



## Series 2

### Wall Mount Gas-Fired Water Boilers

70/110/155

# Boiler Manual

- Installation
- Maintenance
- Startup
- Parts



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 550-142-190/1218

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## ⚠ WARNING

## DO NOT SERVICE THE BOILER WITHOUT AN ECO MAINTENANCE KIT AVAILABLE

The ECO maintenance kit includes components that may have to be replaced when accessing or disassembling parts of the boiler. Failure to replace damaged components and to use only the parts specifically intended for the boiler can result in severe personal injury, death or substantial property damage. See Figure 119, page 115 for part number.

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# 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.

# The ECO Series 2 Gas-fired water boilers

## 1. Stainless steel firetube heat exchanger

## 2. Heat exchanger access cover/burner mounting plate

## 3. Blower

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

Air enters the boiler enclosure through the air intake adapter (16), 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 (11).

## 4. Gas valve

The automatic gas valve senses the vacuum in the venturi (6) caused by flowing air and allows gas to flow when power is applied. A manual gas valve is shipped loose with the boiler. It allows shutting off the gas supply for servicing or shutdown. See instructions in this manual for manual gas valve installation.

## 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 negative pressure. This vacuum pulls gas from the gas valve (4). Gas will only flow if air is flowing. The gas mixes with air in the venturi. The gas/air mixture then flows into the burner (11).

## 7. Supply water temperature dual sensor

This dual sensor monitors boiler outlet water temperature. The ECO control adjusts boiler firing rate so the outlet water temperature is correct, based on the calculated (if outdoor reset used — see page 127) or fixed target temperature.

## 8. Return water temperature sensor

This sensor monitors return water temperature. The ECO control 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, selecting and adjusting control settings, and resetting the control after lockout. This display can be mounted either on the boiler (as shown) or on the wall.

## 10. Flue adapter (fits 3" PVC)

## 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

Other ½" NPT gas connection pipe, manual gas valve, and fittings (including union) shown must be supplied by the installer.

## 15. Control module

The control module responds to signals from the room thermostat, DHW aquastat (if used), boiler sensors (boiler return, boiler supply, flue temperature, and outdoor temperature, if used — see page 127). The control automatically adjusts blower speed (and gas flow rate) to match boiler output to space heating and/or DHW heating demand. The control provides for one heating zone and one DHW zone.

## 16. Air intake adapter (fits 3" PVC)

## 17a. Electrical entrances (line voltage)

The top left side knockouts are designated for line voltage wiring only. Ensure all wiring entrances are sealed.

## 17b. Electrical entrances (low voltage)

The top right side and bottom knockouts are designated for low voltage wiring only. Ensure all wiring entrances are sealed.

## 18. Boiler drain valve (not shown)

Shipped loose for field piping. Pipe drain valve on reducing tee at the lowest point of return piping to boiler. See instructions in this manual.

## 19. Condensate trap nozzle

The outlet at the bottom of the condensate collection dish. This is where condensate is discharged from the boiler. The condensate trap assembly attaches here.

## 20. Flue gas condensate drain trap assembly and bracket

The condensate trap assembly and bracket are field-installed, condensate drain trap is connected to the condensate trap nozzle as shown in this manual.

## 21. Jacket door

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

## 22. Jacket door screws

Two screws secure the jacket door in place.

## 23. 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.

## 24. Flame inspection window

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

## 25. Flue gas dual sensor

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

## 26. Gas valve reference hose (ECO 70 only)

This rubber line connects the gas valve diaphragm reference chamber to the venturi intake to insure the valve senses the correct reference pressure.

## 27. Transformer

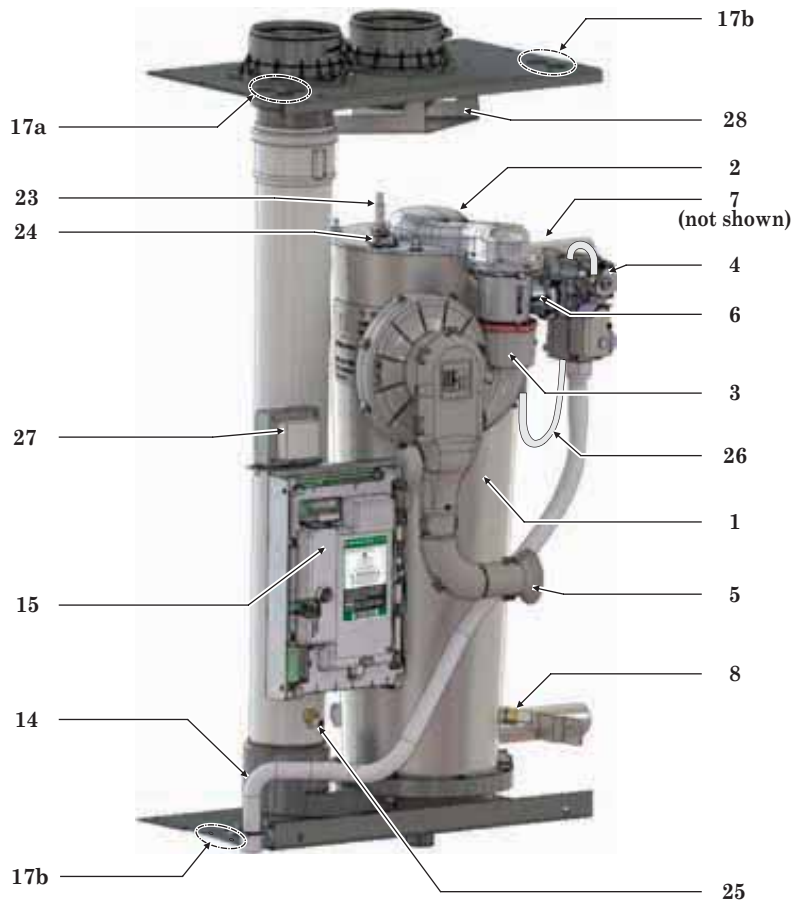
The 120V/24V transformer provides 24V to low voltage control circuitry.

Do NOT splice wiring into transformer.

## 28. Air baffle

The air baffle protects internal boiler components by diverting any incoming moisture or debris away from critical components. It must be temporarily removed while servicing the heat exchanger.

# The ECO 70 Series 2 Gas-fired water boilers *(continued)*



## ECO-70

### Interior

(some details omitted for clarity)

## ECO-70 & 110 Bottom



## ECO-70, 110 & 155 Top

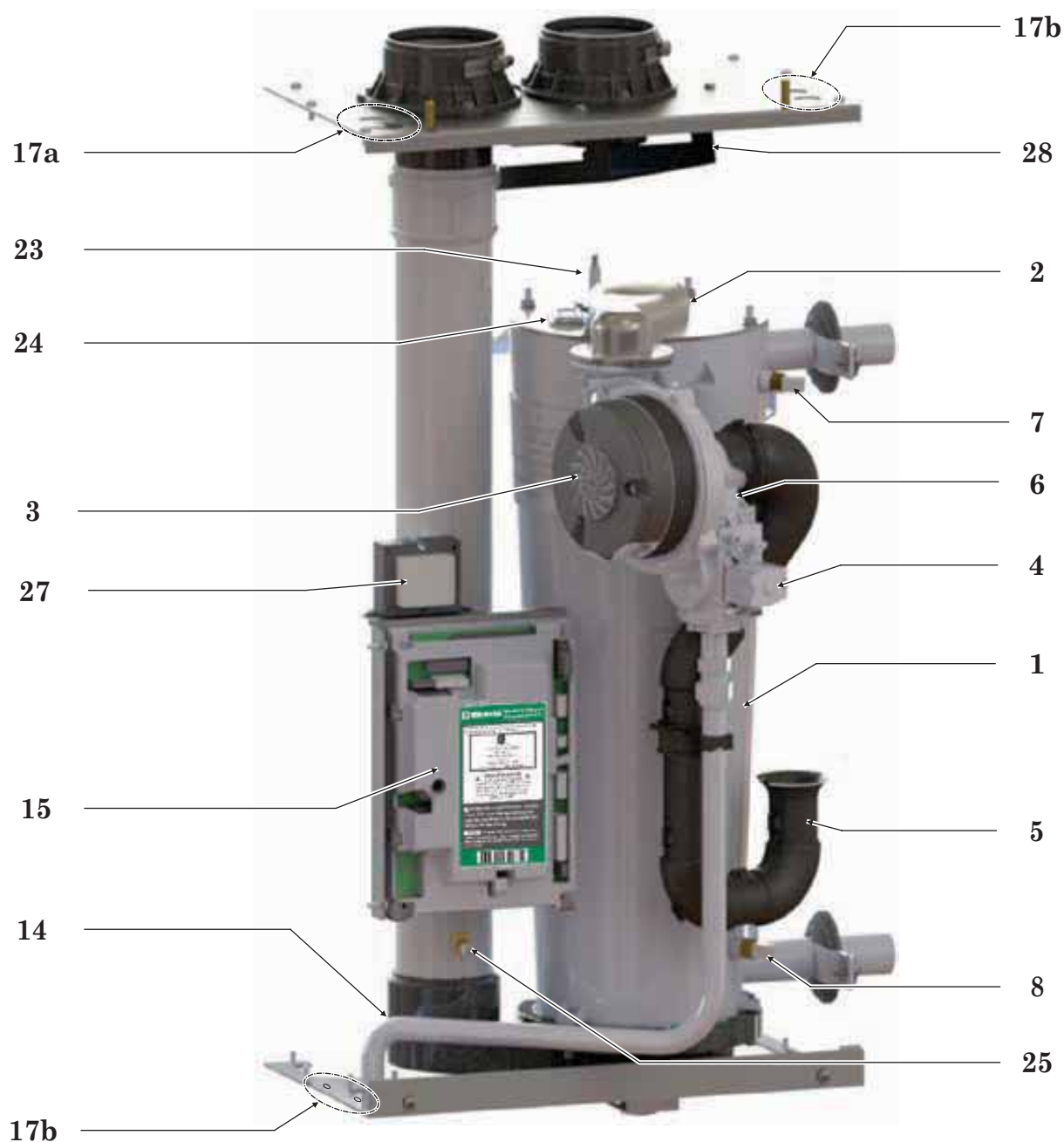


## ECO-70, 110 & 155 Front



ECO-003-70

# The ECO 110 Series 2 Gas-fired water boilers *(continued)*



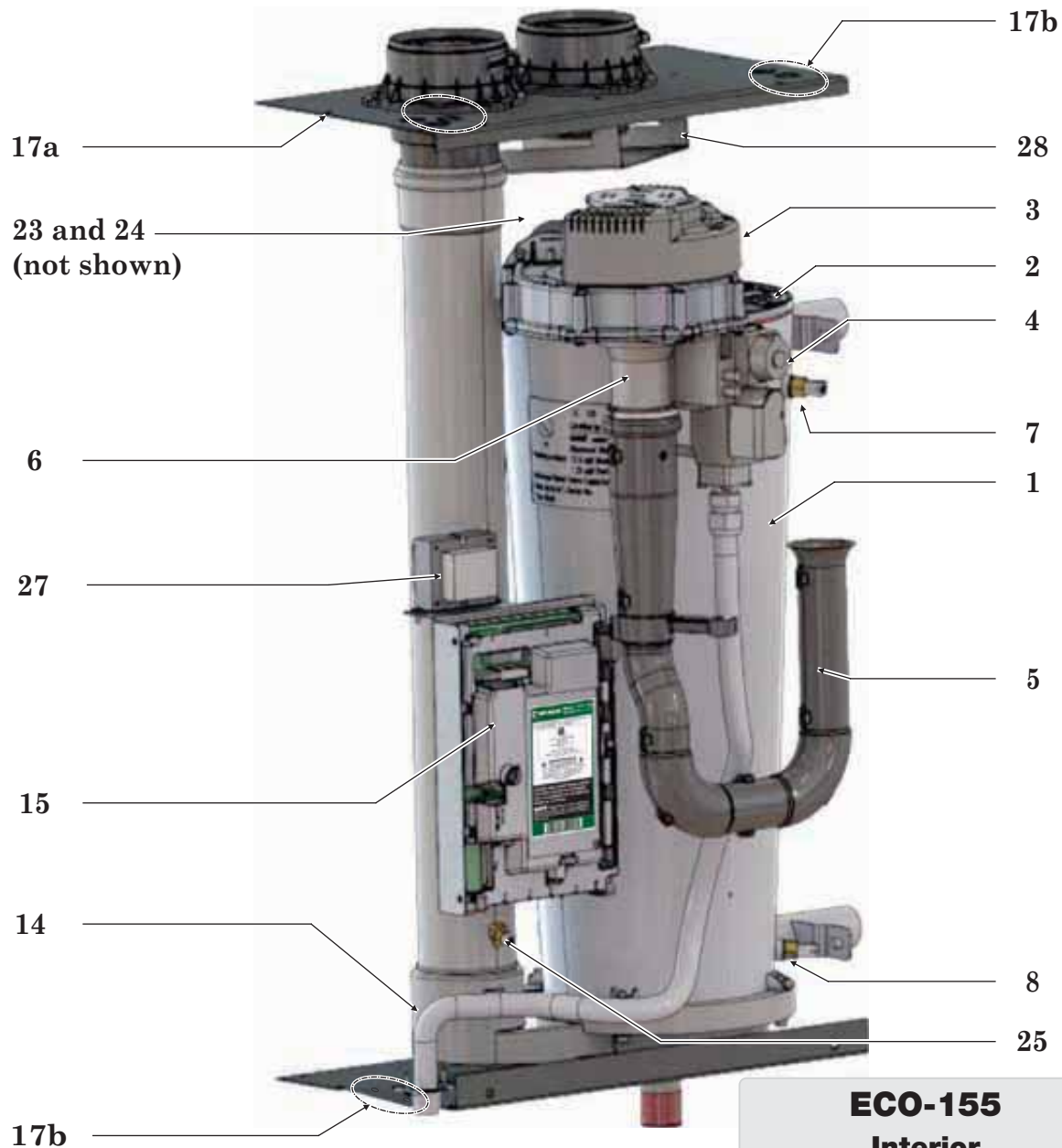
## ECO-110

### Interior

(some details omitted for clarity)

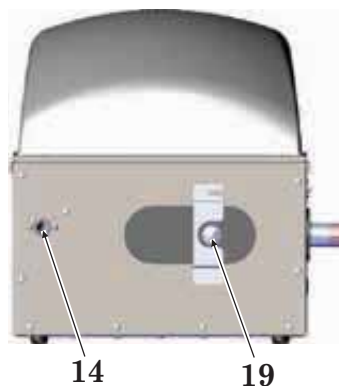
ECO-003-110

# The ECO 155 Series 2 Gas-fired water boilers *(continued)*



## ECO-155 Interior

(some details omitted for clarity)



## ECO-155 Bottom

ECO-003-155

# 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 129 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.**

### EXPANSION TANK

- Relieve pressure from the system before isolating the expansion tank.

