WEIL-McLAIN®

Ultra®

Gas-fired water boilers – Series 4

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.

Part number 550-100-400/0717

Contents

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.

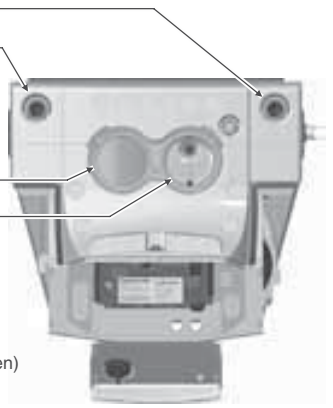
Ultra at-a-glance

(see page 44 and page 46 for details of all models)

Front

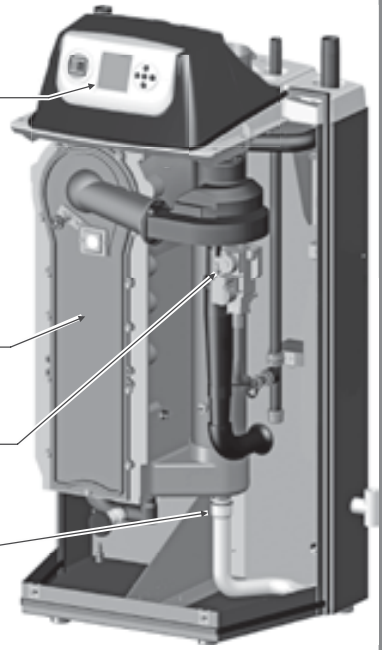
Top

(control panel swung open)



Interior

(typical)



Part number 550-100-090/1113

BASIC INSTALLATION
Quick view . . .

Pages	Procedure
4	**Please read before proceeding** • Read safety information before proceeding
5–6	**Prepare boiler location** • Clearances, floor and foundation • Air openings to room for ventilation
7–8	**Prepare boiler** • Make sure vent/air piping can be connected • Remove from crate • Convert for propane, if required • Hydrostatic test • Place boiler in position
9–15	**Install water piping** • Install boiler trim and near boiler piping • Complete system piping and connections
16	**Appliances left on an existing vent system** • For appliances remaining on a vent system after old boiler is disconnected — verify that the vent system works for remaining appliances
16-26	**Vent/air piping** • Locate air intake piping to prevent contaminants from entering boiler • Install vent/air termination • Install vent and air piping using acceptable materials
27–28	**Install condensate piping** • Connect condensate hose • Install condensate pump and filter, if required
29	**Gas piping** • Verify gas pipe size • Connect boiler to gas line
30-31	**Field wiring** • Connect wiring to boiler and components
32–34	**U-Control operation and setup** • U-Control operation and setup information
35–42	**Start-up** • Clean system, then fill; add inhibitor • Verify water chemistry • Purge air from system • Perform final checks • Start and operate boiler • Perform final verification tests • Fill out Installation and Service Certificate

Part number 550-100-090/1113

BASIC INSTALLATION
(Pages 3–42)

This section covers basic installation and start-up for most applications. It is limited to conventional systems and to sidewall vent/air piping using the Weil-McLain termination cap.

For applications not covered in this section, see the ADVANCED INSTALLATION section.

ADVANCED INSTALLATION
(Pages 44–107)

Read and follow the instructions in the BASIC INSTALLATION section first. Then use the ADVANCED section for additional information.

This section covers multiple boiler systems and additional system types not covered under the BASIC section. It also includes alternative vent/air piping methods, water and gas pipe sizing guidelines and advanced, detailed information on the U-Control.

MAINTENANCE & SPECIFICATIONS
(Pages 108–140)

This section covers maintenance requirements for all boilers, repair parts lists, boiler dimensions and specifications.

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 140 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.

⚠ DANGER **If any part of a boiler, burner or its controls has been sprayed with or submerged under water, either partially or fully, DO NOT attempt to operate the boiler until the boiler has been either replaced or completely repaired, inspected, and you are sure that the boiler and all components are in good condition and fully reliable.**

Otherwise, by operating this boiler, you will cause a fire or explosion hazard, and an electrical shock hazard, leading to serious injury, death, or substantial property damage. See the instructions at right.

Saltwater Damage — The exposure of boiler components to saltwater can have both immediate and long-term effects. While the immediate effects of saltwater damage are similar to those of freshwater (shorting out of electrical components, washing out of critical lubricants, etc.), the salt and other contaminants left behind can lead to longer term issues after the water is gone due to the conductive and corrosive nature of the salt residue. Therefore, Weil-McLain equipment contaminated with saltwater or polluted water will no longer be covered under warranty and should be replaced.

Electrical Damage — If any **electrical component** or **wiring** came into contact with water, or was suspected to have come into contact with water, replace the boiler with a new Weil-McLain boiler.

⚠WARNING **Failure to adhere to the guidelines below 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 109.

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 pump. Instead, shut off the gas supply at a location external to the appliance.

Combustion air —

- DO NOT install combustion air intake where there is a risk of combustion air contamination.

Carbon monoxide detector —

- A carbon monoxide detector that is wired on the same electrical circuit as the boiler is strongly recommended.

SURGE PROTECTOR —

- Provide surge protection in the boiler power supply. This will reduce the possibility of damage to the boiler control.

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. **ADDITIONAL CHEMICAL TREATMENT MAY BE NECESSARY**. See page 35 for details.
- Thoroughly flush the system (**BEFORE** connecting boiler) 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 eat 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 a hot boiler. Thermal shock can cause heat exchanger to crack.

Freeze protection fluids —

- NEVER use automotive or standard glycol antifreeze. Use only freeze-protection fluids made for hydronic systems. Use only freeze-protection fluids recommended in this manual (see page 35). Follow all guidelines given by the antifreeze manufacturer. Thoroughly clean and flush any replacement boiler system that has used glycol before installing the new Ultra boiler

⚠CAUTION **Frozen Water Damage Hazard**

Residences or buildings that are unattended in severely cold weather, boiler system components failures, power outages, or other electrical system failures could result in frozen plumbing and water damage in a matter of hours. For your protection, take preventative actions such as having a security system installed that operates during power outages, senses low temperature, and initiates an effective action. Consult with your boiler contractor or a home security agency.

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 65.

Prepare boiler location

Installations must comply with:

- Local, state, provincial, and national codes, laws, regulations and ordinances.
- National Fuel Gas Code, ANSI Z223.1 /NFPA 54 – latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
- National Electrical Code.
- For Canada only: Natural Gas and Propane Installation Natural Gas and Propane Installation CAN/CSA 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
   - Condensate drain
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.

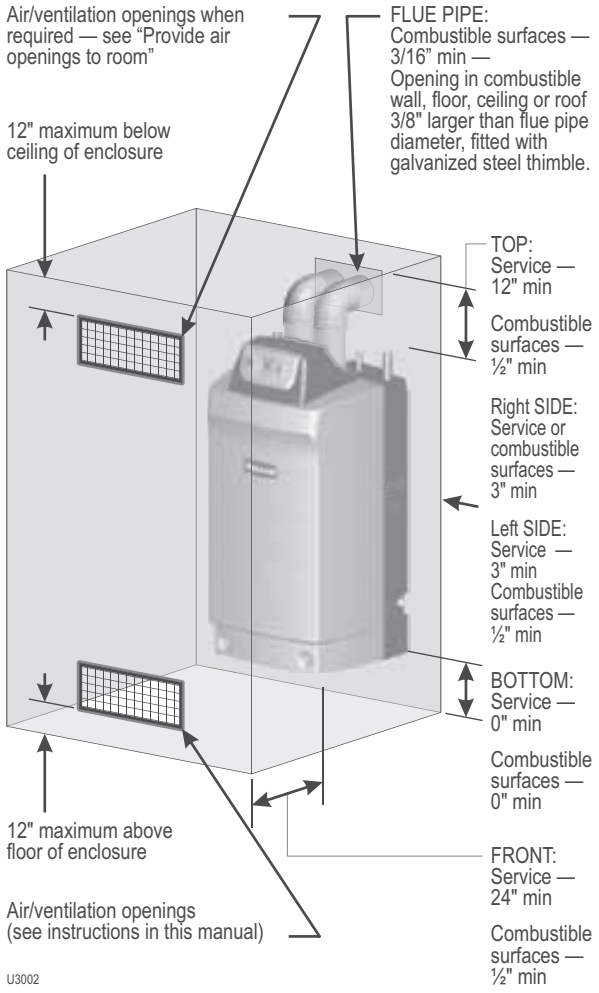
3. The Ultra boiler must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
4. If new boiler will replace existing boiler, check for and correct system problems, such as:
   - System leaks causing oxygen corrosion or heat 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 ½" from combustible materials.
2. Vent pipe — at least 3/16" from combustible materials.
3. See Figure 1 for other clearance minimums.

Figure 1 Clearances required



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.

Wall mounting option

1. Ultra boilers can be wall mounted (using special wall mount kit) or floor mounted. **No clearance is required at the rear of the unit**, either for service or for clearance to combustible surfaces.
2. Boilers can be wall mounted ONLY if using the optional wall-mount kit available from Weil-McLain. See page 50 for instructions.

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. 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.
2. The minimum foundation size is:
   - Ultra-80 to -230: 24 inches wide x 20 inches deep.
   - Ultra-299/310 to -399: 24 inches wide x 23 inches deep.
3. Foundation may be of wood, brick or concrete (minimum 2 inches thick) construction.
4. If flooding is possible, elevate boiler sufficiently to prevent water from reaching boiler.

Residential garage installation

Precautions

1. Take the following special precautions when installing the boiler in a residential garage. If the boiler is located in a residential garage:
   - Mount the boiler at a height above the floor as specified in the National Fuel Gas Code, ANSI Z223.1 NFPA 54 for U. S. installations, or Natural Gas and Propane Installation CAN/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 — Ultra boiler alone in boiler room

1. No air ventilation openings into boiler room are needed when clearances around Ultra boiler are at least equal to the SERVICE clearances shown in Figure 1, page 5.
2. For spaces that do NOT supply this clearance, provide two openings as shown in Figure 1, page 5. Each opening must provide 1 square inch free area per 1,000 Btuh of boiler input.

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

1. Follow the National Fuel Gas Code (U. S.) or Natural Gas and Propane Installation CAN/CSA B149.1 and B149.2 (Canada) to size/verify size of the combustion/ventilation air openings into the space.

WARNING The space must be provided with combustion/ventilation air openings correctly sized for all other appliances located in the same space as the Ultra boiler.

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

2. 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 (direct vent installation).

Part number 550-100-400/0717

Prepare boiler

Vent and air piping (page 16)

1. 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). See instructions beginning on page 16.
2. You must also install air piping from outside to the boiler air intake adapter. The resultant installation is categorized as direct vent (sealed combustion). Note prevention of combustion air contamination on page 16 when considering vent/air termination.
3. Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Ultra boiler using any other means.
4. 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 16.

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.

1. The Ultra boiler is generally easier to handle and maneuver after removing from crate.
2. After removing outer shipping carton from boiler, REMOVE jacket front door by loosening two (2) screws at lower front. Removing the door will prevent possible damage to the door during handling.
3. To remove boiler from pallet (after removing jacket front door):
   a. Remove the lag screws securing the shipping brackets.
   b. Unscrew the two rear boiler legs and remove the shipping brackets.
   c. Replace legs.
   d. Discard the cardboard protector insert on the rear of the boiler.

NOTICE Do not drop boiler or bump jacket on floor or pallet. Damage to boiler can result.

Prepare boiler for propane (when required)

Propane operation

WARNING **Ultra boilers must be converted for propane operation unless specifically manufactured for propane**. Propane-ready boilers have suffix "LP" after the model number. All other boilers require conversion for propane operation.

Refer to propane conversion instructions beginning on page 48.

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

Placing floor-mounted boilers

1. Set boiler in place and check level.
   a. Adjust legs, if necessary to level boiler.

Wall-mounted boilers

1. Boilers can be wall mounted ONLY if using the optional wall-mount kit available from Weil-McLain. See page 50 for instructions.

Prepare boiler *(continued)*

WARNING **DO NOT install a relief valve with a pressure higher than 30 PSIG**. This is the maximum allowable relief valve setting for the Ultra boiler.

Perform hydrostatic pressure test

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

Prepare boiler for test

1. See Figure 2 for reference in following steps.
2. Remove supply line tees* and 3/4" elbow from accessory bag. Pipe to boiler supply connection as shown. Use pipe dope sparingly. (* 1"x1"x1/4" and *1"x1"x3/4" tees with Ultra-80 to -230 or * 1-1/4"x1-1/4"x1/4" and *1-1/4"x1-1/4"x3/4" tees with Ultra 299/310/399.
3. Temporarily plug the ¾" relief valve tapping in the street elbow with a ¾" NPT pipe plug.
4. Connect a hose to the boiler drain valve, the other end connected to a fresh water supply. Make sure the hose can also be used to drain the boiler after test.
5. Connect a nipple and shutoff valve to system supply connection on the supply tee. This valve will be used to bleed air during the fill. (Valve and nipple are not included with boiler.)
6. Connect a shutoff valve to system return connection. (Valve is not included with boiler.)
7. To avoid getting water on boiler, you may want to pipe street elbows on top of shutoff valves and attach catch-buckets beneath.
8. If convenient, install the boiler circulator and any other piping compatible with Figure 2 that would still allow bleeding air from shutoff valves.
9. Follow guidelines in this manual for piping components, locations and sizing.

Fill and pressure test

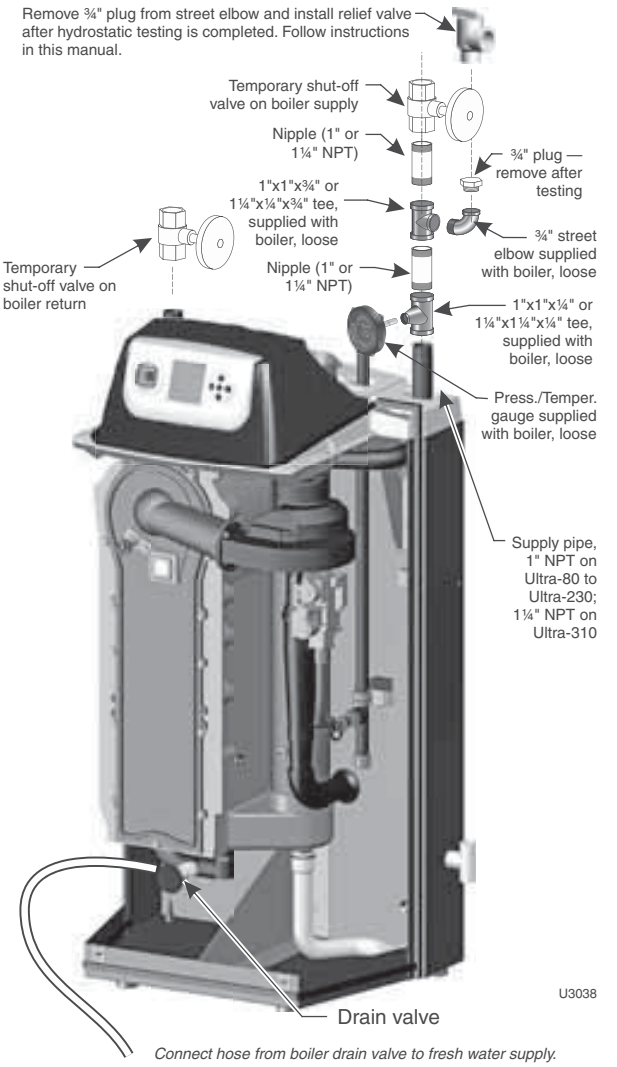
1. Open the shutoff valves you installed on supply and return connections.
2. Slowly open boiler drain valve and fresh water supply to fill boiler with water. The boiler will fill quickly because of its low water content.
3. When water reaches shutoff valves, close boiler drain valve.
4. Close shutoff valves.
5. Slowly reopen boiler drain valve until test pressure on the pressure/temperature gauge reaches at least 45 psig, but no higher than 55 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.

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

Figure 2 Hydrostatic test piping connections



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 nipples and valves unless they will remain for use in the system piping.
4. Remove plug from relief valve street elbow. See page 9 to install relief valve.

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. The U-Control module also provides low water protection by sensing the temperature of the heat exchanger. Some codes/jurisdictions may require additional external controls for high limit and/or low water cutoff protection.

Additional limit controls

Following standard industry practices, if installation is to comply with ASME or Canadian requirements, an additional high temperature limit may be needed. Consult local requirements for other codes/standards to determine if needed.

1. Install a manual reset high temperature limit constructed to prevent a temperature setting above 200°F in system supply piping between boiler and isolation valve. (Note that the U-Control module operating limit function shuts the boiler down at 195°F, or lower if set to a lower value.)

⚠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 30 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 30 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 30 for wiring information).
   c. If using a manual reset limit control or wiring in the manual reset circuit, set U-Control boiler limit at least 20°F less than the external manual reset limit (i.e., set U-Control no higher than 180°F for a 200°F external limit, for example).

Separate low water cutoff

1. A low water cutoff device is recommended when the boiler is installed above piping level, and may be required by certain state or local codes or insurance companies. Consult local requirements to determine. See the NOTICE above regarding the inherent protection provided by the U-Control module.
2. The U-Control's integral protection is accepted in many jurisdictions as meeting the requirement for low water protection. See page 95 for details.
3. When required, use a low water cutoff designed for water installations. Electrode probe-type is recommended. See Replacement parts section at the end of this manual for the Weil-McLain low water cut-off kit.
4. Purchase low water cutoff and install in a tee in the supply piping above boiler.
5. See field wiring instructions beginning on page 30 for wiring additional limit controls.

Backflow preventer

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

Install relief valve

1. Install relief valve in ¾" street elbow piped from boiler supply piping tee (Figure 2, page 8). Pipe the relief valve only as shown, in the location shown.
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 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.

Circulators

The boiler circulator (Taco 007 for Ultra-80 and -105; Taco 0014 for Ultra-155, -230, and -299/310; Taco 0013 for Ultra-399) is shipped loose. Locate it 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 is 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.

Circulator flow rate

Size circulators based on the flow rate required to achieve the temperature change needed. You can closely estimate temperature rise (or drop) through a circuit by using the following formula, where TD is temperature rise (or drop), FLOW is flow rate (in gpm), and BTUH is the heat load for the circuit:

$$\text{FLOW} = \frac{\text{BTUH}}{\text{TD} \times 500}$$

Examples:

Consider a system loop for a system with total heating load equal to 210,000 Btuh. The desired temperature drop through the system piping is 20°F. Then the required flow rate is:

$$\text{FLOW} = \frac{210{,}000}{20 \times 500} = 21 \text{ gpm}$$

SIMPLIFIED: For 20° temperature drop, FLOW = MBH / 10.

Circulator head requirement

The circulator must be capable of delivering the required flow against the head loss that will occur in the piping. Determine the pipe size needed and the resultant head loss using accepted engineering methods. The simplified pipe sizing here is limited to residential systems, and does not include systems with fan coil units or radiant tubing.

⚠CAUTION

The following simplified method for pipe and circulator sizing must be limited to residential applications using baseboard (finned or cast iron), cast iron radiators or convectors. DO NOT apply for radiant heating, fan coil units or commercial installations.

Simplified pipe/circulator selection

1. Install the boiler and piping using the recommended piping layouts beginning on page 12 and in the ADVANCED section of this manual.
2. Size the piping and components for each circuit in the space heating system using Figure 3. **At the flow rates listed, the head loss in all piping will be 0.04 feet per foot of pipe.**
   a. Determine the heating load (Btuh) for each circuit.
   b. Calculate the flow rate for each circuit using its load.
      To use a 20°F temperature drop, just divide the MBH (1,000's of Btuh) by 10.
      Example — Flow for 20°F temp drop with 35,000 Btuh:
      FLOW = 35 MBH / 10 = 3.5 gpm
   c. Find the pipe size in Figure 3 that has a max flow rate just larger than that required for the circuit.
   d. Find the total equivalent length (TEL) of the circuit.
      TEL accounts for losses through fittings and valves by using the equivalent length of pipe that would cause the same head loss. Add these numbers to the measured length of the circuit to find TEL in feet.
      TEL is usually close to 1.5 times the length of the circuit for residential baseboard, radiator or convector applications.
   e. Measure the length of each circuit from the circulator outlet back to its inlet. Then multiply this length times 1.5 to get the approximate TEL of the circuit.
   f. Find the head loss for each circuit:
      TEL = 1.5 X Circuit Length *(feet)*
      HEAD = TEL X 0.04 *(feet water column)*
   g. NOTE: Size system header piping for the total flow of all connected zones.
3. Example:
   a. For a circuit with heating load = 45,000 Btuh (= 45 MBH). Measured length of circuit is 88 feet.
   b. Flow = 45 MBH / 10 = 4.5 gpm.
   c. TEL = 1.5 x 88 feet = 132 feet.
   d. From Figure 3, select 1" pipe (max flow = 7.1 gpm).
   e. Head loss = TEL x 0.04 = 132 x 0.04 = 5.28 feet.
   f. Select a circulator that can deliver at least 4.5 gpm at a head of 5.28 feet. (Read the NOTICE below.)

NOTICE

To use this method, limit the flow through ¾" finned-tube baseboard to 3.9 gpm, or use 1" baseboard and limit flow to 7.1 gpm. If the total load of the circuit requires more flow, split the circuit into two or more.

Also see Figure 9, page 15 for quick-selection information for applications using Taco 007 circulators or equivalent for zone piping.

Figure 3 Flow rates for ***0.04 feet head loss per foot*** of pipe (140°F water)

Pipe size (inches)	MAX Flow rate (GPM) @ 0.04 feet per foot	Pipe size (inches)	MAX Flow rate (GPM) @ 0.04 feet per foot
¾	3.9	2	45
1	7.1	2½	75
1¼	16	3	140
1½	24	4	290

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 3 gallons for 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. When installing air vents and expansion tanks, refer to manufacturer's instructions.
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 4 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 51, page 55.

Diaphragm (or bladder) expansion tank

1. (Figure 4) 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 4, 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 ¾" piping to allow room for air to rise.

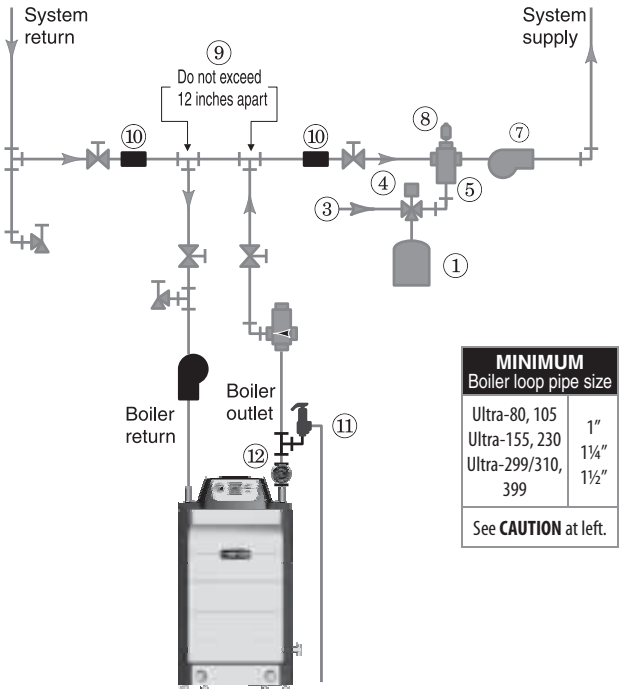
⚠ CAUTION DO NOT install automatic air vents on closed-type expansion tank systems. Air must remain in the system and return to the tank to provide its air cushion. An automatic air vent would cause air to leave system, resulting in water-logging the expansion tank.

DO NOT use a closed-type expansion tank on a system with a Weil-McLain AQUA PLUS water heater. The water heater must use an automatic air vent. Operation of the automatic air vent will deplete air in the piping, causing the expansion tank to waterlog.

