exercising					
Circulator 1	on-off	off	on	on	Circulators exercise 10 seconds every 72 hours of inactivity if on
Circulator 2	on-off	off	on	on	Circulators exercise 10 seconds every 72 hours of inactivity if on
Circulator 3	on-off	off	on	on	Circulators exercise 10 seconds every 72 hours of inactivity if on
Circulator 4	on-off	off	on	on	Circulators exercise 10 seconds every 72 hours of inactivity if on
Freeze Protect Circs					
Circulator 1	on-off	off	on	off	If HxOut sensor out falls below 40F boiler fires low and turns on this circ until 45F
Circulator 2	on-off	off	on	on	If HxOut sensor out falls below 40F boiler fires low and turns on this circ until 45F
Circulator 3	on-off	off	on	off	If HxOut sensor out falls below 40F boiler fires low and turns on this circ until 45F
Circulator 4	on-off	off	on	on	If HxOut sensor out falls below 40F boiler fires low and turns on this circ until 45F



U-Control operation and setup *(continued)*

Figure 67 U-Control diagnostic information (see Figure 65, page 63 for location in menu sequence)

Menu/Item	Units	Low Value	High Value	Default	Comment
Diagnostics					
Temperatures					
Status	Text			data	Current operating status of the boiler. Prepurge, Ignition, Name of the system Type being satisfied, post purge, Warm Weather Shutdown, Trouble
System Supply	°F			data	Temperature of the remote system supply sensor
System Return	°F			data	Temperature of the remote system return sensor
Boiler Out1	°F			data	Temperature of the first sensing element of the boiler's outlet manifold sensor
Boiler Out2	°F			data	Temperature of the second sensing element of the boiler's outlet manifold sensor
Boiler In	°F			data	Temperature of the boiler's heat exchanger inlet sensor
Heat Xchr 1	°F			data	Temperature of the boiler's heat exchanger block (will override modulation if necessary to keep block temperature at target)
Heat Xchr 2	°F			data	Temperature of the boiler's heat exchanger block (redundant sensor)
Flue1	°F			data	Temperature of the first sensing element of the boiler's flue gas sensor
Flue2	°F			data	Temperature of the second sensing element of the boiler's flue gas sensor
Outdoor	°F			data	Temperature of the remote outdoor air temperature sensor
Inputs					
Status	Text			data	Current operating status of the boiler. Prepurge, Ignition, Name of the system Type being satisfied, post purge, Warm Weather Shutdown, Trouble
Priority 1	on-off			data	Call for heat status on Priority 1 Input
Priority 2	on-off			data	Call for heat status on Priority 2 Input
Priority 3	on-off			data	Call for heat status on Priority 3 Input
Analog Input	vdc			data	Value of 0–10 VDC input signal on P15 #5 and #6
Manual Limit	open-closed			data	External manual limit P13-1 & P13-2
Auto Limit	open-closed			data	External auto limit P13-3 & P13-4
Air Pr Switch	open-closed			data	Air flow proving switch P7-4 & P7-5
Gas Pr Switch	open-closed			data	High and low gas pressure switches EP4-1, -2 & -3
Low Wtr Cutoff	open-closed			data	Low water cutoff device on P12-3 & P12-4
Blower Tach	rpm			data	Feedback from blower sensor
Flame Signal	no units			data	Number indicating the presence and quality of the flame used to shutdown boiler
Outputs					
Gas Valve	on-off			data	Control's gas valve circuit status
Circulator 1	on-off			data	Control's circulator 1 relay status
Circulator 2	on-off			data	Control's circulator 2 relay status
Circulator 3	on-off			data	Control's circulator 3 relay status
Circulator 4	on-off			data	Control's circulator 4 relay status
Blower Signal	% of rate			data	Control's signal controlling the blower speed
Add'l Heat Demand	on-off			data	Control's signal controlling the additional heat demand



U-Control operation and setup *(continued)*

Figure 67 U-Control diagnostic information (see Figure 65, page 63 for location in menu sequence), continued

Menu/Item	Units	Low Value	High Value	Default	Comment
Alarm	on-off			data	Control's alarm contact status
Analog Output	vdc			data	Value of 0–10 VDC output signal on P16 #1 and #2
Errors					
Control Fault	#			0	Displays number of control faults
Ignition Retries	#			0	Displays number of ignition attempts boiler is currently on
Manual Reset Cnt	#			0	Displays number of manual reset lockouts since last cleared
Auto Reset Cnt	#			0	Displays number of auto reset lockouts since last cleared
Lockout History 1					Choose this to view the most recent error recorded
Time & Date	text			data	Displays time and date that lockout occurred
Status	text			data	Displays what the status of the boiler at the time of the error
Manual Reset	yes or none			data	Choose this to view the details of manual reset lockouts
Auto Reset	yes or none			data	Choose this to view the details of auto reset lockouts
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Lockout History 2					Choose this to view the second most recent error recorded
Time & Date	text			data	Displays time and date that lockout occurred
Status	text			data	Displays what the status of the boiler at the time of the error
Manual Reset	yes or none			data	Choose this to view the details of manual reset lockouts
Auto Reset	yes or none			data	Choose this to view the details of auto reset lockouts
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Lockout History 3					Choose this to view the third most recent error recorded
Time & Date	text			data	Displays time and date that lockout occurred
Status	text			data	Displays what the status of the boiler at the time of the error
Manual Reset	yes or none			data	Choose this to view the details of manual reset lockouts
Auto Reset	yes or none			data	Choose this to view the details of auto reset lockouts
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Software Versions					
Display	### format			data	Software version of the microprocessor on the display circuit board
Main Micro	### format			data	Software version of the main microprocessor on the control circuit board
Second Micro	### format			data	Software version of the second microprocessor on the control circuit board



U-Control operation and setup *(continued)*

Figure 67 U-Control diagnostic information (see Figure 65, page 63 for location in menu sequence), continued

Menu/Item	Units	Low Value	High Value	Default	Comment
Manual Test Mode					
Status	text			data	Current operating status of the boiler. Prepurge, Ignition, Name of the system Type being satisfied, post purge, Warm Weather Shutdown, Trouble
Target	°F			data	Calculated target temperature based on outdoor temp or the max setpoint if no ODR
Modulation	°F			data	Temperature of the sensor the boiler is using to base its modulation (system supply, boiler outlet or heat exchanger)
System Supply	°F			data	Temperature of the remote mounted system water supply sensor
System Return	°F			data	Temperature of the remote mounted system water return sensor
Boiler Out	°F			data	Temperature of the outlet sensor on the boiler heat exchanger
Boiler In	°F			data	Temperature of the inlet sensor on the boiler heat exchanger
Heat Xchr	°F			data	Temperature of heat exchanger block sensor
Flame Signal	no units			data	Number indicating the presence and quality of the flame used to shutdown boiler
Blower Signal	% of rate			data	Control's output to the blower
Blower Tach	rpm			data	Blower's feedback to the control
Force Rate		Low, Med, High, or Auto		Auto	Used to manually force a rate during a call for heat. Choose auto for normal operation.

Manual Reset					Reset selected condition
---------------------	--	--	--	--	--------------------------

Maintenance Info

Maintenance Info					
Name	text			blank	Contractor name to appear in maintenance reminders and during lockouts
Phone	text			blank	Contractor phone number
Model	text			blank	Displays the boiler model selected in the boiler setup
CP Number	text			blank	Enter the CP# of the boiler
Installed	text			blank	Enter the date the boiler was installed
Last Date	text			data	Date automatically entered when Reset Reminder is choose by contractor
Next Date	text			data	Date automatically calculated when Reset Reminder is selected by contractor
Interval Settings	months	6	24	12	Contractor selects maintenance reminder frequency based on service history
Reset Reminder	menu			menu	Contractor selects this to update Last maintenance Date and Next Date. Homeowner uses this to ignore the reminder and update only the Next Date.

Set Time and Date

Year	text			2008	Set year (homeowner or contractor)
Month	text			1	Set month (homeowner or contractor)
Day	text			1	Set day (homeowner or contractor)
Hour	text			12	Set hour (homeowner or contractor)
Minute	text			0	Set minute (homeowner or contractor)

Valve Test

Open Gas Valve 1	text	On	Off	Off	Activates the first solenoid in the gas valve (for gas valve leakage testing)
Open Gas Valve 2	text	On	Off	Off	Activates the second solenoid in the gas valve (for gas valve leakage testing)



Startup — fill the system

Clean system to remove sediment

1. You must thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by buildup or corrosion due to sediment.
2. If necessary, use an approved chemical cleaning agent, following the manufacturer's guidelines for procedures. A list of approved cleaning products is available at www.Weil-McLain.com. See Replacement parts at the end of this manual for Weil-McLain part numbers to obtain cleaning agents through a Weil-McLain distributor.
3. For zoned systems, flush each zone separately through a purge valve. (If purge valves and isolation valves are not already installed, install them to properly clean the system.)
4. Flush system until water runs clean and you are sure piping is free of sediment.

⚠ WARNING

Do not use petroleum-based cleaning or sealing compounds in boiler system. Damage to elastomer seals and gaskets in system could occur, resulting in substantial property damage.

Before filling the boiler and system with water, verify the following. **DO NOT fill with softened water.** Boiler corrosion can occur.

Failure to comply could result in boiler failure or unreliable operation.

Water chemistry

Water pH between 7.0 and 8.5

1. Maintain boiler water pH between 7.0 and 8.5. Check with litmus paper or have chemically analyzed by water treatment company.
2. If pH differs from above, consult local water treatment company for treatment needed.
3. DO NOT use softened water. Softened water can cause corrosion.

Hardness must be less than 7 grains

1. Consult local water treatment companies for unusually hard water areas (above 7 grains hardness).

Chlorine concentration must be LESS THAN 200 ppm

1. Filling with chlorinated fresh water should be acceptable since drinking water chlorine levels are typically less than 5 ppm.
2. Do not use the boiler to directly heat swimming pool or spa water.
3. Do not fill boiler or operate with water containing chlorine in excess of 200 ppm.

Antifreeze

1. Use only antifreeze listed by Weil-McLain as suitable for use with Ultra Gas Boilers. A list of approved antifreeze products is available at www.Weil-McLain.com.
2. See Replacement parts at the end of this manual for Weil-McLain part numbers to obtain antifreeze through a Weil-McLain distributor.

Use the correct amount of antifreeze

1. Determine the freezing temperature needed (to protect against lowest likely temperature the system water will encounter).
2. Find the antifreeze concentration by volume needed for this temperature from the antifreeze manufacturer's data on the antifreeze container. **DO NOT** exceed 50% by volume concentration of antifreeze.
3. Add up the volume (gallons) of all system piping and components, including the expansion tank and boiler.
 - a. Boiler water content is listed on page 109.
 - b. Remember to include expansion tank water content.
4. Multiply this volume by the (percent) antifreeze needed to find the number of gallons of antifreeze to add.

Fill and test water system

1. Fill system only after ensuring the water meets the requirements of this manual.
2. Close manual and automatic air vents and boiler drain valve.
3. Fill to correct system pressure. Correct pressure will vary with each application.
 - a. Pressure will rise when boiler is turned on and system water temperature increases. Operating pressure must never exceed 80 psig.
4. At initial fill and during boiler startup and testing, check system thoroughly for any leaks. Repair all leaks before proceeding further.

⚠ WARNING

Eliminate all system 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.

Purge air from water system

1. Connect a hose to the purge valve (see purge/drain valves, item 11, in piping diagrams beginning on page 15. Route hose to an area where water can drain and be seen.
2. Close the boiler or system isolation valve between the purge valve and fill connection to the system.
3. Close zone isolation valves.
4. Open quick-fill valve on cold water make-up line.
5. Open purge valve.



Startup — fill the system *(continued)*

Freeze protection (when used)

WARNING Follow these guidelines to prevent possibility of severe personal injury, death or substantial property damage:

NEVER use automotive or standard glycol antifreeze, even glycol made for hydronic systems. Use only freeze-prevention fluids recommended by Weil-McLain for application in Ultra Boiler systems.

Thoroughly flush any system that has used glycol before installing the new Ultra boiler.

Review the material safety data sheet (MSDS) for the fluid used with the boiler owner and leave a copy for reference. The MSDS contains information on potential hazards and first aid procedures for exposure or ingestion.

Check antifreeze inhibitor level at least annually. Glycol concentration and inhibitor levels may change over time. Add antifreeze to increase concentration if necessary. Add inhibitor as needed to bring to acceptable level, using inhibitor test kit to verify.

When using freeze protection fluid with automatic fill, **install a water meter to monitor water make-up.** Freeze protection fluid may leak before the water begins to leak, causing concentration to drop, reducing the freeze protection level.

DO NOT exceed 50% antifreeze by volume. Antifreeze moves more sluggishly than water and can interfere with heat transfer. At antifreeze concentrations higher than 50%, sludge can develop in the boiler, potentially causing damage to the heat exchanger.

Clean the system before filling. Always drain and flush the system thoroughly before filling with antifreeze. Sludge, iron oxide deposits and other sediment in the system inhibit flow and can cause rapid breakdown of inhibitors.

Use only antifreeze recommended by Weil-McLain.

NOTICE Weil-McLain provides information for application of the antifreeze products listed in this document only for use in Weil-McLain Ultra boilers. Do not apply these products or instructions for other applications. Local codes may require a backflow preventer or actual disconnection from city water supply.

- One zone at a time, open the isolation valves. Allow water to run through the zone, pushing out the air. Run until no noticeable air flow is present. Close the zone isolation valves and proceed with the next zone. Follow this procedure until all zones are purged.
- Close the quick-fill water valve and purge valve and remove the hose. Open all isolation valves. Watch that system pressure rises to correct cold-fill pressure.
- After the system has operated for a while, eliminate any residual air by using the manual air vents located throughout the system.
- If purge valves are not installed in system, open manual air vents in system one at a time, beginning with lowest floor. Close vent when water squirts out. Repeat with remaining vents.
- Open automatic air vent (diaphragm-type or bladder-type expansion tank systems only) one turn.
- Starting on the lowest floor, open air vents one at a time until water squirts out.
- Repeat with remaining vents.
- Refill to correct pressure.

Use inhibitor supplied with boiler

- The Ultra boiler is shipped with Sentinel X100 inhibitor and Sentinel inhibitor test kit. See Repair Parts at the end of this manual for re-ordering information.
- After filling the system as directed in these instructions, use a caulking gun to inject the X100 inhibitor into the system, following the instructions on the tube.
- Inject all of the inhibitor supplied with the boiler. Allow time for the water to circulate and mix. Then check the inhibitor level. Add additional inhibitor if necessary.

Check/verify water chemistry

- The system may have residual substances that could affect water chemistry.
- After the system has been filled and leak tested, verify water pH and chlorine concentrations are acceptable.
- Verify antifreeze concentration, when used.
- Follow the instructions on the Sentinel test kit to sample the system water and verify inhibitor concentration.

Check inhibitor and antifreeze concentrations annually

- Test the pH of a sample of system water at least annually. The pH of the water mixture must be between 7.0 and 8.5. (Or use the Sentinel inhibitor test kit to check concentration.)
- If pH is outside this range (or inhibitor test kit indicates low level), the inhibitor level may not be sufficient to prevent corrosion.
- Test antifreeze concentration.

WARNING Test antifreeze concentration at least annually. If concentration is low, add antifreeze or drain system and refill with correct mixture. Follow instructions on page 70 to determine amount of antifreeze needed.