### 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 89.

### Boiler operation —

- Do not block flow of combustion or ventilation air to boiler.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.

### 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 ECO heat exchanger is made of stainless steel, and requires that system water chemistry be within the limits in this manual. **ADDITIONAL CHEMICAL TREATMENT MAY BE NECESSARY.** See page 79 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 heat exchanger reduces heat transfer, overheats the stainless steel 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. Follow all guidelines given by the antifreeze manufacturer. Thoroughly clean and flush any replacement boiler system that has used glycol before installing the new boiler. Use only the products listed by Weil-McLain for use with this boiler. See page 80 for details.

## ⚠ 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 25.

# 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.
- National Electrical Code, ANSI/NFPA 70 - latest edition. Canadian installations must comply with the Natural Gas and Propane Installation Code, CAN/CSA B149.1 or B149.2 Installation Codes.
- Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD1.

### NOTICE

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

## Before mounting the boiler, check:

1. Wall construction — Make sure the wall construction is suitable to carry the weight of the boiler and components. See page 10 for instructions.
2. A floor stand kit is available. See “BOILER ACCESSORIES” on page 115 for part number. See kit instructions for details.
3. The boiler is suitable for INDOOR installation only.
4. Check for nearby connection to:
  - System water piping
  - Venting connections
  - Gas supply piping
  - Electrical power
  - Condensate drain
5. 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.

6. The ECO boiler must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
7. If new boiler will replace existing boiler, check for and correct system problems, such as:
  - Sediment or corrosion in system piping — clean and flush piping BEFORE connecting the new boiler. See page 79.
  - 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.

## 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 with its burner and igniter are at least 18 inches above the floor. Follow the National Fuel Gas Code, ANSI Z223.1 for U. S. installations, or Natural Gas and Propane Installation Code, 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.
- Prevent boiler water and condensate from freezing.

## Provide air openings to room

### ECO boiler alone in boiler room

1. No air ventilation openings into boiler room are needed if clearances around boiler are at least equal to the SERVICE clearances shown in Figure 1, page 9.
2. For spaces that DO NOT supply the minimum service clearances, provide two openings as shown in Figure 1, page 9. Each opening must provide 1 square inch free area per 1,000 Btuh of boiler input.

### ECO boiler in same space with other gas or oil-fired appliances

1. Follow the sizing requirements shown in Figure 25, page 27.

### WARNING

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

Reinstall boiler jacket door after servicing. The boiler jacket 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.

## Vent and air piping

1. The ECO boiler requires a special vent system, designed for pressurized venting. ECO boilers are rated ANSI Z21.13 Category IV (pressurized vent, likely to condense in the vent). See instructions beginning on page 22.
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 22 when considering vent/air termination.
3. Vent and air must terminate near one another unless otherwise specified in this manual. Vent and air piping may be routed vertically through the roof or out a side wall, following the options give in this manual. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the ECO 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 22.

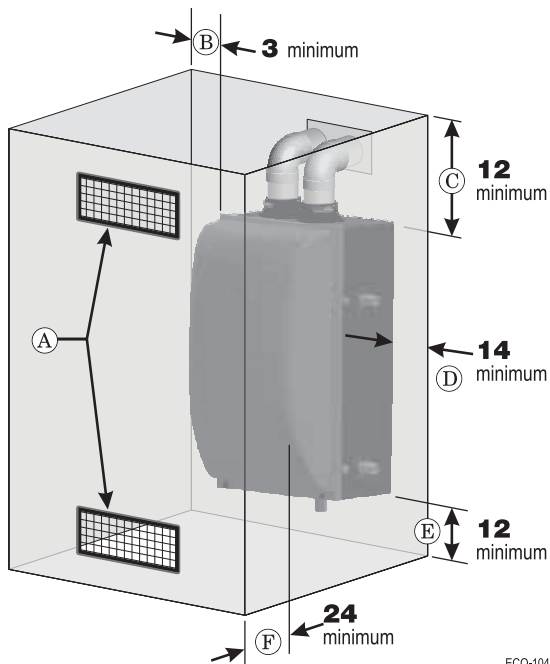
# Boiler location *(continued)*

## Provide clearances for service access — RECOMMENDED

1. See Figure 1 for recommended service clearances.
2. If you do not provide minimum service clearances shown, it might not be possible to service the boiler without removing it from the space.
3. Clearance D, Figure 1 allows for the installation of piping as shown in Figure 8, page 12 plus a close nipple and elbow.

**⚠ WARNING** Closet or small-enclosure installations which do not provide at least these recommended clearances require the specially-sized and placed air openings shown in Figure 2.

**Figure 1** **RECOMMENDED** service clearances (all dimensions are in inches)



ECO-104a

- A Provide combustion air/ventilation openings per Figure 25, page 27 or as otherwise directed in this manual or by applicable codes. **NOTE:** If the installation does not provide the minimum clearances in this illustration, then the enclosure must have air openings located and sized per Figure 2.
- B Left side service clearance = 3 inches minimum
- C Service clearance above top of boiler = 12 inches minimum
- D Right side service clearance = 14 inches minimum
- E Service clearance below the boiler = 12 inches minimum
- F Service clearance in front of the boiler = 24 inches minimum

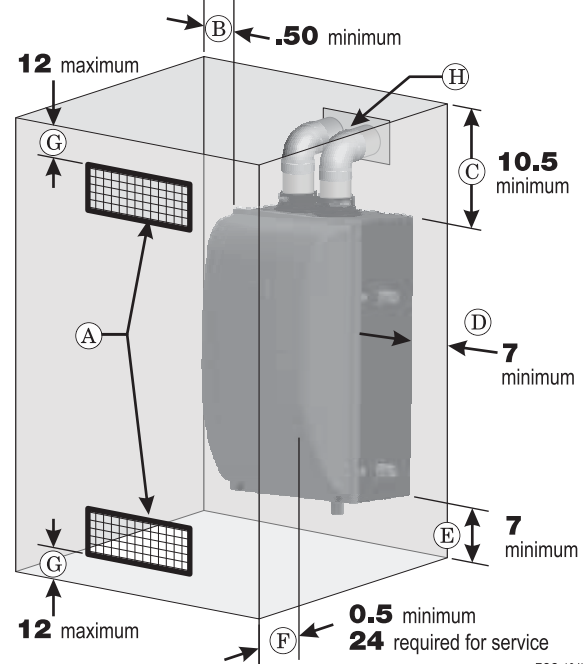
**NOTICE** ADDITIONAL service clearance may be needed, depending on how piping is routed to the boiler.

## Provide clearances from combustible materials — REQUIRED

1. See Figure 2 for REQUIRED minimum clearances. ALL installation must provide at least these minimums.
2. Hot water pipes — at least 1/2" from combustible materials.
3. Vent pipe — at least 3/16" from combustible materials.
4. Clearance D, Figure 2 allows for the installation of a reducer bushing (155 only) and elbow. Other piping may require additional clearance.
5. See Figure 1 for service clearance minimums.

**⚠ WARNING** Closet or small-enclosure installations which do not provide at least the recommended service clearances shown in Figure 1 require the specially-sized and placed air openings shown in Figure 2.

**Figure 2** **REQUIRED** minimum clearances (all dimensions are in inches)



ECO-104b

- A Provide combustion air/ventilation openings per Figure 25, page 27 or as otherwise directed in this manual or by applicable codes. **NOTICE** If the installation does not provide the minimum clearances in Figure 1, then the enclosure MUST HAVE air openings located per Figure 2, above. Each of these air openings must have free area of at least 1 square inch per 1,000 MBH of boiler input.
- B Left side clearance to combustibles = .50 inches minimum
- C Top of boiler clearance to combustibles = 10.5 inches minimum
- D Right side clearance to combustibles = 7 inches minimum
- E Bottom of boiler clearance to combustibles = 7 inches minimum (must be 18 inches above floor for garage installations)
- F Clearance in front of the boiler = 0.5 inches, but **24 inches minimum required for service**
- G Air openings must be located in the FRONT of the enclosure, as shown. They must be no more than 12 inches from the floor or ceiling, as shown.
- H Vent pipe must be minimum 3/16 inch from combustibles. Opening in combustible wall, floor, ceiling or roof must be 3/8" larger than flue pipe diameter, fitted with galvanized steel thimble, or larger if required by codes or as specified by vent pipe manufacturer.

# Wall-mounting the boiler

## Remove boiler from crate

**⚠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.

**⚠WARNING** After the boiler is removed from the shipping carton, **DO NOT** allow the boiler to sit on its bottom. This would cause pressure on protruding plastic, resulting in interior damage. Either lay the boiler on its back or leave on the styrofoam protective shipping base.

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

**⚠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 ECO boiler is generally easier to handle and maneuver after removing the shipping container.
2. Remove items 1, 2, 3 and 5 in Figure 3. Remove trim kit and parts from item 2.
3. **Leave the boiler resting on the styrofoam protective base** (item 6) and bottom cardboard cap (item 7), until ready to place on the wall. If removing the boiler from the shipping base, rest the boiler on its back, NOT on its bottom.

## Wall-mounting requirements

**⚠WARNING** 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).

**The wall must be vertically plumb and capable of carrying the weight of the boiler and any attached piping components.**

The operating weights for wall-mountable boilers are:

ECO 70: 105 pounds

ECO 110: 94 pounds

ECO 155: 120 pounds

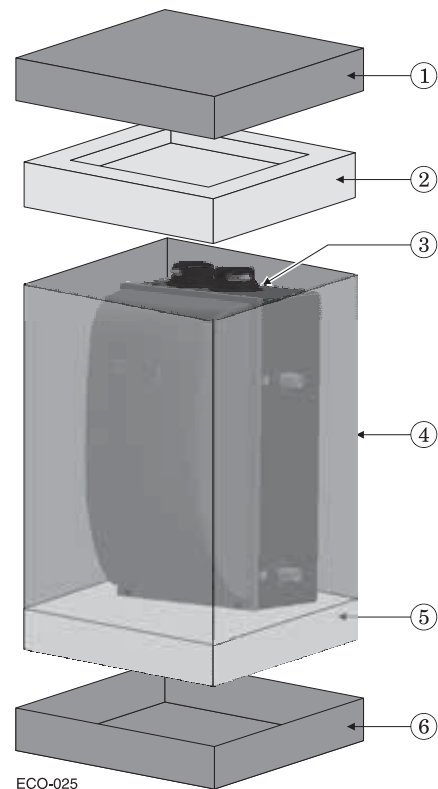
Failure to comply with above and the procedure given below could result in severe personal injury, death or substantial property damage.

1. 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. The mounting surface must not extend above the top of the boiler jacket.
2. Wood stud wall: Install bracket with lag screws (3/8" x 3") included in kit, only into the studs.
3. Metal stud wall: Secure bracket and spacer board to studs with 3/16-inch toggle bolts and 3/16-inch flat washers (not included with kit).

**⚠WARNING** Verify that the studs are suitable for carrying a wall-mounted load. Some metal studs are not designed for this purpose.

4. If the mounting wall has exposed studs, installer must provide a backer board to mount boiler. Boiler cannot be leveled without a backing surface.
5. Mount the boiler on the wall following these instructions. The boiler mounting studs must engage with the wall-mount bracket. Make sure the bracket is not just resting on the edge of the mounting stud or washer. Perform all procedures given in the Boiler Manual on previous pages before mounting the boiler.