⚠ CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 4 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 9). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

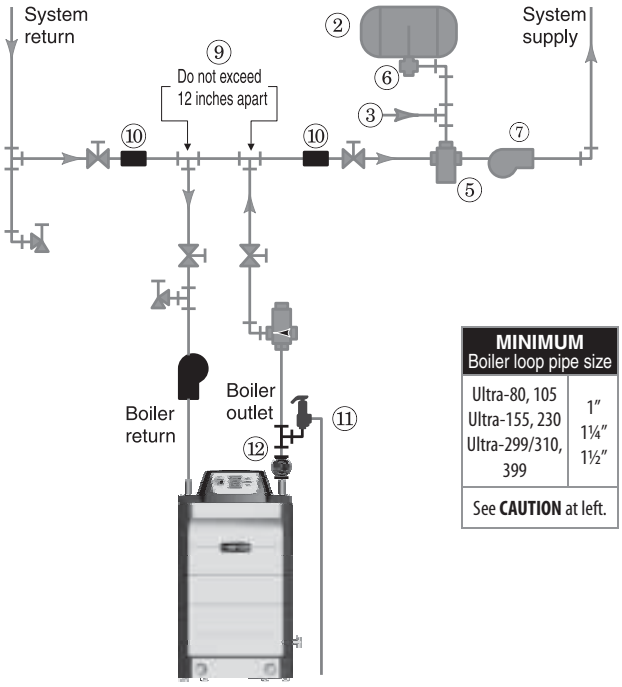
Figure 4 Expansion tank piping

Piping to diaphragm (or bladder) expansion tank



MINIMUM Boiler loop pipe size	
Ultra-80, 105 Ultra-155, 230 Ultra-299/310, 399	1" 1¼" 1½"
See **CAUTION** at left.	

Alternate — Piping to closed-type expansion tank



MINIMUM Boiler loop pipe size	
Ultra-80, 105 Ultra-155, 230 Ultra-299/310, 399	1" 1¼" 1½"
See **CAUTION** at left.	

① Diaphragm-type expansion tank
② Closed-type expansion tank
③ Make-up water supply
④ Fill valve, typical
⑤ Air separator
⑥ Tank fitting
⑦ System circulator
⑧ Automatic air vent
⑨ Primary/secondary connection
⑩ System supply/return sensors
⑪ Relief valve
⑫ Temperature/Pressure gauge

U3039

Install water piping — typical systems

Zoning with zone valves

1. Connect boiler to system as shown in Figure 5 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. Also see the information on page 14 and page 15 for suggested piping and sizing.

⚠CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 5 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

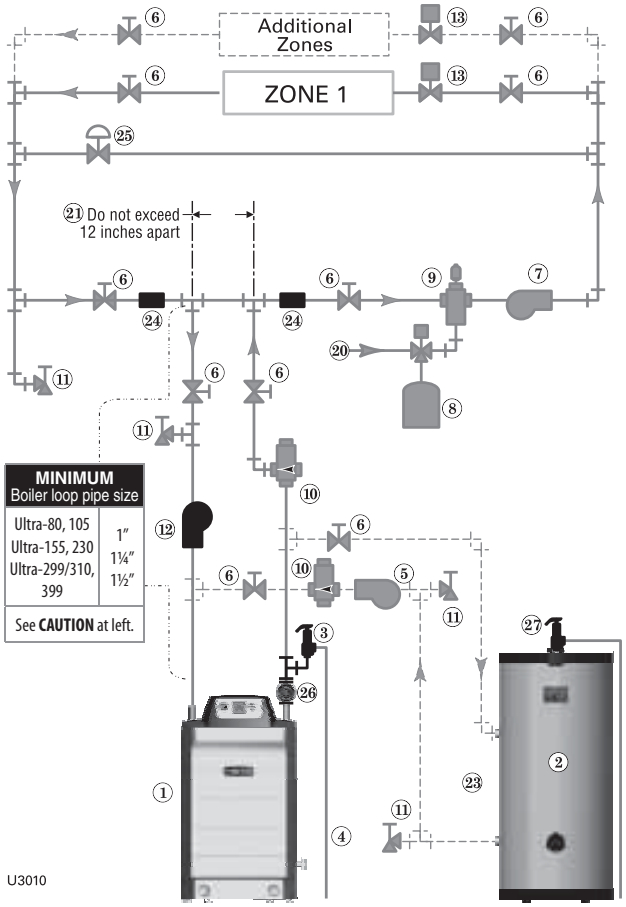
2. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 4, page 11. (DO NOT use a closed-type tank with a AQUA PLUS water heater.)
3. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional time out setting can be used to override). The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop during DHW heating.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

4. Controlling the circulators
   a. The U-Control can control up to three circulators (boiler circulator and two others). Refer to Field wiring, beginning on page 30, for instructions on wiring to circulators.
   b. The factory default settings are: DHW circulator as Circulator 1, boiler circulator as Circulator 2 and system circulator as Circulator 3. See Field wiring instructions, beginning on page 30, for details.

Figure 5 Zone valve zoning plus optional DHW piping



Legend — Figure 5

1 Ultra boiler	12 Boiler circulator
2 Indirect water heater (DHW), if used	13 Zone valves, typical
3 Boiler relief valve (see page 9 for piping details)	20 Make-up water supply
4 Relief valve discharge piping (see page 9 for details)	21 Primary/secondary connection
5 DHW circulator (see page 56 for suggested sizing)	23 DHW connections — see water heater manual for piping
6 Isolation valves	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.
7 System circulator (see information above for wiring)	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
8 Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, if used)	26 Temperature/Pressure gauge
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	27 DHW relief valve, if used
10 Flow/check valves	■ Items supplied with boiler
11 Purge/drain valves	■ Items supplied by others

Other piping alternatives

See page 14 and page 15 and ADVANCED INSTALLATION section for additional piping suggestions.

Install water piping — typical systems *(continued)*

Zoning with circulators

1. Connect boiler to system as shown in Figure 6 when circulator zoning. The boiler circulator cannot be used for a zone. It must supply only the boiler loop. Also see the information on page 14 and page 15 for suggested piping and sizing.

⚠CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 6 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

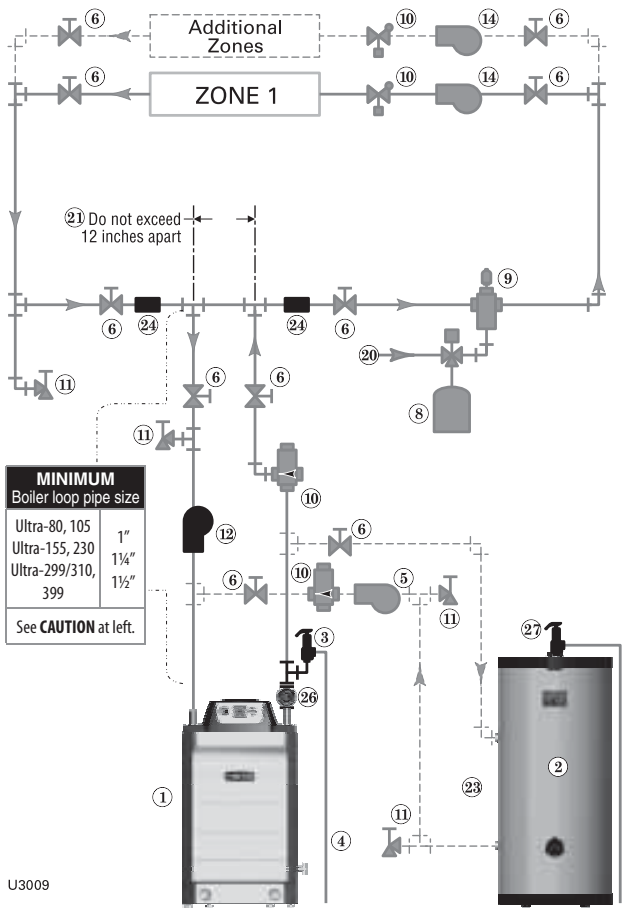
2. Install a separate circulator for each zone.
3. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 4, page 11. (DO NOT use a closed-type tank with a AQUA PLUS water heater.)
4. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional timeout setting can be used to override). The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop during DHW heating.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

5. Controlling the circulators
   a. The U-Control can control up to three circulators (boiler circulator and two others). Refer to Field wiring, beginning on page 30, for instructions on wiring to circulators.
   b. The factory default settings are: DHW circulator as Circulator 1, boiler circulator as Circulator 2. See Field wiring instructions, beginning on page 30, for details.
   c. The zone circulators in Figure 6 must be controlled by circulator relays activated by the zone thermostats or zone controller.

Figure 6 Circulator zoning plus optional DHW piping



Legend — Figure 6			
1	Ultra boiler	11	Purge/drain valves
2	Indirect water heater (DHW), if used (see page 56)	12	Boiler circulator
3	Boiler relief valve (see page 9 for piping details)	14	Zone circulators, typical
4	Relief valve discharge piping (see page 9 for details)	20	Make-up water supply
5	DHW circulator (see page 56 for suggested sizing)	21	Primary/secondary connection (tees no more than 12 inches apart)
6	Isolation valves	23	DHW connections — see water heater manual for piping
7	System circulator (see information above for wiring)	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.
8	Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, if used)	26	Temperature/Pressure gauge
9	Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	27	DHW relief valve, if used
10	Flow/check valves	■	Items supplied with boiler
		■	Items supplied by others

Other piping alternatives

See page 14 and page 15 and ADVANCED INSTALLATION section for additional piping suggestions.

Using with Weil-McLain AQUA PLUS water heaters

See **AQUA PLUS** - Product Manual for typical water piping.

See ADVANCED INSTALLATION section for additional piping information and applications.

AQUA PLUS DHW installation — quick-selection

NOTICE The information in this section is for usage of Ultra boilers with Weil-McLain AQUA PLUS indirect water heaters.

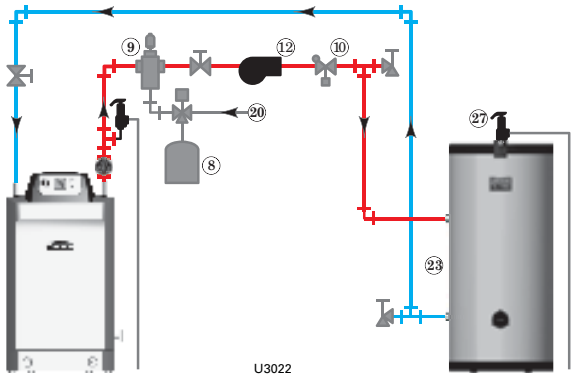
NOTICE For dedicated DHW applications, use the circulator supplied with the boiler to circulate to the water heater as shown in this section.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional timeout setting can be used to override).

⚠CAUTION DO NOT use a closed-type expansion tank on a system with a Weil-McLain AQUA PLUS water heater. The water heater must use an automatic air vent. Operation of the automatic air vent will deplete air in the piping, causing the expansion tank to waterlog. Always use a diaphragm- or bladder-type expansion tank with AQUA PLUS water heaters.

1. Follow the guidelines on this page and page 15 to connect the water heater to the boiler. Use Figure 8 for dedicated water heating-only applications. Use Figure 9 and Figure 10, page 15 for combined space heating/water heating applications.

Figure 8 Ultra boiler with Ultra PLUS or AQUA PLUS water heater — dedicated water heating application, typical piping schematic



2. The AQUA PLUS water heater can also be installed as one of the zones in the system. This method, however, requires flow through the main system even during the summer (non-space heating) months. Piping as shown in Figure 9 and Figure 10, page 15 allows isolation of flow to just the water heater piping during non-heating periods.

Figure 7 Use the table below to size DHW loop piping and select a circulator (see ADVANCED section for other DHW tanks)

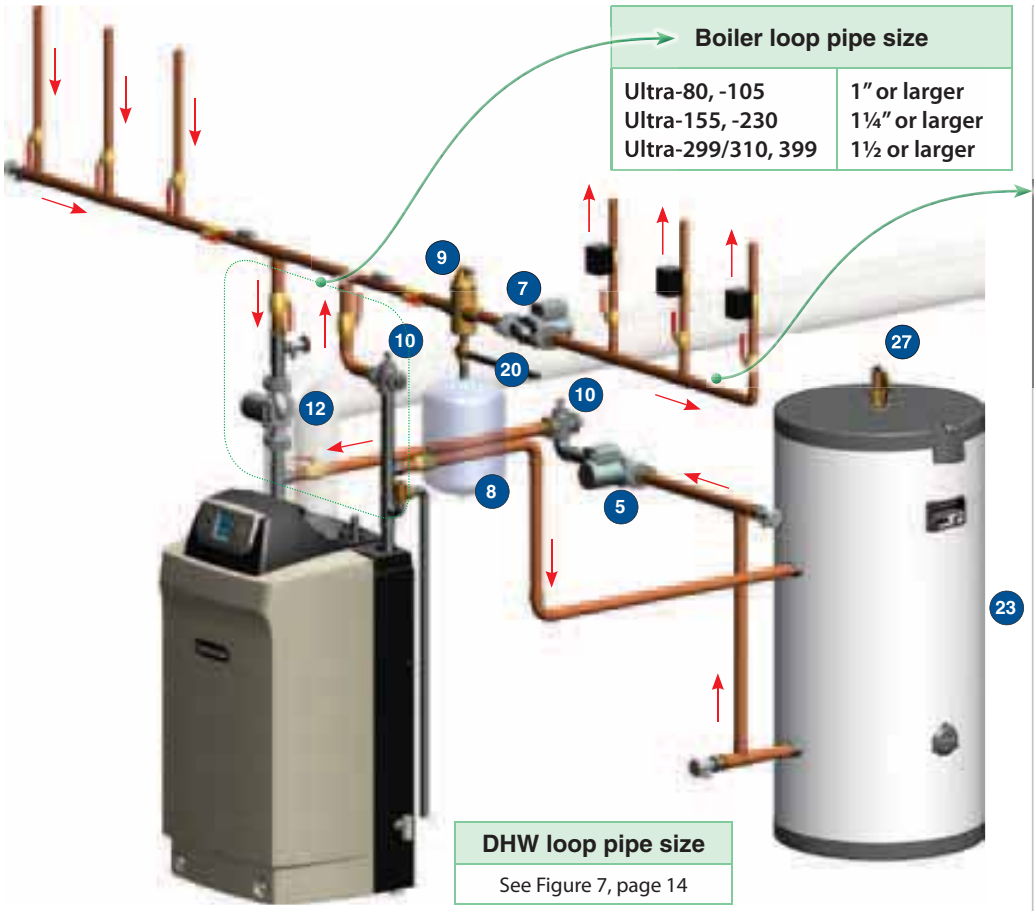
Boiler Ultra	Partial load (see Figure 9 and Figure 10, page 15) (combined space heating/water heating application)						
	PLUS model	GPM	MBH 115/140	GPH 115/140	Head loss (ft)	DHW pipe size	CIRC
-80 (71 MBH)	40	6.5	71/71	160/124	8.5	1	007
	60	6.5	71/71	168/132	8.5	1	007
	80	6.5	71/71	176/140	8.5	1	007
-105 (94 MBH)	40	10.1	94/94	217/154	17.0	1¼	0014
	60	6.4	94/94	211/162	8.6	1	007
	80	6.4	94/94	219/170	8.6	1	007
-155 (139 MBH)	40	12.1	119/98	248/160	15.9	1¼	0014
	60	12.1	139/120	295/220	15.9	1¼	0014
	80	12.1	139/139	305/230	15.9	1¼	0014
-230 (207 MBH)	40	13.5	120/100	251/162	15.2	1¼	0014
	60	18.4	169/128	350/207	23.7	1½	1400-20
	80	13.5	207/207	430/325	15.2	1¼	0014
-299/310 (252 MBH)	40	13.1	120/100	250/162	9.7	1¼	0010
	60	19.3	170/129	351/208	11.7	1½	0014
	80	24.9	252/252	510/381	18.4	1½	1400-20
-399 (365 MBH)	40	13.1	120/100	250/162	9.7	1¼	0010
	60	19.3	170/129	351/208	11.7	1½	0014
	80	24.9	320/253	636/382	18.4	1½	1400-20

Dedicated boiler (see Figure 8) (water heating only)						
PLUS model	GPM	MBH 115/140	GPH 115/140	Head loss (ft)	DHW pipe size	CIRC
40	6.5	71/71	160/124	8.5	1	007
60	6.5	71/71	168/132	8.5	1	007
80	6.5	71/71	176/140	8.5	1	007
40	6.4	94/86	203/141	8.6	1	007
60	6.4	94/94	211/162	8.6	1	007
80	6.4	94/94	219/170	8.6	1	007
40	12.1	119/98	248/160	15.9	1¼	0014
60	12.1	139/120	295/220	15.9	1¼	0014
80	12.1	139/139	305/230	15.9	1¼	0014
40	Not recommended — boiler capacity exceeds maximum output of water heater					
60						
80	13.5	207/207	430/325	15.2	1¼	0014
40	Not recommended — boiler capacity exceeds maximum output of water heater					
60						
80						
40						
60						
80						

Using with Weil-McLain AQUA PLUS water heaters *(cont.)*

See **AQUA PLUS** - Product Manual for typical water piping.

Figure 9 Ultra boiler with Ultra PLUS or AQUA PLUS-40, -60 or -80 water heater, zone valve zoning, typical piping



Boiler loop pipe size	
Ultra-80, -105	1″ or larger
Ultra-155, -230	1¼″ or larger
Ultra-299/310, 399	1½ or larger

DHW loop pipe size

See Figure 7, page 14

System/zone pipe sizing

(Baseboard, convector or cast iron radiators ONLY)

For residential space heating applications (other than radiant heating or unit heaters) ONLY, you can use:

Ultra Model	System header
-80	1″ or larger
-105, -155	1¼″ or larger
-230	1½″ or larger
-299/310, 399	2″ or larger

Recommendations are based on a 20°F temp drop through the system.

Zone piping selection for series loops with finned-tube baseboard — general

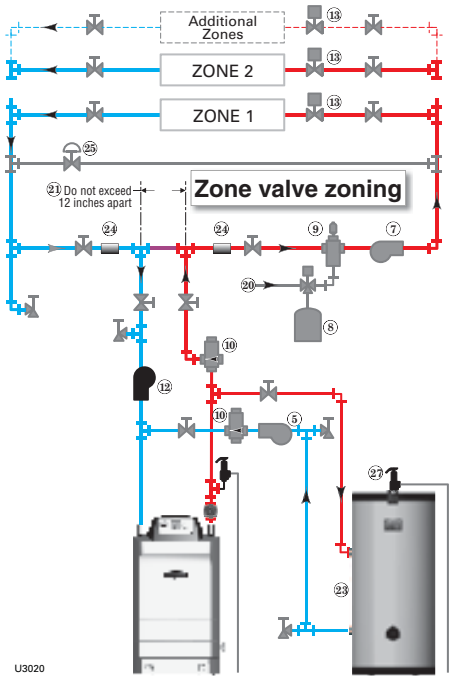
Copper pipe and baseboard size	Max recommended feet of baseboard
¾"	106
1"	179

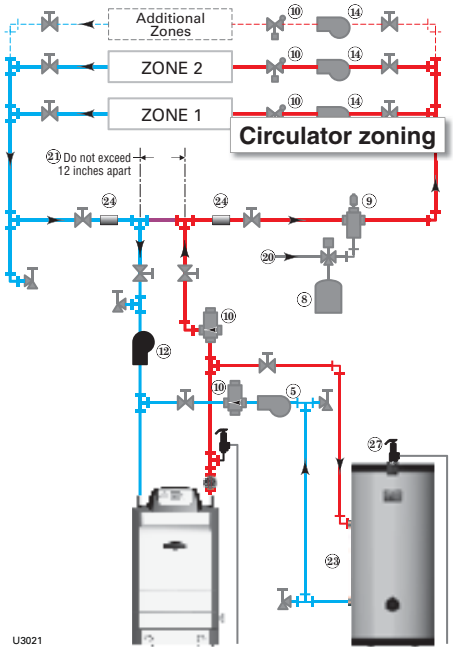
Contact your supplier to size the system and zone circulators needed. See below for zone piping using Taco 007 or equivalent circulators.

Limits for series loop zones with finned-tube baseboard using Taco 007 (or equivalent) circulators

Copper pipe and baseboard	Max load MBH	Max feet of baseboard	Max total length of circuit (feet)
¾"	50	82	93
1"	79	104	123

Figure 10 Ultra boiler with Ultra PLUS or AQUA PLUS water heater, typical piping schematics





Legend for Figure 9 and Figure 10

- **5** DHW circulator (see page 56 for suggested sizing)
- **7** System circulator (provided by installer)
- **8** Diaphragm type expansion tank ONLY — DO NOT use a closed-type tank with AQUA PLUS water heaters, because the automatic air vent will deplete the air from the system, causing the expansion tank to waterlog.
- **9** Air separator with automatic air vent
- **10** Flow/check valves
- **12** Boiler circulator — provided with boiler
- **13** Zone valves, typical
- **20** Make-up water supply
- **21** Primary/secondary connection
- **23** DHW connections — see water heater manual for piping
- **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.
- **27** DHW relief valve must be installed in the tapping on top of the AQUA PLUS water heater.

■ Items supplied with boiler

■ Items supplied by others

Venting/air piping — general

⚠ 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.

⚠ WARNING **You must provide combustion air.**

Direct vent — Install air inlet piping for the Ultra boiler as described in the Boiler manual and this addendum. The air termination fitting must be installed with the clearances and geometry relative to the vent outlet depicted in this manual to ensure that flue products do not enter the air intake.

Direct exhaust — Provide combustion air openings to boiler room/building as specified in this addendum and as required by all applicable codes.

Ensure that the combustion air will not contain any of the contaminants in Figure 11. DO NOT place combustion air supply opening or intake near a swimming pool, for example. Avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage.

Figure 11 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
Buildings under construction (where air is contaminated with particulates)

Venting/air piping — general *(continued)*

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

Every boiler must have its own vent. DO NOT common vent with any other appliance. See page 16.

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.

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

⚠ WARNING Venting/combustion air piping - Installations must provide provisions for combustion and ventilation air in accordance with the section "Air for Combustion and Ventilation," of the National Fuel Gas Code - ANSI Z223.1/ NFPA54 – latest edition, or Sections 8.2, 8.3, or 8.4 of Natural Gas and Propane Installation Code - CAN/CSA B149.1, or applicable provisions of the local building codes.

⚠ WARNING Use only the materials listed in this manual for vent and air pipe and fittings. Failure to comply could result in severe personal injury, death or substantial property damage.

⚠ 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 for Ultra boilers. 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 piping

1. 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 11, page 16, and ensure the air intake will not be likely to draw in contaminated air.
2. Combustion air can be piped individually for each boiler, or it can be manifolded as shown in Figure 59, page 59. Air piping must always terminate on the same side (or roof) of the building as the vent.

Vent piping

1. 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 Figure 14, page 18, and the associated instructions referenced.
2. Each Ultra boiler requires a separate vent. Do not common vent.

Vent and air piping materials

1. See Figure 13, page 19 for approved vent and air piping materials.

Venting & air — general *(cont.)*

Figure 12 Vent and air pipe options and maximum allowable piping lengths

Ultra model	Vent or air pipe size	• Maximum equivalent feet of piping • Number of elbows allowed at these lengths *(All applications include allowance for the terminations.)*											
		Direct vent Sidewall with Weil-McLain vent/air cap		Direct vent Sidewall with separate pipes — or — **Direct exhaust** (sidewall or vertical)		3″ Concentric Sidewall or Vertical DO NOT use CPVC or ABS [Note 1]		4″ Concentric Sidewall or Vertical DO NOT use CPVC or ABS) [Note 1]		Direct vent Vertical with separate pipes		Direct vent Vertical exhaust Sidewall air	
		Direct vent only		Direct vent or Direct exhaust		Direct vent only		Direct vent only		Direct vent only		Direct vent only	
		Length	Ells	Length	Ells	Length	Ells	Length	Ells	Length	Ells	Length	Ells
-80/105	2″*	100 **(ab)**	2	100 **(a)**	2	100 **(ab)**	1	NA		100 **(a)**	1	100 **(a)**	1
	3″	100	2	100	2	100	1	NA		100	1	100	1
-155	3″	100	2	100	2	100	1	NA		100	1	100	1
-230	3″	30 **(c)**	2	30 **(c)**	2	30 **(c)**	1	30 **(c)(d)**	1	30 **(c)**	1	30 **(c)**	1
	4″	100 **(d)**	2	100	2	70 **(d)**	1	100	1	100	1	100	1
-299	4″	100	2	100	2	70 **(d)**	1	100	1	100	1	100	1
-310	4″	100	2	100	2	70 **(d)**	1	100	1	100	1	100	1
-399	4″	100	2	100	2	NA		100	1	100	1	100	1

Note 1:

IPEX 3” and 4” PVC concentric vent kits can be used with standard PVC pipe, fittings and cement (ANSI/ASTM D1785) except where ULC S636 compliance is required. For ULC S636 compliance, all pipe, fittings and cement must be IPEX System 636. When using IPEX kits, use only IPEX product code 196006 for 3” venting or IPEX product code 196021 for 4” venting.