- Check inhibitor level after adjustments are made.



Startup — final checks

Check for gas leaks



Before starting the boiler, and during initial operation, use a leak detector or smell near the floor and around the boiler for gas odorant or any unusual odor. Remove boiler front door and smell interior of boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Repair any leak at once.

DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death or substantial property damage.

Propane boilers only — Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Check thermostat circuit(s)

1. Disconnect the two external wires connected to the boiler thermostat terminals (see Field wiring, beginning on page 51 for terminal locations).
2. Connect a voltmeter across these two incoming wires. Close each thermostat, zone valve and relay in the external circuit one at a time and check the voltmeter reading across the incoming wires.
3. There should NEVER be a voltage reading.
4. If a voltage does occur under any condition, check and correct the external wiring. (This is a common problem when using 3-wire zone valves.)
5. Once the external thermostat circuit wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires. Allow the boiler to cycle.

Inspect/fill condensate system

Inspect/check condensate lines and fittings

1. Inspect the condensate drain line, condensate PVC fittings and condensate trap. (See page 47 for component locations.)
2. Pour water into the top of the boiler's 1" PVC condensate tee and check for any leaks in the condensate drain line or fittings. Repair any leaks.

Fill condensate trap with water

1. Remove boiler front door.
2. Remove the flue inspection plug (item 46, page 3).

3. Pour fresh water into the flue inspection opening until the condensate trap is full of water (water begins to flow out through condensate drain tee).
4. Replace the flue inspection plug.



The condensate trap must be filled with water during all times of boiler operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Final checks before starting boiler

- Read the instructions to adjust and set up the U-Control module.
- Verify that the boiler model is set correctly in the U-Control, and that it displays correctly.
- Verify that the boiler and system are full of water and all system components are correctly set for operation.
- Fill condensate trap with water (see above for procedure).
- Verify electrical connections are correct and securely attached.
- Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

To start the boiler

1. Turn OFF the boiler ON/OFF switch.
2. Read and follow the Operating Instructions, Figure 70, page 75.
3. The U-Control display will show installed sensors when first powered. Make sure the right sensors are detected. If not, determine the cause and correct before proceeding.

If boiler does not start correctly

1. Check for loose connections, blown fuse or service switch off?
2. Is external limit control (if used) open? Is boiler water temperature above 200 °F?
3. Is thermostat set below room temperature?
4. Is gas turned on at meter or boiler?
5. Is incoming gas pressure greater or less than required on page 50 (natural gas) or page 50 (propane)?
6. Are parameters set correctly as per this manual?
7. Is the warm weather shutdown activated?
8. If none of the above corrects the problem, refer to Troubleshooting, beginning on page 83.



Startup — final checks *(continued)*

☐ Check system and boiler

☐ Check water piping

1. Check system piping for leaks. If found, shut down boiler and repair immediately. (See WARNING on page 70 regarding failure to repair leaks.)
2. Vent any remaining air from system using manual vents. Air in the system will interfere with circulation and cause heat distribution problems and noise.

☐ Check vent piping and air piping

1. Check for gas-tight seal at every connection and seam of air piping and vent piping.

▲WARNING Venting system must be sealed gas-tight to prevent flue gas spillage and carbon monoxide emissions which will result in severe personal injury or death.

☐ Check gas piping

1. Check around the boiler for gas odor following the procedure of page 49 of this manual.

▲WARNING If you discover evidence of any gas leak, shut down the boiler at once. Find the leak source with bubble test and repair immediately. Do not start boiler again until corrected. Failure to comply could result in severe personal injury, death or substantial property damage.

☐ Propane boilers — verify conversion

1. Verify propane orifice has been installed per Propane Conversion instructions.

▲WARNING DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death or substantial property damage.

Ultra boilers are shipped ready to fire natural gas ONLY. You must install the propane orifice if the boiler will be connected to propane. See page 9. Failure to comply could result in severe personal injury, death or substantial property damage.

☐ Check flame & combustion with instruments

1. Initiate a call for heat on one of the heat demand inputs.
2. Access the U-Control installer menus by pressing and holding the UP and DOWN arrow keys for five seconds.
3. Use the U-Control display to navigate to Manual test mode (see Figure 65, page 63) and force the firing rate to MAX (high fire).
4. Look at the flame through the flame inspection window. The high fire flame should be blue and should be stable. The burner surface should be covered with orange dots.
5. Remove the flue temperature sensor from the flue pipe and insert a combustion test probe., using a calibrated combustion test instrument.
6. Test for CO₂ (or O₂) and for CO. The CO₂ values must be within 1% of the values listed in Figure 68. If results are acceptable, proceed to step 7. IF NOT, follow the instructions under “Gas valve adjustment procedure” on page 74 to set the CO₂ values. See WARNING below.

▲WARNING If combustion at either high or low fire is outside the range given in Figure 68, follow the procedure given for adjusting the throttle screw on the gas valve. If throttle screw adjustment does not correct the problem, then shut down the boiler and contact your local Weil-McLain representative. Throttle screw adjustment must be done only by a qualified technician, using calibrated test instruments. Failure to comply could result in severe personal injury, death or substantial property damage.

Figure 68 Acceptable CO₂ and CO values (CO₂ must be within 1.0% of these values)

Boiler	Fuel	High fire		Low fire	
		%CO ₂	CO ppm	%CO ₂	CO ppm
Ultra-550	NG	9.2	< 60	9.0	< 60
	LP	10.1	< 60	9.9	< 60
Ultra-750	NG	9.2	< 60	9.0	< 60
	LP	10.1	< 60	10.1	< 60

These values are for altitudes up to 5,500 feet. For higher altitudes, CO₂ may be slightly lower and CO slightly higher.

Startup — final checks *(continued)*

7. Measure natural gas input:
 - a. Operate boiler 10 minutes.
 - b. Turn off other appliances.
 - c. At natural gas meter, measure time (in seconds) required to use one cubic foot of gas.
 - d. Calculate gas input:

$$\frac{3600 \times 1000}{\text{number of seconds from step c}} = \text{Btuh}$$

- e. Btuh calculated should approximate input rating on boiler rating label.
8. Use the U-Control display to navigate to Manual test mode (see Figure 65, page 63) and force the firing rate to MIN (low fire).
9. Look at the flame through the flame inspection window. The low fire flame should be stable and evenly distributed over burner surface with a uniform orange color.
10. Repeat the combustion test of steps 5 and 6 above.
11. Use the U-Control display to navigate to Manual test mode (see Figure 65, page 63) and force the firing rate to AUTO (normal operation).
12. Re-install the flue gas temperature sensor.

WARNING You must re-install the flue gas temperature sensor to prevent flue gas spillage into the boiler enclosure. Failure to comply could result in severe personal injury, death or substantial property damage.

Gas valve adjustment procedure

WARNING DO NOT attempt to adjust the gas valve settings unless you are a qualified technician, and with the use of calibrated combustion test instruments. Adjust the valve settings only as needed to meet the combustion values given in Figure 68.

1. This procedure is only necessary when combustion tests indicate the need, as explained under “ **Check flame & combustion with instruments**, page 73.”
2. Boiler behavior that might indicate a need to check combustion values at high fire (as per page 73) to verify boiler is in adjustment include: difficulty igniting, poor flame stability at low fire, combustion noise or high carbon monoxide values.
3. Combustion readings must be taken at both high fire and low fire.

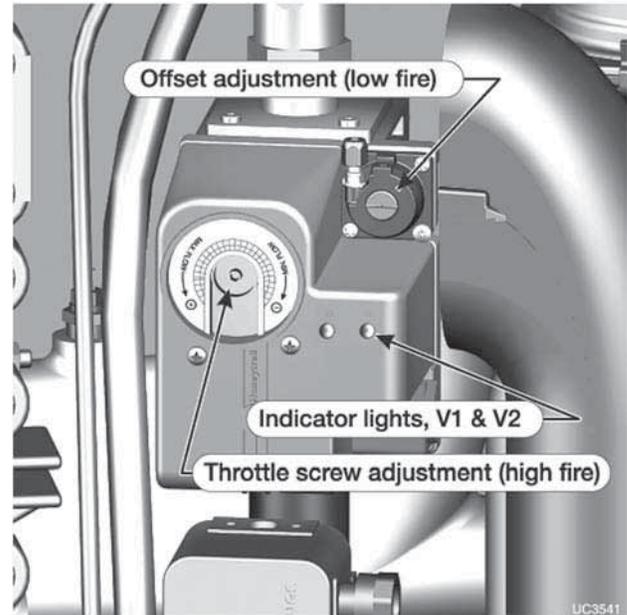
Adjust valve at high fire

1. Use the U-Control display to navigate to Manual test mode (see Figure 65, page 63) and force the firing rate to MAX (high fire). After the boiler has had time to stabilize and high-fire RPM value (see Figure 74, page 82) is reached, take a CO₂ reading.
 - a. See Figure 69 to adjust if necessary.
 - b. Remove the blue cover on the throttle screw opening with a straight-bit screwdriver.

NOTICE Make only small (1/8-turn) throttle screw adjustments. Adjustment can be sensitive, especially on propane.

- c. If the CO₂ is HIGH, turn the throttle screw CLOCKWISE to lower the input. Allow the boiler to stabilize and take another

Figure 69 Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)



reading. Continue until the desired CO₂ value is achieved.

- d. If the CO₂ is LOW, turn the throttle screw COUNTERCLOCKWISE to increase the input. Allow the boiler to stabilize and take another reading. Continue until the desired CO₂ value is achieved.
- e. Re-install the blue cover on the gas valve.

Adjust valve at low fire

1. Lock the boiler into low fire using the U-Control module screen. Verify that the blower rpm value is correct for low fire (see Figure 74, page 82).
2. Check the combustion readings.
3. If results are acceptable at low fire, verify high fire readings again. Restore firing rate to AUTO.
4. If combustion results are not acceptable, remove the cover screw over the offset adjustment (see Figure 69).
5. Use a T40 Torx driver to adjust the setting. Rotate clockwise to increase CO₂, rotate counterclockwise to decrease CO₂. Re-install the cover screw when completed.
6. Consult your local Weil-McLain representative if acceptable results cannot be obtained for both high and low fire.

Adjust and test boiler controls

1. Follow instructions in this manual to set and verify operation of the boiler controls.



U-Control operation and setup *(continued)*

Figure 70 Operating instructions (WARNING — Verify that the U-Control is set for the correct boiler model before proceeding.)

**FOR YOUR SAFETY
READ BEFORE OPERATING**

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

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. Before OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. See below.

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

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

WHAT TO DO IF YOU SMELL GAS

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

OPERATING INSTRUCTIONS

1. Stop! Read the safety information at left on this label. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
2. Set room thermostat(s) to lowest setting. Verify external manual gas cock is open (valve handle parallel to gas piping).
3. Turn OFF all electrical power to the appliance.
4. Rotate two rotary latches at top of access door counterclockwise to release door.
5. Remove boiler access door by tilting forward and lifting up.
6. Turn boiler manual gas valve knob counterclockwise ↶ to open gas supply.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information to the left. If you don't smell gas, go to the next step.
8. Turn ON all electrical power to the appliance.
9. Set thermostat(s) to desired setting.
10. The Ultra display will show symbols and text describing the status of the boiler as it proceeds through its operating sequence. "Standby" status means there is no call for heat. A faucet or flame symbol on the display means the boiler is firing.

Gas valve CLOSED **Gas valve OPEN**

to OPEN to CLOSE

11. If the appliance will not operate when there is a call for heat and piping is not hot, follow the instructions "To Turn Off Gas To Appliance" below and call your service technician or gas supplier.
12. Replace jacket front panel. Make sure panel is seated firmly in place and all joints are visually sealed. See step 4. Rotate latches clockwise.

TO TURN OFF GAS TO THE APPLIANCE

1. Set room thermostats to lowest setting.
2. Turn OFF all electrical power to the appliance.
3. Close external manual gas cock (valve handle perpendicular to gas piping). Remove boiler access door. Turn boiler manual gas valve knob clockwise ↷ to close gas supply.
4. Replace boiler access door.

550-101-255 (0409)

Check-out/startup verification

NOTICE

Fill out start-up data on the Installation and Service Certificate, page 112.

- Verified that the U-Control is set for the correct boiler model?
- Boiler and heat distribution units filled with water?
- Water chemistry verified per page 70?
- Automatic air vents, if used, open one full turn?
- Air purged from system?
- Air purged from gas piping? Piping checked for leaks?
- Primed condensate trap?
- Propane conversion kit installed for propane firing and propane conversion label affixed to jacket?

WARNING

Ultra boilers are shipped ready to fire natural gas ONLY. You must install the propane conversion kit if the boiler will be connected to propane. See page 9. Failure to comply could result in severe personal injury, death or substantial property damage.

- Thermostat circuit wiring checked to ensure there are no stray voltages?
- Followed Operating Instructions, Figure 70, page 75
- Burner flame and combustion verified per page 73?
- Verified control operation for space heating and DHW (if used) per this manual?
- Tested additional field-installed controls — If boiler has additional limits, have they been tested for operation as outlined by manufacturer? (Boiler should be operating and should go off when controls are tested. Verify controls cause automatic reset lockout or manual reset lockout as desired.)
- Set additional field-installed limit control(s) to system temperature requirements? Adjusted balancing valves and controls to provide design temperature to system?
- For multiple zones, adjusted for correct flow in each zone?
- Verified thermostat heat anticipator (if available) set properly (see page 55 for requirements)?
- Cycled boiler with thermostat (and with DHW aquastat, if installed) — Raised to highest setting and verified boiler goes through normal startup cycle? Lowered to lowest setting and verified boiler goes off?
- Measured natural gas input? (page 74)
- Checked incoming gas pressure as specified on page 50 (natural gas) or page 50 (propane).
- Observed several operating cycles for proper operation.
- Set room thermostat to desired room temperature (and DHW aquastat, if installed, to desired DHW storage temperature)?
- Reviewed all instructions shipped with this boiler with owner or maintenance person?
- Fill in **Installation certificate** on page 112.
- Fill out the warranty registration card and send to Weil-McLain.
- Return instructions to envelope and give to owner or place inside boiler housing.

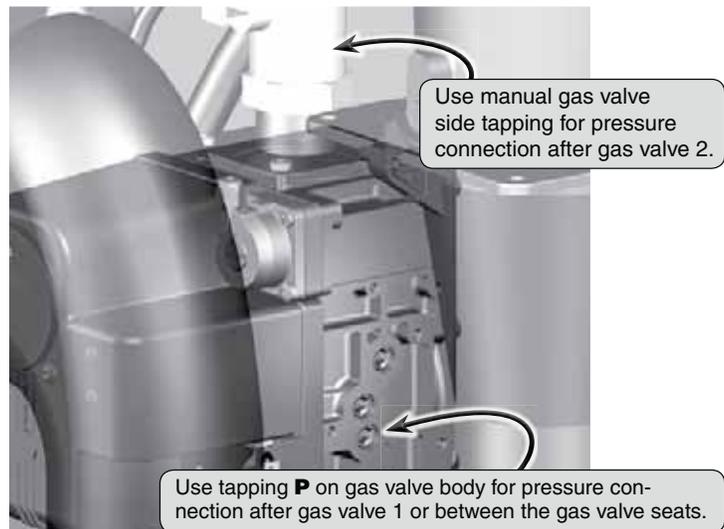
Gas valve leakage testing

WARNING

DO NOT connect a manometer to the manual gas valve or the automatic gas valve. The high vacuum from the blower could pull fluid into the gas line, possibly damaging the gas valves.