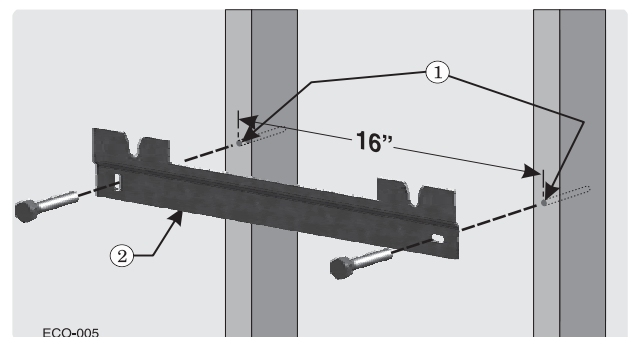
**Figure 3** Boiler shipping container



ECO-025

1	Cardboard cap, top	4	Boiler
2	Spacers (trim kits and parts nested between)	5	Cardboard sleeve
3	Styrofoam protective cap	6	Styrofoam protective base
		7	Cardboard cap, bottom

**Figure 4** Wall-mount bracket and studs



ECO-005

- 1 Studs — Pre-drill through the wall into the studs 1/4 inch diameter x 3 inches deep for 3/8-inch lag screws — Studs must be on 16-inch centers. If studs are any other spacing, provide a secure, solid mounting surface on which to attach the boiler wall-mounting bracket.
- 2 Wall-mount bracket

# Wall-mounting the boiler *(continued)*

## Install the wall-mount bracket (by installer)

1. See Figure 4, page 10.
2. Locate the studs — must be on 16-inch centers. See previous page instructions if studs are not on 16-inch centers.
3. Place the wall-mount bracket (item 2, Figure 4, page 8) on the wall, using a level to align correctly.
4. Place the wall-mount bracket so the mounting slots are centered over the studs.
5. Level the bracket and trace the outline of the screw slots with a pencil.
6. Remove the mounting 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.)
7. Position the wall-mount bracket on the wall. Insert and loosely tighten the two lag screws (or toggle bolts for metal studs).
8. Level the wall-mounting bracket. Then tighten lag screws securely. For drywall or plaster lathe installations, avoid tightening so much that the bracket digs into the wall surface.

## Place boiler on bracket

1. See Figure 5. The wall-mount bracket must be installed before mounting the boiler.
2. Measure 22 1/2 inches below the bottom edge of the wall-mount bracket (item 2). Strike a line or place a piece of masking tape with its top edge even with the 22 1/2-inch mark. (This line, or tape, will indicate whether the boiler has been properly seated onto the wall-mount bracket.)

**⚠ WARNING** The boiler is heavy, and requires two people to lift and place. Wear non-slip leather gloves to prevent possibility of cuts from sheet metal edges.

The jacket door can be left in place when handling the boiler, but the boiler must ONLY be lifted by the bottom and rear of the sheet metal housing — NOT by any pipe or plastic part.

3. **Obtain assistance to lift the boiler into position.**
4. Lift the boiler high enough that its mounting studs (item 3) will be above the wall-mount bracket (item 2).
5. Let the rear of the boiler slide against the lag screw heads as you lower the boiler into place. The V-groove will help guide the studs into the slot.
6. 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 2.
7. Adjust the studs properly until engaged with the bracket and the boiler slips into the correct position.

**⚠ WARNING** When mounting the boiler, use the method described in paragraph 2 above to ensure the mounting studs are properly engaged. If not, the boiler could fall. Failure to comply could result in severe personal injury, death or substantial property damage.

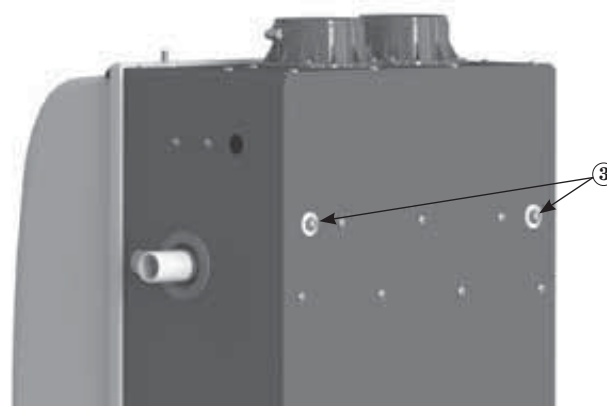
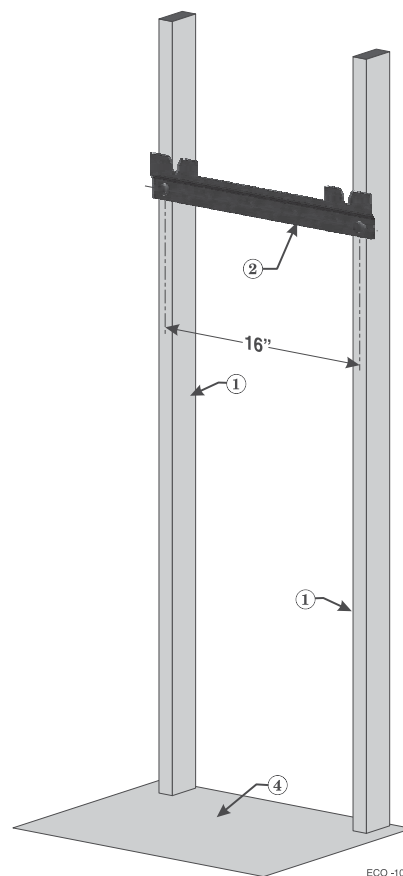
8. Ensure boiler is level front-to-back.

**⚠ WARNING** Ensure boiler is NOT pitched upward with the front of the boiler higher than the back of the boiler. This can prevent condensate from draining properly. Failure to comply could result in severe personal injury, death or substantial property damage.

## Floor-standing boiler option

An optional accessory to allow the boiler to be placed on a level floor is available from Weil-McLain. See kit instructions (available on website) for details. See "BOILER ACCESSORIES" on page 115 for part number information.

**Figure 5** Place boiler on wall-mount bracket



- 1 Studs — Pre-drill through the wall into the studs 1/4 inch diameter x 3 inches deep — Studs must be on 16-inch centers. If studs are any other spacing, provide a secure, solid mounting surface on which to attach the boiler wall-mounting bracket.
- 2 Wall-mount bracket — secure wall mount bracket to wall as instructed on previous page.
- 3 Boiler mounting studs — The V-groove on the wall-mount bracket will help guide the studs into the slots. The studs are attached to the back of the boiler.
- 4 Floor surface

# Display bracket installation

## Determine display unit location

1. Boiler display unit can be mounted on either the right side of the boiler jacket or on the wall in close proximity to the boiler
2. For displays mounted on the boiler jacket, use the provided display bracket.
  - a. For boilers mounted using the optional floor stand kit, always mount the display to the display bracket on the boiler jacket. See page 115 for information on the optional floor stand kit.
3. For displays mounted on the wall, the back plastic housing of the display can mount either directly to the wall or a standard 2" x 4" junction box.
  - a. The display should be mounted within 2 feet of the top right corner of the boiler. If mounted further away, the display's wire harness will not reach.

### NOTICE

DO NOT cut or splice the display wire harness. If display is mounted too far from the boiler for the provided wire harness, relocate the display closer to the boiler.

## Display bracket installation (on boiler jacket)

Install display bracket to the boiler jacket BEFORE installing any piping.

1. Remove the two (2) screws on the top right side of the boiler above the supply pipe shown in Figure 6.
2. The front screw is a pivot to rotate the display bracket up or down depending on the boiler mounting height and desired display angle. Potential mounting angles are demonstrated in Figure 7.
3. Ensure that intended piping locations will not interfere with the display housing when mounted.

### NOTICE

Installing the display bracket after piping may result in interference between the piping and display. Leave clearance around the bracket because the display is larger than the bracket.

It may be helpful to remove the display from the box and **temporarily** fit it up to the bracket to estimate the needed clearance. Remove display before piping boiler. Damage to display may occur, if not removed.

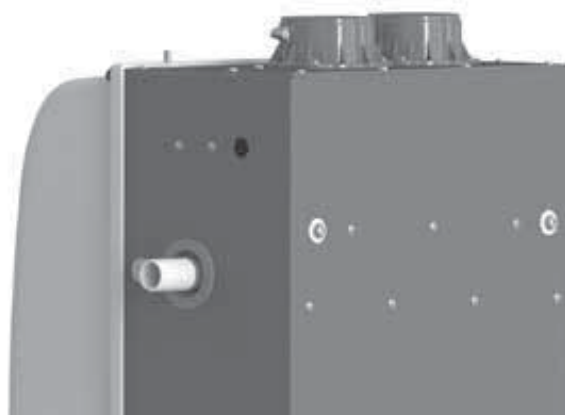
## Display installation on wall

1. Ensure mounting location follows guidelines in paragraph 3 of "Determine display unit location" above.
2. Separate the front and back pieces of plastic.
3. If mounting directly to drywall or plaster, use one of these methods:
  - a. Route wire through the back of the unit like a thermostat by routing wire harness through the wall.
  - b. Use spacers behind the plastic to allow space for routing the wire harness behind the plastic backing and entering through the back.
4. Drill two 3/16-in. mounting holes in wall where marked.
5. Secure back plastic to wall with two (2) anchors and screws making sure allowance has been made for the display wire harness to enter through the back.
6. Keep front half of display safe until it is time to wire the display. Wire the display after piping is complete.

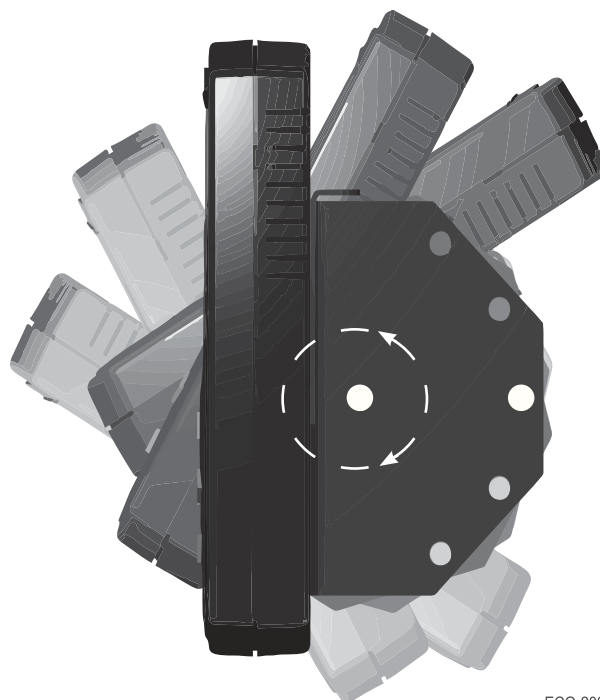
## Display installation on junction box

1. Ensure mounting location follows guidelines in paragraph 3 of "Determine display unit location".
2. Remove one knockout to allow the wire harness to pass through to the back of the plastic once inside the junction box.
3. Mount the display after piping is completed and the display wire harness has been routed to box. Use a bushing or clamp to ensure harness is secure to the junction box and insulation will not be damaged.

**Figure 6** View right side of boiler - screws for mounting display bracket



**Figure 7** Display on bracket - potential mounting angles



ECO-200

# Boiler hydrostatic test

**⚠ WARNING** **DO NOT install a relief valve with a pressure higher than 30 PSIG.** This is the maximum allowable relief valve setting for the ECO boiler. Failure to comply could prevent the relief valve from operating as needed, resulting in possibility of severe personal injury, death or substantial property damage.

**⚠ WARNING** **Use two wrenches when tightening any pipe connection to the boiler.** Failure to prevent the boiler pipes from turning could damage pipes or heat exchanger, resulting in possible severe personal injury, death or substantial property damage.

## Hydrostatic pressure test

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

## Install pipe fittings for relief valve and P/T gauge

1. Install the reducer bushings (155 only), reducing tees, and close nipples, shipped loose with the boiler, located and oriented as shown in Figure 8, page 14.

**NOTICE** Boilers installed in locations with less than the RECOMMENDED service clearances will need to adjust piping layout to meet space requirements.

2. Apply pipe dope to all fittings sparingly.

**⚠ WARNING** **DO NOT install the relief valve until after the hydrostatic test.** Temporarily install a  $\frac{3}{4}$ " pipe plug in the relief valve location as directed in these instructions. The plug must be removed after the test.

**⚠ WARNING** **Connect the relief valve ONLY on the BOILER SUPPLY OUTLET, NOT the boiler return.** Connect the relief valve only as shown in this manual. Ensure relief valve is located above heat exchanger.

Failure to comply with the above could prevent the relief valve from operating as needed, resulting in possibility of severe personal injury, death or substantial property damage.

3. Install the pressure/temperature gauge to the reducing tee as shown in Figure 8, page 14.

## Install fittings and valves required for hydrostatic testing

1. The following piping components (supplied by installer) are required for the test configuration:
  - a. Two shut-off valves (1" NPT on 70/110,  $\frac{1}{4}$ " NPT on 155).
  - b. Two close nipples (1" NPT on 70/110,  $\frac{1}{4}$ " NPT on 155).
  - c.  $\frac{3}{4}$ " NPT pipe plug.

2. **TEMPORARILY** insert a  $\frac{3}{4}$ " NPT pipe plug in the relief valve tapping. After the hydrostatic test, this plug **must** be removed and the relief valve must be installed.

## Fill and pressure test

1. See Figure 9, page 14 for use with the following instructions.
2. CLOSE the boiler drain valve (item 11). Connect a hose to fresh water supply and to the drain valve.
3. Place a bucket under the ends of the isolation valves (item 9 and 10) to catch water drippings.
4. CLOSE isolation valve item 10, then crack open the valve slightly. Leave isolation valve item 9 open.
5. Slowly open the boiler drain valve (item 11) and fresh water supply to fill boiler with water. The boiler and piping will fill quickly because of the low water content.
6. When water begins to flow from bottom isolation valve (item 10), close the valve.
7. Continue filling until water flows from top isolation valve (item 9), then close the valve.
8. When pressure on the pressure/temperature gauge (item 4) reaches at least 45 PSIG, but no higher than 55 PSIG, CLOSE the boiler drain valve (item 11).
9. 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.