Contact Weil-McLain for ordering information and availability of Weil-McLain venting kits.

Polypropylene - Separate pipe and concentric termination by respective manufacturers.

Additional notes

a — Use 3”x2” reducer at boiler

b — Use 3”x2” reducers at termination

c — Use 4”x3” reducer at boiler

d — Use 4”x3” reducers at termination

* Ultra-80 and 105 boilers installed with 2-inch vent piping automatically derate due to the pressure loss in the vent and air piping. The derate ranges up to 10% for the Ultra-80 at 100 feet or 15% for the Ultra-105 at 100 feet.

Equivalent feet for elbows — deduct from maximum equivalent length of piping:

PVC • 7 feet per for each 4-inch elbow & 2 or 3-inch 90° long-radius or 45° elbow
• 16 feet for each 2- or 3-inch short-radius elbow

PP • Centrotherm 3” = 6’ 4” = 20’ Duravent 3” = 17’ 4” = 22’

Stainless steel (AL29-4C) vent pipe

install an adapter at the boiler for all applications. Also install an adapter at the termination unless using separate-pipe termination.

Venting & air — general *(cont.)*

Figure 13 Vent and air piping materials — Use only the materials listed below, ensuring that all materials meet local codes

Item	Material	Standards for installations in:	
		United States	Canada
Plastic piping materials			
Vent or air pipe & fittings	PVC schedule 40	ANSI/ASTM D1785	Plastic vent pipe must be certified to ULC S636 when required. (Note 2) Air pipe can be any of those listed at left if acceptable for local codes.
	PVC-DWV (Note 1)	ANSI/ASTM D2665	
	CPVC schedule 40 (Note 1)	ANSI/ASTM F441	
	ABS-DWV schedule 40 (Note 1)	ANSI/ASTM D2661	
PVC & ABS pipe cement & primer	PVC	ANSI/ASTM D2564	
	CPVC (Note 1)	ANSI/ASTM F493	
	ABS (Note 1)	ANSI/ASTM D2235	
Polypropylene vent pipe, fittings, terminations	**Simpson-Duravent —** Obtain all materials from M&G Simpson-Duravent **Centrotherm Eco Systems InnoFlue® Single-wall —** Obtain all materials from Centrotherm	See manufacturer's literature for detailed information ***MUST USE LOCKING COLLAR ON EVERY JOINT***	ULC S636
AL29-4C piping materials			
Vent pipe AL29-4C stainless steel	Heat Fab, Inc. — Saf-T-Vent® Z-Flex, Inc. — Z-Vent II Simpson Dura-Vent — FasNSeal™	Certified for Category IV and direct vent appliance venting	Certified for Category IV and direct vent appliance venting
Weil-McLain bird screens *(purchase separately)*			
Weil-McLain bird screens	For 2″ or 3″ vent or air termination (cut to size if necessary) 3″ vent screen: W-M part number 383-500-105	For 3″ or 4″ vent or air termination (cut to size if necessary) 4″ vent screen: W-M part number 383-500-110	

Note 1: DO NOT use DWV, CPVC or ABS when using concentric vent termination. Use ONLY PVC schedule 40.

Note 2: IPEX PVC concentric terminations utilize PVC pipe/fittings certified to ULC S636. Where ULC S636 compliance is required, use only IPEX System 636 pipe, fittings and cement.

⚠WARNING AL29-4C vent piping — Install a PVC-to-stainless adapter supplied by the vent pipe manufacturer at the boiler vent connection and at the termination (when using Weil-McLain plate or concentric PVC termination). DO NOT mix piping from different vent pipe manufacturers unless using adapters specifically designed for the purpose by the manufacturer.

⚠WARNING Plastic piping — Do not attempt to connect different types of plastic piping together.

⚠WARNING DO NOT use cellular core pipe.

⚠WARNING All vent and air pipes require a **bird screen at each termination** where specified in the manual or vent supplement. Purchase bird screens separately from Weil-McLain or vent kit supplier. Note that most kits do not include the screens.

Sidewall vent/air termination: *Separate pipes*

Allowable vent/air pipe materials

1. Use only the materials listed in Figure 13, page 19.
2. The Weil-McLain vent termination kit includes inside and outside wall plates, bird screens, and mounting hardware to secure the plates (kit included with boiler).

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 14.
2. Maximum lengths listed in Figure 14 allow for 2 elbows. Additional elbows required 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 82 to complete the air and vent piping between the termination and the boiler.

Determine location — separate elbows

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

1. Locate the vent/air terminations using the following guidelines.
2. The air piping must terminate in a down-turned elbow as shown in Figure 15. This arrangement avoids recirculation of flue products into the combustion air stream.
   a. Apply the configuration on the left side of Figure 15 unless the terminations would fail to meet minimum clearance to grade or snow line.
   b. Apply the configuration on the right side of Figure 15 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 15 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 insulated enclosure around the vent and air pipes. The vent and air terminations must exit through the enclosure as shown in Figure 15, 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 15.

⚠WARNING Do not exceed the maximum lengths of the outside vent piping shown in Figure 15. 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 14 Maximum piping lengths for separate vent and air pipe sidewall termination

Boiler Ultra	Maximum Piping, 2" *		Maximum Piping, 3" *		Maximum Piping, 4" *	
	Feet	Elbows	Feet	Elbows	Feet	Elbows
-80 **	100	2	100	2	Not allowed	
-105 **	100	2	100	2		
-155	Not allowed		100	2		
-230	Not allowed		30	2	100	2
-299/310	Not allowed		Not allowed		100	2
-399	Not allowed		Not allowed		100	2

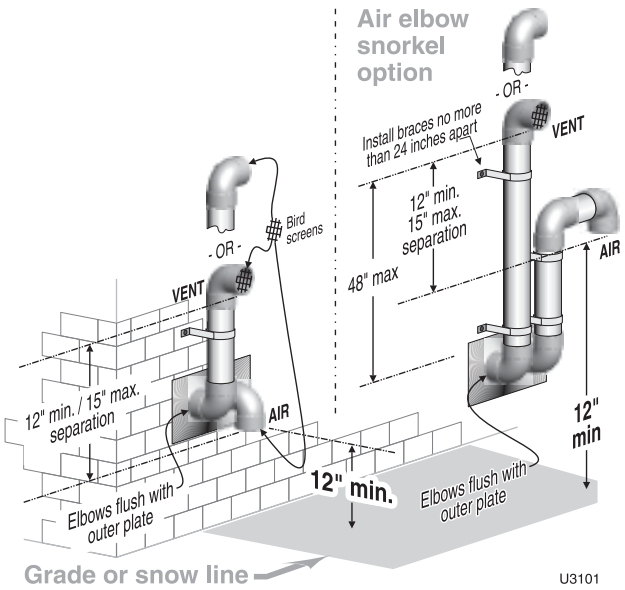
* Install pipe reducers to adapt from pipe size used to the outside diameter required at the boiler. You do not have to reduce allowable pipe length for the reducers.

** Ultra-80 and 105 boilers installed with 2-inch vent piping automatically derate due to the pressure loss in the vent and air piping. The derate ranges up to 10% for the Ultra-80 at 100 feet or 15% for the Ultra-105 at 100 feet.

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

- 7 feet for each additional 4-inch elbow (90° or 45°)
- 7 feet for each additional 2 or 3-inch long radius elbow
- 16 feet for each 2 or 3-inch short radius elbow
- 7 feet for each 2 or 3-inch 45-degree elbow.

Figure 15 Sidewall termination — separate pipes — configuration options and minimum clearances from vent to air terminations



Sidewall vent/air termination: *Separate pipes* *(continued)*

4. You must 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 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 7 feet above any public walkway.
      - At lease 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.
   b. Do not terminate closer to 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment. Never terminate above or below any of these within 4 feet horizontally.
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.

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 71 to complete piping from boiler to termination.

Figure 16 Sidewall termination with separate pipes — clearances to openings

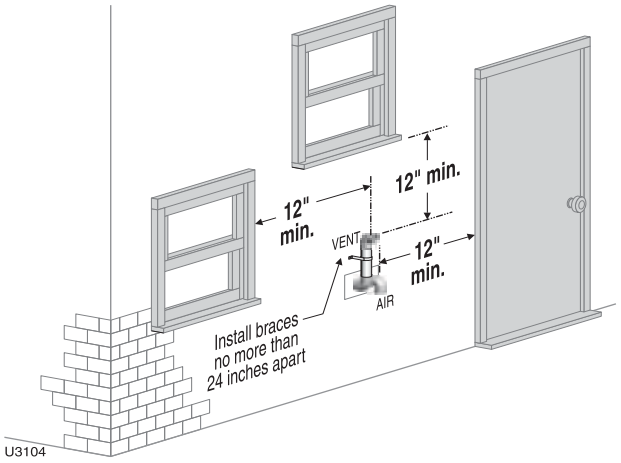


Figure 17 Sidewall termination with separate pipes — clearances to public walkway or forced air intake

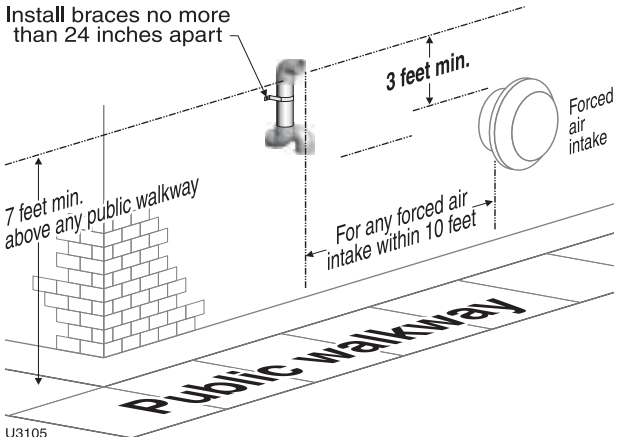
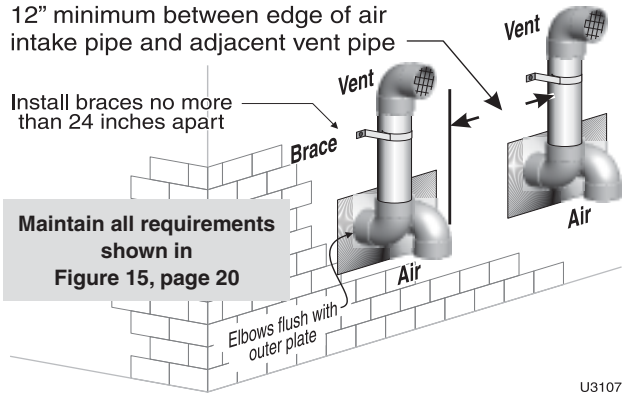


Figure 18 Multiple terminations — separate pipes — clearance from vent of one to air intake of the next



Sidewall vent/air termination: *Separate pipes* (continued)

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 18, page 21 for U. S. installations.
3. For Canadian installations, provide clearances required by Natural Gas and Propane Installation CAN/CSA B149.1 or B149.2 Installation Code.
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 59, page 59.

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 noncombustible construction, size the vent pipe hole at least 0.4" larger than the vent pipe diameter:
      - 2¾" hole for 2"
      - 4" hole for 3"
      - 5" hole for 4"
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in Figure 20.
3. Use a sidewall termination plate as a template for correct location of hole centers. Sidewall termination plates must be purchased separately. See the parts list at the end of this manual for part numbers.
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 20) by inserting bird screens. Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
2. When completed, the air termination coupling must be oriented at least 12 inches below the vent termination and at least 12 inches above grade or snow line as shown in Figure 15, page 20.
3. You can orient the vent termination elbow either directly outward or 90 degrees away from the air inlet elbow as shown in Figure 15, page 20.
4. Maintain the required dimensions of the finished termination piping as shown in Figure 15, page 20.
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 extending the vent and air pipes out from the wall, install a coupling on each pipe. Mount the piping with the coupling flush with the outer plate.

Figure 19 Multiple terminations — separate pipes — clearance from vent of one to air intake of the next — alternate configuration of air and vent terminations

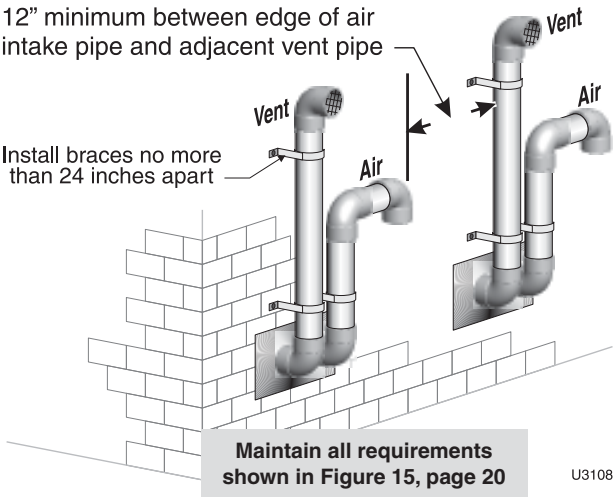
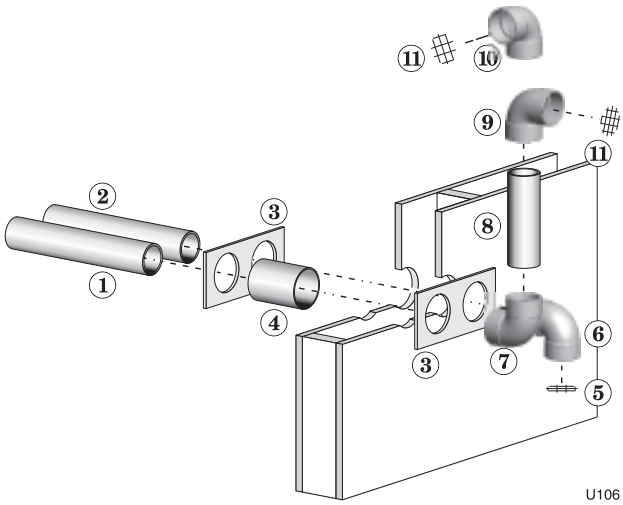


Figure 20 Sidewall termination assembly — using separate pipes



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

Vertical vent/air termination: *Separate pipes*

Allowable vent/air pipe materials

1. Use only the materials listed in Figure 13, page 19.
2. Purchase bird screens for vent and air terminations separately. See the parts list at the end of this manual.

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 21.
2. Maximum lengths listed in Figure 21 allow for 1 elbow. Additional elbows required a reduction in maximum length as explained in the table notes.

Connecting from termination to boiler

1. Install the termination penetrations as instructed in the following. Then proceed to page 82 to complete the piping between the termination and the boiler.

Determine location

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 22. 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 22. 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.
4. You must 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.

Figure 21 Maximum piping lengths for separate vent and air pipe vertical termination

Boiler Ultra	Maximum Piping, 2" *		Maximum Piping, 3" *		Maximum Piping, 4" *	
	Feet	Elbows	Feet	Elbows	Feet	Elbows
-80	30	1	100	1	Not allowed	
-105	30	1	100	1		
-155	Not allowed		100	1		
-230	Not allowed		30	1	100	1
-299/310	Not allowed		Not allowed		100	1
-399	Not allowed		Not allowed		100	1

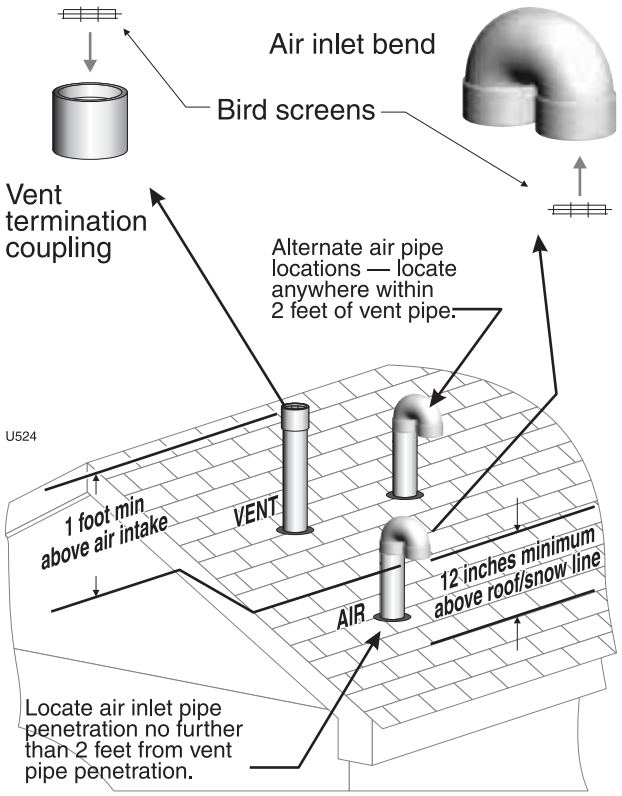
* Install reducers as necessary where connecting to the boiler vent and air connections.

For piping using more than 1 elbow, reduce maximum allowable length:

- 7 feet for each additional 4-inch elbow (90° or 45°)
- 7 feet for each additional 2 or 3-inch long radius elbow
- 16 feet for each 2 or 3-inch short radius elbow
- 7 feet for each 2 or 3-inch 45-degree elbow.

NOTE: The 180-degree return bend is included in the allowed fittings. No deduction is required.

Figure 22 Vertical termination — separate pipes



Vertical vent/air termination: *Separate pipes* (continued)

5. Maintain clearances to vent termination as given below:
   a. Vent must terminate:
      - At least 6 feet from adjacent walls.
      - No closer than 5 feet below roof overhang.
      - At least 7 feet above any public walkway.
      - 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.
   b. Air inlet must terminate at least 6 inches above the roof or snow line and at least 12 inches below the vent termination as shown in Figure 22, page 23.
   c. Do not terminate closer to 4 feet horizontally from any electric meter, gas meter, regulator, relief valve or other equipment. Never terminate above or below any of these within 4 feet horizontally.
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.

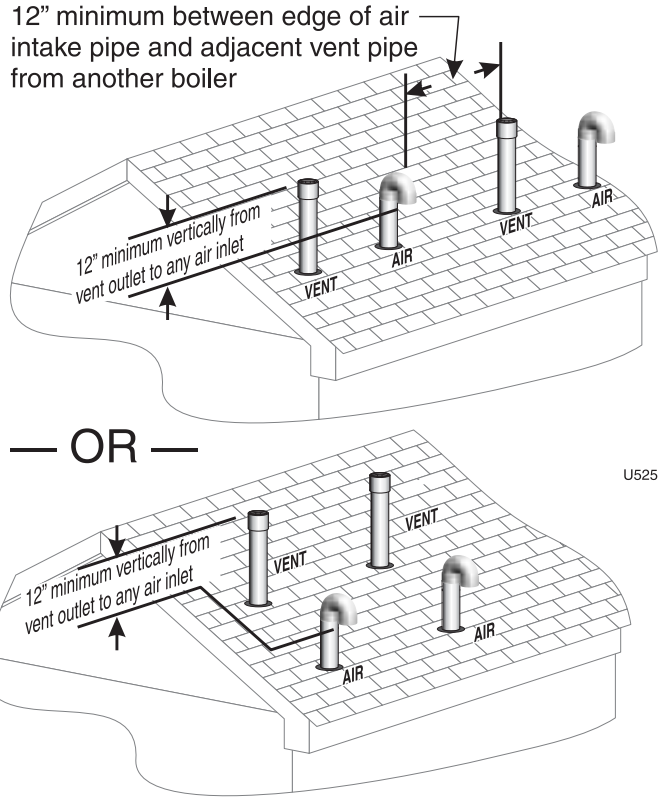
Prepare roof penetrations

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 noncombustible construction, size the vent pipe hole at least 0.4" larger than the vent pipe diameter:
      - 2¾" hole for 2"
      - 4" hole for 3"
      - 5" hole for 4"
   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 22, page 23.
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.

Termination and fittings

1. Prepare the vent termination elbow and the air termination elbow (Figure 22, page 23) by inserting bird screens. Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
   a. If using 3-inch piping for an Ultra-230, cut a 4-inch bird screen by placing 3-inch fitting on screen and cutting around it as a template.
2. The air piping must terminate in a down-turned 180-degree return bend as shown in Figure 22, page 23. 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.

Figure 23 Termination location — separate pipes — terminations for multiple boilers



3. The vent piping must terminate in an up-turned coupling as shown in Figure 22, page 23. 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.
4. Maintain the required dimensions of the finished termination piping as shown in Figure 22, page 23.
5. 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 23)

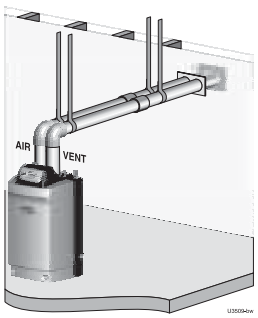
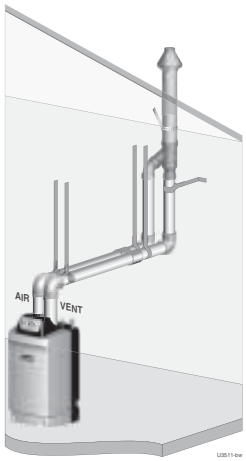
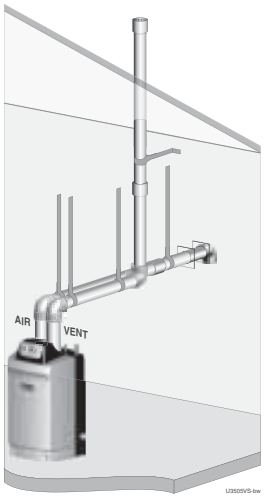
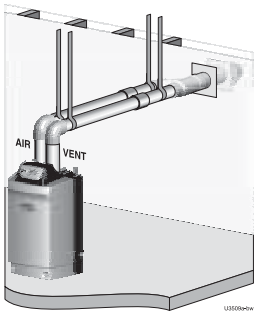
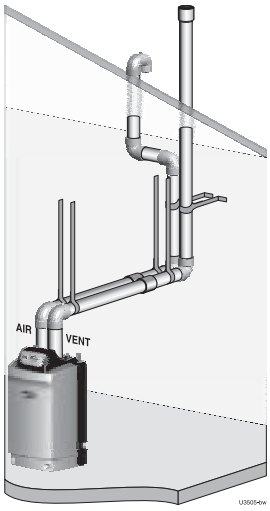
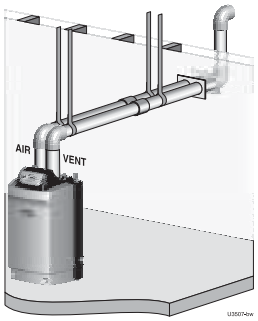
1. When terminating multiple Ultra boilers, terminate each vent/air connection as described in this section.

⚠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 Natural Gas and Propane Installation CAN/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.