1. Refer to the gas valve manufacturer's instructions for the procedure to test the valve.
2. To operate the two valve solenoids independently, navigate to the Valve Test Screen on the U-Control (see Figure 65, page 63 for access sequence).
3. When in the Gas Valve Test Screen, you will see two options:
 - a. Open Gas Valve 1
 - b. Open Gas Valve 2
4. To open only gas valve 1, highlight it and press enter/save.
5. While still in the Gas Valve test screen, give the boiler a call for heat. The boiler will go through its normal Ignition sequence, but will only open Gas Valve 1.
6. After gas valve 1 has opened, end the call for heat.
7. This procedure can be repeated by selecting and entering Open Gas Valve 2.
8. After the testing is complete and the call for heat has been removed, use the back button to exit the Gas Valve Test Screen. This will then reset the control to open both Gas Valves for any call for heat.

Figure 71 Gas valve test pressure tapping



Gas pressure switch settings

1. After testing the gas pressure switches, restore the settings to the following:
 - a. High gas pressure switch — 14" w.c.
 - b. Low gas pressure switch — 2" w.c.

WARNING

Install a 100% lockup gas pressure regulator in the gas supply line if inlet pressure can exceed 14" w.c. at any time. Adjust the lockup regulator for 7 to 10" w.c. inlet pressure. This setting provides a cushion below the setting of the high gas pressure switch. Failure to comply could result in shutdown by the high gas pressure switch, resulting in possible serious property damage due to freeze-up.



Annual startup and general maintenance

Figure 72 Service and maintenance schedules

Service technician (see following pages for instructions)		Owner maintenance (see Ultra User's Information Manual for instructions)		
ANNUAL START-UP (See First-year special inspection)	General:			
	Reported problems.	Daily	<ul style="list-style-type: none"> • Check boiler area. • Check air openings. • Check pressure/temperature gauge. • Verify boiler front door is securely in place. 	
	Inspect interior; clean and vacuum if necessary; WARNING — no solvents.		Monthly	<ul style="list-style-type: none"> • Check vent piping. • Check air piping. • Check relief valve. • Check condensate drain system. • Check automatic air vents (if used).
	Clean base collector and condensate trap and fill with fresh water.		Periodically	<ul style="list-style-type: none"> • Test low water cutoff by pressing test button.
	Check for leaks (water, gas, flue, condensate).		Every 6 months	<ul style="list-style-type: none"> • Check boiler piping (gas and water). • Operate relief valve.
Check system water chemistry, inhibitor level and antifreeze concentration, if used.		End of season	<ul style="list-style-type: none"> • Shut boiler down (unless boiler used for domestic water). 	
Verify flue and air lines in good condition and sealed tight.				
Check system water pressure/system piping/expansion tank.				
Check control settings.				
Ignition electrode (clean with steel wool and reposition).				
Ignition and ground wiring.				
Wiring and connections.				
Perform start-up checkout and performance verification beginning with Startup — fill the system, page 70.				
Flame inspection (stable, uniform).				
Flame signal (see Figure 73, page 81).				
Clean heat exchanger if flue temp is more than 54°F above return water temp.				
Inspect jacket front door gaskets; replace if necessary.				
Additional if combustion or performance indicate need:				
Clean heat exchanger.				
Remove and clean burner using compressed air only.				
Vacuum the blower.				
Review:				
Review with owner.				

⚠ 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.



Annual startup

HANDLING CERAMIC FIBER MATERIALS

REMOVAL OF SIGHT GLASS GASKET

⚠ WARNING The sight glass gasket in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, “Crystal-line silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).”:

- ❑ Avoid breathing dust and contact with skin and eyes.
 - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite 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 sight glass gasket to prevent airborne dust.
- ❑ Remove sight glass gasket from the boiler and place it in a plastic 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.

FIRST-YEAR SPECIAL INSPECTION

1. **No later than 12 months** after the boiler is installed, perform a first-year inspection of the boiler. This must include the following **in addition to routine annual start-up procedures**.
 - a. Remove the heat exchanger cover plate. Inspect the heat exchanger and clean if necessary. See instructions for removing and replacing the heat exchanger cover plate, and for cleaning the heat exchanger, in the Maintenance section of this manual.
 - b. Make sure the burner is clean.
 - c. Make sure the burner gasket is in good condition. Replace if necessary.
 - d. Disconnect condensate trap and drain lines. Inspect, then flush thoroughly.
2. Determine follow-up maintenance and service needs based on the condition of the heat exchanger and condensate lines.
 - a. If the heat exchanger shows substantial fouling, or if condensate lines show accumulation of sediment, schedule a follow-up service call to perform the first-year inspection again, sooner than the normal twelve months between.
 - b. Heavy fouling of the exchanger or condensate lines indicates possible combustion air contamination. Inspect the air intake area carefully, and remove possible contaminants. See “Corrosive contaminants and sources,” Figure 19, page 26, for products to avoid.

⚠ WARNING You must eliminate causes of corrosion and contamination to ensure reliable operation of the boiler and system.



Annual startup *(continued)*

▲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 Figure 72, page 77 and explained on the following pages must be performed to assure maximum boiler efficiency and reliability. 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.

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 free of any of the contaminants listed on page 26 of this manual. If any of these are present in the boiler intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual and the Ultra Boiler Vent Supplement.

Inspect boiler interior & door gaskets

1. Remove front door and inspect interior of boiler.
2. Visually inspect the door gaskets. Make sure all are in good condition. Obtain replacements if any gasket is damaged.

▲WARNING Door gaskets must be intact, and must provide a reliable seal. Replace any damaged gasket.

3. Remove the venturi air inlet silencer and clean if necessary. Replace silencer.
4. Vacuum any sediment from the inside of the boiler and components. Remove any obstructions.

▲WARNING Do not use solvents to clean any of the boiler components. The components could be damaged, resulting in unreliable or unsafe operation.

Clean condensate trap

1. Remove flue inspection plug (item 46, page 3).
2. Inspect base collector with flash light. Flush out with water as needed.
3. Loosen condensate trap line hose clamps and remove trap line.
4. Empty water from trap line and inspect. Flush out if needed with fresh water.
5. Check condensate fittings and condensate line to drain. Flush if necessary to clean.
6. Reinstall condensate trap line and tighten hose clamps.
7. Fill trap with fresh water by pouring into flue inspection plug opening.
8. Replace flue inspection plug.

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 gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using procedure on page 49.

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 combustion air piping

1. 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 boiler, verify that air inlet pipe 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.



Annual startup *(continued)*

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. Reinstall caps. Make sure vents do not leak. Replace any leaking vents.
5. Check system water chemistry (inhibitor concentration, pH and hardness). See page 70.

Check expansion tank

1. 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. See section 3 of this manual for suggested best location of expansion tanks and air eliminators.
 - 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 examples in this manual.
2. 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 (or tanks) 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.

Inspect ignition electrode

1. Remove the ignition electrode from the boiler heat exchanger.
2. Remove any white oxides accumulated on the ignition electrode using steel wool. If the ignition electrode cannot be cleaned satisfactorily, replace ignitor with a new one.
3. Reinstall ignition electrode, making sure gasket is in good condition and correctly positioned.
4. Replace gasket if necessary.
5. Make sure the ignition electrode ground wire is under the top screw that secures the ignitor to the casting.

Check ignition wiring

1. Check ignition cable electrical resistance. A good cable will have resistance between 900 and 1000 ohms. Replace if not acceptable.
2. Inspect boiler ground wire from ignition electrode to ground terminal strip.
3. Verify all wiring is in good condition and securely attached.
4. Check ground continuity of wiring using continuity meter.
5. Replace ground wires if results are not satisfactory.

Check all boiler wiring

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

Check control settings

1. Use the U-Control display to navigate through all settings. Adjust settings if necessary.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform startup and checks

1. Start boiler and perform checks and tests specified in this manual.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.
3. Complete the check-out procedure on page 76.



Annual startup *(continued)*

Check burner flame *(See Figure 75)*

WARNING The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on page 78 of this manual. Failure to comply could result in severe personal injury.

1. Inspect flame through the observation window using the procedure on page 73.
 - a. The high fire flame should be blue and should be stable. The burner surface should be covered with orange dots.
 - b. The low fire flame should be stable and evenly distributed over burner surface with a uniform orange color.
2. If the flame is unsatisfactory at either high fire or low fire, perform the testing specified on page 73. If the problem remains, turn off the boiler and allow the boiler to cool down.
3. To access the burner, first turn off all power to the boiler:
 - a. Disconnect the two wire harnesses connected to the blower.
 - b. Use a 13-mm socket wrench to remove the three nuts that secure the mixing tube to the right-end heat exchanger section (Figure 75).
 - c. The mixing tube, blower, venturi and gas train can be pulled to the right to clear the mounting stud, then pulled forward and placed on a support while working. (If necessary, disconnect the ignitor ground wire and the wire harnesses to the gas valve and gas pressure switches.)
4. Remove the burner gasket and burner (see Figure 76).
5. Clean the burner ports both inside and outside surfaces, using a vacuum cleaner or compressed air. If necessary, use a soft-bristled brush to loosen particles.

WARNING Do not use compressed air unless doing so outside and wearing eye protection.

6. To replace the burner:
 - a. Insert the burner first. When inserting, place your hand inside the burner throat and tilt the back end of the burner up until the burner flange meets the heat exchanger. This is necessary to prevent the burner from rubbing on the heat exchanger burner support stubs on the left end section.
 - b. Align the burner flange notch with the notch in the casting above the burner opening.
 - c. Inspect the burner gasket. It must be in good condition. If not, replace with a new gasket (see Replacement parts at the end of this manual).
 - d. Place the gasket over the three studs.

NOTICE The burner-opening studs are unevenly spaced to ensure the gasket and the mixing tube are properly positioned.

7. Position the mixing tube over the studs. Replace the three nuts. Tighten securely (to 12 N-m/106 in-lbs/8.8 ft-lbs).
8. Reconnect any wiring that was disconnected.
9. Retest the boiler, making sure the flame is acceptable after the cleaning.

Check flame signal

1. Navigate to Diagnostics/Inputs on the U-Control display (see Figure 65, page 63). The flame signal value must be at least 20 above the Shutdown values given in Figure 73.

Figure 75 Burner access

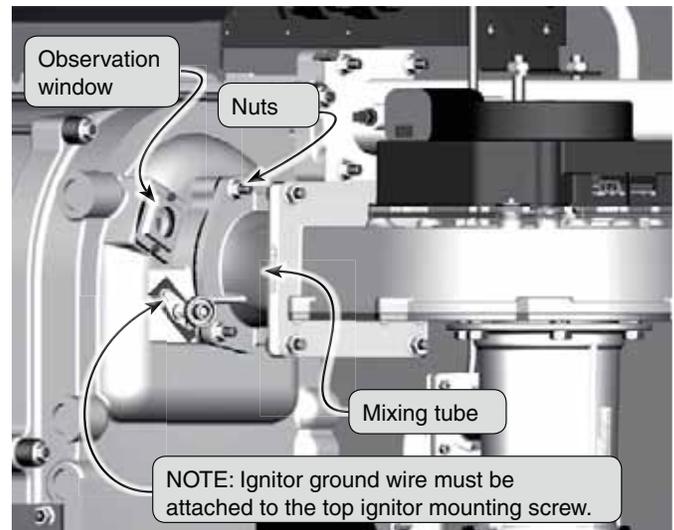


Figure 76 Burner removal and replacement

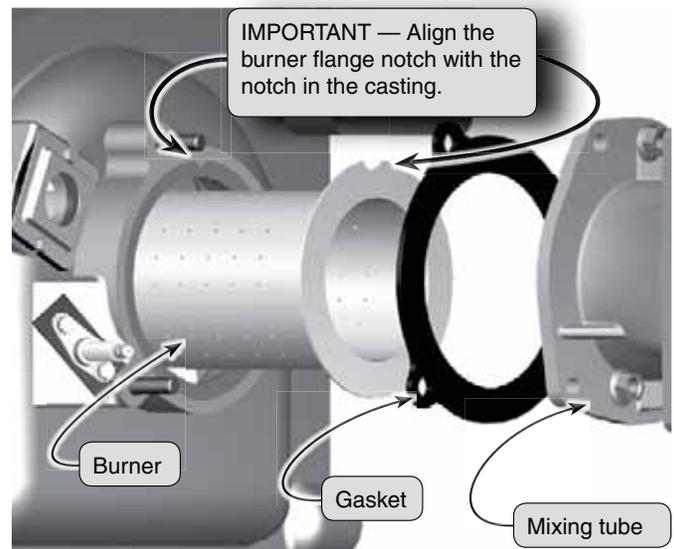


Figure 73 Flame signal shutdown values

Model Ultra –	Shutdown flame signal	Restore flame signal
550	110	130
750	110	130

2. If the flame signal drops to less than 20 above the Shutdown values, the U-Control will attempt to correct by increasing the boiler firing rate to increase flame signal.



Annual startup *(continued)*

3. A lower flame signal may indicate a fouled ignitor or damaged ignitor insulation. If cleaning the ignitor does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the ignitor.
4. If flame signal still remains low, inspect the vent and air piping. Then inspect the heat exchanger, following the procedures given in this manual for removal and reinstallation of the heat exchanger cover plate and other boiler components. Clean the heat exchanger as described in this manual if necessary.

Check flue gas temperature

1. Set the boiler to high fire. Then adjust the U-Control module display to view flue gas temperature and boiler return temperature.
2. The flue gas temperature should be no more than 54 °F higher than the boiler return temperature.
3. If the flue temperature is higher than this, shut down the boiler, allow to cool, and follow the procedure starting on page 93 to clean the heat exchanger.

Check blower speeds

1. For installations at altitudes above 5,500 feet, make sure the control is set up for high altitude in the boiler setup menu. The U-Control module automatically adjusts low fire and ignition rates to compensate for high altitude conditions.
2. For installations below 5,500 feet, DO NOT enable high altitude.
3. Use the U-Control display to navigate to Manual test mode (see Figure 65, page 63).
4. Set the firing rate to MINIMUM (low fire).
5. Write down the blower RPM value shown and compare to the value in the table below. Low fire rate (and corresponding blower speed) is adjusted in the boiler setup menu.
6. Set the firing rate to MEDIUM (ignition rate).
7. Write down the blower RPM value. It should be within 200 RPM of the value listed in the table below.
8. Set the firing rate to MAXIMUM (high fire).
9. Write down the blower RPM value. It should be within 200 RPM of the value given in the table below.
10. If any of the values are outside the ranges listed in the previous steps, contact the factory for technical assistance.

Figure 74 Blower speeds for altitudes up to 5,500 feet (factory setting) and high altitude (over 5,500 ft)

Ultra –	Low fire		Ignition		High fire	
	Factory setting	High altitude	Factory setting	High altitude	Factory setting	Maximum setting
550	1300	1900	2500	2800	5725	5950
750	1300	1825	2350	2650	5275	5500

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 manual section 3, page 12, 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.

Following installation, the valve lever must be operated AT LEAST ONCE A 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. 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 under-sizing.

Review with owner

1. Review the User’s Information Manual with the owner.
2. Emphasize the need to perform the maintenance schedule specified in the User’s Information Manual (and in this manual as well).
3. Remind the owner of the need to call a licensed contractor should the boiler or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure and to schedule an annual startup at the beginning of the next heating season.