10. 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.

**⚠ 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 (item 11).

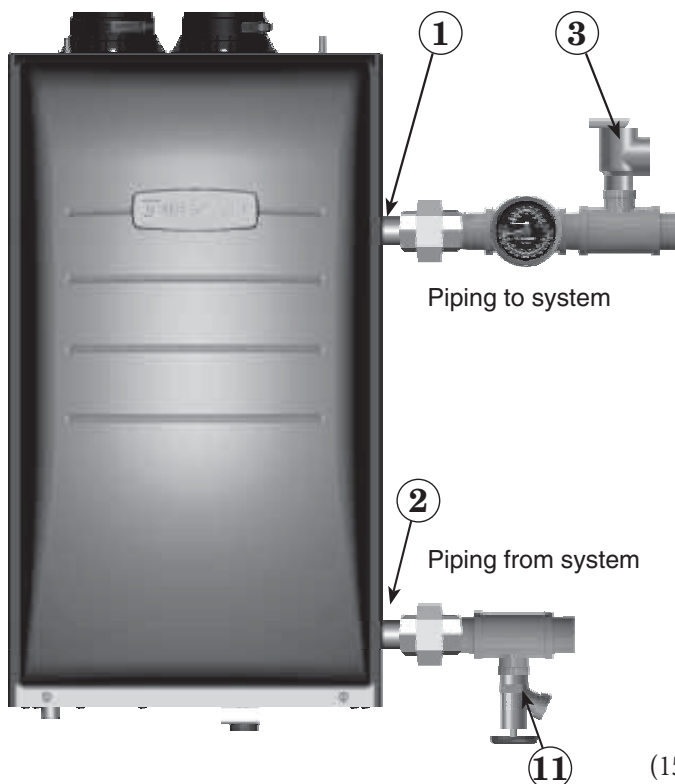
**⚠ WARNING** Use caution when releasing pressure from the boiler. Rapid water flow could cause injury.

3. Remove hose after draining.
4. Remove nipples and valves unless they will remain for use in the system piping.
5. Remove plug and install relief valve as specified in the following WARNING.

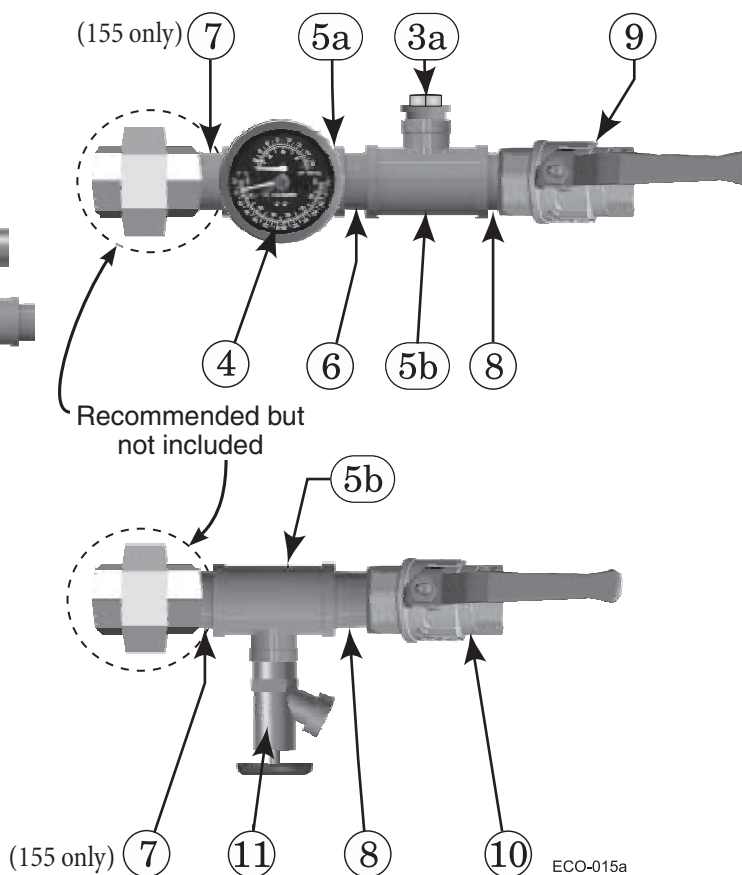
**⚠ WARNING** Remove plug from relief valve street elbow. Install the relief valve in the  $\frac{3}{4}$ " street. See page 45 or page 50 to install relief valve discharge piping. Failure to install the boiler relief valve could result in severe personal injury, death or substantial property damage.

# Boiler hydrostatic test *(continued)*

**Figure 8** Install pipe fittings for relief valve and pressure/temperature gauge — **DO NOT mount relief valve until AFTER hydrostatic testing** (see legend below)



**Figure 9** Install piping components required for hydrostatic test (see legend below)



ECO-015a

- 1 Boiler supply (outlet) connection, (male, 1" NPT )
- 2 Boiler return (inlet) connection, (male, 1" NPT )
- 3 Boiler relief valve, shipped loose with boiler — **DO NOT mount relief valve until AFTER hydrostatic testing.**
- 3a **TEMPORARILY ONLY** — Insert a 3/4" NPT plug in the relief valve tapping of the reducing tee. **This MUST BE REMOVED after the test and the relief valve mounted here.**
- 4 Pressure/temperature gauge, shipped loose with boiler
- 5a Reducing tee, NPT, 1" x 1" x 1/4" on 70/110, & 1 1/4" x 1 1/4" x 1/4" on 155, shipped loose with boiler
- 5b Reducing tee, NPT, 1" x 1" x 3/4" on 70/110, & 1 1/4" x 1 1/4" x 3/4" on 155, shipped loose with boiler
- 6 Nipple, NPT 1" x close on 70/110, & 1 1/4" x close on 155, shipped loose with boiler
- 7 Bushing, NPT, 1 1/4" x 1", shipped loose with boiler (155 only)
- 8 Nipple, NPT 1" x close on 70/110, & 1 1/4" x close on 155, by installer
- 9 Isolation valve on supply connection, by installer (1" NPT on 70/110, 1 1/4" NPT on 155)
- 10 Isolation valve on return connection, by installer (1" NPT on 70/110, 1 1/4" NPT on 155)
- 11 3/4" NPT boiler drain valve, shipped loose with boiler — after hydrostatic testing, move drain valve to lowest point on the return piping if not already there.

# Converting boiler to propane — ECO 70

## Prepare boiler for propane — ECO 70 only (if required)

### Propane operation



**ALL ECO boilers must be converted for propane operation.**

**Converting an 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 79 of this manual.

**Verify 70 propane gas orifice size** — See Figure 10. Verify when installing that the orifice size marking is correct. Orifices will be stamped as in illustration or with “3.75” for model 70.

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

## Installing propane orifice — ECO 70 only



**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.

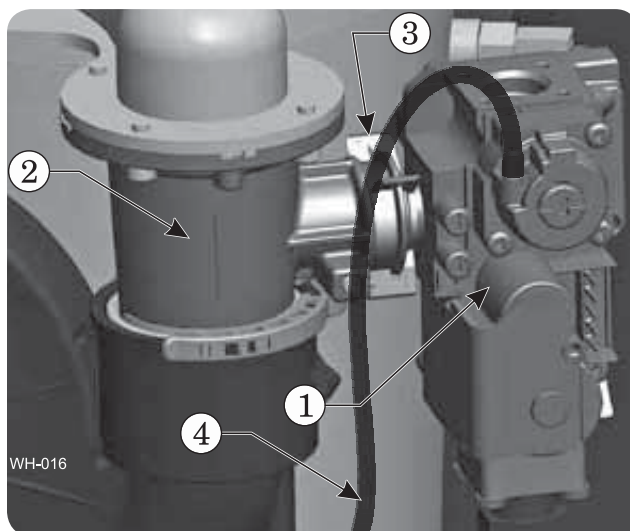
Following conversion of an installed boiler, follow all instructions in this manual to start up the boiler and verify operation of the boiler and all system components.

1. Locate the propane orifice from the propane conversion kit bag.
2. Verify that the stamping on the orifice is correct for the model size (see Figure 10).
3. If the jacket door is not already removed, remove it.
4. Locate the gas valve and venturi (see Figure 11).
5. Pull the gas valve retention ring (item 3, Figure 11) off of the gas valve/venturi joint.
6. Carefully pull the gas valve to the right until it is free of the venturi. Leave the pressure reference hose (item 4, Figure 11) connected at both ends.

**Figure 10** Propane gas orifice identification  
ECO 70 (may be stamped 3.75)



**Figure 11** Gas valve and venturi



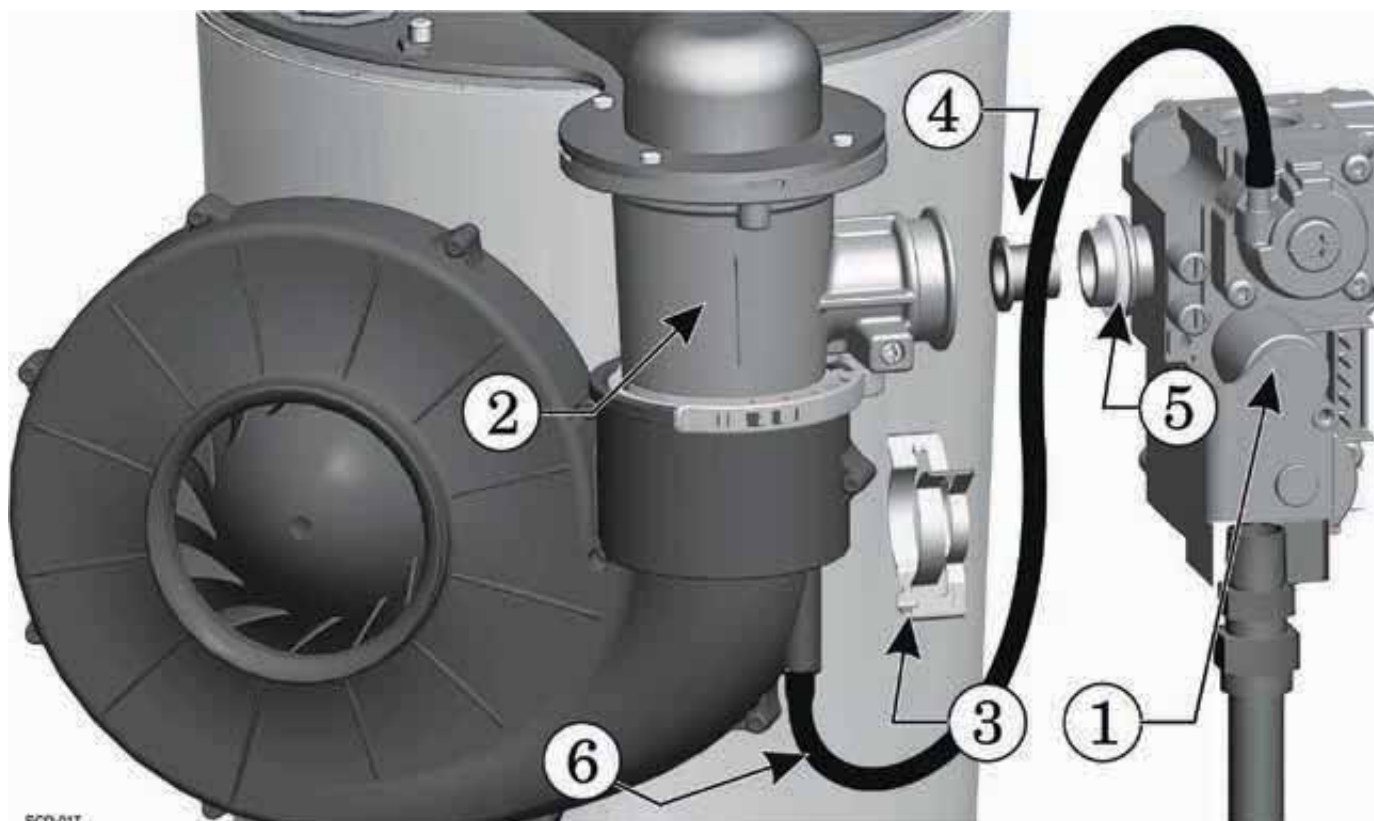
- |   |  |
|---|--|
| 1 | Gas valve  |
| 2 | Venturi  |
| 3 | Gas valve retention ring                               |
| 4 | Pressure reference hose — LEAVE CONNECTED AT BOTH ENDS |



**Support the gas valve after disconnecting it. DO NOT allow it to hang from the gas valve flex line.** When re-attaching the gas valve, ensure the gas valve-to-venturi O-ring (item 5, Figure 12, page 16) is in place and in good condition. Inspect the gas valve flex line to ensure it is undamaged and in good condition.

# **Converting boiler to propane — ECO 70** *(continued)*

**Figure 12** Installing the propane gas orifice (some details omitted for clarity)



7. See Figure 12. Insert the propane gas orifice (item 4) into the gas valve outlet as shown.
8. Press the orifice into the gas valve outlet until the bushing flange butts against the gas valve outlet.