DIRECT VENT

Figure 24 DIRECT VENT APPLICATIONS — Vent and air termination options

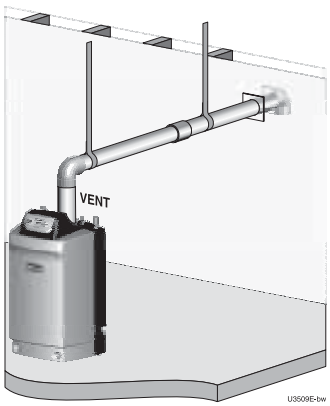
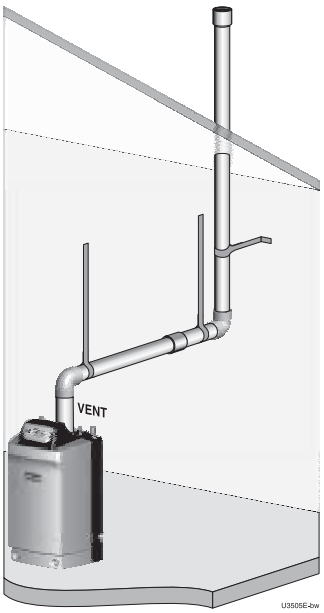
DIRECT VENT SIDEWALL termination		DIRECT VENT VERTICAL termination		DIRECT VENT VERTICAL vent and SIDEWALL air	
Weil-McLain sidewall termination plate (See Boiler manual page 67)		3" or 4" concentric termination (See Boiler manual page 72)		Vertical vent termination and Sidewall air termination (See Boiler manual page 79)	
3" or 4" concentric termination (See Boiler manual page 72)		Vertical termination with separate vent and air pipes (See Boiler manual page 73)			
Sidewall termination with separate vent and air pipes (See Boiler manual page 66)					

Direct vent installation sequence

Step 1	Install the boiler.
Step 2	Determine the termination method — sidewall or vertical, concentric or separate pipes, etc.
Step 3	Determine proper location for wall or roof penetration for each termination.
Step 4	Install termination assembly as described in this manual.
Step 5	Install air and vent piping from boiler to termination.
Step 6	Install pipe supports and brackets as required.

DIRECT EXHAUST

Figure 25 DIRECT EXHAUST APPLICATIONS — Vent termination options (combustion air from room)

DIRECT EXHAUST Sidewall termination		DIRECT EXHAUST Vertical termination	
Sidewall vent termination **(See Boiler manual page 83)**		**Vertical vent termination** **(See Boiler manual page 83)**	
Direct exhaust installation sequence	**Step 1** Install the boiler. **Step 2** Determine the proper location for roof or 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. • Vertical terminations only — Install terminations as described in this addendum. • 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.		

Install condensate line

Prepare condensate fittings

1. Remove PVC fittings and gasket from the accessories bag.
2. Deburr and chamfer outside and inside of ½" x 1¼" PVC nipple to ensure even cement distribution when joining.
3. Clean nipple ends and all fittings. Dry thoroughly.
4. 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 ¼ 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.
5. See Figure 26.
6. Assemble the ½" PVC nipple to the PVC reducing elbow as shown.
7. Allow joint to dry completely.
8. Then slide gasket over nipple as shown in Figure 27.
9. Slide nipple through jacket condensate line hole to position as shown in Figure 27.
10. Cement the ½" tee to the protruding ½" nipple. Be sure both nipple and reducing elbow finish upright.

⚠ CAUTION Firmly press the reducing elbow 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.

Connect condensate trap line and fittings

1. Remove condensate trap line from bag.
2. Ultra-80 & -105 only — Figure 28
   a. Guide the condensate trap line through the bracket hole as shown.
   b. Place a hose clamp over the end of the condensate line.
   c. Then slide the end of the trap line over the heat exchanger condensate connection.
   d. Tighten the hose clamp to secure the trap line.
   e. Place a hose clamp over the other end of the condensate trap line.
   f. Slide the trap line over the reducing elbow and secure with the hose clamp.
3. Ultra-155 and larger — Figure 30, page 28 or Figure 31, page 28
   a. Slide a hose clamp over each end of the condensate trap line.
   b. Slide the trap line onto the heat exchanger condensate connection and PVC reducing elbow as shown.
   c. Tighten the hose clamps to secure the trap line.

Figure 26 Condensate trap assembly

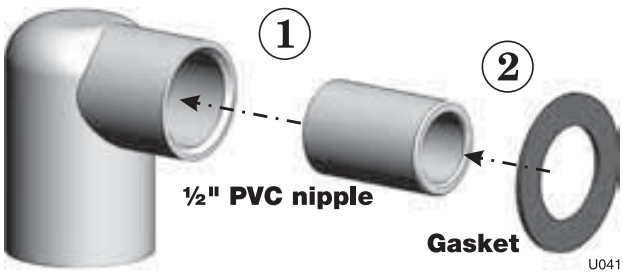


Figure 27 Condensate trap assembly into jacket

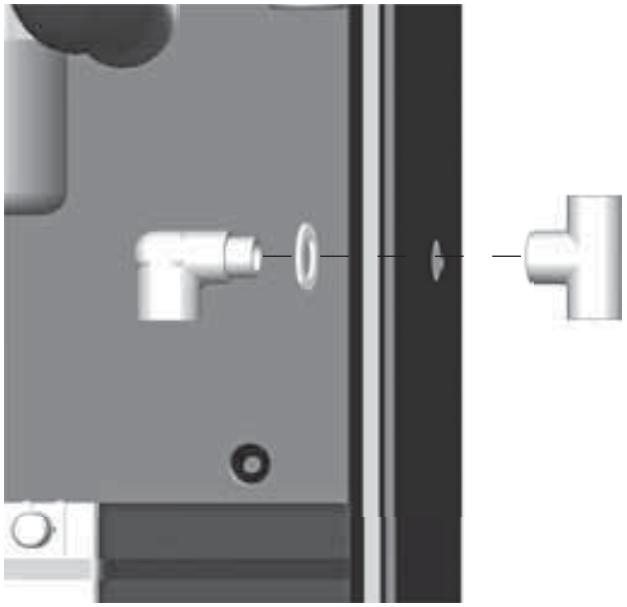
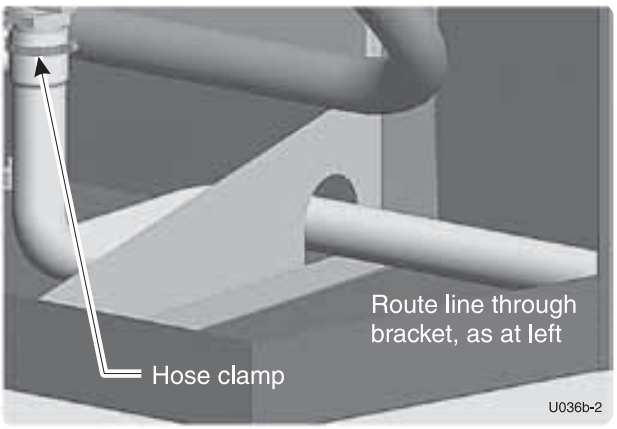


Figure 28 Condensate drain — Ultra-80 & -105



Install condensate line *(continued)*

Condensate drain tubing

1. Connect condensate drain tubing to the ½" PVC tee and run to floor drain or condensate pump (see Figure 32). Use ½" PVC or CPVC pipe; or 5/8" I. D. 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, F656, or F493. For Canada, use CSA or ULC certified PVC or CPVC pipe, fittings and cement.

2. Leave the top of the ½" 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 29 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 29 Suggested condensate pump capacity, GPH

Boiler	Minimum recommended condensate pump capacity, per boiler, GPH		
Ultra-80	2	**Ultra-230**	6
Ultra-105	3	**Ultra-299/310**	8
Ultra-155	4	**Ultra-399**	8

Figure 30 Condensate drain — Ultra-155 & -230 (PVC tee installation shown applies to all models)

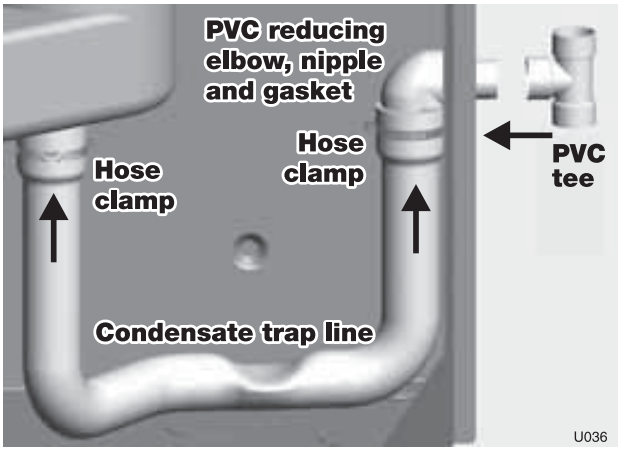


Figure 31 Condensate drain — Ultra-299/310 & -399

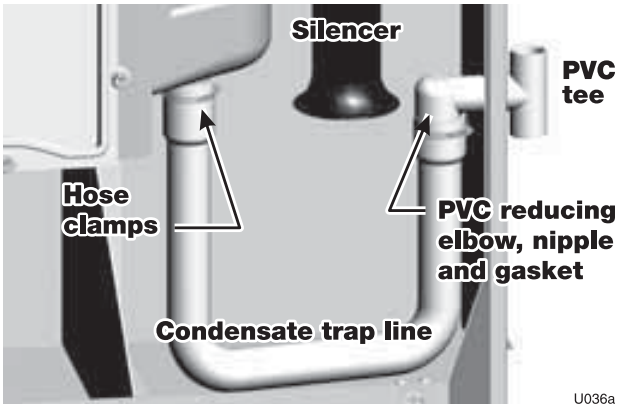
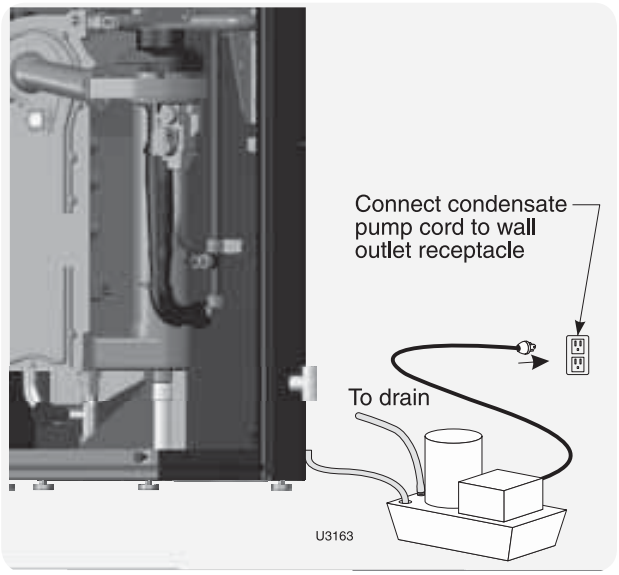


Figure 32 Condensate pump (by others), typical



Gas piping

Connecting gas supply piping

1. Remove jacket front panel and refer to Figure 33 to pipe gas to boiler.
   a. Install ground joint union for servicing, when required.
   b. Install manual shutoff valve in gas supply piping outside boiler jacket when required by local codes or utility requirements.
   c. In Canada — When using manual main shutoff valve, it must be identified by the installer.
2. Wall-mounted boilers
   a. Refer to separate Ultra Boiler Wall-mounting instructions.
   b. Gas connection may enter from the bottom of boiler as explained in the Wall-mounting instructions.
3. Support piping with hangers, not by boiler or its accessories.
4. Purge all air from gas supply piping.
5. Before placing boiler in operation, check boiler and its gas connection for leaks.
   a. Close manual main shutoff valve during any pressure testing at less than 13" w.c.
   b. Disconnect boiler and gas valve from gas supply piping during any pressure testing greater than 13" w.c.

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

6. 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 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.

⚠WARNING Ultra boilers are shipped ready to fire natural gas ONLY. (Exception: Ultra-80LP is propane-ready.) You must install the propane orifice if the boiler will be connected to propane. See page 48. Failure to comply could result in severe personal injury, death or substantial property damage.

Gas pipe sizing

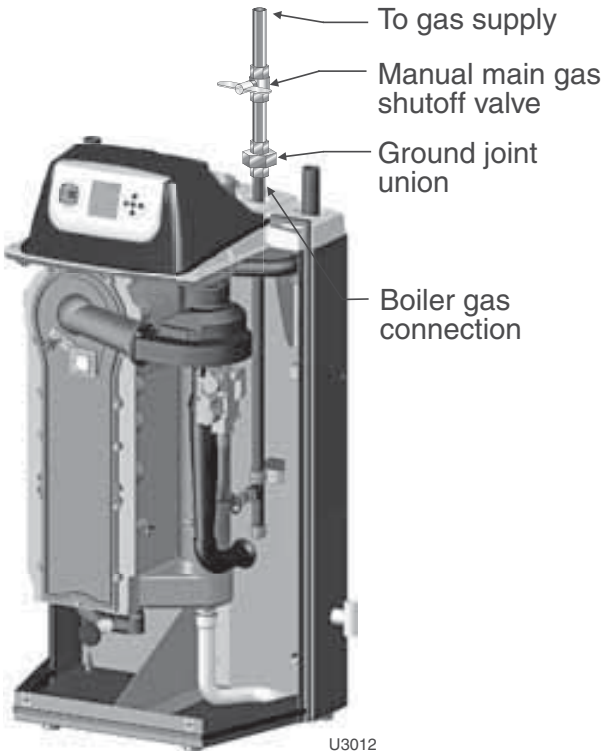
1. See page 93 for gas line sizing information.

Check gas pressure at inlet to boiler

1. See Figure 39, page 40, Figure 40, page 40, or Figure 41, page 41 for location of the gas inlet pressure test port.

⚠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 33 Connect gas supply piping



Natural gas supply pressure

1. Pressure required at gas valve inlet pressure port:
   a. Maximum: 13" w.c. with no flow (lockup) or with boiler on
   b. Minimum: 4" w.c. (for all except 5" for -299/310) with gas flowing (verify during boiler startup, while boiler is at high fire)
2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 13" w.c. at any time. Adjust lockup regulator for 13" w.c. maximum.

Propane supply pressure

1. Adjust propane supply regulator provided by gas supplier for 13" w.c. maximum pressure.
2. Pressure required at gas valve inlet pressure port:
   a. Maximum: 13" w.c. with no flow (lockup) or with boiler on
   b. Minimum: 4" w.c. with gas flowing (verify during boiler startup, while boiler is at high fire).

Field wiring — basic system

⚠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 The installation must comply with: National Electrical Code and any other national, state, provincial or local codes or regulations. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

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, and/or the Canadian Electrical Code Part I, CSA C22.1, Electrical Code.

NOTICE The boiler when installed, must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70 – latest edition, and/or the Canadian Electrical Code Part I, CSA C22.1, Electrical Code.

Wiring — general

1. The U-Control provides plug-in, color-coded, non-interchangeable terminal strips for all field wiring. See the schematic diagram (Figure 111, page 96) & ladder diagram (Figure 112, page 97).
2. The U-Control provides programmable flexibility in system operation, allowing control of 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

See this and following pages for wiring information. Also see the Advanced section of this manual for additional wiring connections and options.

Make the following connections, some of which depend on your system and how the U-Control will be programmed.

❑ **Connect 120VAC power (minimum 15-amp source)**

❑ **Connect wiring for up to three circulators**

❑ **Connect thermostats and/or heat demand contacts**

- The U-Control can regulate the boiler for up to three different heating systems.

❑ **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.
- Locate the sensors on the system piping as shown in Figure 4, page 11 and other piping drawings throughout this manual.

Line voltage power input

1. Provide and install a fused disconnect or service switch (15-ampere rated recommended) as required by applicable codes.
2. Connect minimum 15-ampere, 120 VAC power wiring to Ultra boiler line voltage terminal strip as shown in Figure 34, page 31, and Figure 111, page 96.

Wiring circulators

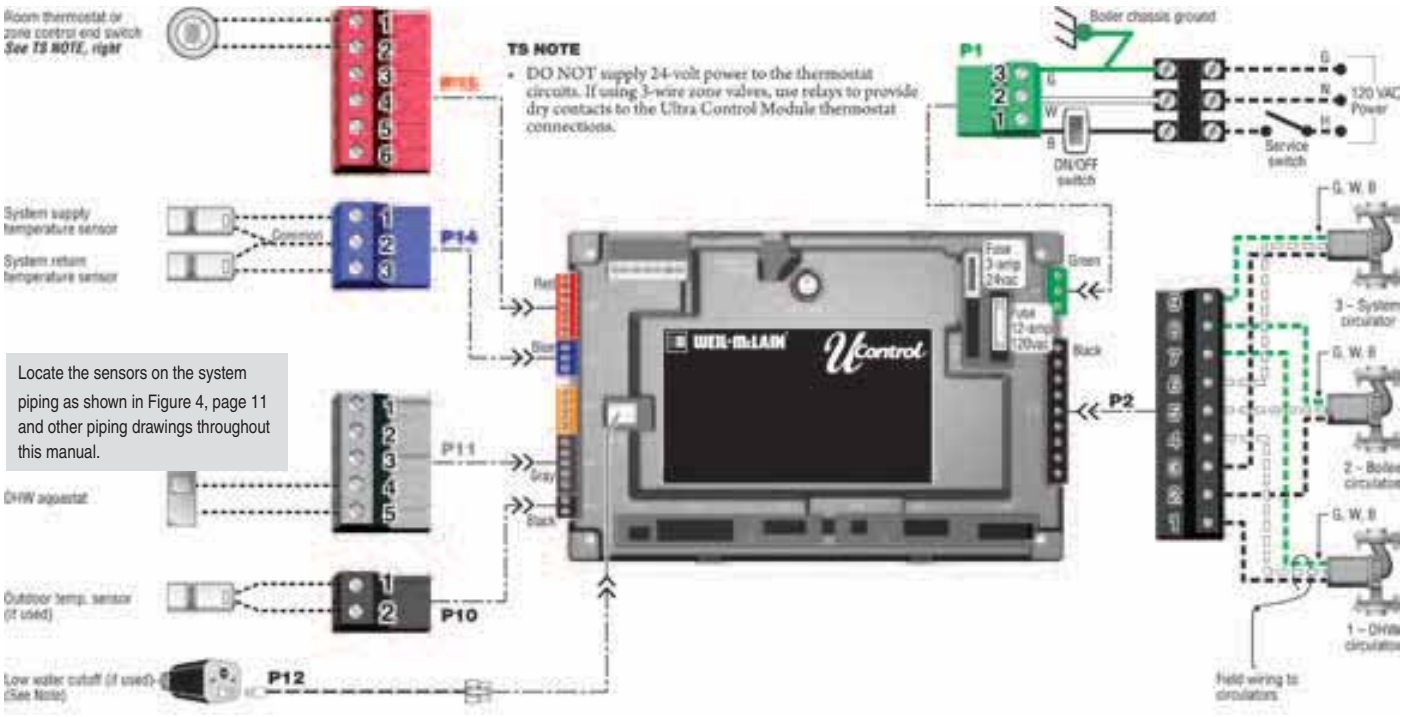
1. The U-Control provides for connection of up to three circulators, one of which must be the boiler circulator. In addition, you can connect a system circulator and a DHW circulator, for examples.

⚠WARNING **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.

See page 94 (Advanced section) for other wiring options

Field wiring — basic system *(continued)*

Figure 34 Simplified wiring — basic system with DHW and space heating (see ADVANCED section for more information)



Wire the DHW tank aquastat to the U-Control “heat demand 1” input, terminals P11 #4 and #5.
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.
Attach a sensor (supplied with boiler) to the system supply pipe and wire to terminals P14 #1 and #2. [Locate sensor in the position shown in piping diagrams on page 11 through page 15.]
Attach a sensor (supplied with boiler) to the system return pipe and wire to terminals P14 #2 and #3. [Locate sensor in the position shown in piping diagrams on page 11 through page 15.]
Install the outdoor temperature sensor (supplied with boiler) and wire to terminals P10 #1 and #2. **The outdoor sensor must be installed unless specifically exempted in the Energy Act statement on page 137.**
Wire the DHW circulator (supplied by installer) as circulator 1, following instructions on Connect the boiler circulator (supplied with boiler) as circulator 2, following instructions on page 30.
Wire the boiler circulator (supplied with boiler) as circulator 2, following instructions on page 30.
Wire the system circulator (supplied by installer) as circulator 3, following the instructions on page 30.

NOTICE **Detailed control information and additional wiring** — see the ADVANCED INSTALLATION section of this manual.

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 three circulators (boiler circulator plus two others), assignable for each of the three possible inputs.
- ❏ Programmable priority assignments for the 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.
- ❏ Dual sensors for boiler outlet temperature and flue temperature, providing redundant protection.
- ❏ Integral low water protection (by monitoring boiler heat exchanger temperature).
- ❏ Boiler is shipped with an outdoor sensor and strap-on system supply and return sensors.

Sequence of operation

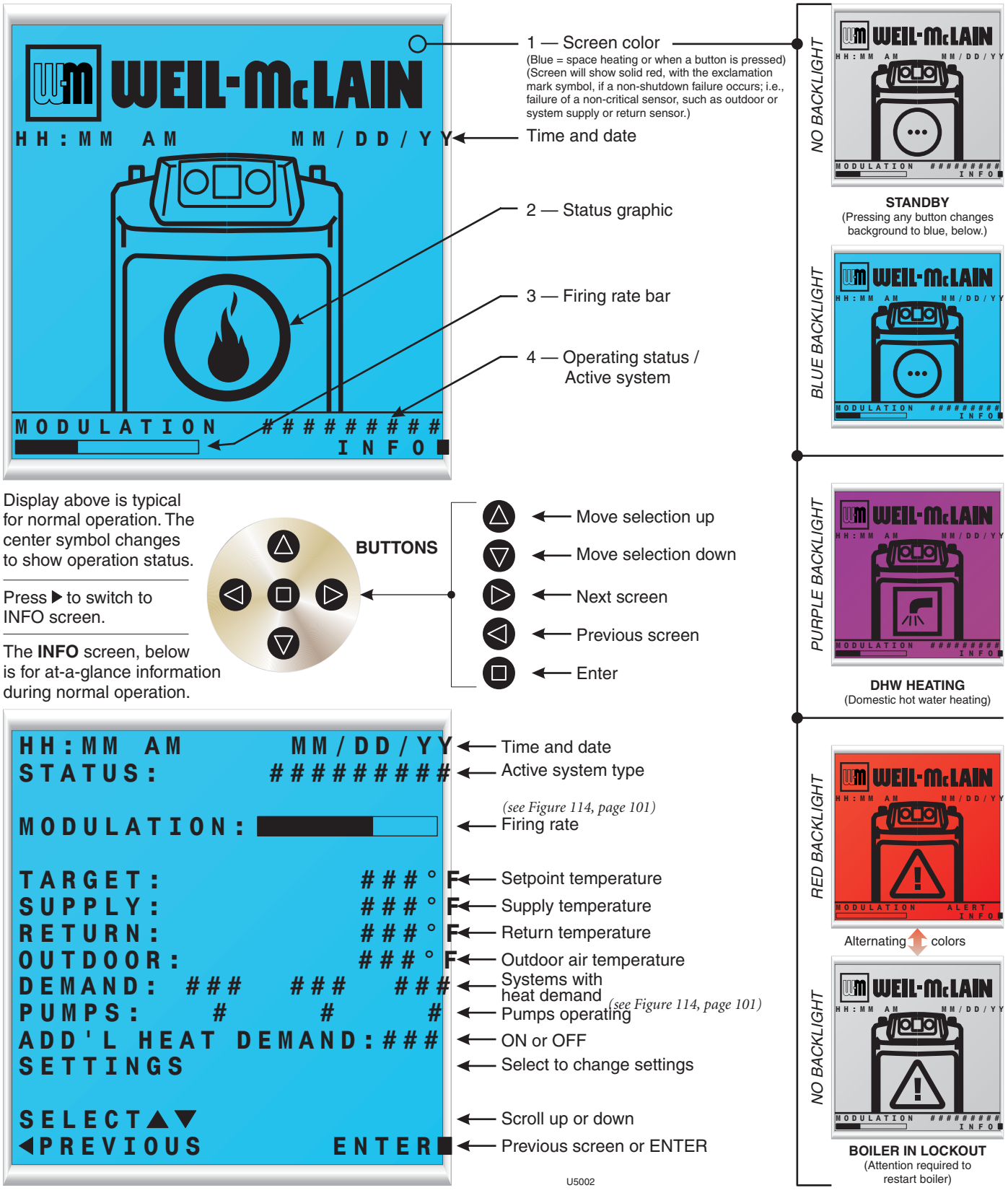
1. Figure 35 is a summary of the operating sequence for the U-Control.
2. The symbols shown appear in the display as the U-Control cycles the boiler.
3. The wrench symbol appears when a scheduled maintenance date arrives. This informs the homeowner to call the contractor for service.
4. The exclamation mark symbol appears when a problem has been detected.