Troubleshooting

VERIFY PROPER OPERATION AFTER SERVICING.

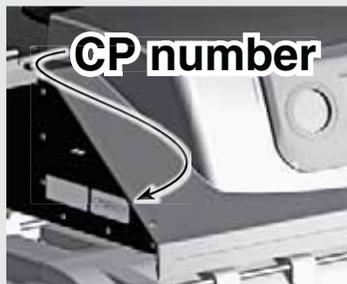
CAUTION Before servicing and making connections . . . **ALWAYS TURN POWER OFF TO THE BOILER TO PREVENT ELECTRICAL SURGES, WHICH CAN DAMAGE BOILER COMPONENTS.**

WARNING **ELECTRICAL SHOCK HAZARD** — The boiler ON/OFF switch does not turn off all power to the boiler. **TURN OFF ALL POWER TO THE BOILER WHEN SERVICING.** Internal wiring is still powered when the switch is off.

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to boiler before servicing. Failure to comply could result in severe personal injury, death or substantial property damage.

WARNING Never jumper (bypass) any device except for momentary testing. Severe personal injury, death or substantial property damage can result.

NOTICE
Before calling, always complete the “**Ultra Gas Data Collection Sheet**” (page 92). Record the boiler size and CP number (located on the left side of the control box, shown at right).



Reinstall boiler jacket front door

WARNING Reinstall boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

Before troubleshooting:

1. See Figure 77 for tools and kits recommended for troubleshooting Ultra boilers.
2. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to boiler.
3. Check the U-Control’s last three lockout histories.
 - a. See Figure 67, page 67 for access information.
 - b. Scroll down to DIAGNOSTICS and press the enter key.
 - c. Scroll down to ERRORS and press the enter key.
 - d. Record the first four data records and then highlight the history record you want to view.
 - e. Follow information at the bottom of the screen to navigate through your lockout histories.

Figure 77 Tools and kits for troubleshooting

Tools needed for troubleshooting	Purpose
#2 Phillips Screwdriver	Remove 4 screws to remove the top front cover
U-Control Screwdriver or 1/16" flat blade screwdriver	Used for wiring on terminal blocks for the U-Control (comes with boiler)
3/16" Allen Wrench (Hex Key)	To remove gas valve pressure tap plugs
3/8" Wrench	To remove gas pressure tap plug
13 mm Nut driver/ratchet	To remove the heat exchanger cover plate, mixing tube or blower
3 mm Allen wrench (Hex Key)	To adjust gas valve throttle
4 mm Allen wrench (Hex Key)	To add orifice to change from natural to propane
5 mm Allen wrench (Hex Key)	To disassemble venturi from blower (blower plate access)
13 mm wrench	To access combustion system and heat exchanger assembly, blower or mixing tube
Multimeter	To take measurement readings on sensors and electrical components
Manometer (Incline or digital)	To measure the gas pressure coming to the boiler.
Combustion analyzer (Digital preferred)	For combustion testing.
Contact thermometer	For checking surface temperatures of heat exchanger and pipes
T40 torx	For gas valve offset adjustment
8 mm wrench	For gas piping to venturi



Troubleshooting *(continued)*

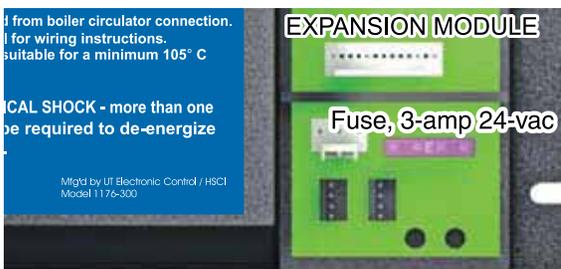
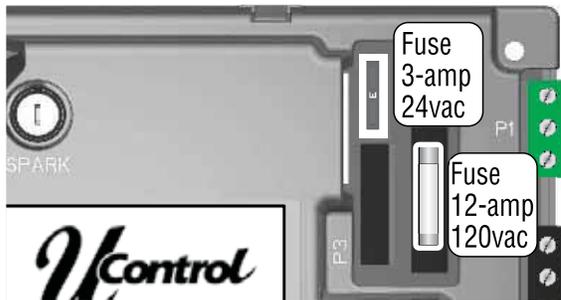
Check the following:

1. Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for 24 VAC between thermostat wire nuts and ground.
2. Make sure all external limit controls are either installed (and closed) or temporarily jumpered for testing.
3. Make sure that connectors to control module are securely plugged in at module and originating control.
4. Gas pressures as specified on page 50 (natural gas) or page 50 (propane).

Always check control module fuses

▲WARNING ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent control module or other components from operating.

1. Turn OFF power to boiler at external line switch.
2. Remove jacket door and jacket top panel. Rotate the swing-away control panel forward to expose the U-Control module and Expansion module.
3. Remove and inspect the two U-Control fuses and the Expansion module fuse (located as shown below).



4. If necessary, replace the fuse:
 - a. Low voltage circuit fuses on U-Control and Expansion module are 3-amp fast-blow (Littelfuse 326012P).

- b. Line voltage circuit fuse is 12-amp slow-blow (Littelfuse 257003).

▲WARNING Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death or substantial property damage.

5. Reinstall jacket top panel and boiler jacket door after checking the fuses.
6. Restore power to boiler at external line switch and verify boiler operation after completing boiler service.

Checking temperature sensors

1. The boiler temperature sensors (flue, outdoor, boiler out, boiler in, heat exchanger and system) are all resistance-type devices.
2. Figure 78 shows the correct value for the sensor at various temperatures.
3. Use the resistance values at 32°F, 60°F, 70°F and 212°F to measure the sensor resistance at known temperatures (freezing point, room temperature and sea level boiling point). For freezing point and boiling point, insert the sensor in water at that temperature. Use an ohmmeter to read resistance value.
4. To check whether the control module is correctly sensing temperature, you can use a resistance decade box. Connect the decade box temporarily in place of a sensor and read the corresponding temperature on the U-Control display. The temperature should be close to the value corresponding to the input resistance.

Figure 78 Sensor resistance values

Sensor resistance values					
Temp (°F)	Sensor ohms		Temp (°F)	Sensor ohms	
	Min	Max		Min	Max
32	34265	37871	120	4517	4992
40	27834	30764	130	3698	4088
50	21630	23907	140	3043	3364
60	16944	18727	150	2517	2782
70	13372	14780	160	2091	2311
80	10629	11747	170	1744	1928
90	8504	9399	180	1461	1615
100	6847	7568	190	1229	1359
110	5545	6129	200	1038	1147



Troubleshooting *(continued)*

WARNING Make sure to determine the causes of outages. Do not leave the boiler operating without a complete diagnosis.

U-Control fault indications

1. The U-Control provides diagnostic information for both automatic reset conditions and manual reset conditions. See Figure 67, page 67 for information available on the U-Control display.
2. Figure 79 shows the screen behavior during an automatic or manual reset condition. The table below the display illustration lists manual reset conditions and how to reset from them.
3. Figure 80, page 86 lists conditions that will cause the control to display a constant red screen. The boiler will automatically restart if the condition self-corrects or the technician uses the U-Control's manual reset screens to reset.

Figure 79 U-Control display toggles when in lockout, with screen flashing red to gray

NOTICE: Screen background color alternates from RED to no backlight (gray screen).

SEE TOP LINE OF DISPLAY FOR ERROR

↓

3
ALTERNATING
SCREENS

Select **MANUAL RESET** to reset condition. Make sure to correct the cause of the problem if possible.

The service technician can change the interval setting by selecting this line.

Select **RESET REMINDER** to reset the counter. The reset reminder will not occur again until the INTERVAL time has elapsed.

MAINTENANCE

NAME : #####

PHONE : ### - ### - ####

MODEL : ULTRA #####

CP# : #####

INSTALLED : DD/MM/YY

LAST DATE : DD/MM/YY

NEXT DATE : DD/MM/YY

INTERVAL SETTINGS

RESET REMINDER

◀ PREVIOUS ENTER ▶

—Alternating Date/Time & Error Info Here—

STATUS : #####

MODULATION :

TARGET : ### ° F

SUPPLY : ### ° F

RETURN : ### ° F

OUTDOOR : ### ° F

DEMAND : ### ### ###

PUMPS : # # #

ADD'L HEAT DEMAND : ###

SETTINGS

MANUAL RESET

SELECT ▲▼

◀ PREVIOUS ENTER ▶

U5003



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers

U-Control Error Condition Log

The U-control is able to record information about the boiler's condition at the time of the three previous faults or errors. This information is available to view in Contractor Menus under "DIAGNOSTICS" by selecting "ERRORS." The control will display the following information:

Information	Description	Action
Control Fault	Records number	Select and press the enter key to reset this count
Ignition Retries	Displays the number of ignition attempts in the current ignition sequence.	
Manual Reset Count	Records number of lockouts that required a manual reset since this count was last cleared.	Select and press the enter key to reset this count
Auto Reset Count	Records number of lockouts that have automatically reset since this count was last cleared.	Select and press the enter key to reset this count
Lockout History 1	Details of present or last recorded lockout	Select and press the enter key for more details
Lockout History 2	Details of boiler during the second oldest lockout still in memory	Select and press the enter key for more details
Lockout History 3	Details of boiler during the oldest lockout still in memory	Select and press the enter key for more details

How to read the last 3 lockout histories:

1. Scroll down to "DIAGNOSTICS" and press the enter key (Square Key in center)
2. Scroll down to "ERRORS" and press the enter key (Square Key in center)
3. Scroll down to "LOCKOUT HISTORY #" and press the enter key.
4. Scroll to choose the either "MANUAL RESET" or "AUTO RESET" and press the enter key to display the fault condition that was recorded.
5. Press the left arrow key to return to the LOCKOUT HISTORY # screen. Scroll up or down to highlight other choices and press the enter key to view the details of the boiler's condition when the lockout was recorded.
6. TO CLEAR ALL LOCKOUT HISTORIES: While on the "ERRORS" screen, hold the Left and Right arrow buttons simultaneously for 5 seconds.

U-Control Fault Displays, Diagnostics and Suggested Corrective Actions

Display	Condition	Diagnostics	Corrective Action(s)
Nothing shown on display screen and blower running at full speed	Control is not receiving 24V power	Check wiring for short circuit or incorrect wiring.	Correct wiring per wiring diagram including connection of transformer to the U-Control.
		Check 3-amp low voltage fuse on U-Control shown on page 100.	Replace fuse with proper part found in replacement part section of this manual. If fuse blows again recheck wiring per diagram.
		Check transformer connection to the U-control per wiring diagram. Check for 24V output of transformer.	Replace transformer if it is receiving 120Vac, but not outputting 24Vac.



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers *(continued)*

Display	Condition	Diagnostics	Corrective Action(s)
Nothing is shown in display screen and no other boiler components are operating	Control is not receiving 120V power	Check service switch and/or circuit breaker to boiler turned is on.	Turn on service switch to power boiler.
		Is there 120 Volts at the service switch?	Troubleshoot and correct the power supply to the service switch.
		Is the Ultra's ON/OFF POWER SWITCH located behind the control pod turned on?	Turn the Ultra's power switch behind the control pod to ON.
		Check for 120 volts at the line voltage terminal block located inside the control pod.	Correct wiring inside the control pod using the wiring diagram in this manual.
		Inspect 12-amp fuse as shown on page 100. Replace if necessary.	Replace the fuse with proper part found in the replacement part section of this manual. If fuse blows again recheck wiring per diagram.
Nothing is shown on display screen, but boiler is operating	Occurs when the communication is lost from the U-control to the display.	Check for loose connections and proper pin alignment/engagement on the U-Control's plug P9 and the back of the display circuit board.	Check for continuity on the wire harness from the display to the U-control. See repair parts section for proper replacement part.
		Cycle power off and on using boiler power switch and check for operation.	Replace with new display module. See repair parts section for proper replacement part.
TEMP RISE TOO QUICKLY	Occurs when supply water temperature in heat exchanger rises faster than 2°F per second during the first two minutes the burner is on.	Automatically resets after 1 minute delay or using manual reset on display.	Verify water piping is installed correctly using primary/secondary connection to the boiler loop.
		Manual reset is necessary after 5 automatic resets have occurred during the same Priority heat demand. Reset using manual reset screen on display	Minimum pipe size for boiler loop is 2" unless boiler circulator selection requires larger piping.
			Verify proper circulator sizing for boiler size and system requirements. See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
SUPPLY 58F > RETURN	Boiler Out temperature has exceeded the Boiler In temperature by more than 58°F	Automatically resets after 30 second delay or using manual reset on display.	Verify water piping is installed correctly using primary/secondary connection to the boiler loop.
		After 20 automatic resets occur the boiler will need a manual reset.	Minimum pipe size for boiler loop is 2" unless boiler circulator selection requires larger piping.
			Verify proper circulator sizing for boiler size and system requirements. See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
RETURN > SUPPLY	Occurs when a return water temperature is greater than the corresponding supply temperature by 10°F or more. Applies to system sensors or boiler sensors. Condition must occur for 10 minutes for system sensors.	Automatically resets when condition no longer exists.	Verify proper flow direction of the boiler circulator. This circulator should be installed to push water through the boiler's return pipe as shown in Figure 7, page 15.
			Verify proper placement of system sensors for single or multiple boiler systems. System sensors should be on system piping not on the boiler loop.
			System sensors may need located further away from boiler loop connection to the system if proximity to the boiler loop is causing sensors to be heated inaccurately.



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers *(continued)*

Display	Condition	Diagnostics	Corrective Action(s)
TEMPERATURE SENSOR	Occurs when a temperature sensor has electrically shorted (SHORT) or has become disconnected (OPEN).	Reset using manual reset screen on display	<p>Check all the temperature readings of the boiler on the DIAGNOSTICS - TEMPERATURES menu to determine if any sensors are currently displayed as SHORT or OPEN. Compare this to the boiler temperatures recorded in the DIAGNOSTICS - ERRORS - LOCKOUT HISTORY # - TEMPERATURES during the last several lockout conditions.</p> <p>Determine which sensors are suspect and measure their resistance value and compare it to the values shown in Figure 109. If the resistance values are incorrect replace the temperature sensor. Refer to repair parts section for proper part number.</p> <p>OUTDOOR TEMP, SYSTEM SUPPLY, and SYSTEM RETURN are the optional outdoor air temperature and system water temperature sensors. If these are not being used they will always be shown as OPEN. This is normal unless the sensors were installed.</p> <p>Check wire harness for loose connections and pin engagement at sensor connection, chassis mount connection through sheet metal cabinet, and U-Control module. Unplug connection at sensor and at U-Control and check continuity between ends.</p> <p>If problem persists after checking items above replace U-Control. Refer to repair parts section for kit number.</p>
	Occurs on high flue gas temperature condition	<p>Automatic reset occurs in 2½ minutes if temperature drops below 216°F.</p> <p>Manual reset is required if the temperature rises above 225°F. Reset using manual reset screen on display</p>	<p>Follow procedure for above for SHORT and OPEN sensor conditions to properly diagnose sensor. In addition inspect heat exchanger combustion chamber and flueways for abnormal wear or buildup.</p> <p>Inspect vent system for abnormal wear or damage.</p> <p>Contact Weil-McLain Technical Support.</p>
	Occurs when dual temperature sensors values have spread by more than 10°F	Automatically resets when sensors are within 10°F.	Follow procedure for above for SHORT and OPEN sensor conditions to properly diagnose sensor. If measured resistance values of sensors convert to temperatures separated by more than 10°F replace the sensor.
LOW WTR CUTOFF OPEN	Occurs when Low Water Cutoff Device contacts open for more than 1 second	Requires manual reset of U-Control and may require manual reset of LWCO device depending on model.	<p>Check for low water condition in system. Repair system as necessary refer to piping section of this manual.</p> <p>If low water condition does not exist check Diagnostics — Inputs screen to view status of Low Water Cutoff. If shown as OPEN check wiring between LWCO and U-Control.</p> <p>Low water cutoff indicator light codes: GREEN on = Normal operation GREEN + AMBER on = Service probe soon RED + AMBER = Control locked out RED blinking = LWCO component failure</p> <p>WARNING When the service indicator light code occurs, schedule a service appointment as soon as possible to avoid the boiler shutting down on low water lockout. To service the probe, shut off all power supplies to the boiler. Close the boiler isolation valves. Then drain enough water from the boiler to allow removing the low water cutoff. Inspect the probe. Clean if necessary to remove scale accumulation. Reinstall the low water cutoff and restore boiler to operation. If the problem persists, replace the low water cutoff probe.</p>
DISPLAY COMM	Occurs when display communications out for 30 seconds	Automatically resets when communication is re-established.	Check for a loose connection at the molex plug on the control and connection on the back of the display.