**⚠ DANGER** Inspect the O-rings on the propane gas orifice and on the gas valve outlet (item 5, Figure 12). The O-rings must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

9. Reposition gas valve into the venturi and reinstall the gas valve retention ring (item 3, Figure 12).

**⚠ 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.

10. After installation is complete, attach the propane conversion label (in conversion kit bag) next to the boiler rating plate.
11. Perform complete start-up sequence (beginning on page 79), including check for gas leaks and checking for proper operation.
12. Reinstall jacket door.

## **LEGEND** for Figure 12

- |   |  |
|---|--|
| 1 | Gas valve  |
| 2 | Venturi  |
| 3 | Gas valve retention ring                               |
| 4 | Propane orifice with o-ring                            |
| 5 | Gas valve o-ring                                       |
| 6 | Pressure reference hose — LEAVE CONNECTED AT BOTH ENDS |

## **⚠ WARNING**

**The jacket door must be in place during operation.** DO NOT operate the boiler with the jacket door removed except for inspection and testing as directed in this manual.

# Converting boiler to propane — ECO 110

## Prepare boiler for propane — ECO 110 only (if required)

### Propane operation



**ALL ECO boilers must be converted for propane operation.**

**Converting an 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 79 of this manual.

**Verify 110 propane gas orifice size** — See Figure 13. Verify when installing that the orifice size marking is correct. Orifices will be stamped as in illustration or “3.7” for model 110.

ECO 110 boiler Series 1 and ECO 110 boiler Series 2 boilers use different size orifices. You must confirm the series boiler you have and use the correct orifice size.

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

## Installing propane orifice — ECO 110 only



**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.

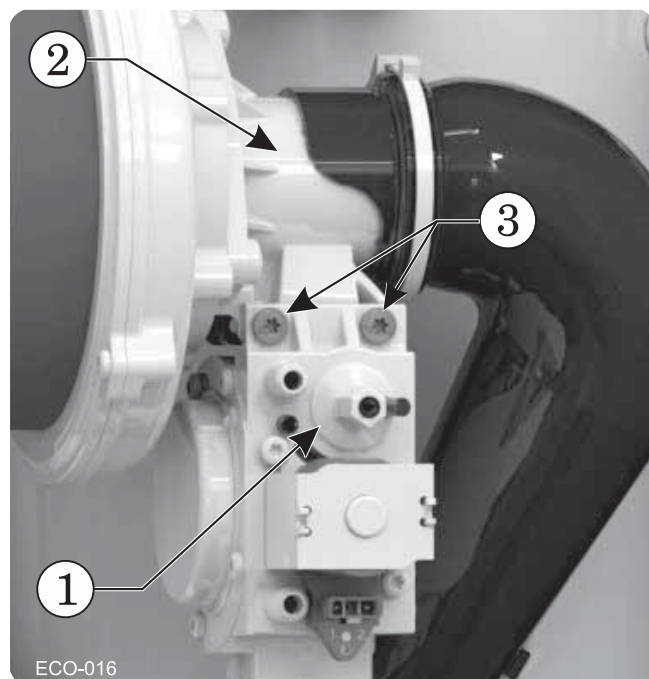
1. Locate the propane orifice from the propane conversion kit bag.
2. Verify that the stamping on the orifice is correct for the model size (see Figure 13).
3. If the jacket door is not already removed, remove it.
4. Locate the gas valve and venturi (see Figure 14).
5. Release the gas line from the silencer bracket clip (item 5, page 18) and rotate it out of the way.
6. Use a T25-mm Torx bit to remove the two (2) bolts (item 3) that secure the gas valve to the venturi.

**Figure 13** Propane gas orifice identification  
ECO 110 (may be stamped 3.7 only)



ECO-160

**Figure 14** ECO 110 Gas valve and venturi



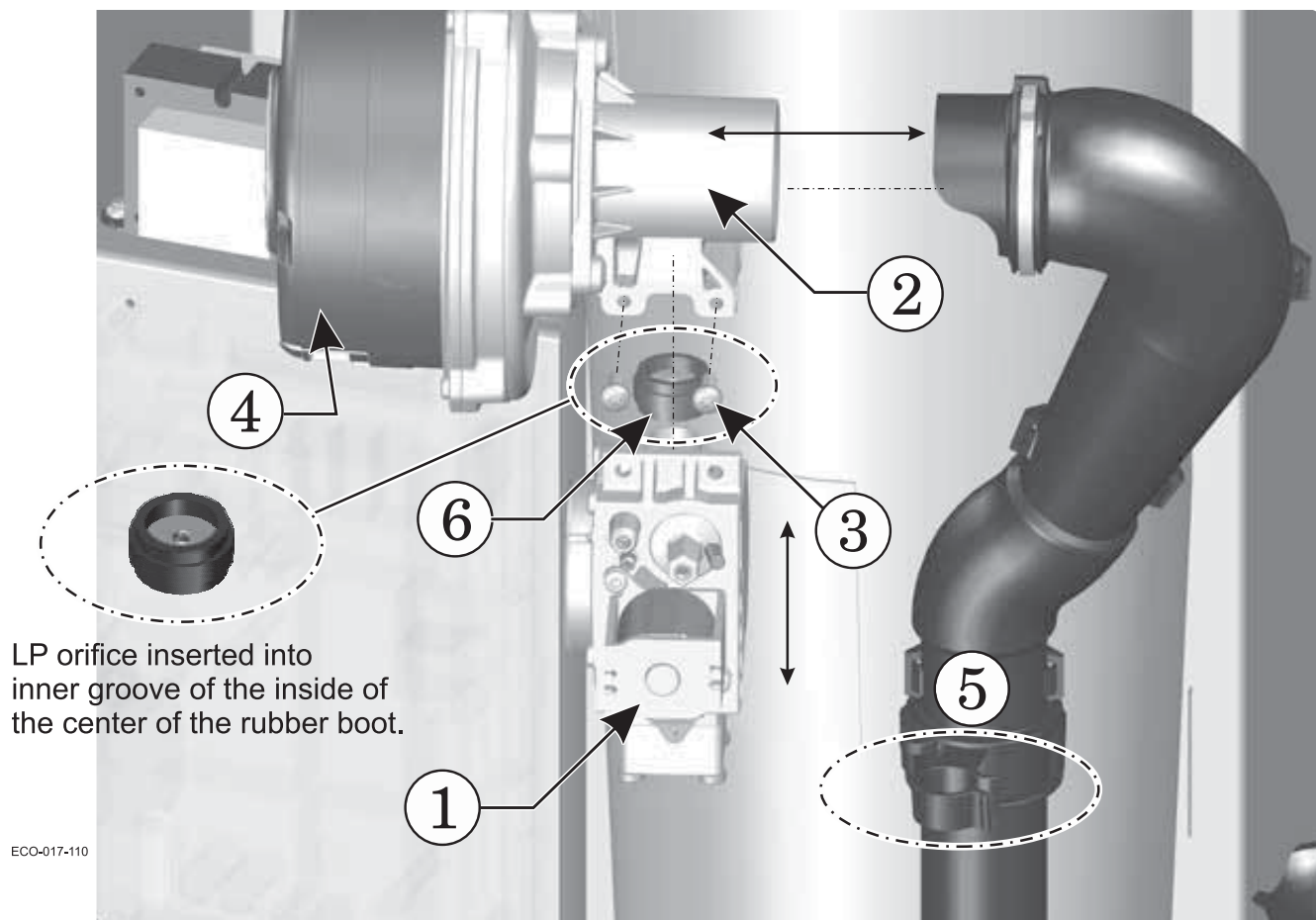
- |   |                             |
|---|-----------------------------|
| 1 | Gas valve                   |
| 2 | Venturi                     |
| 3 | Gas valve screws to venturi |



**Support the gas valve after disconnecting it. DO NOT allow it to hang from the gas valve flex line.** When re-attaching the gas valve, ensure the gas valve propane orifice is properly seated in rubber boot (item 6, Figure 15, page 18) and is in place and in good condition. Inspect the gas valve flex line to ensure it is undamaged and in good condition.

# **Converting boiler to propane — ECO 110** *(continued)*

**Figure 15** Installing the propane gas orifice (some details omitted for clarity)



7. See Figure 15. Carefully pull the gas valve down until it is free of the venturi. Securely support the gas valve — DO NOT leave it dangling.
8. Remove the rubber boot from the gas valve or venturi.
9. Insert the propane gas orifice into the rubber boot. Orifice must be seated into the inner groove inside the center of the rubber boot.
10. Install the rubber boot (item 6) guaranteeing that it is firmly seated on the gas valve opening.

**⚠ DANGER** When re-attaching the gas valve, ensure the gas valve rubber boot (item 6, Figure 15) is in place and in good condition. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

11. Reposition gas valve onto the venturi and reinstall the gas valve retention bolts (item 3). Make sure the rubber boot is fully seated on both the gas valve and venturi.
12. Swing the silencer bracket clip (item 5) back into position and snap on to the gas line.

**⚠ 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.

## **LEGEND** for Figure 15

- 1 Gas valve
- 2 Venturi
- 3 Bolts (2) for attaching gas valve to venturi
- 4 Blower
- 5 Air silencer bracket clip
- 6 Propane orifice with boot

13. After installation is complete, attach the propane conversion label (in conversion kit bag) next to the boiler rating plate.
14. Perform complete start-up sequence (beginning on page 79), including check for gas leaks and checking for proper operation.
15. Reinstall jacket door.

**⚠ WARNING** **The jacket door must be in place during operation.** DO NOT operate the boiler with the jacket door removed except for inspection and testing as directed in this manual.

# Converting boiler to propane — ECO 155

## Prepare boiler for propane — ECO 155 only (if required) Propane operation

**⚠ WARNING** ALL ECO boilers must be converted for propane operation.

**Converting an 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 79 of this manual.

**Verify propane gas orifice size** — See Figure 16. Verify when installing that the orifice size marking is correct. Orifice will be stamped as in illustration.

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

## Installing propane orifice — ECO 155 only

**⚠ 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 the propane orifice from the propane conversion kit bag.
2. Verify that the stamping on the orifice is correct for the model size (see Figure 16).
3. If the jacket door is not already removed, remove it.
4. See Figure 17, page 20 and Figure 18, page 20 for the following.
5. Locate the gas valve and venturi (items 1 and 3).
6. Release the gas line to silencer bracket (item 6) from the gas line and rotate it forward out of the way.
7. Use a 5mm hex wrench to remove the three (3) Allen screws (item 2) that secure the gas valve to the venturi.

**Figure 16** Propane gas orifice identification  
ECO 155



8. See Figure 18, page 20. Carefully pull the gas valve to the right until it is free of the venturi. Securely support the gas valve — DO NOT leave it dangling.

**⚠ WARNING** Support the gas valve after disconnecting from the venturi. DO NOT allow it to hang from the gas valve flex line. When re-attaching the gas valve, ensure the gas valve grommet (item 8, Figure 18, page 20) is in place and in good condition. Inspect the gas valve flex line to ensure it is undamaged and in good condition.

9. Insert the propane gas orifice (item 7) into the gas valve opening as shown in Figure 18, page 20.
10. Make sure that the rubber grommet (item 8) is firmly seated in the gas valve opening.

**⚠ DANGER** When re-attaching the gas valve, ensure the gas valve grommet (item 8, Figure 18, page 20) is in place and in good condition. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

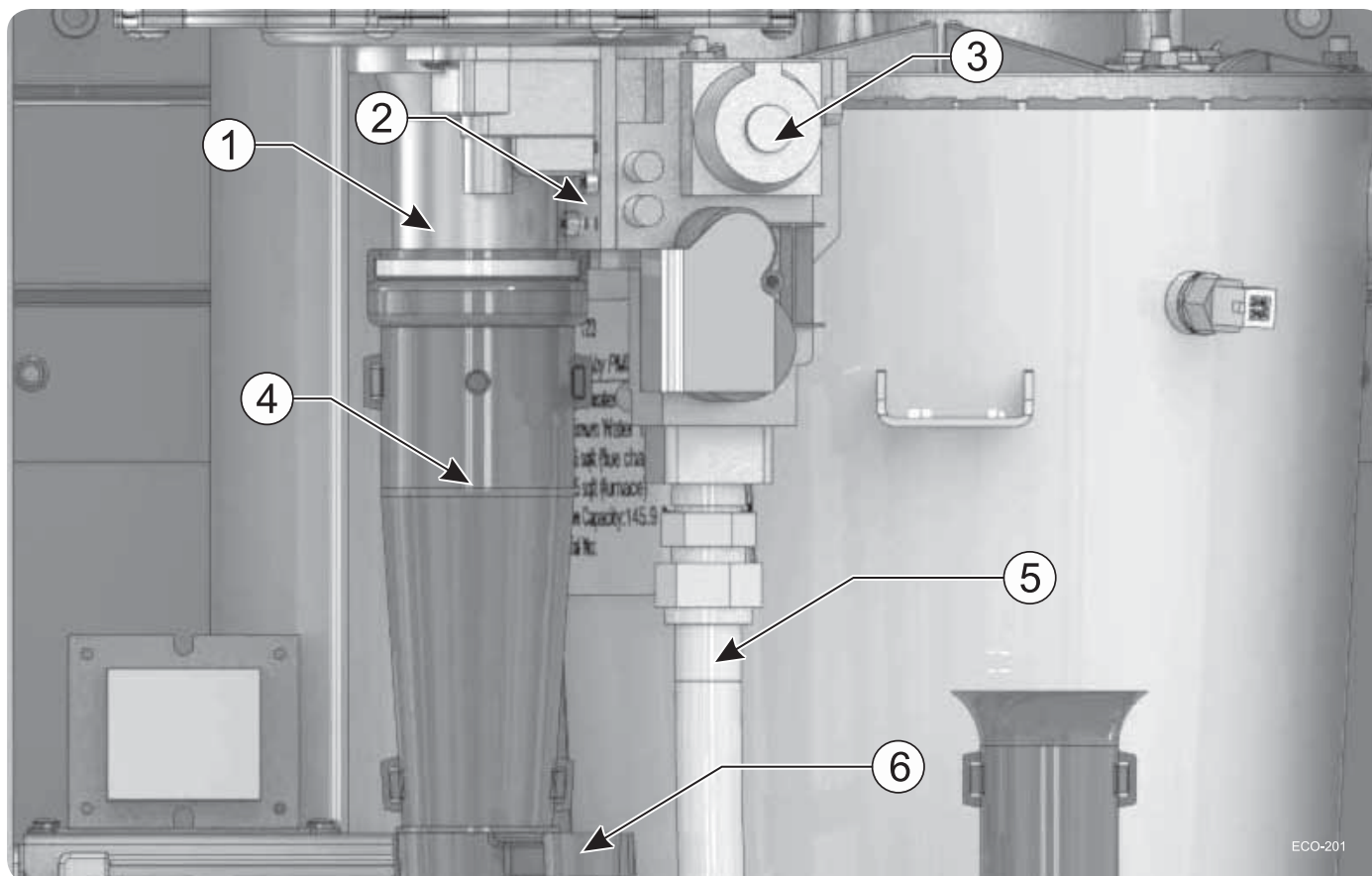
11. Reposition gas valve onto the venturi and reinstall the gas valve retention screws (item 2).
12. Swing the gas line to silencer bracket (item 6) back into position and snap onto the gas line.