Figure 35 U-Control sequence of operation

Display	Control action *(also see Figure 36, page 33)*
POWER UP	• Check the boiler model listed on the power-up screen. If it is not correct, turn off the boiler. See Figure 115, page 102 to change setting. • 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	• 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	• 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	• 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	• 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. After 5 failures, the control waits 60 minutes, then tries again. • If priority timer times out, switch to next priority and start priority timer • If demand satisfied, go to postpurge
DHW heating	• 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. After 5 failures, the control waits 60 minutes, then tries again. • If priority timer times out, switch to next priority and start priority timer • If demand satisfied, go to postpurge
Blower on	• Demand satisfied (temperature reaches target temperature or limit setting) • Gas valve off • Blower to ignition speed for postpurge • Return to standby after purge
Maintenance	• 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	• Display turns RED due to error or limit event • Flashing display means lockout condition — display toggles between three screens as in Figure 124, page 117.
WWSD	• Warm weather shutdown — the boiler will not be allowed to fire if the outside temperature is greater than the WWSD setting.

U-Control operation and setup *(continued)*

Figure 36 U-Control display and navigation



U-Control operation and setup *(continued)*

NOTICE **For detailed control information and additional wiring**, see the ADVANCED INSTALLATION section of this manual.

WARNING **Low-temperature systems** (radiant slab, etc.) — **DO NOT** use the Ultra boiler control as the only means of water temperature regulation for low-temperature systems if higher-temperature systems are also supplied.

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).
2. Control priority 3 is also available, and preset to run all three circulators if desired, but requires settings to be configured.

Figure 37 Factory default settings

Priority	Type	Target temperature	Circulators enabled
1	DHW Direct	190°F	#1 Only
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 and #3
3	Custom	180°F fixed (if no outdoor sensor) or 180°F at 0°F outside / 130°F at 70°F outside	None

3. You can use the factory default settings for most systems supplying space heating with finned-tube baseboard 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 5, page 12 or Figure 6, page 13.
   b. If the DHW tank is a separate zone off of the system main, or if it is piped as in Figure 48, page 52, you will need to enable additional circulators for DHW operation. The U-Control is factory programmed to operate only the DHW circulator during DHW heating.
   c. The heat emitters in the system must be finned tube baseboard only. Other heat emitters require changes in the U-Control setup. See ADVANCED INSTALLATION section for information.
4. Wiring to use the factory default settings — see information in Figure 34, page 31 for wiring instructions.

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. 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.)
3. 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 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.
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 137.
   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. Typical cold water fill pressure for a residential system is 12 psi.
   b. Pressure will rise when boiler is turned on and system water temperature increases. Operating pressure must never exceed 25 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.

Use inhibitor supplied with boiler

1. 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.
2. 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.
3. 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.

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.

Check/verify water chemistry

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

Check inhibitor concentration annually

1. 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.)
2. If pH is outside this range (or inhibitor test kit indicates low level), the inhibitor level may not be sufficient to prevent corrosion.
3. Test antifreeze concentration.

WARNING Test antifreeze concentration at least annually. If concentration is low, add antifreeze or drain system and refill with correct mixture.

4. Follow instructions on antifreeze container to determine the amount of antifreeze needed. **DO NOT** exceed 50% by volume concentration of antifreeze.
5. Check inhibitor level after adjustments are made.

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 12 and page 52. 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.
6. 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.
7. 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.
8. After the system has operated for a while, eliminate any residual air by using the manual air vents located throughout the system.
9. 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.
10. Open automatic air vent (diaphragm-type or bladder-type expansion tank systems only) one turn.
11. Starting on the lowest floor, open air vents one at a time until water squirts out.
12. Repeat with remaining vents.
13. Refill to correct pressure.

Startup — final checks

Check for gas leaks

⚠WARNING 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 30 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 27 for component locations.)
2. Pour water into the top of the boiler's ½" PVC condensate tee and check for any leaks in the condensate drain line or fittings. Repair any leaks.

Fill condensate trap with water

1. Loosen the hose clamp securing the right end of the condensate trap to the PVC reducing elbow (see page 27 for details).
2. Slide the trap hose end off of the elbow.
3. Fill the trap with fresh water to within an inch of the end of the hose.
4. Replace trap hose on PVC reducing elbow and tighten the hose clamp.

⚠WARNING The condensate trap must be filled with water during all times of boiler operation to avoid flue gas emission from the condensate drain line. [Prime the condensate trap (by pouring water into the outlet tee while restricting flow in drain tube) if boiler has been out of service for an extended period.] 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 vent condensate trap with water (by removing hose clamp and hose at PVC reducing elbow). Replace hose on PVC reducing elbow and tighten clamp.
- ❑ 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.

Startup — final checks *(continued)*

To start the boiler

1. Turn OFF the boiler ON/OFF switch.
2. Read and follow the Operating Instructions, Figure 38, page 39.
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 less than 5" w.c. for natural gas or 4" w.c. for propane?
6. Are parameters set correctly in this manual?
7. Is the warm weather shutdown activated?
8. If none of the above corrects the problem, refer to Troubleshooting, beginning on page 115.

❑ Check system and boiler

❑ Check water piping

9. Check system piping for leaks. If found, shut down boiler and repair immediately. (See WARNING on page 35 regarding failure to repair leaks.)
10. 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 29 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. Exception: The Ultra-80LP is factory-equipped to fire propane. You must install the propane orifice if the boiler will be connected to propane. See page 48.

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

Startup — final checks *(continued)*

Figure 38 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 toggle the power switch and/or turn the manual gas valve. If the switch or valve 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.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

OPERATING INSTRUCTIONS

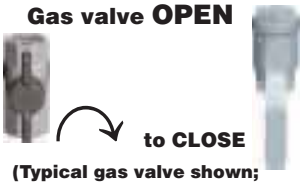
1. **STOP!** Read the safety information at left on this label. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
2. Set room thermostat(s) to lowest setting.
3. Turn OFF all electrical power to the appliance.
4. Toggle the power switch located on Boiler to “off” position.
5. Locate boiler manual gas valve (in the gas piping connected to the boiler).
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.
8. If you smell gas, **STOP!** Turn the boiler manual gas valve to OFF. Then follow WHAT TO DO IF YOU SMELL GAS. If you don't smell gas, go to step 9, below.
9. Turn ON all electrical power to the appliance including the power switch located on Boiler.
10. Set thermostat(s) to desired setting.
11. The boiler display will show symbols and/or text describing the status of the boiler as it proceeds through its operating sequence. "Standby" status means the burner is off.
12. 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.

(ON Position Shown)

Gas valve **CLOSED**

to OPEN

Gas valve **OPEN**



to CLOSE

(Typical gas valve shown; Actual valve may vary)

TO TURN OFF GAS TO THE APPLIANCE

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

550-101-272 (0617)

Startup — final checks *(continued)*

❑ Check flame & combustion with instruments

⚠WARNING For Ultra-399 propane boilers, special start-up is required. See page 41 for procedure. See DANGER on page 49 before proceeding.

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 115, page 102) 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 CO_2 (or O_2) and for CO. The CO_2 values must be within 1.0% of the values listed in Figure 42, page 41. If results are acceptable, proceed to step 7. IF NOT, follow the instructions under "Throttle screw adjustment procedure" to set the throttle screw position. See WARNING below.

⚠WARNING If combustion at either high or low fire is outside the range given in Figure 42, follow the procedure given on page 41 for adjusting the throttle screw on the venturi. 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.

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:

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

   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 115, page 102) 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 4 and 5 above.
11. Use the U-Control display to navigate to Manual test mode (see Figure 115, page 102) and force the firing rate to AUTO (normal operation).
12. Replace the flue gas temperature sensor. When replacing the sensor, remove the rubber grommet from the probe. Insert the rubber grommet into the flue pipe, then insert the probe into the rubber grommet.

Figure 39 Models 80 & 105 — Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)

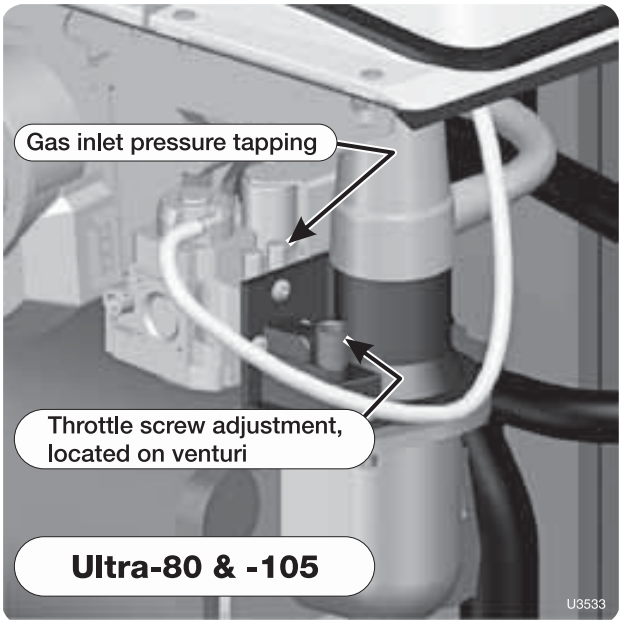
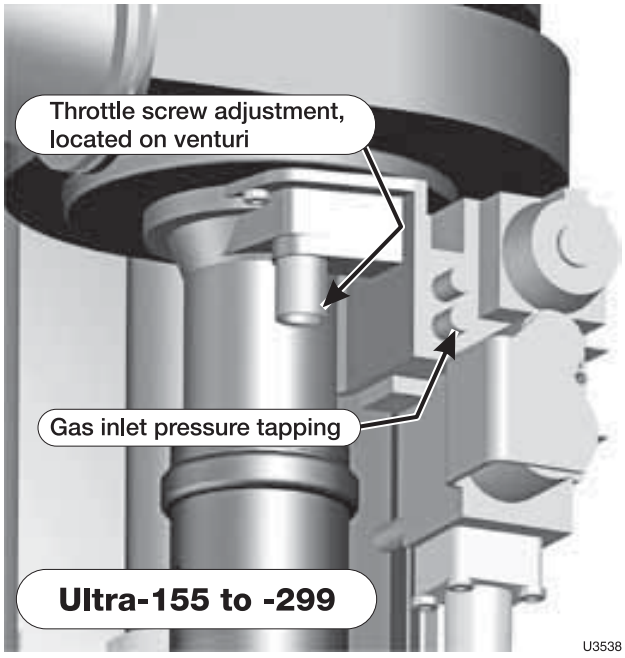


Figure 40 Models 155, 230 & 299/310 — Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)



Startup — final checks *(continued)*

⚠WARNING You must replace 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.

Ultra-399 propane conversion & start-up

Ultra-399 boilers are converted for propane by adjustment of the gas valve throttle screw (no orifice change) — Figure 41. This must only be done while using a combustion analyzer.

1. Turn the gas valve throttle screw clockwise 5 turns before starting the boiler. Then follow the start-up procedure on page 40.
2. Once the boiler is started, make slight adjustments to the throttle screw to obtain a CO_2 of 10.2% with CO less than 100 ppm air free. (Allow the combustion analyzer's reading to stabilize before making adjustments.)
3. After the boiler has been set up correctly, the conversion is complete. Fill in the information on the propane conversion label and attach the label to the boiler rating plate.

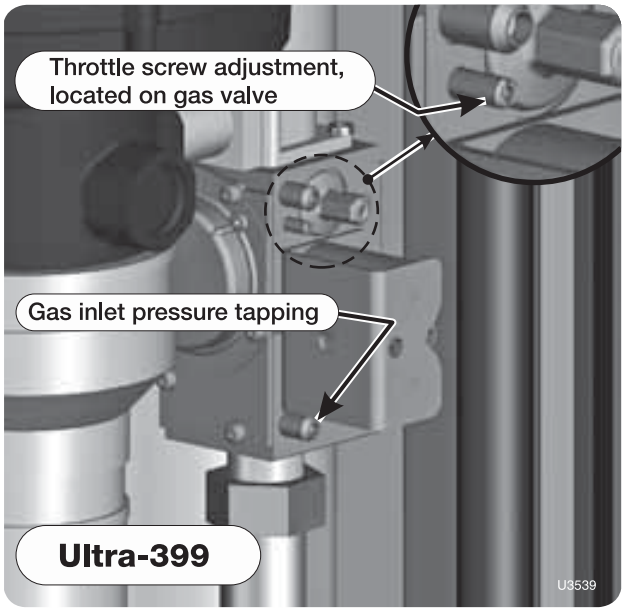
Throttle screw adjustment procedure

See Figure 39, page 40, Figure 40, page 40, or Figure 41 for location of the throttle screw.

⚠WARNING DO NOT attempt to adjust the throttle screw unless by a qualified technician, and with the use of calibrated combustion test instruments. Adjust the throttle screw only as needed to meet the combustion values given in Figure 42.

1. This procedure is only necessary when specified elsewhere in this manual or when combustion tests indicate the need, as explained under "❑ **Check flame & combustion with instruments**, page 40."
2. Boiler behavior that might indicate a need to check combustion values at high fire (as per page 40) 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. DO NOT attempt an adjustment of the throttle screw at low fire. Just check the combustion values.
4. Use the U-Control display to navigate to Manual test mode (see Figure 115, page 102) and force the firing rate to MAX (high fire). After the boiler has had time to stabilize, take a CO_2 reading.
   a. If the CO_2 is HIGH, turn the throttle screw CLOCKWISE to lower the input. Allow the boiler to stabilize and take another reading. Continue until the desired CO_2 value is achieved.
   b. If the CO_2 is LOW, turn the throttle screw COUNTER-CLOCKWISE to increase the input. Allow the boiler to stabilize and take another reading. Continue until the desired CO_2 value is achieved.
5. Lock the boiler into low fire. Check the combustion readings. If results are acceptable at low fire, verify high fire readings again. Restore firing rate to AUTO.
6. Consult your local Weil-McLain representative if acceptable results cannot be obtained for both high and low fire.

Figure 41 Model 399 — Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)



❑ Adjust and test boiler controls

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

Figure 42 Acceptable CO2 and CO values (CO2 values must be within 1.0% of the values listed)

Boiler Ultra	Fuel	High fire		Low fire	
		%CO_2	CO ppm	%CO_2	CO ppm
-80	NG	8.6	< 60	7.8	< 60
	LP	9.6	< 60	8.6	< 60
-105	NG	9.0	< 60	8.4	< 60
	LP	10.1	< 60	9.2	< 60
-155	NG	9.0	< 60	8.0	< 60
	LP	10.0	< 60	8.5	< 60
-230	NG	9.0	< 60	8.0	< 60
	LP	10.0	< 60	9.0	< 60
-299/310	NG	9.0	< 60	8.0	< 60
	LP	10.0	< 60	9.0	< 60
-399	NG	9.2	< 100	8.4	< 60
	LP	10.2	< 100	10.0	< 60

The values above are with the boiler front door removed. Values will typically increase about 0.2% once the door is reinstalled.

The values above are for altitudes up to 5,500 feet. For higher altitudes, CO_2 may be slightly lower and CO slightly higher.

Check-out/startup verification

- ❑ Verified that the U-Control is set for the correct boiler model?
- ❑ Entered installation date and installer contact information into U-Control?
- ❑ Boiler and heat distribution units filled with water?
- ❑ Water chemistry verified per page 35?
- ❑ Sentinel X100 corrosion inhibitor added and water tested to be within range?
- ❑ 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 orifice installed for propane firing and propane conversion label affixed to jacket?

⚠WARNING Ultra boilers are shipped ready to fire natural gas ONLY. Exception: The Ultra-80LP is factory-equipped to fire propane. To fire on propane, for all other models, you must follow the instructions in this manual to install the propane orifice or conversion kit, or make adjustments required, 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 38, page 39?
- ❑ Burner flame and combustion verified per page 40?
- ❑ Verified control operation for space heating and DHW (if used) per this manual?
- ❑ Tested additional field-installed controls? — If boiler has a low water cutoff, additional high limit or other controls, 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?
- ❑ 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 40)
- ❑ Checked incoming gas pressure by connecting manometer to gas valve ahead of boiler? (Gas pressure must be at least 5 inches w.c. for natural gas, and 4 inches w.c. for propane, with boiler operating at high fire, and no more than 13 inches w.c. with boiler operating or boiler off.)
- ❑ 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**, page 140.
- ❑ Fill out the warranty registration card and send to Weil-McLain.
- ❑ Return instructions to envelope and give to owner or place inside boiler housing.

NOTICE Fill out start-up data on the Installation and Service Certificate, page 140.

ADVANCED INSTALLATION
(Pages 44–107)

READ AND FOLLOW INSTRUCTIONS IN THE BASIC INSTALLATION SECTION FIRST. This section is supplemental information only.

This section covers multiple boiler systems and system types not covered under the BASIC section. It also includes alternative vent/air piping methods, water and gas pipe sizing guidelines and advanced, detailed information on the U-Control and boiler wiring.

ADVANCED INSTALLATION
Quick view . . .

Pages	Procedure
44–47	**Identify and locate boiler components** • Read about boiler features and functions.
48–49	**Modify boilers for propane operation, if required** • All boilers except the Ultra-399 require an orifice change to operate on propane — follow instructions.
50–51	**Wall mounting option** • Wall mounting Ultra boilers requires a special kit. • Follow instructions in this section to wall mount the boiler.
52–55	**Additional system piping applications** • This section provides additional piping suggestions not covered in the BASIC section. • It includes an application with an existing indirect water heater piped as a zone.
56–57	**Sizing DHW piping and circulators** • This section provides information on boiler head loss vs flow and other information needed for sizing DHW piping.
58–64	**Installing multiple Ultra boilers** • This section provides application information and suggested piping for multiple boiler systems.
66–92	**Vent / air piping alternatives** • This section provides installation instructions for four additional vent / air piping methods not covered in the BASIC section (two sidewall configurations and two vertical configurations).
93	**Gas piping** • Size or verify sizing of gas supply lines with the information in this section.
94–98	**Field wiring** • This section includes wiring diagrams and additional wiring options available with the U-Control module.
99–107	**U-Control operation and setup — advanced** • This section provides a complete description of U-Control setting options and diagnostics.

The Ultra Gas-fired water boiler, Featuring UControl Flexibility

Ultra Models -80, -105, -155 and -230

1. Cast aluminum Nanogate coated heat exchanger

2. Heat exchanger access cover

3. Blower

The advanced blower design and air inlet silencer on Ultra boilers result in very quiet operation.

Models Ultra-80 & 105 — Air enters the boiler enclosure through the air intake adapter (18), flows through the enclosure, enters the air inlet silencer (5), then enters the blower. The blower pulls air through the silencer and pushes it into the venturi (6), where it mixes with gas before entering the burner.

Models Ultra-155 & 230 — 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.

4. Gas valves and sense lines

The automatic gas valve (4a) senses the vacuum in the venturi caused by flowing air, and allows gas to flow when power is applied. Models 80 and 105 use a sensing line (4c) from the gas valve to the blower outlet so the gas valve references the same pressure as the venturi inlet.

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. This vacuum pulls gas from the gas valve. So gas will only flow if air is flowing. On model 80 and 105, the gas/air mixture enters the burner after the venturi. On models 155 and 230, the gas/air mixture enters the blower before passing on to the burner.

7. Outlet water temperature dual sensor

This sensor monitors boiler outlet water temperature. The control module adjusts boiler firing rate so the outlet temperature is correct, based on boiler outlet and system supply temperatures.

8. Boiler return water temperature sensor

This sensor monitors return water temperature. The control module reduces or increases boiler input, depending on how close the return water temperature is to the outlet water temperature.

9. 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.

10. Flue pipe adapter with internal drain

11. Burner (not shown)

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

12. Water outlet pipe (system supply)

13. Water return pipe (system return)

14. Gas connection pipe

15. *U-Control* Module

The ***U-Control*** Module responds to signals from the room thermostats, DHW aquastats (when used), boiler sensors (boiler return, boiler supply, 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.

16. Swing-away control panel assembly

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

17 Air intake adapter

The air intake adapter incorporates an internal drain on models 80 and 105.

18. Electrical entrance

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

19. Boiler drain valve

20. Flue gas condensate drain

Connect the boiler internal condensate trap line to the heat exchanger here (parts supplied with boiler, but field installed).

21. Flue gas condensate drain connection

The condensate trap PVC fittings are field-installed, connected to the condensate trap line as shown in this manual.

22. Front door

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

23. Jacket door retainer screws

Two (2) screws secure the door in place.

24. 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.

25. Flame inspection window

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

26. Flue gas dual sensor

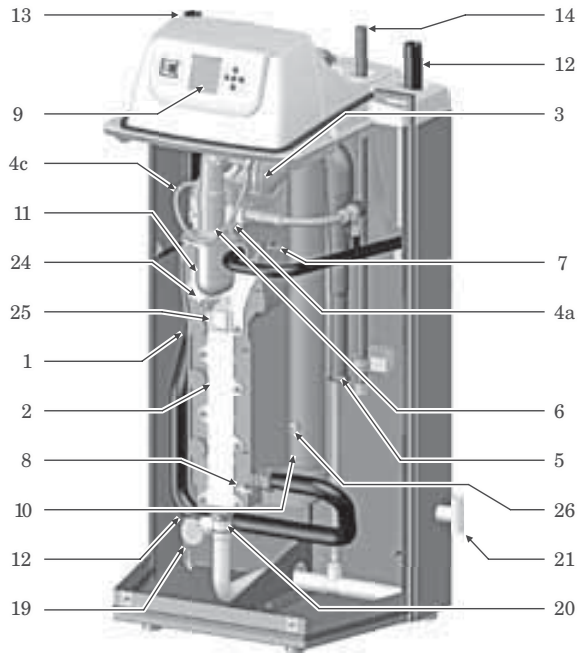
This dual sensor monitors the flue gas exit temperature. The control module will shut down the boiler if flue gas temperature gets too hot. This protects the flue pipe and the heat exchanger from overheating.

27. ON/OFF switch

The Ultra Gas-fired water boiler, Featuring UControl Flexibility

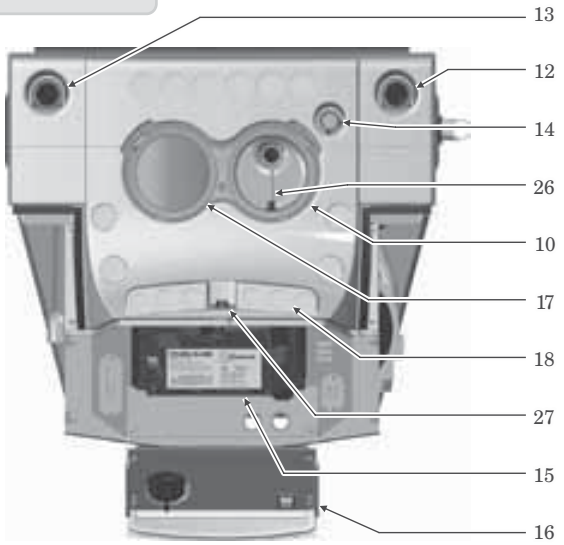
Front view
(all models)

Ultra-80 & 105 (front door removed)

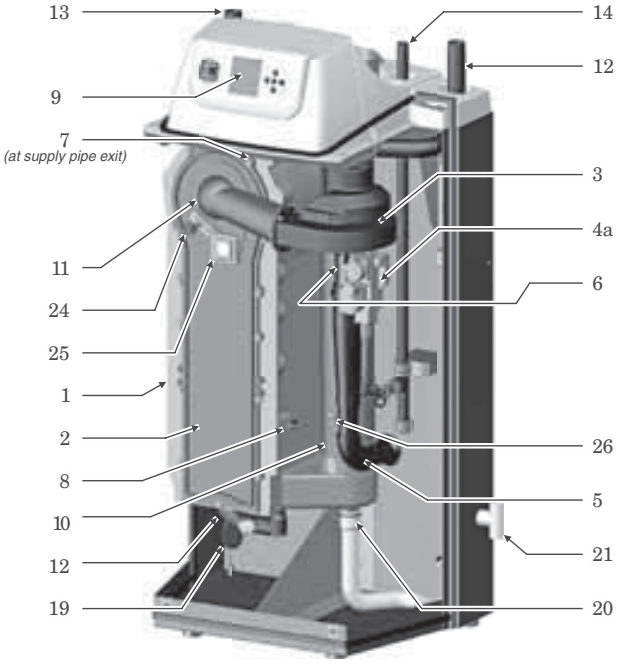


Top view
(all models)

Top is shown with top cover removed and control panel swung down for easy access to wiring terminals.