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers *(continued)*

Display	Condition	Diagnostics	Corrective Action(s)
LIMIT OPEN	Occurs when manual or automatic reset limit opens.	Automatic external limit will reset 2.5 minutes after external limit device closes. Manual limit fault must be reset by choosing Reset Lockout on the display.	Is there an external safety device connected? If yes, trouble shoot the external limit to determine and correct the cause that opened the limit. Also check for loose wiring connections.
			Remove the top front cover and inspect the ORANGE — 4 PIN connector P13. Ensure a jumper is installed between pins 1&2 if not using a manual reset external limit. Ensure a jumper is installed between pins 3&4 if not using an automatic reset external limit.
HIGH TEMP LIMIT	Boiler temperature sensor reached High Temp Limit setting (adjustable from 50°F to 200°F)	Reset using manual reset screen on display	Verify all isolation valves are open and circulators are programmed into the U-Control properly. Each Priority input can be configured to turn on any combination of three circulator outputs. Refer to the U-Control Setup section to configure these properly for the system.
			Verify water piping is installed correctly using primary/secondary connection to the boiler loop. Minimum pipe size for boiler loop is 2" unless boiler circulator selection requires larger piping.
			Verify proper circulator sizing for boiler size and system requirements.
			See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
FLAME FAULT	Occurs when flame is detected when there should be no flame	Reset using manual reset screen on display	Burner may be operating too hot due to incorrect combustion. Inspect flame and conduct combustion test. Force boiler into hi-fire. Check flue gases with combustion analyzer and correct using the maintenance and startup procedure in this manual.
			Verify FLAME SIGNAL value quickly goes to zero on the DIAGNOSTICS - INPUTS screen when the gas valve closes.
			Check for flame at burner via flame current with burner off. Turn boiler off and watch flame through observation port. If flame continues after shutdown replace gas valve and venturi.
BLOWER FAULT	Blower unable to reach required speed or does not reach 0 RPM when turned off.	Reset using manual reset screen on display	Check wire harness for loose connections and pin engagement at blower connections, chassis mount connection through sheet metal cabinet, and U-Control module. Unplug connection at sensor and at U-Control and check continuity between ends. Blower is connected to both low voltage and line voltage harness.
			Check Diagnostics - Inputs screen with boiler in standby mode and blower not running. If BLOWER SPEED is not 0 RPM then replace blower.
			If blower does not rotate during ignition sequence check for 120V power at blower connection. If 120Vac power at blower motor and it doesn't start replace blower. Check power at U-Control. If 120Vac is not present at U-Control when boiler is powered replace U-Control. Refer to repair parts section.
AIR PRESSURE SW FAULT	Air Pressure switch is open	High pressure in the exhaust pipe or high vacuum in the boiler intake or cabinet has caused the air pressure switch to open. The switch is closed in normal operating conditions.	Check exhaust and intake pipe for restrictions or blockage.
			Check condensate drain for blockage. If condensate is unable to drain out of the boiler it can begin to block the flow of exhaust gases. Clean condensate collection area of base and condensate trap. Refill trap with fresh water.
			Check the P7 connection as seen on Figures 97 & 98 to determine proper jumper wire location.



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers *(continued)*

Display	Condition	Diagnostics	Corrective Action(s)
GAS PRESSURE SW FAULT	Gas pressure switch is open (high or low)	Either the low gas pressure switch or high gas pressure switch has opened due to incorrect gas pressure being supplied to the boiler. Remove front door of boiler and look at pressure switches. The upper switch is the high gas pressure switch and the lower one is a low gas pressure switch. Whichever switch has locked-out will have an indicator light on. Switches can be reset by pushing on plastic cover in the middle of the dial as indicated on the switch. U-control will also need reset using display after gas pressure switch has been reset.	Check gas pressure at tee mounted behind gas pressure switches during high and low fire and boiler off. Pressure should always be within limits on rating label. Undersized gas supply pipes or regulators may cause low gas pressure issues while the boiler is operating and possibly high gas pressure when the boiler shuts down.
			<p>Ensure the pressure regulator in the gas supply line is a lockup-type.</p> <p>Ensure gas pressure switch settings are correct. Low Pressure Switch Setting = 2 inches H₂O High Pressure Switch Setting = 14 inches H₂O</p>
IGNITION FAULT	Boiler went through 2 ignition attempts and never detected flame	Reset using manual reset screen on display.	Look into the flame inspection window for the spark during the ignition cycle.
			Watch the two indicator lights on the gas valve during the ignition cycle. The lights should turn on.
			Check condensate trap for blockage allowing condensate to accumulate inside heat exchanger
			Fouled, worn, bent, or faulty ignitor. Fouled ignitors can be cleaned for additional use with fine grit sand paper or steel wool. Worn or badly fouled ignitors should be replaced with the proper repair part. Ignitor rods should be parallel with a 3.5mm (0.138in) spark gap.
			Dirty burner and/or heat exchanger will cause high back pressure and poor ignition. Follow procedure in maintenance section of this manual to clean burner and heat exchanger using flue cleaning tool and rinse method.
			Visual inspection of flueways will often will not be able to diagnose condition.
			Check combustion settings on high and low fire and adjust per setup instructions if necessary.
			Check incoming gas pressure with boiler off and at high fire. Adjust within limits on rating label.
			Verify correct boiler model is selected in control and high altitude is selected for installations 5500ft and higher above sea level.
			Check ignition cable resistance. Should measure 1000 Ohms (+/- 50 Ohms)
			Check for flue pipe and intake pipe restrictions or blockage
			Check burner fasteners and gaskets
Check venturi gaskets and proper propane orifice and blower orifice.			
Check wiring between U-Control and expansion module.			



Troubleshooting *(continued)*

Figure 80 Troubleshooting suggestions for Ultra boilers *(continued)*

Display	Condition	Diagnostics	Corrective Action(s)
GAS VALVE FAULT	The U-Control has detected a problem with its gas valve output circuit	Reset using manual reset screen on display	Check wire harness connections between gas valve and U-Control. Check wiring between U-Control and expansion module. If lockout reoccurs replace U-Control.
HW FAULT EXPANSION BRD	Expansion Control Board hardware has failed.	Expansion Control Board has detected an issue with it's hardware and has locked out. Requires a manual reset.	Check boiler size selected in U-Control against boiler rating label. Correct if necessary to select the proper boiler size.
GV FAULT EXPANSION BRD	Gas valve output of the Expansion module	Expansion Control Board has detected an issue with the gas valve circuit. Requires a manual reset.	Check the wire harnesses between the U-Control, Expansion module, and gas valve.
EXP BOARD COM FAULT	Expansion Control Board communication fault	Communication has been lost between the U-Control and the Expansion Control Board.	Check the communication wire harness between the two controls.



Ultra Gas Boiler Data Collection Sheet

Customer Info:		Maintenance Info:	
Contact:		Name:	
Contractor:		Phone:	
Job name:		Model:	
City, state:		CP#:	
Distributor:		Installed:	

System Components:	
Near boiler pipe size:	
Boiler circulator model:	
DHW tank (yes/no):	
DHW direct/system:	
Dhw model:	
Dhw pipe size:	
DHW circulator model:	
Is there air in system?:	

Diagnostic Errors:	
Control fault:	
Ignition retries:	
Manal reset CNT:	
Auto reset CNT:	

Software Versions:	
Display:	
Main micro:	
Second micro:	

Boiler/System Piping Details (Please Sketch)
Please note the placement of system sensors

Lockout History	#1
HH:MM MM/DD/YY:	
Status:	
Manual reset:	
If yes-description:	
Auto reset:	
If yes-description:	
Priority 1:	
Priority 2:	
Priority 3:	
Manual limit:	
Auto limit:	
Air press switch:	
Gas press switch:	
Low WTR Cutoff:	
Blower tach:	
Flame Signal:	
Outputs:	
Gas valve:	
Circulator 1:	
Circulator 2:	
Circulator 3:	
Circulator 4:	
Blower signal:	
Additional heat demand:	
Alarm:	
Temperatures:	
System supply:	
System return:	
Boiler out 1:	
Boiler out 2:	
Boiler in:	
Heat xchr 1:	
Heat xchr 1:	
Flue 1:	
Flue 2:	
Outdoor:	

Lockout History	#2
HH:MM MM/DD/YY:	
Status:	
Manual reset:	
If yes-description:	
Auto reset:	
If yes-description:	
Priority 1:	
Priority 2:	
Priority 3:	
Manual limit:	
Auto limit:	
Air press switch:	
Gas press switch:	
Low WTR Cutoff:	
Blower tach:	
Flame Signal:	
Outputs:	
Gas valve:	
Circulator 1:	
Circulator 2:	
Circulator 3:	
Circulator 4:	
Blower signal:	
Additional heat demand:	
Alarm:	
Temperatures:	
System supply:	
System return:	
Boiler out 1:	
Boiler out 2:	
Boiler in:	
Heat xchr 1:	
Heat xchr 1:	
Flue 1:	
Flue 2:	
Outdoor:	

Lockout History	#3
HH:MM MM/DD/YY:	
Status:	
Manual reset:	
If yes-description:	
Auto reset:	
If yes-description:	
Priority 1:	
Priority 2:	
Priority 3:	
Manual limit:	
Auto limit:	
Air press switch:	
Gas press switch:	
Low WTR Cutoff:	
Blower tach:	
Flame Signal:	
Outputs:	
Gas valve:	
Circulator 1:	
Circulator 2:	
Circulator 3:	
Circulator 4:	
Blower signal:	
Additional heat demand:	
Alarm:	
Temperatures:	
System supply:	
System return:	
Boiler out 1:	
Boiler out 2:	
Boiler in:	
Heat xchr 1:	
Heat xchr 1:	
Flue 1:	
Flue 2:	
Outdoor:	



Maintenance

Disconnect power

⚠️ WARNING Electrical shock hazard — Disconnect all electrical power to the boiler before attempting maintenance procedures. Failure to complete could result in severe personal injury, death or substantial property damage.

Install boiler jacket front door after startup or servicing

⚠️ WARNING Reinstall boiler jacket front door after start-up or servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances.

Inspect boiler jacket door gaskets. Gaskets must be in good condition, with no tears or gaps. Replace if necessary.

Failure to keep the door securely sealed and fastened could result in severe personal injury or death.

Perform start-up and check/out

⚠️ WARNING Removing and reinstalling components can change boiler behavior. After any maintenance procedure, you must prove the boiler is operating correctly. To do so, follow the complete procedure for boiler and system start-up, beginning on page 72. Failure to comply could result in severe personal injury, death or substantial property damage.

General maintenance

1. Oil motors in system requiring regular oiling.
2. See Oiled bearing circulators for motor oiling procedures.

Oiled bearing circulators

1. Check circulators in the system. Oil any circulators requiring oil, following circulator manufacturer's instructions. Over-oiling will damage the circulator.

Cleaning the heat exchanger — pin side when required

1. Shut down boiler:
 - a. Follow “To Turn Off Gas to Appliance” instructions on boiler and Lighting instructions.
 - b. Do not drain boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for boiler to cool to room temperature if it has been firing.
3. Rotate the two rotary latches on the front door. Tilt the top of the door forward, then lift up. Use a 13-mm wrench or socket to remove the nuts on the front cover plate and remove the plate. Use the cleanout plug in the flue pipe to rinse debris into the condensate drain. Flush the condensate drain, then refill.
4. Follow the applicable procedures under “Accessing & cleaning the heat exchanger,” page 94.

Clean the cast aluminum heat exchanger when required — water side

1. In order for the efficiency of boilers to increase beyond the condensing limit, new materials have been introduced for the heat exchanger, including aluminum.
2. Aluminum has excellent heat transfer characteristics and is light in weight.
3. These new materials also require cleaning solutions that differ from those used in conventional cast iron and steel boilers.

⚠️ WARNING One common cleaning method that **CANNOT** be used with systems containing aluminum is a solution of trisodium phosphate, commonly referred to as “TSP”

The reason that trisodium phosphate cannot be used is that the cleaning solution has a very high pH level — while removing the scale in the system, it also removes the natural protective oxide layer from the aluminum. The oxide layer will reform, but if small amounts of the trisodium phosphate remain in the system, the chemical will continue to remove the protective oxide layer, leading to reduced heat exchanger life.

4. Use **ONLY** the cleaning product available from Weil-McLain, Sentinel X400. See the Repair Parts section at the end of this manual for ordering information.



Maintenance *(continued)*

Accessing & cleaning the heat exchanger

Remove heat exchanger cover plate and burner

1. Close the external manual gas valve.
2. Disconnect all power to the boiler.
3. Allow the boiler to cool if it has been operating.
4. Use a 13-mm wrench or socket to remove the nuts that secure the heat exchanger cover plate to the heat exchanger (Figure 82, page 95).
5. Follow the procedure on page 81 to remove the burner. Disconnect wire harnesses as required to move the mixing tube and blower assembly out of the way.
6. Remove the flue inspection cover.

Use heat exchanger cleaning tool

1. Use the Heat Exchanger Cleaning Tool (supplied with the boiler) or a piece of 20-gauge or lighter sheet metal $\frac{3}{4}$ " wide by about 18 inches long to loosen deposits.
2. Slide the cleaning tool through the heat exchanger pins in the three directions shown in Figure 81, page 95.
3. Vacuum most of the debris out of the base through the flue inspection opening.

Water spray the heat exchanger

1. Disconnect the condensate line at the bottom of the heat exchanger so debris will not clog the trap.
 - a. Loosen the hose clamps at both ends of the condensate line.
 - b. Remove the line and place a pan under the trap connection.
2. Use the burner opening to spray water down onto the heat exchanger pins. Continue spraying until all debris on the pins has been flushed into the base.
 - a. Spray water into the flue inspection opening to flush remaining sediment to the condensate outlet.
 - b. Spray water through the condensate line to clean it thoroughly.
 - c. Remove the pan and re-install the condensate line.
 - d. Re-install the flue inspection plug.