**⚠ 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.

13. After installation is complete, attach the propane conversion label (in conversion kit bag) next to the boiler rating plate.

# **Converting boiler to propane — ECO 155** *(continued)*

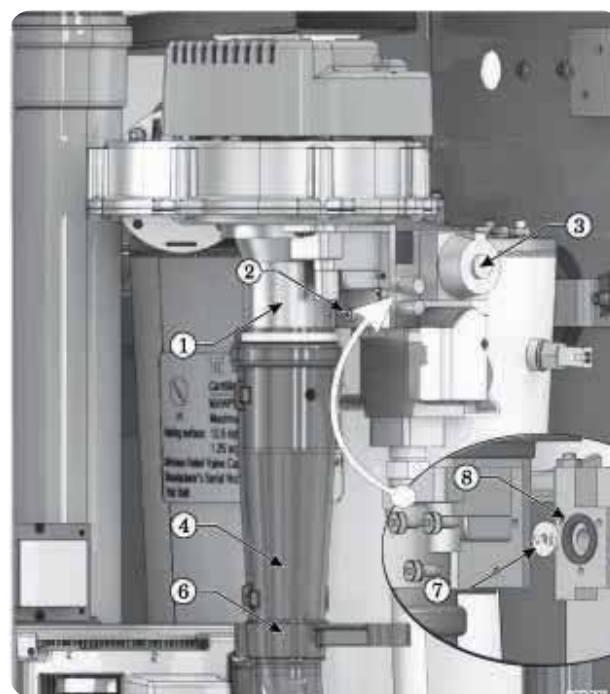
**Figure 17** Installing the propane gas orifice (some details omitted for clarity)



**LEGEND** for Figure 17 and Figure 18

- 1 Venturi (leave venturi attached to blower)
- 2 (3) hex-head screws, 5mm hex (remove and retain)
- 3 Gas valve
- 4 Air silencer (leave connected to venturi)
- 5 Flexible gas line
- 6 Gas line to silencer bracket (rotate forward before disconnecting gas valve from venturi)
- 7 Propane orifice (in propane conversion kit envelope)
- 8 Rubber grommet (must be installed in valve for all applications) — make sure grommet is properly seated in valve before inserting the propane orifice

**Figure 18** Gas valve and venturi



- 14. Perform complete start-up sequence (beginning on page 79), including check for gas leaks and checking for proper operation.
- 15. Reinstall jacket door.



**The jacket door must be in place during operation.** DO NOT operate the boiler with the jacket door removed except for inspection and testing as directed in this manual.

# Gas piping — sizing gas lines

**NOTICE**

Boiler gas connection is ½" NPT. Size gas lines large enough to provide gas to all connected appliances.

## Natural Gas:

### Pipe sizing for natural gas

- Size gas piping from meter outlet to entrance of boiler in accordance with Figure 19 and Figure 20.
- Use total input of all connected appliances. Divide total input in Btuh by 1,000 to obtain cubic feet per hour of natural gas.
  - Pipe lengths in Figure 19 are equivalent length of straight pipe. Convert pipe fittings to equivalent lengths using data from Figure 20.
  - Figure 19 is only for natural gas with specific gravity 0.60, with a pressure drop through the gas piping as listed in the table.
  - For additional gas pipe sizing information, refer to ANSI Z223.1 NFPA 54 - latest edition (or Natural Gas and Propane Installation CAN/CSA B149.1 or B149.2 for Canadian installations).

### Natural gas supply pressure

- Pressure required at gas valve inlet pressure port:
  - Maximum: 13" (330 mm) w.c. with no flow (lockup).
  - Minimum gas pressure, with gas flowing (verify during boiler startup, while boiler is at high fire):  
ECO 70: 3½" (89 mm) w.c.  
ECO 110: 3½" (89 mm) w.c.  
ECO 155: 3½" (89 mm) w.c.
  - Nominal gas pressure: 7.0" (178 mm) w.c.
- 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 Gas:

**WARNING**

You must follow the instructions, beginning on page 15, to operate the boiler on propane. Failure to comply could result in severe personal injury, death or substantial property damage.

### Pipe sizing for propane gas

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

### Propane supply pressure

- Adjust propane supply regulator provided by gas supplier for 13" (330 mm) w.c. maximum pressure.
- Pressure required at gas valve inlet pressure port:
  - Maximum: 13" (330 mm) w.c. with no flow (lockup).
  - Minimum gas pressure, with gas flowing (verify during boiler startup, while boiler is at high fire):  
ECO 70: 3½" (89 mm) w.c.  
ECO 110: 3½" (89 mm) w.c.  
ECO 155: 3½" (89 mm) w.c.
  - Nominal gas pressure: 11.0" (279 mm) w.c.

**Figure 19** Pipe capacity for 0.60 specific gravity natural gas; pipe length is in equivalent feet.

Gas pipe total length, feet	Capacity						
	Cubic feet per hour, natural gas, 0.60 specific gravity Gas pressure 13" (330 mm) w.c. or less Pressure drop 0.3 inches (7.6 mm) w.c.						
	½"	¾"	1"	1¼"	1½"	2"	2½"
10	132	278	520	1050	1600	3050	4800
20	92	190	350	730	1100	2100	3300
30	73	152	285	590	890	1650	2700
40	N/A	130	245	500	760	1450	2300
50	N/A	115	215	440	670	1270	2000
75	N/A	105	175	360	545	1020	1650
100	N/A	96	150	305	460	870	1400
150	N/A	90	120	250	380	710	1130

**Figure 20** Equivalent lengths of straight pipe for typical gas line fittings.

Pipe size inches	Equivalent length, feet			
	90° Elbow		Tee	
	short radius	long radius	line flow	branch flow
½	3.6	2.2	1.7	4.2
¾	4.4	2.3	2.4	5.3
1	5.2	2.7	3.2	6.6
1¼	6.6	3.2	4.6	8.7
1½	7.4	3.4	5.6	9.9
2	8.5	3.6	7.7	12.0
2½	9.3	4.0	9.3	13.0

## Venting/air piping — general

Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 - latest edition, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 - latest edition, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1.

**⚠ DANGER** Do not install the ECO 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 ECO boiler cannot be common vented with any other appliance.** When an existing boiler is replaced with an ECO boiler, the ECO boiler CANNOT use the existing common vent. The ECO 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

Perform the test sequence below for **each** appliance remaining on the original common vent system. Operate each appliance individually, with other appliances turned off. This procedure will test whether the common vent system can properly vent each appliance.

#### Existing vent test procedure

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

1. Seal any unused openings in the common venting system.
2. 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.
3. 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.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. 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.
6. 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.

#### ⚠ WARNING

**You must pipe combustion air to the boiler air intake.**

Install air inlet piping for the ECO boiler as described in this manual.

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.

Ensure that the combustion air will not contain any of the contaminants in Figure 16. Do not pipe combustion air 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.

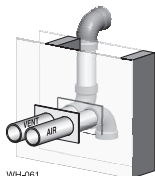
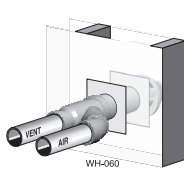
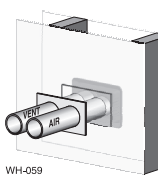
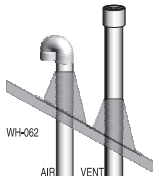
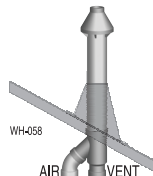
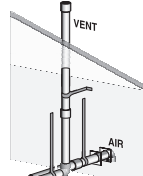
**Figure 21** Corrosive contaminants and sources

Products to avoid
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Excessive dust and dirt
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

# Venting & air — general *(continued)*

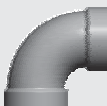

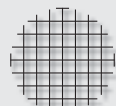
**Figure 22 ECO venting and air piping — DIRECT VENT ONLY — OPTIONS and PIPING LIMITS**
**NOTICE**

The table below lists the acceptable vent/air pipe terminations described in this manual. Follow all instructions provided to install the vent/air system. **NOT SHOWN** below, but also approved, are the polypropylene piping and terminations listed in Figure 23, page 24. For these applications, use **ONLY** the manufacturers' parts listed and follow all instructions provided by the pipe manufacturer.

Maximum vent and air pipe length = 100 feet for all applications (Minimum length for all applications is 2 feet)												USE SWEEP ELBOWS ONLY		
ECO Model	(All applications include allowance for the termination fittings plus one elbow in air piping and one elbow in vent piping).													
	See Figure 23, page 24 for material specifications   See Figure 119, page 115 for part/kit numbers													
	Vent and air pipe sizes: Maximum vent lengths apply for either 2" or 3" vent and air pipe. If using 2" pipe, provide 3"x 2" tapered reducers at boiler connections and at Weil-McLain vent/air cap or at concentric terminations. Boilers will derate as vent/air pipe length increases — see rating data on Figure 132, page 127 for derate amounts.													
	SIDEWALL termination						VERTICAL termination							
	Separate pipes [Note 1]		PVC or PP Concentric [Note 1]		3" Weil-McLain PVC vent/air cap [Note 1]		Separate pipes [Note 1]		PVC or PP Concentric [Note 1]		Vertical Vent, Side Air [Note 1]			
														
	See page 28		See page 30		See page 32		See page 32		See page 36		See page 38			
	Size, inches	Materials Fig. 23, page 24	Size, inches	Materials Fig. 23, page 24	Size, inches	Materials Fig. 23, page 24	Size, inches	Materials Fig. 23, page 24	Size, inches	Materials Fig. 23, page 24	Size, inches	Materials Fig. 23, page 24		
	70	2	PVC/PVC-DWV CPVC, PP, SS	2	PVC/PVC-DWV CPVC, PP, SS	2	PVC/PVC-DWV CPVC, PP, SS	2	PVC/PVC-DWV CPVC, PP, SS	2	PVC/PVC-DWV CPVC, PP, SS	2	PVC/PVC-DWV CPVC, PP, SS	
3		PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS		
110	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC Concentric only	—	—	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS		
155	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, SS, PP**	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, PP, SS	3	PVC/PVC-DWV CPVC, SS,	3	PVC/PVC-DWV CPVC, PP, SS		
	** Model 155 may be concentric sidewall vented using Centrotherm polypropylene pipe (Eco Systems InnoFlue® Single-wall) ONLY if using Centrotherm stainless steel concentric termination kit, part number ICWS3513.													
<div><div>⚠ WARNING</div><div>All elbows in vent and air piping must be sweep elbows ONLY. DO NOT use short-radius elbows. When transitioning to 3" to 2", use tapered reducer with 3" PVC nipple (L ≥ 6"). Do not use 3" to 2" bushing. Bushings will not seal in boiler adapters.</div></div>														
Equivalent feet for elbows (USE SWEEP ELBOWS ONLY) — deduct from max. equivalent length of piping (does not apply to termination fittings). PVC • 7 feet per for each additional 90° sweep elbow or 45° elbow — If piping contains more than 1 elbow in air or vent piping, other than termination fittings. PP • Centrotherm 3" = 6' 4" = 20' Duravent 3" = 17' 4" = 22'														
Note 1:	Material abbreviations: PP = polypropylene, SS = AL29-4C stainless steel If using polypropylene or stainless pipe, provide adapters to for 3" boiler connections and for terminations, if required IPEX 3" PVC concentric vent kits can be used with standard PVC pipe, fittings and cement (ANSI/ASTM D1785) except if ULC S636 compliance is required. For ULC S636 compliance, all pipe, fittings and cement must be IPEX System 636. If using IPEX kits, use only IPEX product code 196006 for 3" venting. Contact Weil-McLain for ordering information and availability of Weil-McLain venting kits.													
Note 2:	Use only Weil-McLain approved termination kits listed in Figure 119, page 115.													