Ultra-155 & 230 (front door removed)



U3001

The Ultra Gas-fired water boiler, Featuring UControl Flexibility

Ultra Models -299/310 and -399

1. Cast aluminum Nanogate coated heat exchanger

2. Heat exchanger access cover

3. Blower

The advanced blower design and air inlet silencer on Ultra boilers result in very quiet operation.

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.

4. Gas valves and sense lines

The automatic gas valve (4a) senses the vacuum in the venturi caused by flowing air, and allows gas to flow when power is applied. The manual gas valve (4b) allows shutting off the gas supply for servicing or shutdown.

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. This vacuum pulls gas from the gas valve. So gas will only flow if air is flowing. The gas/air mixture enters the blower before passing on to the burner.

7. Outlet water temperature dual sensor

This sensor monitors boiler outlet water temperature. The control module adjusts boiler firing rate so the outlet temperature is correct, based on boiler outlet and system supply temperatures.

8. Boiler return water temperature sensor

This sensor monitors return water temperature. The control module reduces or increases boiler input, depending on how close the return water temperature is to the outlet water temperature.

9. 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.

10. Flue pipe adapter with internal drain

11. Burner (not shown)

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

12. Water outlet pipe (system supply)

13. Water return pipe (system return)

14. Gas connection pipe

15. *U-Control* Module

The ***U-Control*** Module responds to signals from the room thermostats, DHW aquastats (when used), boiler sensors (boiler return, boiler supply, 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.

16. Swing-away control panel assembly

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

17. Air intake adapter

18. Electrical entrance

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

19. Boiler drain valve

20. Flue gas condensate drain

Connect the boiler internal condensate trap line to the heat exchanger here (parts supplied with boiler, but field installed).

21. Flue gas condensate drain connection

The condensate trap PVC fittings are field-installed, connected to the condensate trap line as shown in this manual.

22. Front door

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

23. Jacket door retainer screws

Two (2) screws secure the door in place.

24. 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.

25. Flame inspection window

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

26. Flue gas dual sensor

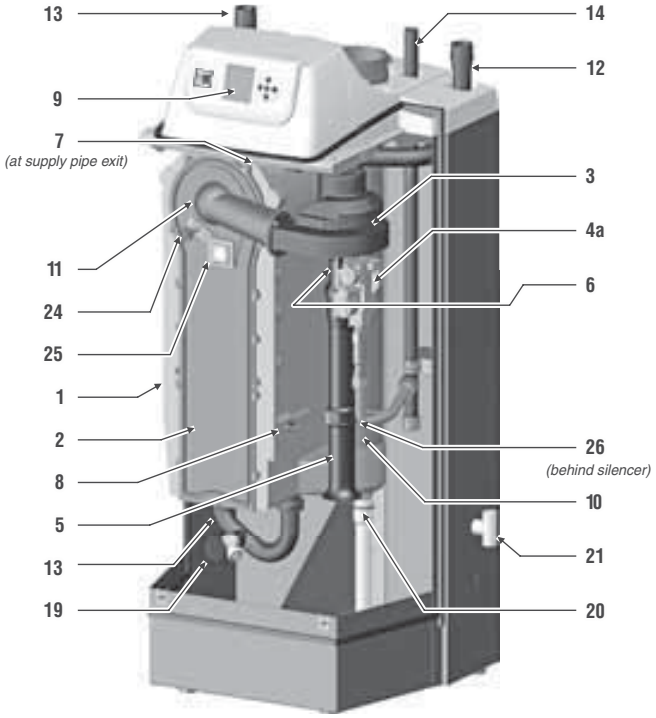
This dual sensor monitors the flue gas exit temperature. The control module will shut down the boiler if flue gas temperature gets too hot. This protects the flue pipe and the heat exchanger from overheating.

27. ON/OFF switch

The Ultra Gas-fired water boiler, Featuring UControl Flexibility

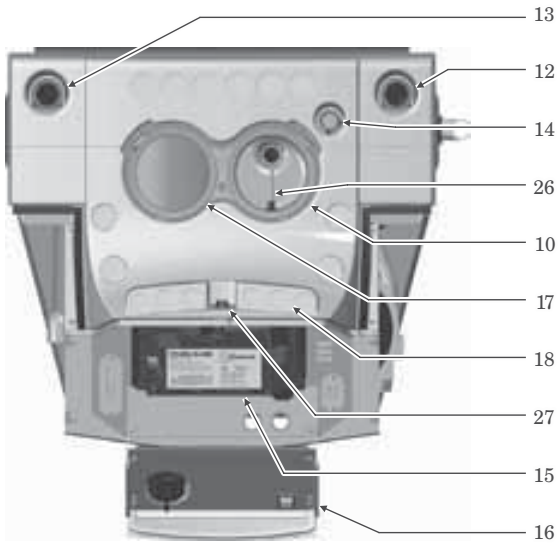
Front view
(all models)

Ultra-299/310 (front door removed)

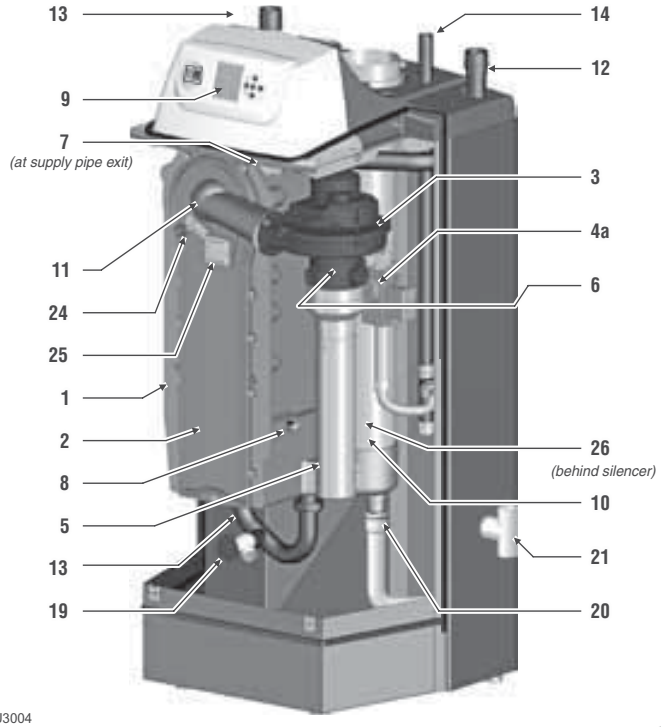


Top view
(all models)

Top is shown with top cover removed and control panel swung down for easy access to wiring terminals.



Ultra-399 (front door removed)



U3004

Prepare boiler — convert for propane

Prepare boiler for propane (when required)

Propane operation

WARNING **Ultra boilers must be converted for propane operation unless specifically manufactured for propane.** Propane-ready boilers have suffix "LP" after the model number. All other boilers require conversion for propane operation.

Ultra-80 natural gas boilers require installation of a burner in addition to an orifice change. **DO NOT** use the instructions in this manual for these boilers. Use only the instructions included in the special-order conversion kits.

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. You must also completely test the boiler after conversion to verify performance and start up the boiler following instructions beginning on page 35 of this manual.

High altitude installations — For installations more than 5,500 feet above sea level, obtain the high altitude propane orifice kit..

Verify orifice size — See Figure 43. Verify when installing that the orifice size marking matches boiler size. Use only the special-order **high altitude** orifice for altitudes above 5,500 feet.

For Ultra 310 boiler:

— Sea level (to 5,500 feet), Part number 540-202-833, Assembly Bag Orifice Gas Ult 310 Canada supplied with boiler.

— High altitude (above 5,500 feet), Part number 383-500-648, Kit Conversion Liquefied Petroleum (Propane) Gas Ultra 310 - special order.

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

Installing propane orifice

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.

1. Locate propane orifice disc from conversion kit bag.
2. Verify that the stamping on the orifice disk matches the model size (see Figure 43).
3. With the new boiler on its back, remove jacket front door by removing two (2) screws at lower front.

Figure 43 Orifice identification

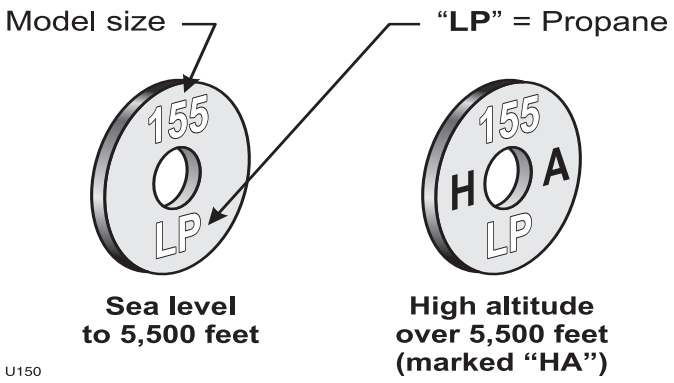
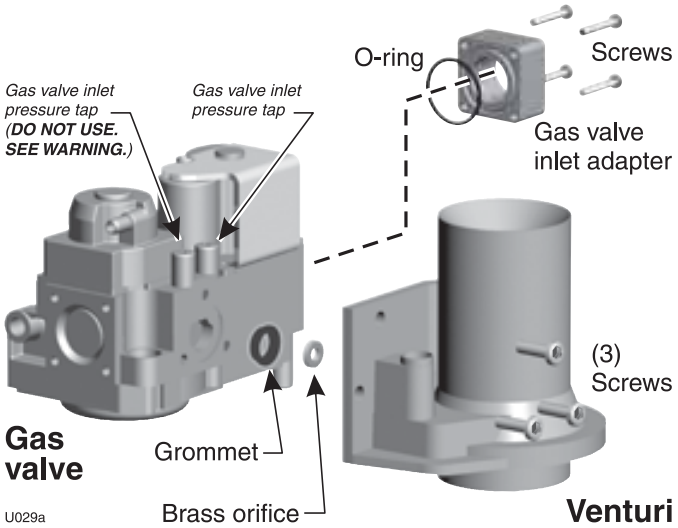


Figure 44 Installing propane orifice (Ultra-105 or Ultra-80LP ONLY)



Prepare boiler — convert for propane *(continued)*

4. Lift the door away from boiler.
5. Remove the air inlet silencer from the adapter:
   a. Models 80 and 105: See Figure 134, page 133.
   b. Models 155 and 230: See Figure 135, page 134.
   c. Models 299/310 and 399: See Figure 136, page 135.
6. Disconnect the gas valve electrical plug.
7. See Figure 43, page 48 or Figure 45. Remove the 4 screws securing gas valve inlet adapter to valve.
8. Use a 5mm wrench to remove the three Allen-head screws securing the gas valve to the venturi (Figure 43, page 48 or Figure 45).
9. Place orifice in the black rubber grommet in the side of the gas valve and secure in valve (Figure 43, page 48 or Figure 45).

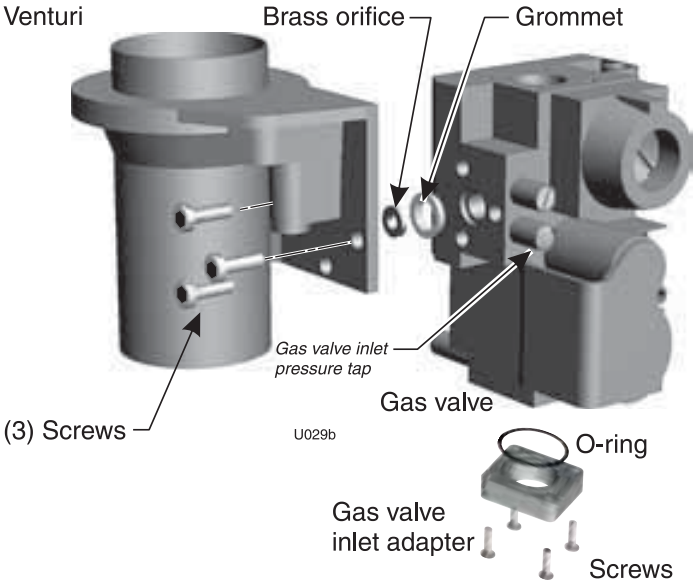
⚠ DANGER See Figure 43, page 48 or Figure 45. Inspect the O-ring between the gas valve and gas valve inlet adapter whenever they are disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

10. Reposition gas valve against venturi and replace (3) Allen-head screws securing valve to venturi (Figure 43, page 48 or Figure 45).
11. See Figure 43, page 48 or Figure 45. Secure gas valve inlet adapter to gas valve with 4 screws. Make sure the plastic hose is connected from gas valve to inlet elbow on Ultra-80 and -105.

⚠ WARNING **DO NOT ATTEMPT TO MEASURE VALVE OUTLET PRESSURE.** The valve could be damaged by manometer fluid contamination. Failure to comply could result in severe personal injury, death or substantial property damage.

12. Connect gas valve electrical plug to valve terminals.
13. Re-attach the air inlet silencer.
14. After installation is complete, attach the propane conversion label (in conversion kit bag) next to the boiler rating plate.
15. Replace jacket front panel.

Figure 45 Installing propane orifice (Ultra-155, -230, & -299/310)



Ultra-399 boilers

⚠ DANGER Ultra-399 boilers are converted for propane by adjustment of the gas valve throttling screw. See instructions on page 41 of this manual.

Do not perform the propane conversion of an Ultra-399 boiler without using a flue gas analyzer. The proper use of a flue gas analyzer is required to determine proper gas valve settings. Improper gas valve settings can cause severe personal injury, death or substantial property damage.

Placing boiler — wall-mounting option

Wall-mounted boilers (Ultra-80 through -399)

1. The wall-mounting kit is NOT supplied as standard equipment with the boiler, and must be purchased separately. See **WARNING** below.

⚠WARNING Wall mount Ultra boilers only using the Weil-McLain Ultra boiler wall-mounting kit and accompanying instructions. (See Repair parts section for part number of wall mounting kit.) DO NOT use the shipping bracket to wall mount the boiler.

The wall must be vertically plumb and capable of carrying the weight of the boiler. The operating weights for wall-mountable boilers are:
Ultra-80: 139 pounds Ultra-105: 145 pounds
Ultra-155: 181 pounds Ultra-230: 192 pounds
Ultra-299/310: 229 pounds Ultra-399: 229 pounds

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

2. Verify kit contents:
   a. Wall-mount bracket.
   b. Black iron bushing, 1" x 1/8" NPT.
   c. Lag screws, (2) 3/8" x 3" hex head.
   d. Grommet, (1) 7/8" O. D. & grommets, (2) 1 3/8" O. D.
   e. Automatic air vent, 1/8" NPT.
   f. Items b through e are needed only if routing piping through bottom of enclosure (applies only for Ultra-80 through -230).
   g. Verify all parts listed above are available before proceeding.
3. Stud spacing: Bracket holes are spaced for studs on 16-inch centers. For other stud spacing, provide secure, solid mounting surface on which to attach the boiler wall-mounting bracket.
4. Wood stud wall: Install bracket with lag screws (3/8" x 3") included in kit, only into the studs.
5. Metal stud wall: Secure bracket to studs with 3/16-inch toggle bolts and 3/16-inch flat washers (not included with kit).
6. **DO NOT** attempt to attach the wall mount bracket using anchors or any means other than directly securing to the wall studs (or equivalent wood structure if studs are not on 16-inch centers).
7. The boiler bracket must engage with the wall-mount bracket. Make sure the brackets are not just resting edge to edge.
8. Mount the boiler on the wall following these instructions. Perform all procedures given in the Boiler Manual on pages 1 through 9 before mounting the boiler.

⚠WARNING The boiler is heavy. Use caution not to drop the boiler or cause bodily injury while lifting and handling. Verify that the boiler is securely attached to prevent possibility of boiler falling after installation.

Figure 46 Install wall-mount bracket

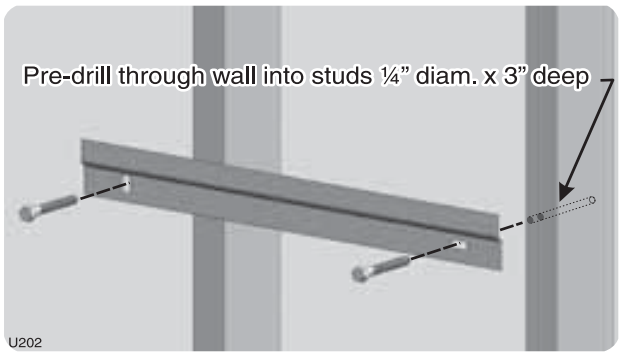
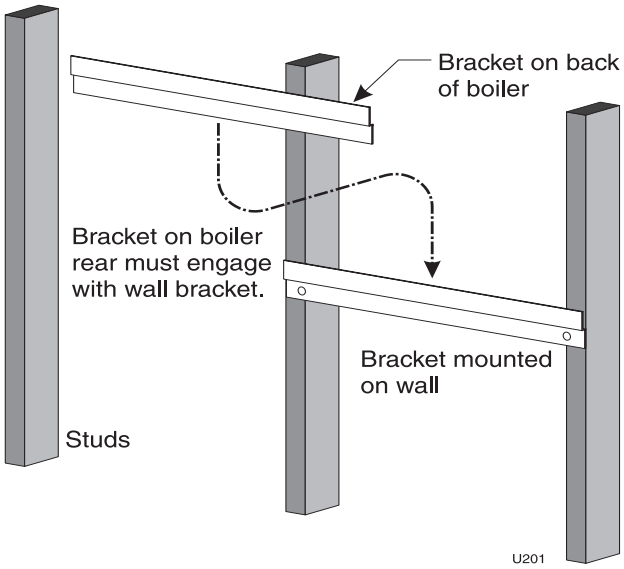


Figure 47 Place boiler on wall-mount bracket



Placing boiler — wall-mounting option *(continued)*

Prepare boiler for wall mounting

1. Remove the jacket front panel. This will simplify lifting and handling the boiler when mounting.
2. When piping will be routed out the top of the boiler, no special preparation is needed other than that given in this manual.

Install wall-mount bracket

1. Locate studs.
2. Place the wall-mount bracket on the wall, using a level to align correctly.
3. Place the bracket so the mounting slots are centered over the studs.
4. Level the bracket and trace the outline of the screw slots with a pencil.
5. Remove bracket and drill holes 1/4" diameter by 3 inches deep, centered on the screw slot outlines. (For metal stud walls, using 3/16" toggle bolts, drill required clearance holes.)
6. See Figure 47, page 50. Position bracket on wall. Insert and loosely tighten the two lag screws (or toggle bolts for metal studs).
7. Level the bracket. Then tighten screws securely. For drywall or plaster lathe installations, avoid tightening so much that brackets dig into wall surface.

Place boiler on bracket

1. Measure 30 3/4 inches below the bottom edge of the wall-mount bracket for Ultra-80 to -230 (35 5/8" for Ultra-299/310/399). Strike a line or place a piece of masking tape on the wall with its top edge even with the 30-inch mark. (This line, or tape, will indicate whether the boiler has been properly seated onto the wall-mount bracket.)
2. Obtain assistance to lift the boiler into position:
   a. Lift the boiler high enough that its rear bracket will be above the wall-mount bracket.
   b. Let the rear of the boiler slide against the lag screw heads as you lower the boiler into place.
   c. When the brackets are engaged correctly, the bottom of the boiler enclosure will be at or near the pencil line, or tape, you applied in step 1.
   d. If the boiler does not slide down close to the mark, or tape, adjust until the brackets properly engage.

Install water piping — advanced

Zoning with zone valves

(alternate to piping shown in Figure 5, page 12)

High-flow-rate/high-head-loss DHW circuits

1. For applications requiring DHW circuit flow rates higher than allowable for the boiler, or for high pressure-drop coil-type DHW tanks, connect the piping as in Figure 48. The DHW water only flows through the secondary circuit connector piping. NOTE: Make sure to size the connector piping (Figure 48, item 23) to handle the total flow it must handle.
2. Connect boiler to system as shown in Figure 48 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.

⚠CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 48 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

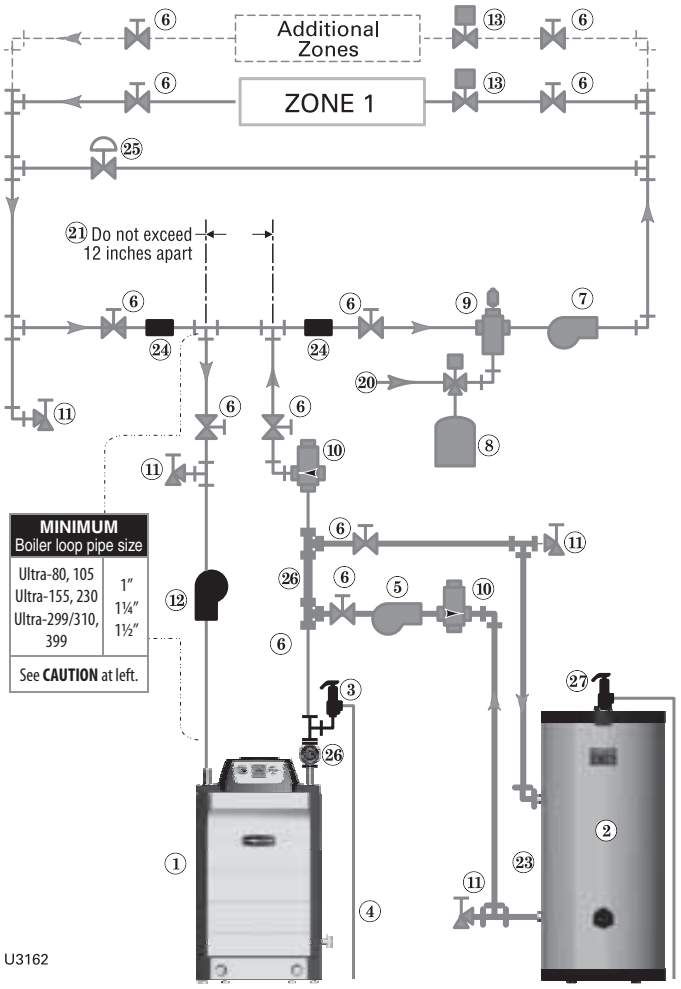
3. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 4, page 11.
4. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional timeout setting can be used to override). The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop during DHW heating.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

5. Controlling the system circulator and boiler circulator
   a. You will have to set up the U-Control to operate both the boiler circulator and the DHW circulator during DHW operation. The system circulator should be off during DHW heating. Read the instructions on U-Control operation and setup, beginning on page 32.

Figure 48 Zone valve zoning plus optional DHW piping



Legend — Figure 48	
1 Ultra boiler	12 Boiler circulator
2 Indirect water heater (DHW), if used	13 Zone valves, typical
3 Boiler relief valve (see page 9 for piping details)	20 Make-up water supply
4 Relief valve discharge piping (see page 9 for details)	21 Primary/secondary connection (tees no more than 12 inches apart)
5 DHW circulator (see page 56 for suggested sizing)	23 DHW supply/return
6 Isolation valves	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.
7 System circulator (see information above for wiring)	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
8 Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, if used)	26 Temperature/Pressure gauge
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	27 DHW relief valve, if used
10 Flow/check valves	■ Items supplied with boiler
11 Purge/drain valves	■ Items supplied by others

Install water piping — advanced *(continued)*

Example system with DHW as a zone, zoning with circulators

1. Connect boiler to system as shown in Figure 49 when circulator zoning. The boiler circulator cannot be used for a zone. It must supply only the boiler loop. Also see the information on page 10 for suggested piping and sizing.