Inspect cover plate gasket

1. Inspect the silicone cord heat exchanger cover plate gasket. Replace if damaged.
2. Make sure the cover plate gasket is in the groove of the heat exchanger.

WARNING

If the silicone cord gasket has been damaged or stretched, replace it before placing the boiler back in operation. To install the silicone cord gasket:

- When installing the silicone cord gasket, the seam should start at the top middle of the gasket groove. See Figure 82, page 95.
- Carefully place the cord in the groove all around the cleanout plate.
- Do not splice pieces together. The gasket must be installed as one piece.
- When inserting the gasket, do not stretch the cord or stretch around corners. This could cause the cord not to seal correctly, resulting in possible flue gas or condensate leakage.

Failure to comply could result in severe personal injury, death or substantial property damage.

Re-install cover plate

1. Re-install the cover plate following the sequence shown in the appropriate illustration, Figure 83, page 95 or Figure 84, page 95.
2. Re-install the hex head nuts on the cover plate mounting studs and tighten in the staggered pattern shown for the boiler model (Figure 83, page 95 for Ultra-550 or Figure 84, page 95 for Ultra-750) until the cover plate is uniformly tightened.

WARNING

Gradually tighten the cover plate nuts in the sequence shown. Torque to 18 N-m/160 in-lbs/13 ft-lbs.

Re-install burner, mixing tube and blower assembly

1. Follow the procedure on page 81 to re-install the burner and other components.
2. Reconnect wiring, including the ignitor ground wire connection to the top ignitor mounting screw.

Restart and test the boiler

1. Restore gas supply and power to the boiler.
2. Start the boiler and verify operation following the procedures given in this manual.



Maintenance *(continued)*

Figure 82 Removing heat exchanger cover plate

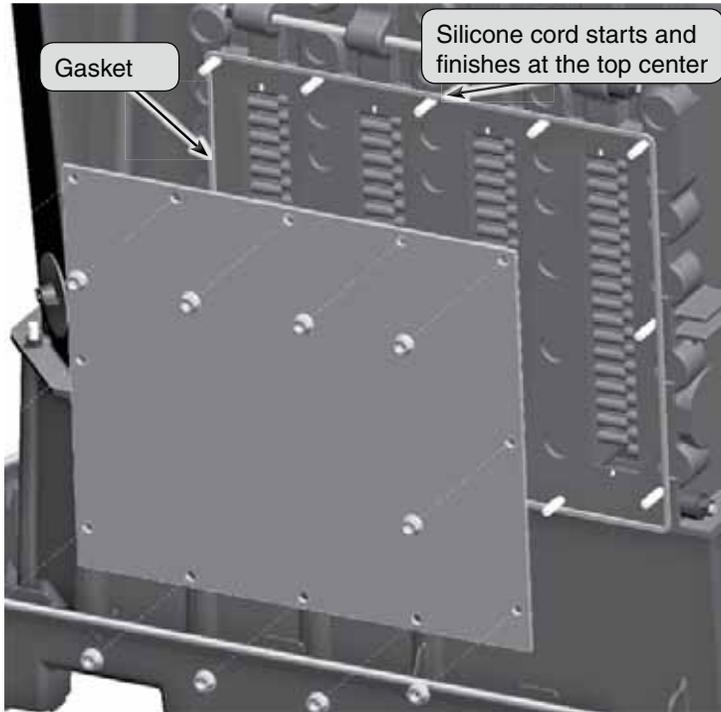


Figure 81 Cleaning heat exchanger with cleaning tool

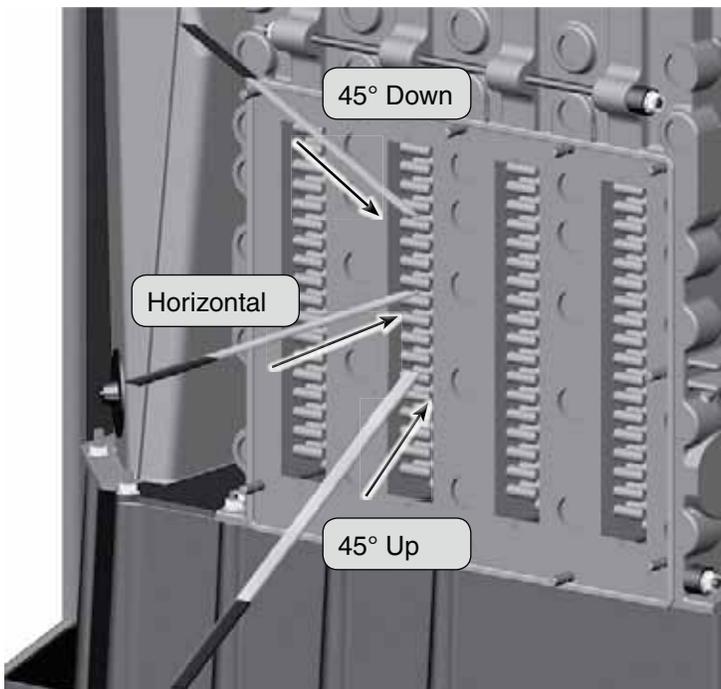


Figure 83 Nut tightening sequence — Ultra-550
Gradually tighten the nuts, repeating the sequence shown below until the torque reaches 160 inch-pounds +/- 10 inch-pounds / 18 N-m +/- 1 N-m

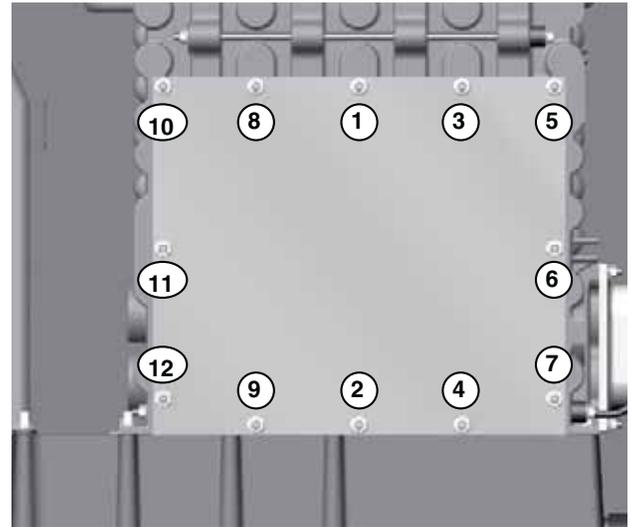
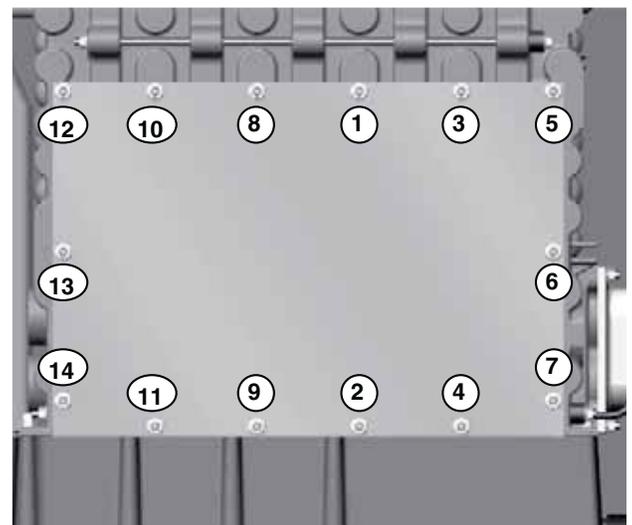


Figure 84 Nut tightening sequence — Ultra-750
Gradually tighten the nuts, repeating the sequence shown below until the torque reaches 160 inch-pounds +/- 10 inch-pounds / 18 N-m +/- 1 N-m





Replacement parts

⚠ WARNING Replacement parts must be purchased through a local Weil-McLain distributor. When ordering, specify boiler model and size and include description and part number of replacement part. Results from using modified or other manufactured parts will not be covered by warranty and may damage boiler or impair operation.

NOTICE Weil-McLain part numbers are found in Weil-McLain Boilers and Controls Repair Parts Lists.

⚠ WARNING **The boiler contains ceramic fiber materials.** Use care when handling these materials per instructions on page 78 of this manual. Failure to comply could result in severe personal injury.

Reinstall boiler jacket front door after startup or servicing

⚠ WARNING Inspect boiler jacket front door gaskets and reinstall boiler jacket front door after start or servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

Figure 85 Propane conversion kits

⚠ WARNING Propane conversion must follow the instructions in this manual. Refer to page 9 for details.

Natural to propane conversion kits — provided with boiler			
Sea level (up to 5,500 feet) and High altitude (over 5,500 feet)			
Model	Kit part #	Kit includes	Instructions
Ultra-550	383-600-074	550 LP Propane orifice Propane conversion label	See page 9
Ultra-750	383-600-075	750 LP Propane orifice 750 LP Blower orifice plate (2) blower orifice plate gaskets Propane conversion label	



Replacement parts *(continued)*

Figure 86 Miscellaneous parts and kits

Item	Description	Part Number for Ultra 550/750
1	Condensate neutralizer kit (up to 1000 MBH)	383-600-076
2	Heat exchanger cleaning tool	591-706-200
3	Pressure relief valve ASME 30 PSI, 3/4" NPT female ASME 50 PSI, 3/4" NPT female ASME 80 PSI, 3/4" NPT female	383-600-063 383-600-064 383-600-065
4	Bird screen (1 each required for vent and air pipe termination) 6-inch (for 6-inch vent or air pipe) 8-inch (for 8-inch vent or air pipe)	560-907-633 560-907-634
5	CHEMICALS Antifreeze, aluminum-safe, Sentinel X500 (5 liters) Corrosion inhibitor, Sentinel X100 (one tube, 275 ml) Inhibitor quick-test kit Cleaner, Sentinel X400 (one tube, 275 ml).	592-900-004 592-900-002 592-900-005 592-900-003
6	Annual maintenance kit (for Ultra-550 or Ultra-750) consisting of: (1) ignitor (2) washers for ignitor (2) blower connection gaskets (1) ignitor gasket (1) inhibitor test kit (1) length of silicone cord for cleanout (2) screws for ignitor (1) suppressor plate	383-600-079

Go to www.weil-mclain.com to locate Weil-McLain distributors



Replacement parts *(continued)*

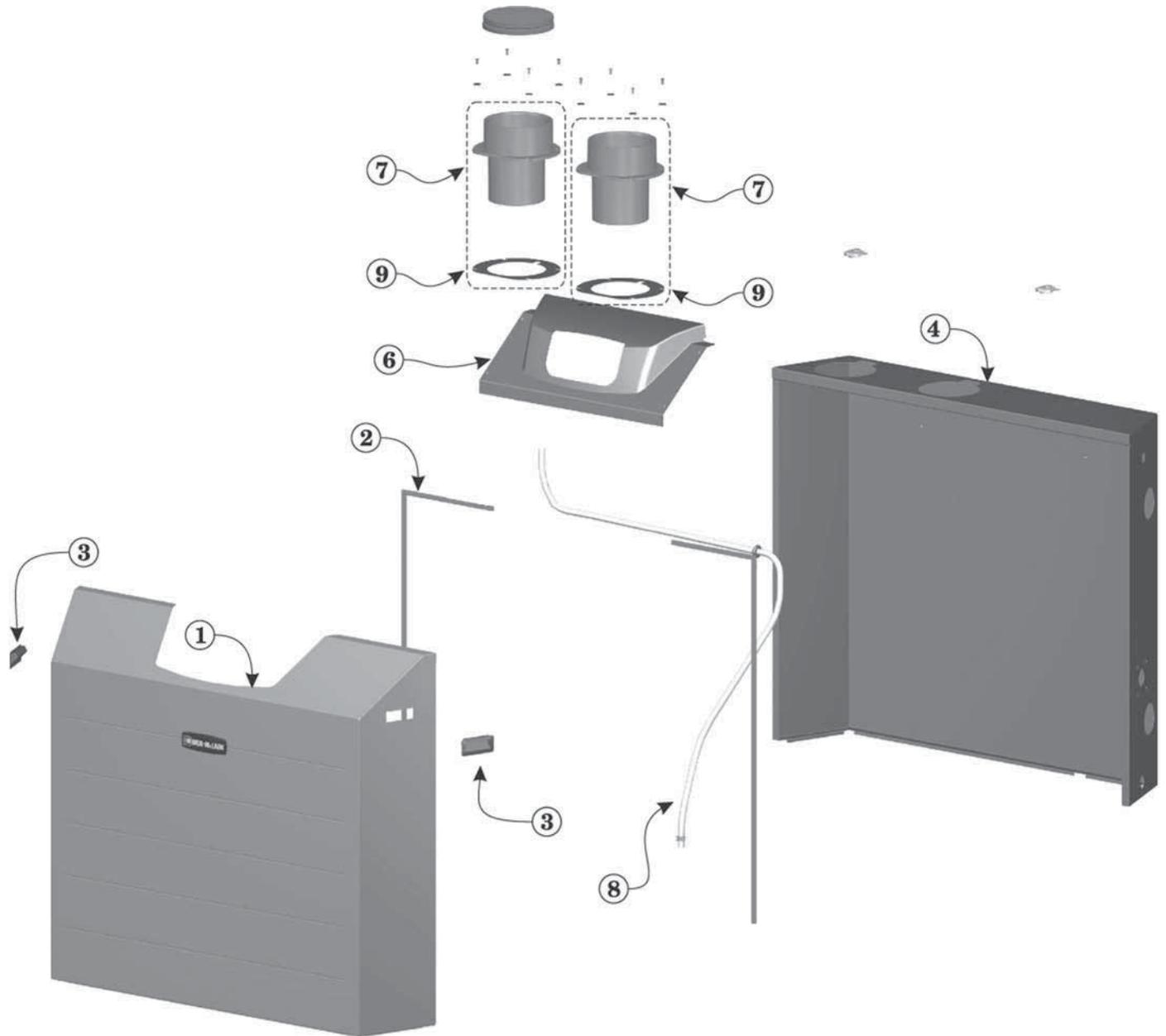
Figure 87 Jacket parts

Item	Description	Part Number for Ultra 550/750
1	Jacket front door	383-600-052
2	Door seal	383-600-022
3	Handle (2 required)	383-500-611
4	Back Jacket	383-600-050
5	Jacket seal kit (base seal, door seal, grommets and gaskets)	383-600-053
6	Plastic top cover (includes cover, gaskets and hardware)	383-600-054
7	Inlet/outlet adapter kit (includes adapter for flue or air, gasket, and hardware)	383-600-051
8	Flue pipe drain hose kit (includes hose from flue adapter to heat exchanger condensate outlet and hose clamp)	383-600-023
9	Flue pipe adapter gasket	590-300-016