# Venting & air — general *(continued)*

**Figure 23 Vent and air piping materials** — Use only the materials listed below, ensuring that all materials meet local codes (see Figure 119, page 115 for part/kit numbers)

Item	Material	Standards for installations in:		
		United States	Canada (Note 2)	
Plastic piping materials		Vent or air piping	Vent piping	Air piping
Vent or air pipe & fittings	PVC schedule 40 (Note 1)	ANSI/ASTM D1785	ULC S636	PVC, PVC-DWV, CPVC or polypropylene
	PVC-DWV schedule 40 (Note 1)	ANSI/ASTM D2665	N/A	
	CPVC schedule 40 (Note 1)	ANSI/ASTM F441	ULC S636	
	ABS-DWV schedule 40 (intake only)	ANSI/ASTM D2261	ULC S636	
PVC & ABS pipe cement & primer	PVC (Note 1)	ANSI/ASTM D2564/F656	ULC S636	Use only cement and primer suitable for piping material used
	CPVC (Note 1)	ANSI/ASTM F493	ULC S636	
	ABS (Note 1)	ANSI/ASTM D2235	ULC S636	
Polypropylene vent pipe, fittings, terminations and cement	<b>Simpson-Duravent</b> — Obtain all materials from M&G Simpson-Duravent <b>Centrotherm Eco Systems InnoFlue® Single-wall</b> — Obtain all materials from Centrotherm Note: See page 115 for correct appliance adapters to be used.	See manufacturer's literature for detailed information <b>MUST USE LOCKING COLLAR ON EVERY JOINT</b>	ULC S636	PVC, PVC-DWV, CPVC or polypropylene
AL29-4C® stainless steel piping materials				
Vent pipe AL29-4C® stainless steel	Heat Fab, Inc. — Saf-T-Vent® Z-Flex, Inc. — Z-Vent II Dura-Vent — FasNSeal™ Metal-Fab, Inc. — CORR/GUARD Centrotherm Eco Systems — InnoFlue®	Certified for Category IV and direct vent appliance venting	Certified for Category IV and direct vent appliance venting	
Weil-McLain stainless steel bird screens, 2" or 3" (purchase separately) — see Figure 119, page 115 for part numbers				
Note 1:	Weil-McLain concentric vent kits are made from PVC pipe and fittings.	<div>⚠ WARNING</div> ADAPTERS — AL29-4C piping — Install a PVC-to-stainless adapter supplied by the AL29-4C stainless pipe manufacturer at the 3" PVC boiler vent connection and at the termination (if using Weil-McLain plate or concentric PVC termination).  ADAPTERS — Polypropylene piping — Provide adapters from polypropylene pipe to the 3" PVC connections at the boiler and at terminations, if required (Weil-McLain sidewall plate, for example).  ADAPTERS — If using 2" piping, where approved for the application, provide adapters for the 3" PVC boiler connections and at the terminations, if required (Weil-McLain sidewall plate, for example)		
Note 2:	System 636 PVC concentric terminations utilize PVC pipe/fittings certified to ULC S636. If ULC S636 compliance is required, use only System 636 pipe, fittings and cement.			
⚠ WARNING	DO NOT mix piping from different pipe manufacturers unless using adapters specifically designed for the purpose by the manufacturer.			
⚠ WARNING	Every joint on <b>polypropylene vent piping must</b> include a locking collar.			
⚠ WARNING	DO NOT use cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in venting systems.			
⚠ WARNING	DO NOT cover non-metallic vent pipe and fittings with thermal insulation.			
		<div>⚠ WARNING</div> <b>USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING</b> — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.		
	<div>⚠ WARNING</div> <b>ALL</b> vent and air pipes require a <b>BIRD SCREEN at each termination</b> . Most kits do not include the bird screens. Purchase bird screens separately from Weil-McLain or vent kit supplier if not included. [Note — bird screening is integral to the 3" PVC Weil-McLain sidewall vent cap, available for purchase from Weil-McLain. No additional screening is required.]			

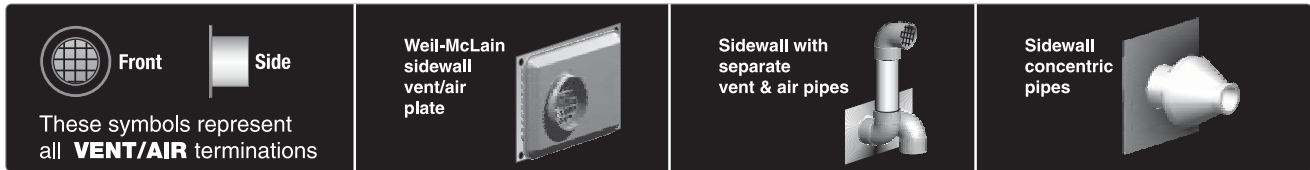
# Commonwealth of Massachusetts installations

**Commonwealth of Massachusetts** — When the boiler is installed within the Commonwealth of Massachusetts, the boiler must be installed by a licensed plumber or gas fitter. Read and comply with the instructions below.

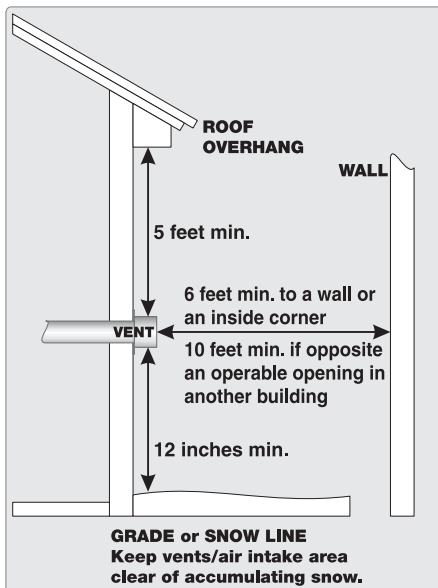
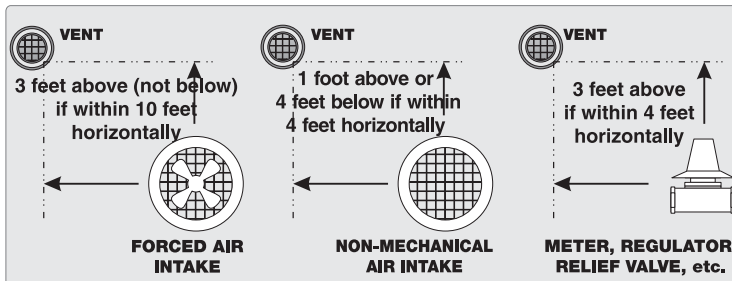
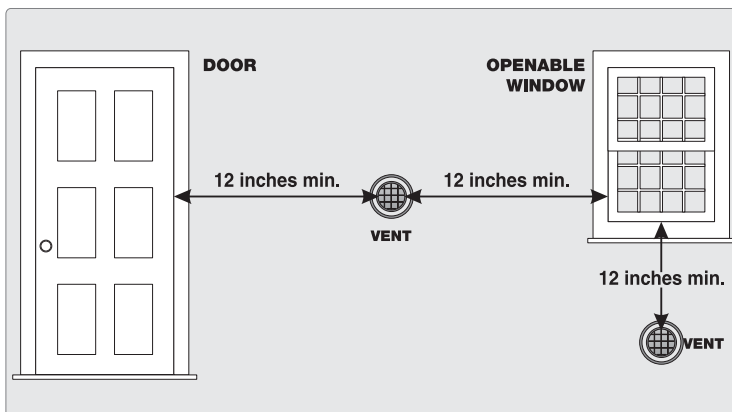
- (a) For all sidewall horizontally-vented gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above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

# Vent termination requirements

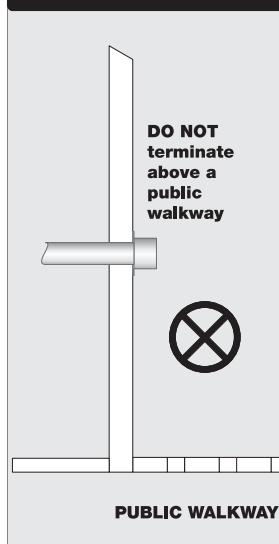
**Figure 24** The vent termination must be located to meet all requirements below (also applies to vertical vent terminations). The minimum distance from adjacent public walkways, adjacent buildings, openable windows and building in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1. The vent termination clearances below are for U.S.A., for Canadian vent termination clearances please refer to the requirements of CAN/CSA B149.1 Natural Gas and Propane Installation Code. Consideration should be given to avoid possible damage caused by vent plumes and condensate when choosing a venting configuration and location. Maintain a minimum clearance of 4 ft. (1.22m) horizontally from, and in no case above or below, unless a 4 ft. (1.22m) horizontal distance is maintained, from electrical meters, gas meters, regulators, and relief equipment.



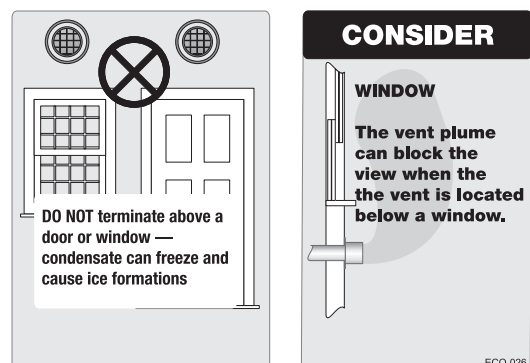
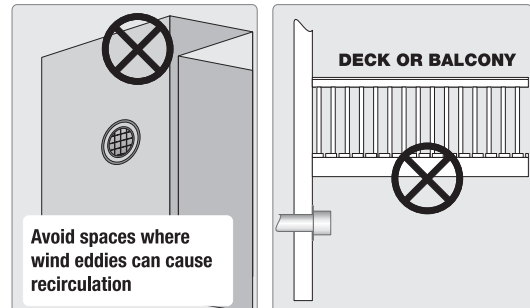
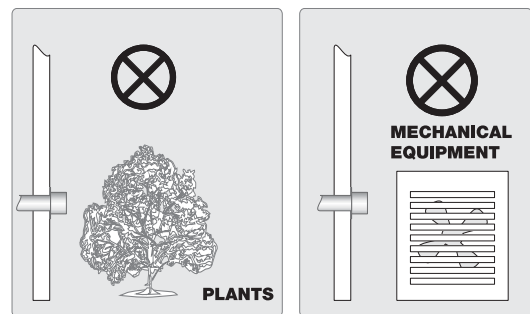
## MINIMUM CLEARANCES



## DO NOT TERMINATE:



## DO NOT TERMINATE:



# Boiler room air openings

**Figure 25** Combustion and ventilation air openings for Direct Vent installations, also follow the National Fuel Gas Code, ANSI Z223.1/NFPA 54 - latest edition, and/or Natural Gas and Propane Installation Code, CAN/CSA B149.1 or applicable provisions of the local building codes.

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<div><div><div><div><div><div></div><div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div></div><div><div><div></div></div><div><div></div></div></div><div><div><div></div></div></div></div><div><div><div></div></div></div></div><div><div><div></div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> <div><div><div></div></div></div> 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# DIRECT VENT — Sidewall with separate pipes

## Allowable vent/air pipe materials & lengths

**▲WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

1. Locate the termination such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 22, page 23.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler vent and air connections. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition piece at the boiler vent connection. The air piping must be PVC or CPVC. Provide a 3" PVC transition piece at the boiler air connection if using 2" air piping.

## Determine termination location

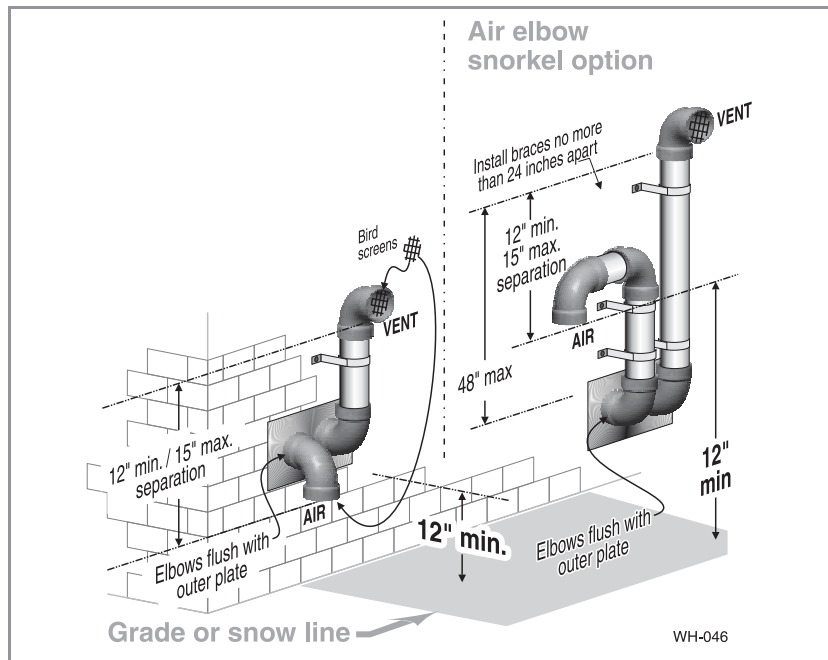
1. The air and vent terminations must be installed as shown in Figure 26 and Figure 28, page 29.
2. The terminations must comply with clearances and limitations shown in Figure 24, page 26.
3. Locate the terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

**▲WARNING** Do not exceed the maximum lengths of the outside vent piping shown in Figure 26. 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 if using longer lengths. The chase must allow for inspection of the vent pipe, and insulation must be protected from water.