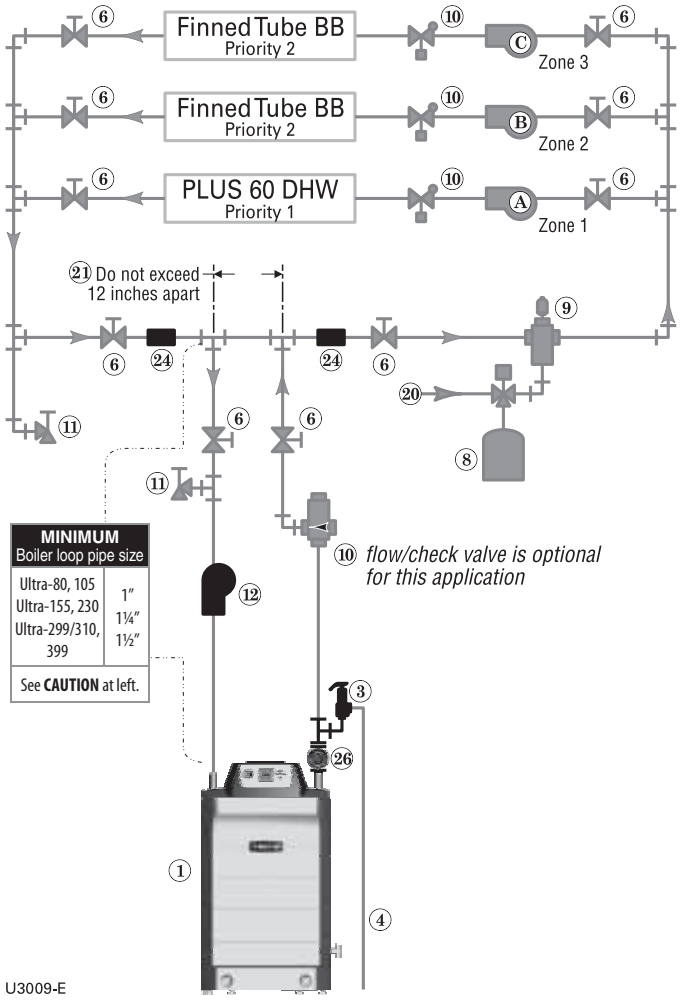
⚠ CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 49 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

2. Install a separate circulator for each zone.
3. DO NOT use a closed-type tank with a AQUA PLUS water heater in the system. The automatic air vent required on the water heater will deplete air in the system, causing the expansion tank to waterlog. Use only a diaphragm- or bladder-type tank, suitable for automatic air vent applications.
4. In this example, the AQUA PLUS 60 DHW tank is piped as a zone in the system, with piping connections to the tank in accordance with the AQUA PLUS manual.
5. Wiring to the U-Control
   a. Priority 1 = AQUA PLUS 60 (zone 1): wire AQUA PLUS 60 aquastat terminals to U-Control P11, pins 4 and 5. Wire DHW circulator, A, to U-Control P2, terminals 1, 4 and 7 (H, N, G).
   b. Wire zone pumps B and C to a two-zone circulator relay.
   c. Priority 2 = finned-tube baseboard (zones 2 and 3): wire circulator relay end switch 1 to U-Control P15, pins 1 and 2.
6. Make sure to set Priority 1 to DHW system, not DHW direct.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

7. Controlling the system circulator and boiler circulator
   a. You will have to set up the U-Control to operate both the boiler circulator and the DHW circulator during DHW operation. Read the instructions on U-Control operation and setup, beginning on page 32.

Figure 49 Circulator zoning plus optional DHW piping



ADVANCED INSTALLATION

Legend — Figure 49

1	Ultra boiler	10	Flow/check valves
2	Indirect water heater (DHW), if used	11	Purge/drain valves
3	Boiler relief valve (see page 9 for piping details)	12	Boiler circulator
4	Relief valve discharge piping (see page 9 for details)	20	Make-up water supply
6	Isolation valves	21	Primary/secondary connection (tees no more than 12 inches apart)
8	Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, 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.
9	Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	26	Temperature/Pressure gauge
		■	Items supplied with boiler
		■	Items supplied by others

Install water piping — advanced *(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 50 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.

⚠ CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 50 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

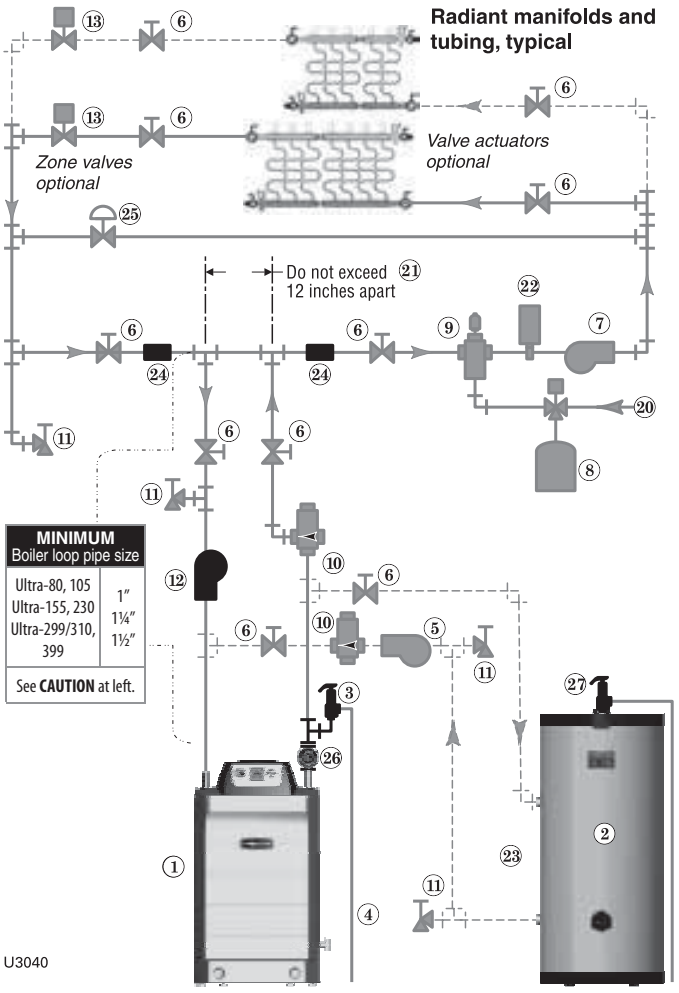
3. Adding the recommended high limit control (Figure 50, item 22) can help ensure supply water temperature will not exceed the maximum allowable for the radiant system. Wire this limit control in either the manual reset or automatic reset external limit circuit of the U-Control.
4. When using a closed-type expansion tank, connect the expansion tank and make-up water piping as shown in Figure 4, page 11.
5. Connect DHW (domestic hot water) piping to indirect storage water heater as shown.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional timeout setting can be used to override). The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop during DHW heating.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

6. Controlling the circulators
   a. The U-Control can control up to three circulators (boiler circulator and two others). Refer to Field wiring, beginning on page 30, for instructions on wiring to circulators.
   b. The factory default settings are: DHW circulator as Circulator 1, boiler circulator as Circulator 2. See Field wiring instructions, beginning on page 30, for details.

Figure 50 Typical radiant heating system piping plus optional DHW



Legend — Figure 50	
1 Ultra boiler	13 Zone valves, when used (zoning may also be done using manifold-mounted valve actuators)
2 Indirect water heater (DHW), if used	20 Make-up water supply
3 Boiler relief valve (see page 9 for piping details)	21 Primary/secondary connection (tees no more than 12 inches apart)
4 Relief valve discharge piping (see page 9 for details)	22 Optional high limit temperature control, set to protect radiant tubing
5 DHW circulator (see page 56 for suggested sizing)	23 DHW supply/return
6 Isolation valves	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.
7 System circulator (see information above for wiring)	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
8 Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, if used)	26 Temperature/Pressure gauge
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	27 DHW relief valve, if used
10 Flow/check valves	■ Items supplied with boiler
11 Purge/drain valves	■ Items supplied by others
12 Boiler circulator	

Install water piping — advanced *(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 51 for typical installation of balancing valve and check valve.

⚠CAUTION Use **at least** the **MINIMUM** pipe size shown in Figure 51 on all boiler loop piping (connecting boiler to and from the primary/secondary connection, item 21). **Use only primary/secondary piping as shown.** Failure to follow these guidelines could result in system problems.

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 51. Use appropriate valves to prevent chilled medium from entering boiler.

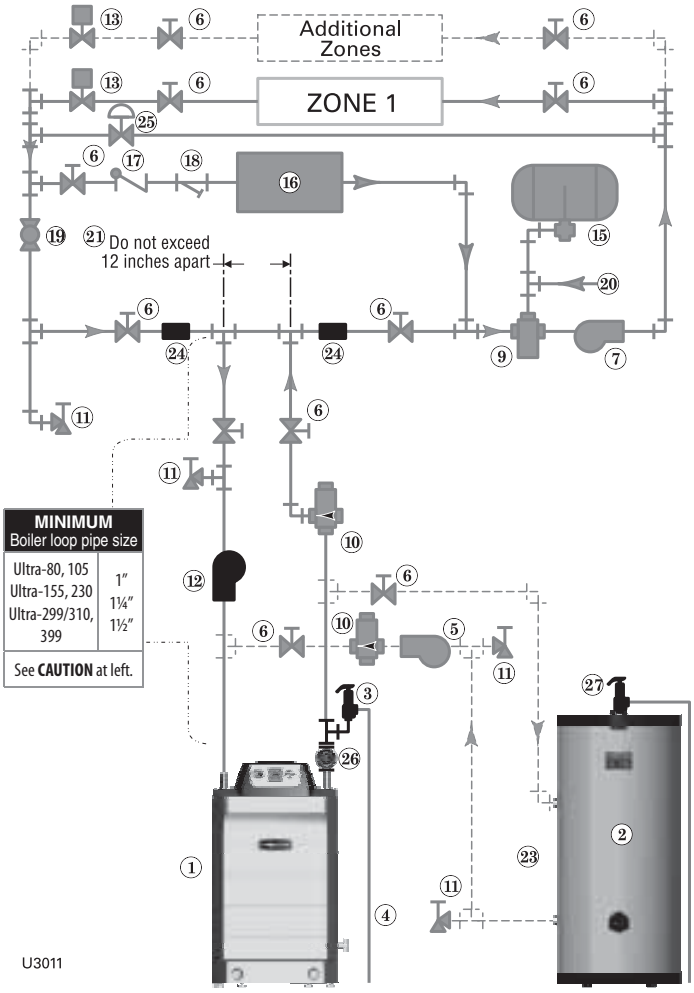
If boiler is connected to heating coils located in air handling units where they can be exposed to refrigerated air, use flow control valves or other automatic means to prevent gravity circulation during cooling cycle.

NOTICE By default, the U-Control Module turns off space heating during DHW heating (if DHW input is priority 1). The boiler circulator will turn off, preventing hot water from circulating to the system (optional timeout setting can be used to override). The flow/check valve shown on the boiler outlet piping prevents gravity circulation in the boiler loop during DHW heating.

NOTICE Overriding the Outdoor Reset function by setting control to DHW mode when system is intended for space heating may violate **Section 303 of the 2007 Energy Act.** See page 137 for compliance information and exemptions.

3. Controlling the circulators
   a. The U-Control can control up to three circulators (boiler circulator and two others). Refer to Field wiring, beginning on page 30, for instructions on wiring to circulators.

Figure 51 Chilled water system plus optional DHW piping



   b. The factory default settings are: DHW circulator as Circulator 1, boiler circulator as Circulator 2. See Field wiring instructions, beginning on page 30, for details.

Legend — Figure 51

1 Ultra boiler	16 Water chiller
2 Indirect water heater (DHW), if used	17 Check valve
3 Boiler relief valve (see page 9 for piping details)	18 Strainer
4 Relief valve discharge piping (see page 9 for details)	19 Balancing valve
5 DHW circulator (see page 56 for suggested sizing)	20 Make-up water supply
6 Isolation valves	21 Primary/secondary connection (tees no more than 12 inches apart)
7 System circulator (see information above for wiring)	23 DHW supply/return
8 Diaphragm (or bladder) type expansion tank (see page 56 for piping of closed-type expansion tank, 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.
9 Air separator [with automatic air vent only on systems using diaphragm (or bladder) type expansion tank]	25 Systems using high-head pumps may require a bypass pressure regulator to prevent damage to control valves.
10 Flow/check valves	26 Temperature/Pressure gauge
11 Purge/drain valves	27 DHW relief valve, if used
12 Boiler circulator	■ Items supplied with boiler
13 Zone valves, typical	■ Items supplied by others
15 Closed-type expansion tank	

Sizing direct-connected DHW piping

Direct-connected DHW piping

NOTICE For **Weil-McLain AQUA PLUS water heaters**, refer to the AQUA PLUS water heater manual for application information. Also see quick-select information on page 14. The information here is for other water heater designs.

NOTICE When using the Ultra boiler for dedicated DHW applications, use the circulator supplied with the boiler (007 for Ultra-80/105; 0014 for Ultra-155/230/299/310; 0013 for Ultra-399) to circulate to the water heater, except where higher flow rates may be required for the heater used. Use the following method to select a circulator for the water heater on combined space heating/DHW systems.

1. To pipe the DHW tank and boiler, follow the suggested piping diagrams beginning on page 12.
2. Figure 55, page 57 shows the pump curves for typical DHW circulators. Use these curves along with boiler pressure drop data from Figure 54, page 57 to size the DHW piping and circulator.
3. Procedure to select a DHW circulator:

Step 1:

From the water heater manufacturer's data, find:

- Required boiler water flow rate, GPM, at 190°F.
- Pressure drop across the water heater at this flow rate, in feet water column (this is H3 in the formula below).

Step 2:

Find your boiler model in Figure 54, page 57.
Select a flow rate in the Flow rate column just larger than the required boiler water flow rate from Step 1.

Step 3:

Read across the row selected to find the boiler pressure drop, H1, and the pressure drop in the piping, H2. Make sure to use the copper pipe size given in column 3 when piping the water heater.

Step 4:

Add the pressure drop across the water heater, from Step 1, to the values of H1 and H2 for total head loss.

$$H_{total} = H1 + H2 + H3$$

Step 5:

Select a circulator that can deliver the required flow rate, gpm, against the total head loss found in Step 4.

Example:

Consider an Ultra-155 used with a water heater that requires a flow of 12 gpm with boiler water at 190°F. The water heater is to be piped as in Figure 52.
From the example water heater manufacturer's data, the head loss across the water heater at 12 gpm is 5.5 feet water column.
Read down the first column of Figure 54, page 57 for the Ultra-155 until you find a flow rate just larger than the required 12 gpm. You'll find a value of 13 gpm in the third row. At 13 gpm, with an Ultra-155, the recommended pipe size is 1¼ inch. From the table, the head losses are:

H1 = 13.3 feet H2 = 3.9 feet

H3 = 5.5 feet (from water heater manufacturer's data)

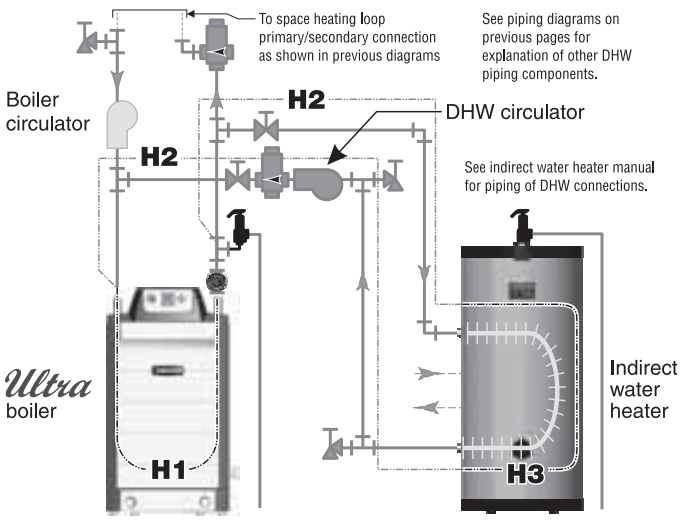
H_{total} = 13.3 + 3.9 + 5.5 = 22.7 feet.

The closest circulator selection (from Figure 55, page 57) that can deliver 12 gpm at 22.7 feet head is either a Taco 1400 (top chart) or a Taco 0013 (bottom chart).

Note that, if the water heater were piped as in Figure 53, then H1 would be 0, so total head loss would be H2 + H3, or 9.4 feet (3.9 + 5.5). A Taco 0010 would handle the load if piped this way.

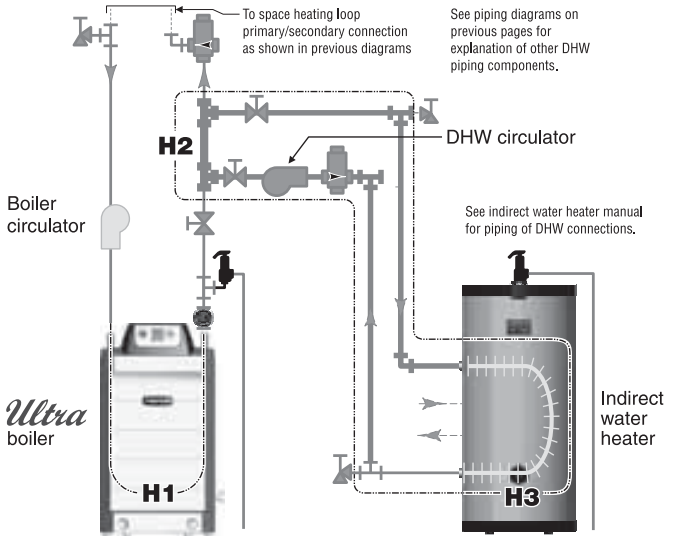
NOTICE See previous pages in this manual for piping details not shown below. For DHW piping as shown below, use sizing information in Figure 54, page 57.

Figure 52 DHW piping direct-connected across the boiler



H1 = Head loss through boiler **H3** = Head loss through water heater
H2 = Head loss through DHW piping U3046

Figure 53 DHW piping as a secondary circuit — for high-flow-rate applications



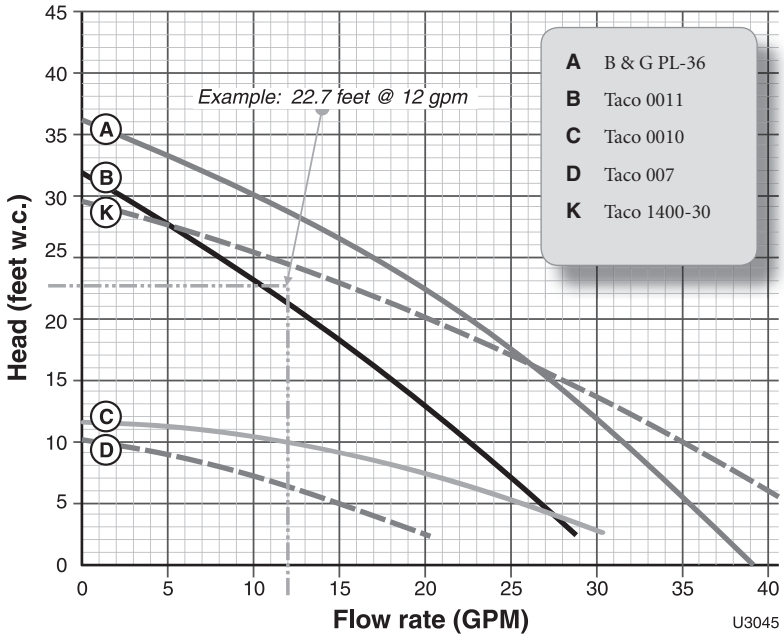
H1 = **0** (no DHW flow through boiler) **H3** = Head loss through water heater
H2 = Head loss through DHW piping U3046a

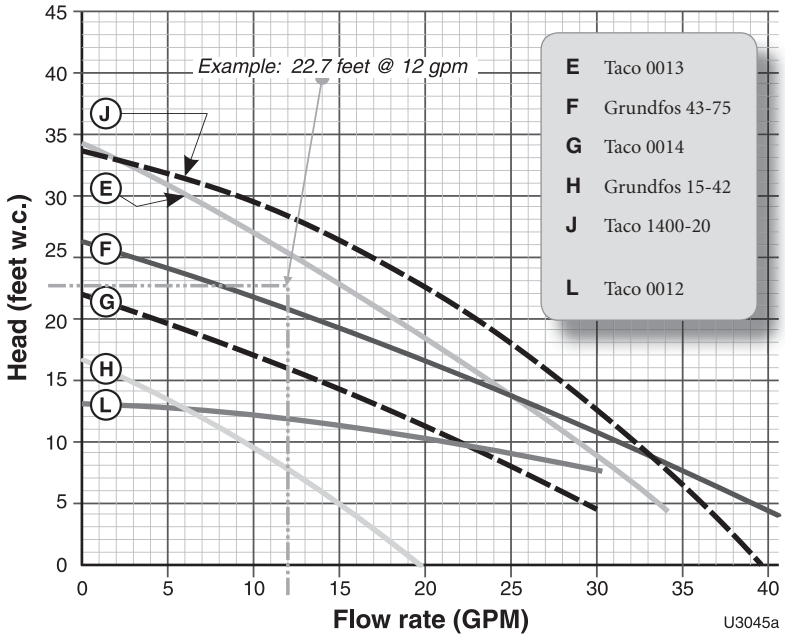
Sizing direct-connected DHW piping *(continued)*

Figure 54 Pipe sizing and head losses for DHW applications *(H1=Ultra boiler head loss; H2=piping head loss)*

Flow rate	Temp rise	Pipe size	H1	H2
GPM	°F	Inches	Boiler head loss Feet w.c.	Piping head loss Feet w.c.
Ultra-80 (71,000 Btuh output)				
7	20	1	6.6	2.7
9	16	1	11.6	4.2
10	14	1¼	14.6	2.5
Ultra-105 (94,000 Btuh output)				
7	27	1	7.0	2.7
9	21	1	11.2	4.2
10	19	1¼	13.6	2.5
13	14	1¼	22.2	3.9
Ultra-155 (139,000 Btuh output)				
9	31	1¼	6.2	2.1
10.0	28	1¼	7.7	2.5
13	21	1¼	13.3	3.9
16	17	1¼	20.5	5.7
Ultra-230 (207,000 Btuh output)				
13	32	1¼	9.4	3.9
16	26	1¼	13.7	5.7
21	20	1½	22.0	2.9
Ultra-299/310 (279,000 Btuh output)				
18	31	1½	6.6	2.2
22	25	1½	9.5	3.1
29	19	2	17.4	2.9
Ultra-399 (365,000 Btuh output)				
22	34	1½	9.5	3.1
29	25	2	15.5	2.9
36	20	2	22.8	4.3

Figure 55 Pump curves for typical circulators suggested for DHW loop





Multiple boiler installations

Placing multiple boilers

1. Locate multiple boilers in boiler room according to:
   a. Figure 56 (side-to-side), or
   b. Figure 57 (back-to-back).
   c. Figure 58 (wall mounting).
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 5. 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 the illustrations at right.
4. Chalk line 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, expansion tank, primary circulator and other accessories.

Wall mounting *(Ultra Models 80 – 399)*

1. Ultra boilers may be wall mounted, following the instructions on page 50. (See Repair parts section for part number of wall mounting kit.)
2. When wall mounting boilers, provide approximately 6 inches between boilers for easy removal of boiler jacket door. See Figure 58.
3. Follow all applicable codes regarding piping, electrical connections and clearances.
4. When wall mounting boilers, verify the wall construction is suitable for the structural load. See page 50 for details.