Go to www.weil-mclain.com to locate Weil-McLain distributors

Replacement parts *(continued)*

Figure 88 Jacket parts



UC7012



Replacement parts *(continued)*

Figure 89 Heat exchanger

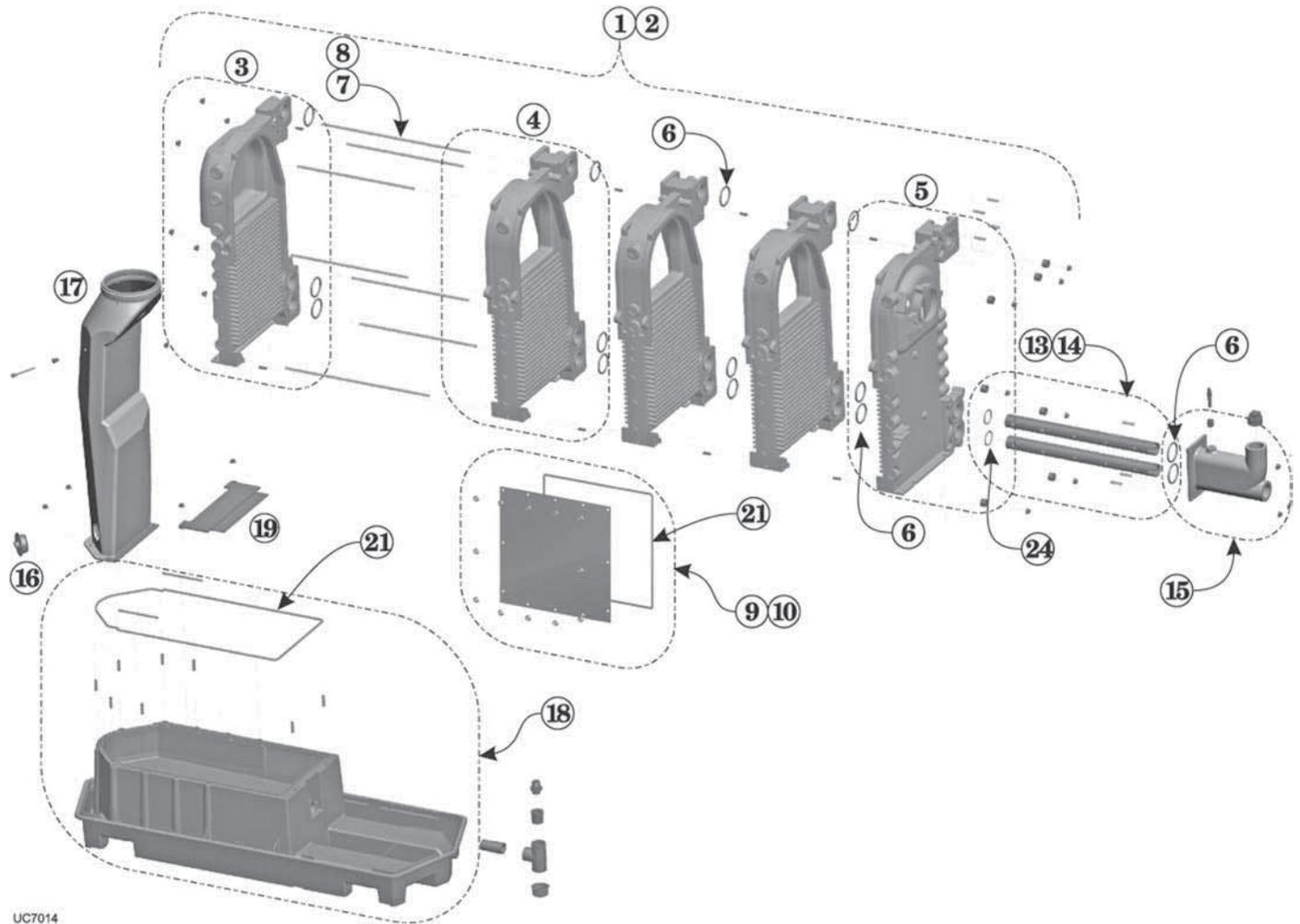
Item	Description	Boiler Models	Part Number
1	5 section heat exchanger assembly kit (includes sections, o-rings, sealing cord & hardware)	550	383-600-029
2	6 section heat exchanger assembly kit (includes sections, o-rings, sealing cord & hardware)	750	383-600-028
3	Left end section replacement kit (includes section, o-rings, sealing cord and hardware)	550 / 750	383-600-036
4	Intermediate section replacement kit (includes section, o-rings, sealing cord and hardware)	550 / 750	383-600-037
5	Right end section replacement kit (includes section, o-rings, sealing cord and hardware)	550 / 750	383-600-038
6	Section/manifold o-ring, 60-mm (single o-ring only)	550 / 750	590-318-039
7	5 section draw rod kit	550	560-134-510
8	6 section draw rod kit	750	560-134-511
9	5 section heat exchanger cover plate kit (includes plate, nuts, sealing cord and silicone RTV sealant)	550	383-600-040
10	6 section heat exchanger cover plate kit (includes plate, nuts, sealing cord and silicone RTV sealant)	750	383-600-041
11	5 section supply distribution tube kit (distribution tube, o-ring and nuts)	550	383-600-033
12	6 section supply distribution tube kit (distribution tube, o-ring and nuts)	750	383-600-032
13	5 section return distribution tube kit (distribution tube, o-rings and nuts)	550	383-600-031
14	6 section return distribution tube kit (distribution tube, o-rings and nuts)	750	383-600-030
15	Return manifold casting kit (includes manifold, o-ring and nuts)	550 / 750	383-600-034
16	Inspection plug	550 / 750	561-444-101
17	Aluminum flue pipe	550 / 750	383-600-025
18	Plastic base assembly kit (includes base, sealing cord, silicone RTV sealant and hardware)	550 / 750	383-600-026
19	Base cover plate (5-section only)	550 / 750	383-600-027
20	Base seal kit (base sealing gasket cord)	550 / 750	383-600-021
21	Red silicone cord kit (cover plate and base)	550 / 750	383-600-020
22	Tube of silicone RTV, high temperature, red	550 / 750	513-000-001
23	Tube of silicone RTV, high adhesive, black	550 / 750	513-000-000
24	Return distribution tube o-ring, 45 mm	550 / 750	590-318-040
25	Heat exchanger o-ring replacement kit (Not shown) [includes (18) 60-mm o-rings (Item 6); (2) 45-mm o-rings (Item 24); sealing cord; and silicone RTV sealant]	550 / 750	383-600-039

Go to www.weil-mclain.com to locate Weil-McLain distributors



Replacement parts *(continued)*

Figure 90 Heat exchanger



UC7014



Replacement parts *(continued)*

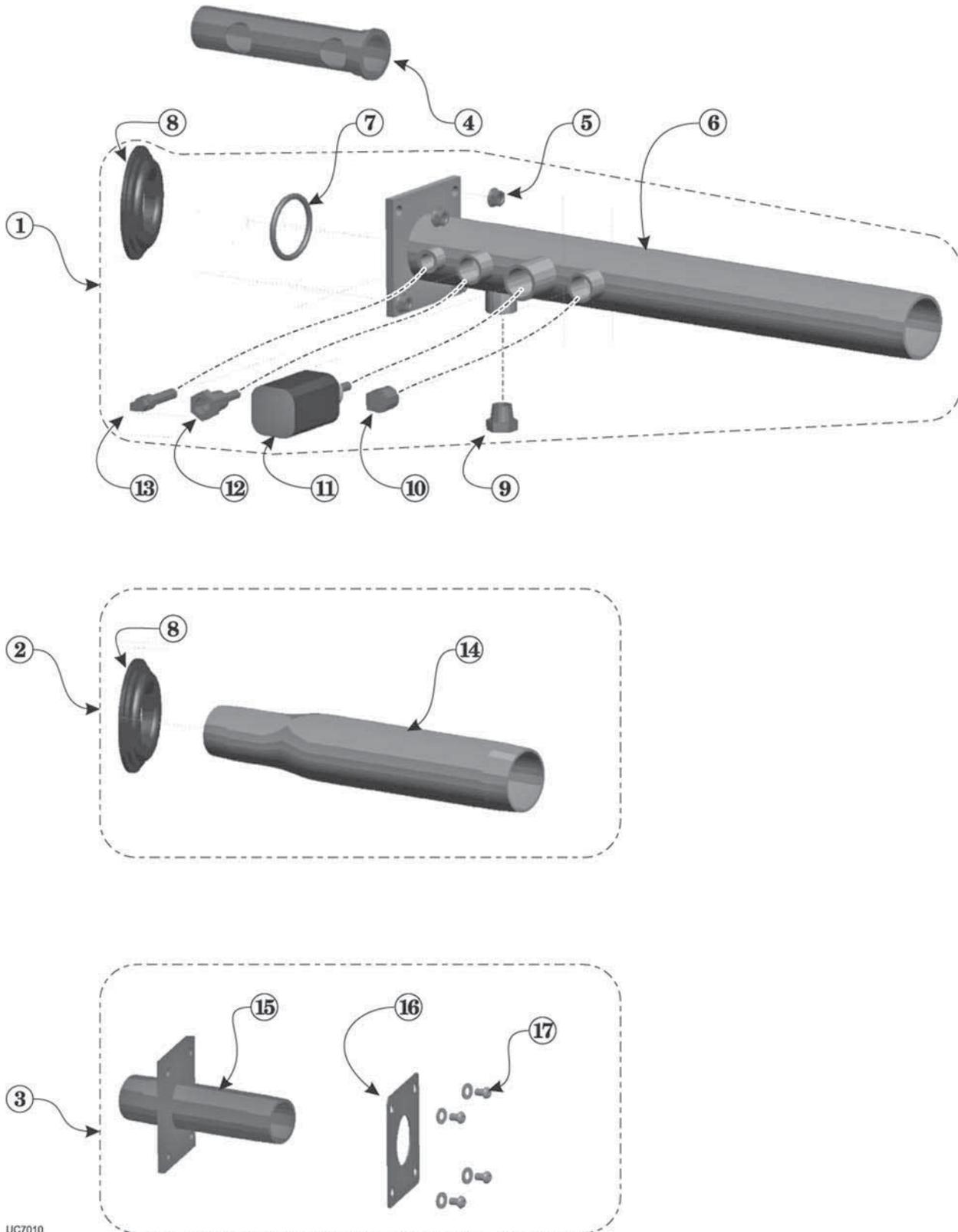
Figure 91 Piping

Item	Description	Boiler Models	Part Number
1	Supply manifold kit (Includes items 5 through 8 and 10 through 14)	550 / 750	383-600-055
2	Return pipe kit (includes items 9 and 14)	550 / 750	383-600-035
3	Inlet gas pipe kit (includes items 16, 17, and 18)	550 / 750	383-600-056
4	Supply distribution pipe	See Figure 90, page 101	
5	Serrated-flange nut, M8-1.25 (four required)	550 / 750	In Item 1
6	Supply distribution manifold, 2" NPT	550 / 750	In Item 1
7	Section/manifold o-ring, 60 mm (included in Item 1; also see Item 6, Figure 90, page 101)	550 / 750	590-318-039
8	Supply/return pipe grommet, 2" NPT x 3½" diameter (included in Item 1)	550 / 750	562-248-747
9	P/T gauge pressure sensor line check valve	550 / 750	383-500-275
10	Plug, ½" NPT	550 / 750	In Item 1
11	Low water cut-off	550 / 750	383-600-069
12	P/T gauge temperature sensor well	550 / 750	383-500-270
13	Supply temperature sensor	See Figure 96, page 107	
14	Return pipe, 2" NPT	550 / 750	In Item 2
15	Inlet gas pipe with flange	550 / 750	In Item 3
16	Inlet gas pipe gasket (included in Item 3)	550 / 750	590-300-017
17	Screws, 3/8-16 x ½", button head; washers, 3/8" SAE (4 of each required)	550 / 750	In Item 3



Replacement parts *(continued)*

Figure 92 Piping



UC7010



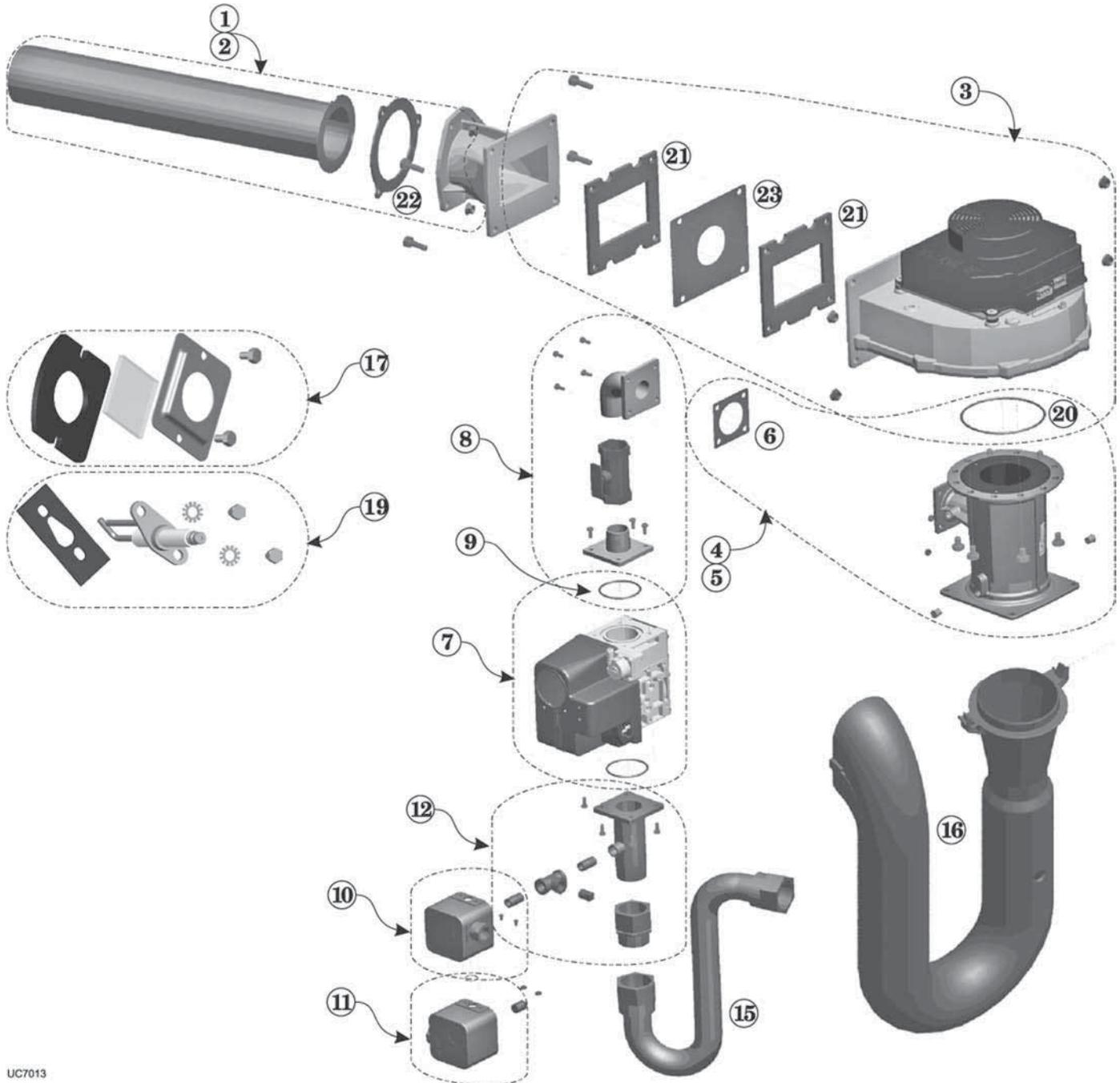
Replacement parts *(continued)*

Figure 93 Burner, blower, venturi and gas train

Item	Description	Part Number for Ultra 550/750
1	5 section burner replacement kit (includes burner, gasket and nuts)	383-600-044
2	6 section burner replacement kit (includes burner, gasket and nuts)	383-600-043
3	Blower assembly kit (includes blower, gasket, o-ring and hardware)	383-600-045
4	5 section venturi replacement kit (includes venturi, o-ring and gasket)	383-600-067
5	6 section venturi replacement kit (includes venturi, o-ring and gasket)	383-600-068
6	Venturi to gas pipe gasket	590-300-022
7	Gas valve replacement kit (includes gas valve only)	383-600-066
8	Gas valve to venturi piping kit (includes piping, gasket, o-ring and hardware)	383-600-046
9	O-Ring, gas valve to adapter pipe	590-318-042
10	High gas pressure switch replacement kit (includes switch and nipple)	383-600-048
11	Low gas pressure switch replacement kit (includes switch and nipple)	383-600-049
12	Gas pressure switch piping	383-600-047
13	Gas pressure switch harness (not shown)	383-600-059
14	Gas valve harness (not shown)	591-391-960
15	Flexible gas line	560-900-021
16	Air silencer	560-900-020
17	Inspection glass kit (includes retainer, glass, gasket and screws)	383-500-020
18	Ignition cable kit (not shown)	383-500-619
19	Ignition electrode kit (includes ignitor, gasket and hardware)	383-600-070
20	Venturi-to-blower o-ring (included in item 4 and item 5)	590-318-041
21	Blower outlet gasket (included in item 3)	590-300-018
22	Burner gasket (included in item 1 and item 2)	590-300-011
23	Blower orifice plate for Ultra-550 (used for both natural gas and propane)	383-600-078
	Blower orifice plate for Ultra-750 (used only on Ultra-750 propane)	See propane conversion kit (Figure 85, page 96)

Replacement parts *(continued)*

Figure 94 Burner, blower, venturi and gas train



UC7013



Replacement parts *(continued)*

Figure 95 Controls

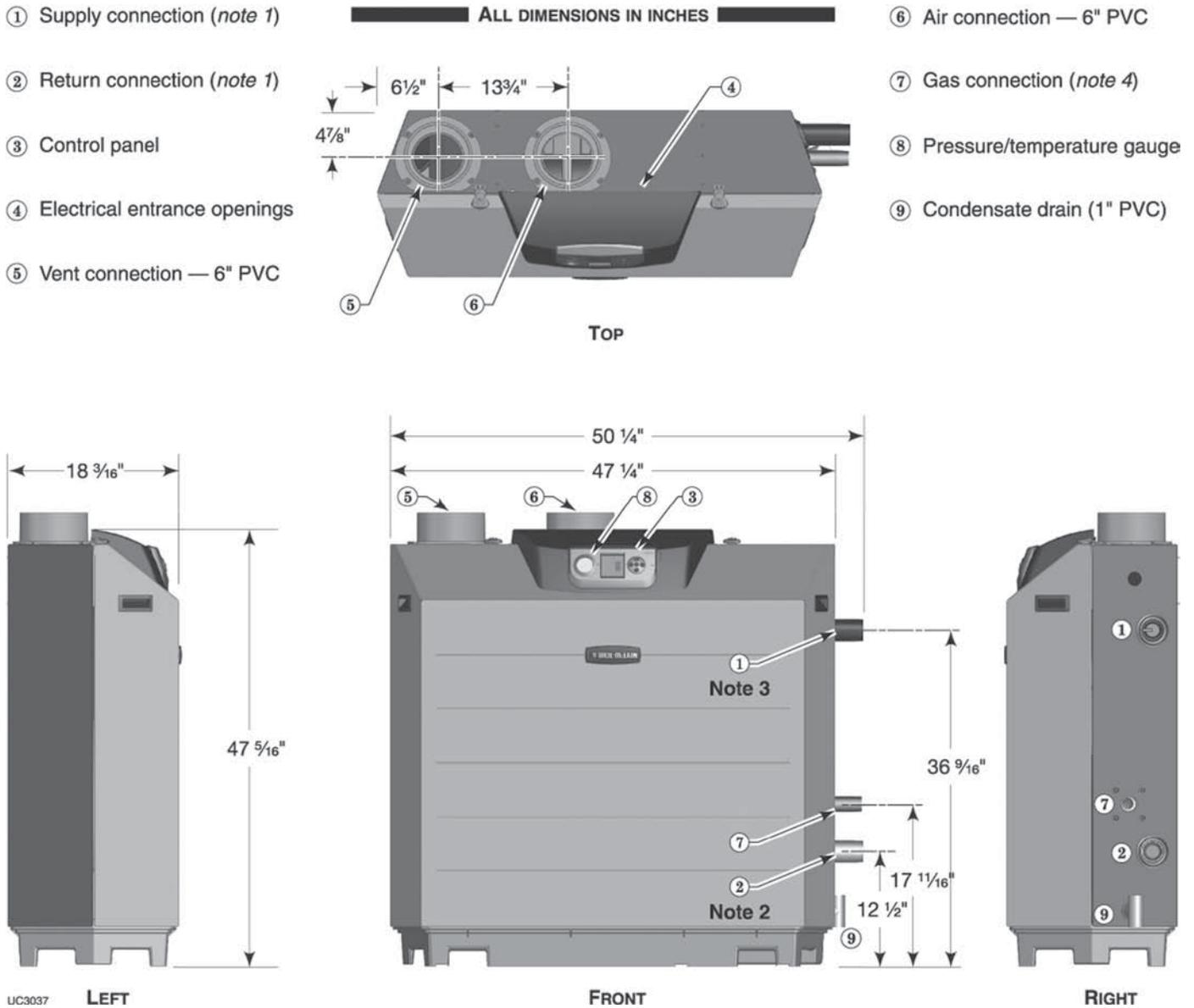
Item	Description	Part Number for Ultra 550/750
1	3-amp, fast-blow ATO (5 fuses)	383-500-603
2	12-amp, slow-blow AG (5 fuses)	383 500 604
3	CSD1 U-control module	383-600-062
4	NON-CSD1 U-control module	383-500-658
5	Expansion module	383-600-060
6	Display board assembly	383-500-659
7	Display bracket kit	383-600-042
8	Supply temperature sensor replacement kit, dual sensor (sensor only)	383-600-072
9	Return temperature sensor replacement kit, single sensor (sensor and bushing)	383-600-071
10	Outdoor temperature sensor	510-312-218
11	System temperature sensors	383-500-601
12	Flue Temperature sensor replacement kit (sensor and grommet)	383-500-600
13	Heat exchanger temperature sensor	383-500-602
14	On/off power switch	383-500-205
15	Transformer, 120v/24v	383-500-628
16	Pressure/temperature gauge assembly	570-218-054
17	120 volt, 3-wire receptacle, pre-wired	591-391-959
18	Air pressure switch kit (includes switch, tube and mounting screws)	383-600-073
19	Hose barb for air pressure switch sensing tube connection (not shown)	562-302-525
20	Air pressure switch sensing tube (included in item 18)	In Item 18
21	Blower power relay	570-350-230
22	Ultra U-control terminal block kit (not shown)	383-500-642
23	Display to U-control wire harness, RS485 (not shown)	383-500-633
24	Expansion module to display harness (not shown)	591-391-961
25	Upper line voltage wire harness (EP2, EP4, power input and blower relay) (not shown)	383-600-057
26	Low line voltage wire harness (not shown)	591-391-958
27	Upper low voltage wire harness (not shown)	383-600-058
28	Lower low voltage wire harness (P4 through P9 and other) (not shown)	591-391-956
29	Jumper for low voltage terminal blocks (5 jumpers) (not shown)	383-500-641
30	Flue temperature sensor gasket	590-318-011

Go to www.weil-mclain.com to locate Weil-McLain distributors



Dimensions

Figure 97 Dimensional data



Notes	
1	Boiler supply and return connections are both 2" NPT.
2	Circulator must be mounted in the return piping.
3	Relief valve is shipped loose. See page 13 for mounting details. Relief valve mounts on supply pipe off of supply tee as shown.
4	Boiler gas connection, 1/4" NPT.



Ratings — Ultra boilers

Figure 98 Ratings and engineering data



DOE

Boiler Model Number	CSA Input	CSA Gross Output	Net I=B=R Ratings	Boiler Water Content	Combustion Efficiency	Thermal Efficiency	Vent/Air Pipe Size (inches)
	Btuh (Note 5)	Btuh (Note 5)	Btuh (Note 1)	Gallons	% (Note 3)	% (Note 4)	(Note 2)
Ultra-550	550,000	517,000	450,000	5.5	94.7	93.9	6
Ultra-750	750,000	702,000	610,000	6.5	94.0	93.6	6 or 8

Notes	
1	Net I=B=R 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 pickup. Ratings are based on a piping and pickup allowance of 1.15. An additional allowance should be made for unusual piping and pickup loads.
2	Ultra boilers can be direct-vent (ducted combustion air) or direct-exhaust vented (combustion air from boiler room), either through a side wall or through the roof, as instructed in this manual and compliant with all local codes. Ultra boilers require special venting, consistent with Category IV boiler. Use only the vent materials and methods specified in this manual.
3	Combustion efficiency is based on I=B=R testing procedure BTS-2000, and equal to 100% minus flue loss.
4	Thermal efficiency is based on I=B=R testing procedure BTS-2000.
5	Ratings shown are for sea level applications only. For altitudes above sea level, the Ultra boiler requires no modifications and automatically derates itself by approximately 4% per 1000 feet above sea level. For elevations over 5,500 feet, configure the U-Control with HIGH ALTITUDE = YES.



Ratings — multiple Ultra boilers

Figure 99 Ratings and engineering data (see Figure 101 for notes)



DOE

Boilers in system Model Ultra –		Total CSA input	DOE Heating capacity	Boiler H.P.	Net water ratings	Manifolded combustion air duct size	Foundation size			
							Side-to-side arrangement <i>(height 2" to 4")</i>		Back-to-back arrangement <i>(height 2" to 4")</i>	
550	750	Input, MBH	Output, MBH	-	MBH	Square inches	Length (inches)	Width (inches)	Length (inches)	Width (inches)
		-	Note 1	-	Note 2	Figure 31, page 37	Note 3			
2		1100	1034	30.9	900	550	106	21	51	40
	2	1500	1404	41.9	1220	750				
3		1650	1551	46.3	1350	825	165	21	110	40
	3	2250	2106	62.9	1830	1125				
4		2200	2068	61.8	1800	1100	224	21	110	40
	4	3000	2808	83.9	2440	1500				
5		2750	2585	77.2	2250	1375	283	21	169	40
	5	3750	3510	104.9	3050	1875				
6		3300	3102	92.7	2700	1650	342	21	169	40
	6	4500	4212	125.8	3660	2250				
7		3850	3619	108.1	3150	1925	401	21	228	40
	7	5250	4914	146.8	4270	2625				
8		4400	4136	123.6	3600	2200	460	21	228	40
	8	6000	5616	167.8	4880	3000				



Ratings — multiple Ultra boilers *(continued)*

Figure 100 Engineering data (see Figure 101 for notes)

Boiler Model Ultra –	Shipping weight	Operating weight	Water content	Water flow rate per boiler		Vent/air pipe size — Provide a separate vent for each boiler	Electrical service required
	Pounds per boiler	Pounds per boiler	Gallons per boiler	GPM @ 30°F rise	GPM @ 40°F rise		Amps per boiler
		Note 4		Note 5	Note 6		
550	505	476	5.5	34	26	6"	25 (boiler) 15 (circulator 4)
750	550	529	6.5	47	35	6" or 8"	25 (boiler) 15 (circulator 4)

Figure 101 Notes for Figure 99 and Figure 100

1	Based on standard test procedures outlined by DOE for individual boilers, BTS-2000.
2	Net I=B=R ratings are based on piping and pickup allowance of 1.15. Consult Weil-McLain Technical Services for other allowances.
3	Foundation sizes in Figure 99 provide 12 inches between boilers and approximately 2 inches from boiler to edge of foundation. Smaller foundations are possible with reduced service clearances. See page 7 for details. <ul style="list-style-type: none"> • For side-to-side installations, see Figure 2, page 7. • For back-to-back installations, see Figure 3, page 7.
4	Operating weight is the total weight of the boiler, including water.
5	All Ultra installations require a separate vent pipe and termination for each boiler. Vent piping cannot be manifolded. Install and terminate vents as described in vent/air installation instructions in this manual. Combustion air piping can be individually piped or manifolded. See Figure 31, page 37, for manifolded air piping.
6	Boiler total amp load is 18 amps, which includes up to three circulators not exceeding 2.2 amps per circulator. Electrical service required is the minimum recommended breaker or fuse size. DO NOT use larger than a 30-amp breaker or fuse. In addition, circulator #4 requires a separate power supply for circulator amperage not to exceed 10 amps. Electrical service required is the recommended breaker size of 15 amps. DO NOT use a higher-amp-rated breaker or fuse.



Installation and Service Certificate

Boiler Model _____ Series _____ CP Number _____ Date Installed _____

- BTU Input _____
- 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)

(Phone) (Installer's Signature)

START-UP DATA					
Boiler Model		CO ₂ High fire	%	CO ₂ Low fire	%
Fuel	Natural _____ LP _____	CO High fire	ppm	CO Low fire	ppm
Was orifice changed? _____		Was gas valve throttle adjusted for propane? _____			
Natural gas input rate measured _____ Btuh					
U-CONTROL SET-UP DATA					
Boiler Model		WWSD Temp	°F	Add'l Heat Demand Type	1 _____ 2 _____ 3 _____ 4 _____
High Altitude	yes _____ no _____	Adjust Outdoor	°F	Add'l Heat Demand Time	minutes
Manual Reset Temp			°F		
PRIORITY 1 Settings		PRIORITY 2 Settings		PRIORITY 3 Settings	
System Type		System Type		System Type	
Max Supply	°F	Max Supply	°F	Max Supply	°F
Min Supply	°F	Min Supply	°F	Min Supply	°F
Max OD Reset	°F	Max OD Reset	°F	Max OD Reset	°F
Min OD Reset	°F	Min OD Reset	°F	Min OD Reset	°F
Modulate On Diff	°F	Modulate On Diff	°F	Modulate On Diff	°F
Modulate Off Diff	°F	Modulate Off Diff	°F	Modulate Off Diff	°F
Max On Time	minutes	Max On Time	minutes	Max On Time	—
Min On Time	—	Min On Time	minutes	Min On Time	minutes
Boost Interval	minutes	Boost Interval	minutes	Boost Interval	minutes
Pre-pump Time:	seconds	Pre-pump Time:	seconds	Pre-pump Time:	seconds
Post-pump Time:	seconds	Post-pump Time:	seconds	Post-pump Time:	seconds
Circulator 1	on-off	Circulator 1	on-off	Circulator 1	on-off
Circulator 2	on-off	Circulator 2	on-off	Circulator 2	on-off
Circulator 3	on-off	Circulator 3	on-off	Circulator 3	on-off
Circulator 4	on-off	Circulator 4	on-off	Circulator 4	on-off
Maximum Rate	%Rate	Maximum Rate	%Rate	Maximum Rate	%Rate
Minimum Rate	%Rate	Minimum Rate	%Rate	Minimum Rate	%Rate
Circulator Exercising			Freeze Protection Circulators		
Circulator 1	on _____ off _____	Circulator 1	on _____ off _____		
Circulator 2	on _____ off _____	Circulator 2	on _____ off _____		
Circulator 3	on _____ off _____	Circulator 3	on _____ off _____		
Circulator 4	on _____ off _____	Circulator 4	on _____ off _____		