Figure 56 Side-to-side mounting of multiple Ultra boilers

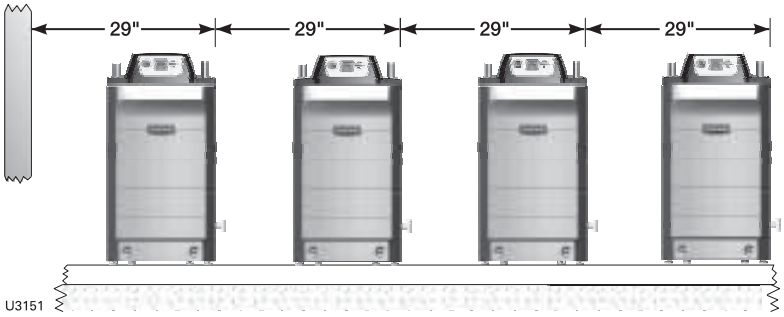


Figure 57 Back-to-back installation of multiple Ultra boilers

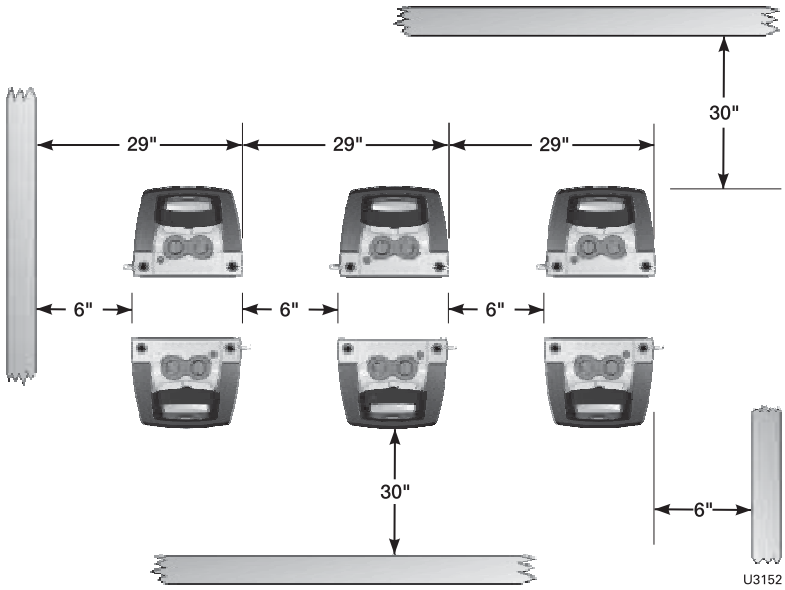
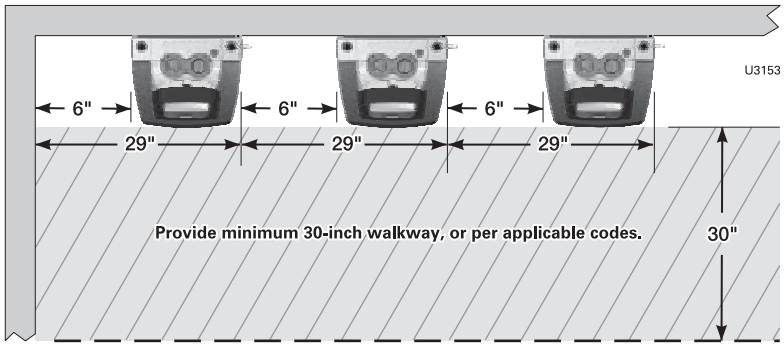


Figure 58 Wall mounting multiple Ultra boilers



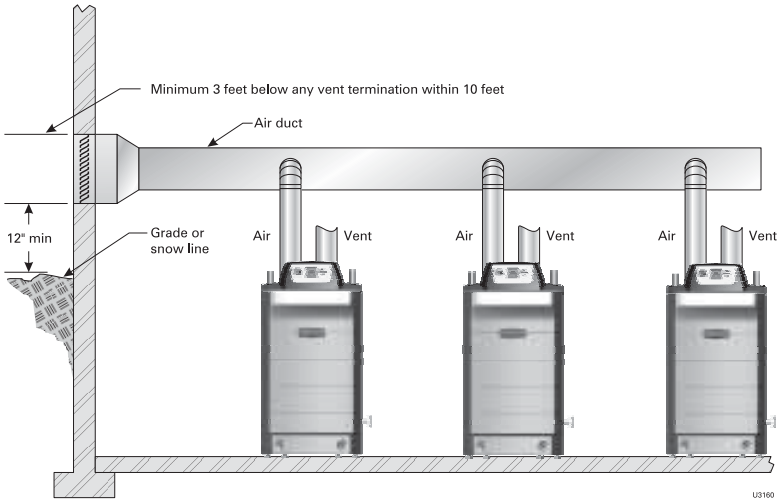
Multiple boiler installations *(continued)*

Manifolded combustion air option

1. Multiple Ultra boilers can use a common combustion air manifold.
   a. See Figure 139, page 138 for minimum cross sectional area of combined air ducts.
   b. Provide minimum clearance to adjacent vents and grade/snow line as shown in Figure 59.
   c. Provide minimum free area in duct (adjusted for louver restriction) of **1 square inch per 2,000 Btuh** total boiler input.
   d. If combustion air damper is used, wire to boilers to prevent operation except after damper has opened.

⚠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 59 Manifolded combustion air option



⚠WARNING DO NOT use common venting — the manifold option is only for combustion air — all vent pipes must be routed and terminated individually as described in this manual.

See Figure 139, page 138 for minimum cross sectional area of combined air ducts.

OR

Calculate required cross section (for area in square inches):

MIN. AREA = TOTAL MBH INPUT DIVIDED BY 2

Example: A multiple boiler system with (6) Ultra-155 boilers has a total input of 6 x 155 = **930** MBH (930,000 Btuh). The required duct cross sectional area is:

MIN. AREA = 930 DIVIDED BY 2 = 465 sq. inches

Multiple boiler installations *(continued)*

Easy-Fit® piping installation

1. Main header and Easy-Fit® Manifold pipe sizing.
   a. New system — See page 10.
   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 60 or Figure 61. Size manifolds to handle total connected boiler output as shown.
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 60.
   b. Use either tees (Figure 60) or crosses (Figure 61) 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 60 and Figure 61.
   b. Return manifold must be on the return side of the main and supply manifold must be on the supply side of the main. Drawings in this manual show flow in system main from right to left. For system flowing left to right, reverse the locations of the manifolds accordingly.
4. Connect from Easy-Fit® manifold branches to boiler supply and return connections using copper or steel pipe, sized for the required flow rate.
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. Some local codes may require the use of individual water level controls and limits on each boiler when isolation valves are installed.
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 60 and Figure 61 show details of Easy-Fit® manifolds.
   b. Figure 62, page 61 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 63, page 62 and Figure 64, page 63 are three-dimensional piping drawings of typical multiple boiler installation.
   d. Figure 65, page 64 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 providing a low water control and additional limit for each boiler. Consult local codes to determine if omission of the individual boiler isolation valves may allow the use of a single water level control and additional limit for the entire multiple boiler system. **The U-Control module proves water level using a dual temperature sensor installed in the Ultra heat exchanger.** This will satisfy some code requirements for low water cutoff protection.

Maximum connected load per manifold:
2-inch manifold — 450 MBH
3-inch manifold — 1400 MBH
4-inch manifold — 2900 MBH

Figure 60 Single-sided EZ-Fit Header connection

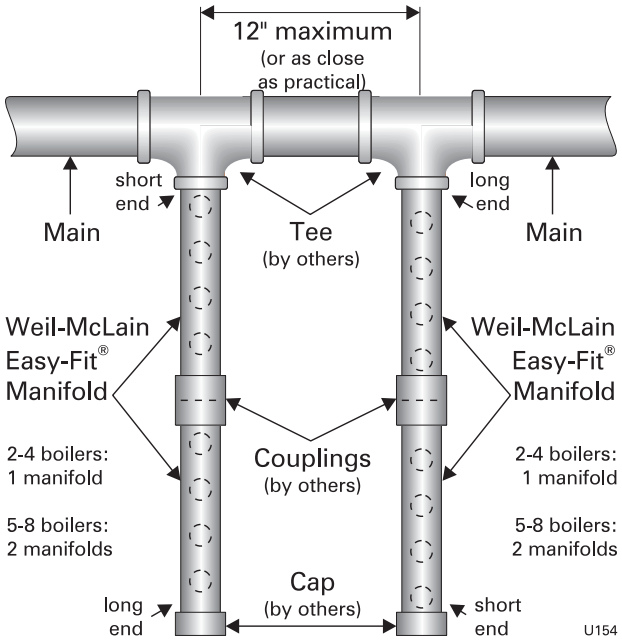
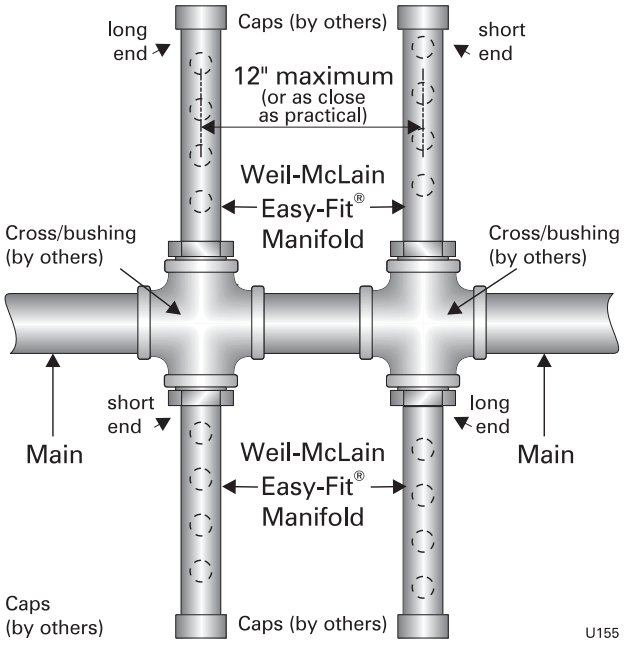
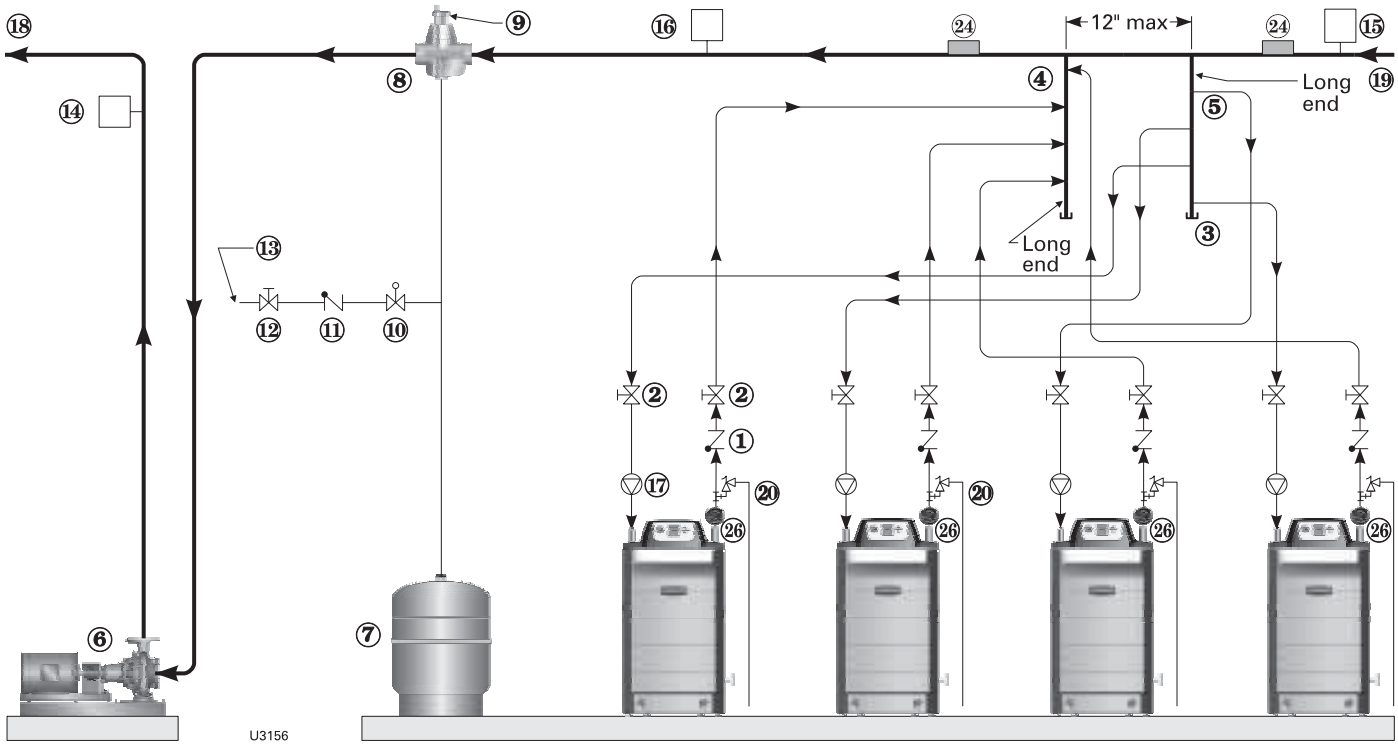


Figure 61 Double-sided EZ-Fit Header connection



Multiple boiler installations *(continued)*

Figure 62 Piping schematic — typical piping for multiple Ultra boilers, using Weil-McLain Easy-Fit manifolds

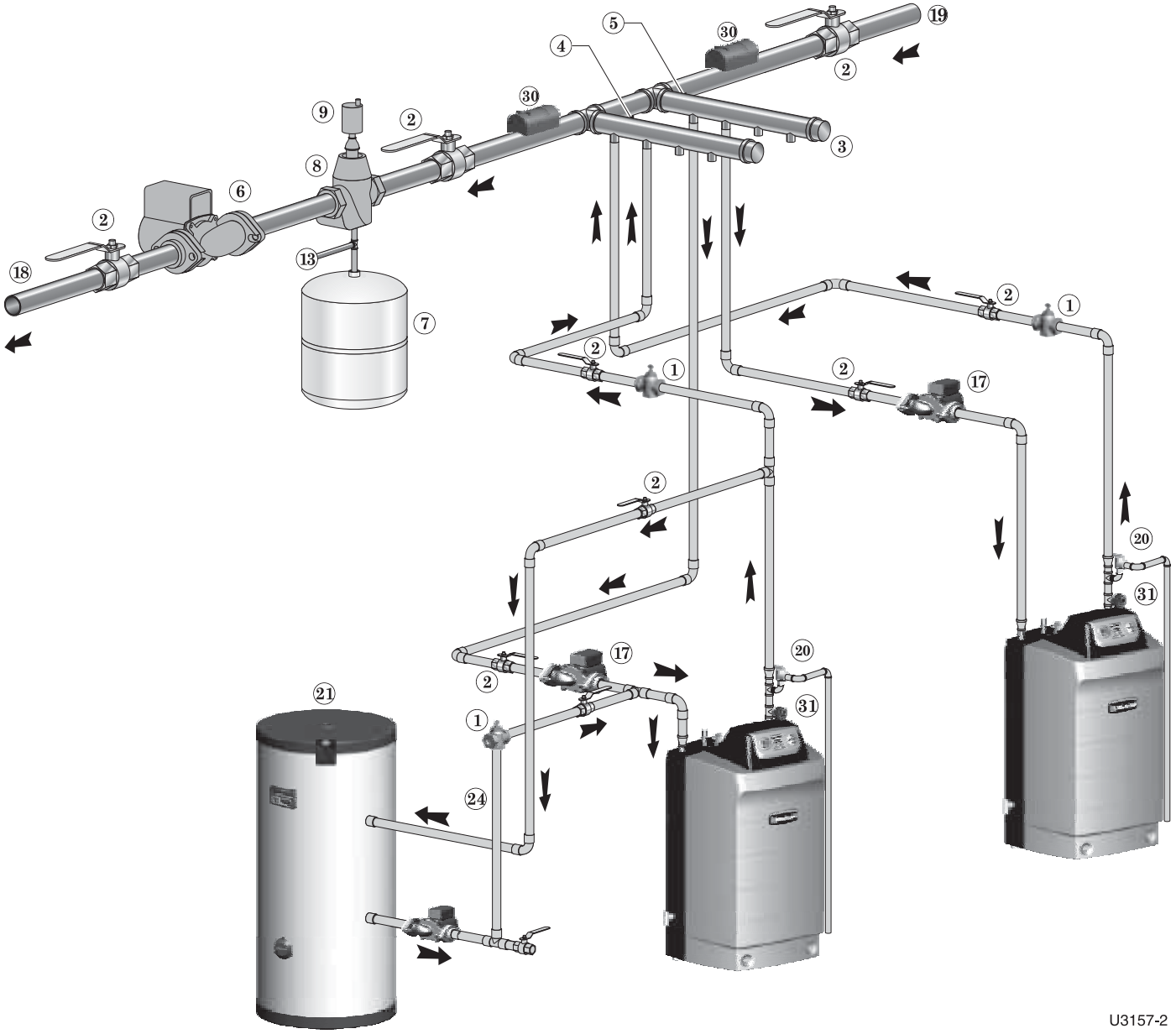


Legend — Figure 62

1 Flow/check valve (each boiler)	11 Check valve or backflow preventer, as required by applicable codes
2 Isolation valves (when used)	12 Isolation valve
3 Cap	13 Cold water supply
4 Easy-Fit® Manifold (supply) — layout and size per page 60	14 Supply water temperature control (when used)
5 Easy-Fit® Manifold (return) — layout and size per page 60	15 Low water cutoff (when used) (place above primary header)
6 Primary circulator	16 Water flow switch (when used)
7 Expansion tank (diaphragm type)	17 Boiler circulator (each boiler)
8 System air eliminator	18 System supply
9 System automatic air vent	19 System return
10 Pressure reducing valve	20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual
	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.
	26 Temperature/pressure gauge

Multiple boiler installations *(continued)*

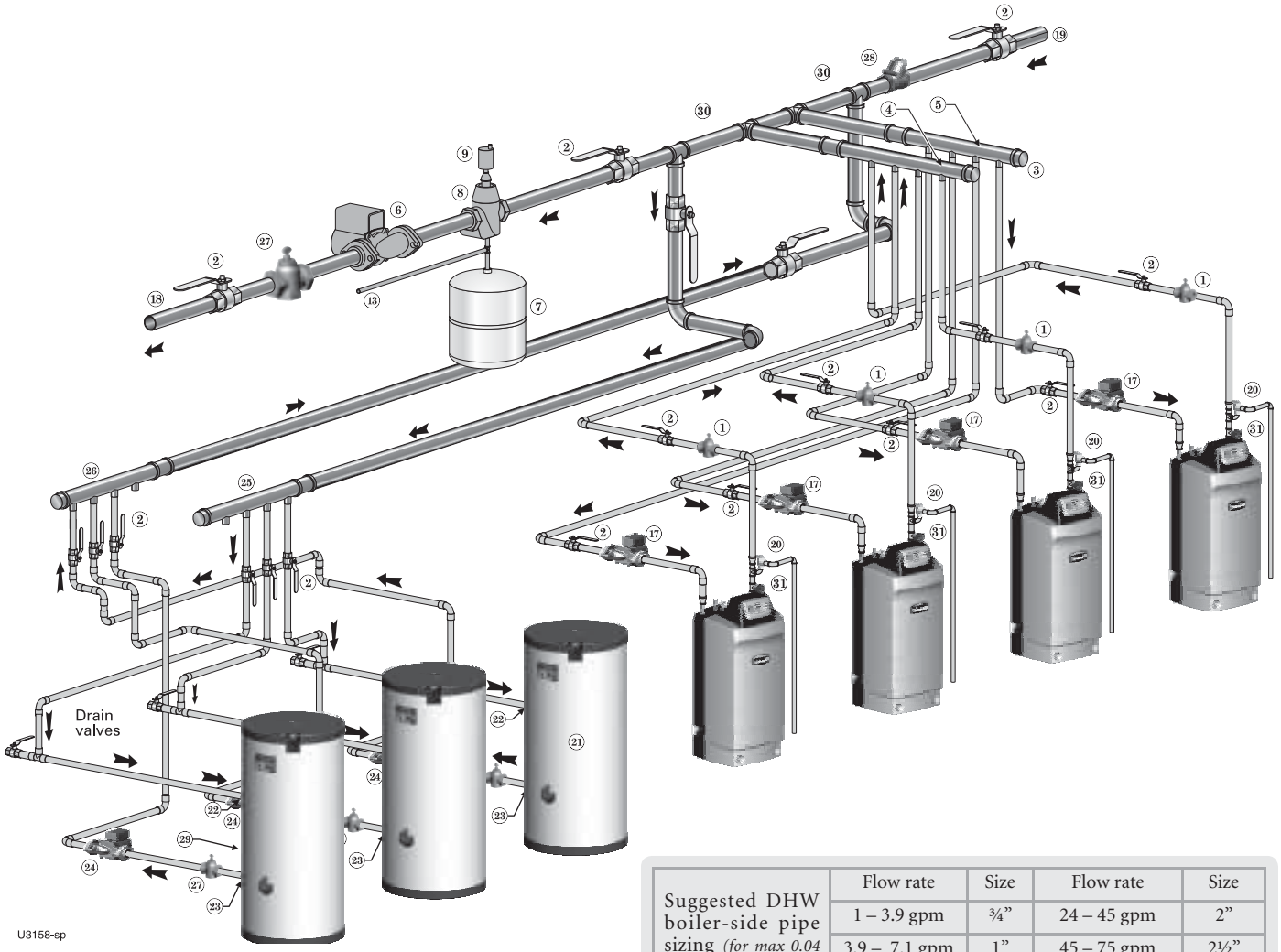
Figure 63 Piping layout — typical piping for multiple Ultra boilers, using Weil-McLain Easy-Fit manifolds (2-boiler system)



Legend — Figure 63	
1 Flow/check valve (each boiler)	18 System supply
2 Isolation valves (when used)	19 System return
3 Caps	20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual
4 Easy-Fit® Manifold (supply) — layout and size per page 60	21 Indirect-fired storage water heaters (Weil-McLain AQUA PLUS shown) — Example is shown connected to one boiler of the system. Preferably, use the last boiler in the lead/lag sequence and set its Priority to **DHW Direct** so it will switch to DHW firing and turn off its boiler circulator on a call for domestic water heating.
5 Easy-Fit® Manifold (return) — layout and size per page 60	24 DHW boiler-side circulator
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)	32 Temperature/pressure gauge
8 System air eliminator	
9 System automatic air vent	
13 Cold water supply	
17 Boiler circulator (each boiler)	

Multiple boiler installations *(continued)*

Figure 64 Piping layout — typical piping for multiple Ultra boilers, with DHW storage heaters (4-boiler system)



Suggested DHW boiler-side pipe sizing *(for max 0.04 feet head loss per foot of total equivalent length, TEL)*	Flow rate	Size	Flow rate	Size
	1 – 3.9 gpm	¾"	24 – 45 gpm	2"
	3.9 – 7.1 gpm	1"	45 – 75 gpm	2½"
	7.1 – 16 gpm	1¼"	75 - 140 gpm	3"
	16 – 24 gpm	1½"	140 – 290 gpm	4"

Legend — Figure 64

1 Flow/check valve (each boiler)
2 Isolation valves (when used)
3 Caps
4 Easy-Fit® Manifold (supply) — layout and size per page 60
5 Easy-Fit® Manifold (return) — layout and size per page 60
6 Primary circulator
7 Expansion tank (diaphragm type)
8 System air eliminator
9 System automatic air vent
13 Cold water supply
17 Boiler circulator (each boiler)
18 System supply
19 System return
20 Boiler relief valve and discharge piping, installed per Ultra Boiler Manual
21 Indirect-fired storage water heaters (Weil-McLain AQUA PLUS shown) — Example is shown with reverse-return boiler-side piping using a single circulator. Alternate: each water heater could have its own circulator.
22 Boiler water inlet
23 Boiler water outlet
24 DHW boiler-side circulators
25 DHW boiler-side supply Easy-Fit® Manifold
26 DHW boiler-side return Easy-Fit® Manifold
27 Flow/check valves (to prevent induced or gravity flow in heating system or DHW piping)
28 Check valve to prevent heat migration in heating system.
29 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.
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.
31 Temperature/pressure gauge

NOTICE This piping is suggested only. The layout above should be controlled with a boiler sequencing panel that provides DHW operation as well. Wire the heating system circulator to operate only on call for heat. Alternatively, use the boiler sequencing panel to provide domestic priority by disabling the heating system circulator any time there is a DHW call for heat. The boiler circulators, item 17, must 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.