## Multiple vent/air terminations

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

Figure 26 INSTALLATION SEQUENCE — Separate pipes sidewall



- Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.**  
**Polypropylene AL29-4C S.S.** See notices at left.
- Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected sidewall location.
- Step 3** Make sure the selected sidewall termination location complies with Figure 24, page 26. (Multiple boiler sidewall plates must also comply with Figure 27, page 29.)
- Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required. Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.
- Step 5** Prepare the sidewall penetrations and secure the sidewall plates as instructed in this section. See "Prepare wall penetrations" on page 29. **Polypropylene AL29-4C S.S.** See notices at left.
- Step 6** The air piping must terminate in a **down-turned elbow** as shown above. The vent piping must terminate in an **elbow pointed outward or away from the air inlet** as shown above. See illustration above.
- Step 7** Install vent and air piping between the boiler and the sidewall openings. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. See page 41 for general guidelines. **Polypropylene AL29-4C S.S.** See notices at left.
- Step 8** Install pipe supports every 5 feet on both the horizontal and vertical runs. Install a hanger support within 6 inches of any upturn in the piping, or per vent pipe manufacturer's instructions. **Polypropylene AL29-4C S.S.** See notices at left.
- Step 9** Attach the vent termination exterior piping: Use either of the configurations shown above, as needed to ensure clearance above grade or snow line.
- Step 10** The vent and air pipes may run up as high as 4 feet 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.
- Step 11** 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 the illustration above, maintaining all required clearances.



**▲WARNING**

**USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING**  
— DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Sidewall with separate pipes *(continued)*

Polypropylene AL29-4C S.S. See notices on previous page.

- ⚠ 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.
- Place wall penetrations to obtain minimum clearances shown in Figure 27 for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.
  - The air inlet of a ECO 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.

## Prepare wall penetrations

- Air pipe penetration:
  - Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
- Vent pipe penetration:
  - 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.
  - Insert a galvanized metal thimble in the vent pipe hole as shown in Figure 28.
- Use the provided paper template for correct location of hole centers.
- Use of a sidewall termination plate is REQUIRED.
  - Kits for several vent sizes are available from Weil-McLain. See "VENT/AIR PARTS AND KITS" on page 115.
  - Plate may be field fabricated from corrosion resistant material of sufficient strength. Plate must allow venting to maintain minimum clearance to combustibles.

- ⚠ WARNING** Ensure that the plate material is strong enough to prevent the termination from being pushed inward if struck or pushed from the outside.

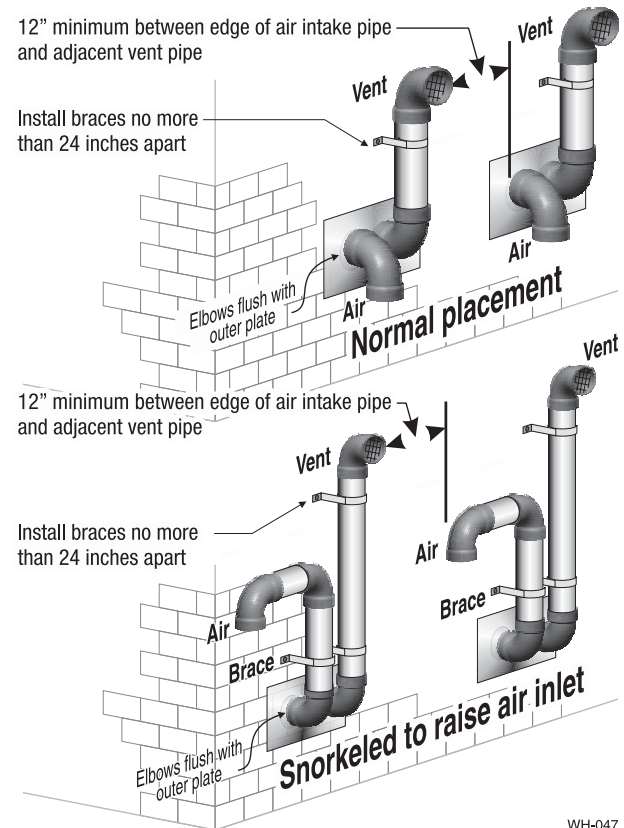
- Follow all local codes for isolation of vent pipe when passing through floors or walls.
- Seal exterior openings thoroughly with exterior caulk.

## Termination and fittings

- Prepare the vent termination elbow and the air termination elbow by inserting bird screens. (See Figure 26, page 28.) Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
- Secure the elbows so they will butt against the sidewall termination plate.
- 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 26, page 28.
- You can orient the vent termination elbow either directly outward or 90 degrees away from the air inlet elbow as shown in Figure 26, page 28.
- Maintain the required dimensions of the finished termination piping as shown in Figure 26, page 28.
- For multiple boiler terminations, see Figure 27.
- Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

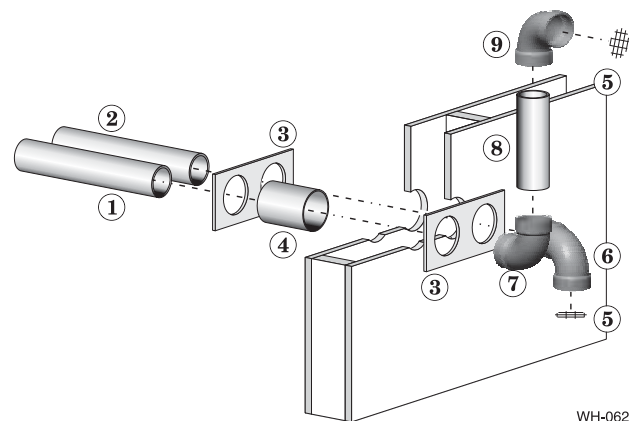
**NOTICE** If extending the vent and air pipes out from the wall, install a coupling on each pipe. Mount the piping with the coupling flush with the outer plate.

**Figure 27** Multiple separate pipes sidewall terminations — maintain vertical spacing between vent and air fittings shown in Figure 26, page 28



WH-047

**Figure 28** Sidewall termination assembly — using separate pipes



WH-062

- |   |                                     |
|---|-------------------------------------|
| 1 Vent piping   | 4 Galvanized thimbles, by installer |
| 2 Air piping  | 5 Bird screen, by installer         |
| 3 Sidewall termination plates: for 3" PVC, use plates supplied with boiler in W-M vent/air plate kit; for 3" AL29-4C or 2" PVC, purchase optional sidewall separate pipes plate kit | 6 Air inlet elbow                   |
|   | 7 Elbow                             |
|   | 8 Nipple                            |
|   | 9 Elbow (vent termination)          |

# DIRECT VENT — Sidewall concentric

## Allowable vent/air pipe materials & lengths

1. The concentric termination kit must be purchased separately.

**▲WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

2. Locate the termination such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 22, page 23.
3. This termination requires a 45-degree elbow that is not supplied with the termination kit. The maximum vent/air pipe lengths include allowance for this elbow.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler vent and air connections and at the termination if using a 3" PVC concentric vent kit. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition at the boiler vent connection. Air pipe must be PVC or CPVC. Provide a 3" PVC transition at the boiler air connection if using 2" air pipe. Provide transition pieces to PVC at the vent and air pipe termination connections.

## Determine termination location

1. The concentric termination kit must be installed as shown in Figure 31, page 31.
2. The termination must comply with clearances and limitations shown in Figure 24, page 26.
3. Locate the termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

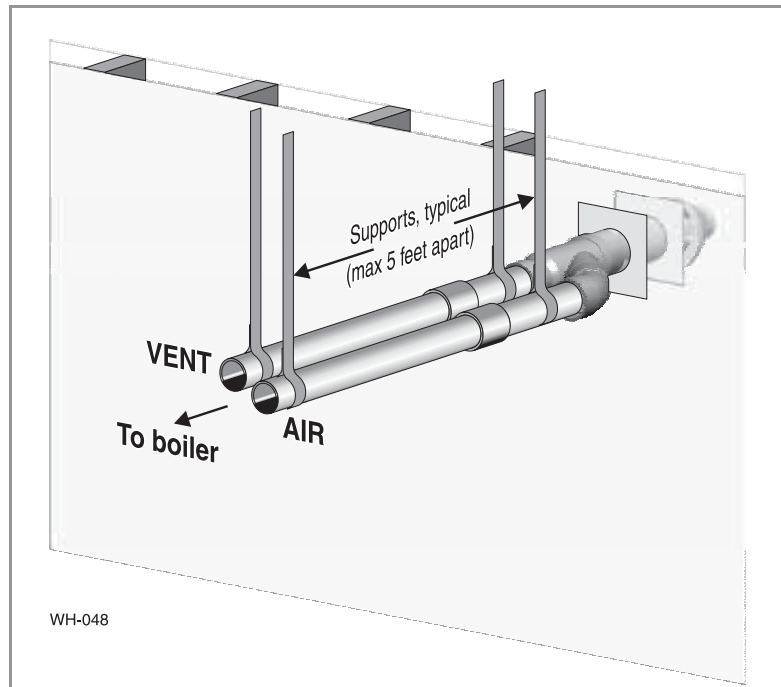
## Multiple vent/air terminations

1. When terminating multiple ECO boilers, install each concentric termination 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 as shown in Figure 30, page 31 for U. S. installations. For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.
3. The air inlet of a ECO boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 29 INSTALLATION SEQUENCE — Concentric horizontal



**Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.** **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected sidewall location.

**Step 3** Make sure the selected sidewall termination location complies with Figure 24, page 26. (Multiple boiler concentric terminations must also comply with Figure 30, page 31.)

**Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required.

**Step 5** Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.

**Step 6** The concentric termination must be assembled and installed before piping from the boiler to the termination.

**Step 7** Prepare the sidewall penetration — assemble the concentric termination kit and secure the cover plates as instructed in this section. Provide the supports indicated and mount the termination assembly. See "Install termination — concentric pipes" on page 31. **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 8** Install vent and air piping between the boiler and the concentric vent/air termination. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. See page 41 for general guidelines.

**Step 9** Install pipe supports every 5 feet on both the horizontal and vertical runs. **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 10** Install a hanger support within 6 inches of any upturn in the piping. **Polypropylene** **AL29-4C S.S.** See notices at left.



### ▲WARNING

**USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Sidewall concentric *(continued)*

Polypropylene AL29-4C S.S. See notices on previous page.

## Install termination — concentric pipes

1. Assemble the vent termination as described for concentric terminations, on page 40.

**▲WARNING** If necessary, you can shorten the lengths of the inner and outer pipes for a shorter finished assembly. But you must ensure the pipes butt correctly at both ends. Failure to properly assemble the concentric termination can result in flue gas recirculation, causing possible severe personal injury or death.

2. Wall penetration:

- a. Preferably, use a thimble with a 4½-inch hole. If not using a thimble, carefully use a hole saw to cut a hole not larger than 4¾ inches in diameter through the wall. The finished hole must provide a solid stop for the rain cap ribs, as shown in the inset to Figure 31.

**▲WARNING** Ensure that the wall material is strong enough to prevent the rain cap from being pushed inward if struck or pushed from the outside.

3. Secure the termination in place so the rain cap will butt against the outside wall or outer thimble plate as shown in Figure 31.
4. Before beginning vent and air piping from the boiler to the concentric termination, mount and secure the concentric termination as shown in Figure 31.

**▲WARNING** The vent and air piping must be securely supported, and must not rest its weight on the boiler fittings. Failure to properly support the vent and air piping could result in vent piping damage, resulting in possible severe personal injury, death or substantial property damage.

The supports/bracing used must support the termination assembly to prevent slippage or movement. See instructions provided with concentric kit for details.

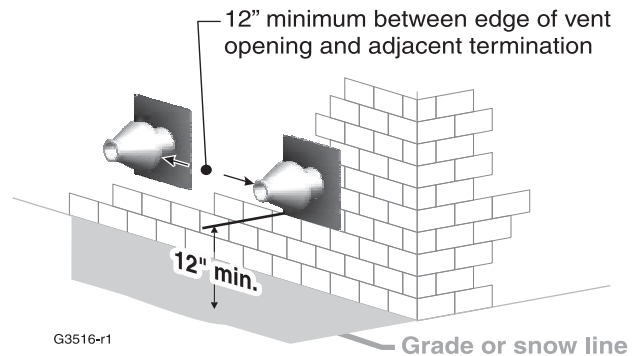
The clamps used on the outside of the termination pipe must not cut into the pipe or contain sharp edges that could cause a crack to form.

**▲WARNING** When inserting the partially-assembled termination kit through the wall penetration, wrap plastic or other protection over the end of the exposed assembly to prevent debris from entering the pipes. If the air passages become blocked, the boiler will not operate. Once the rain cap has been cemented to the assembly, there is no way to correct the problem. The assembly would have to be replaced if it were cut to be removed and cleaned. Altering the assembly in any way could result in severe personal injury or death due to toxic flue product emissions.

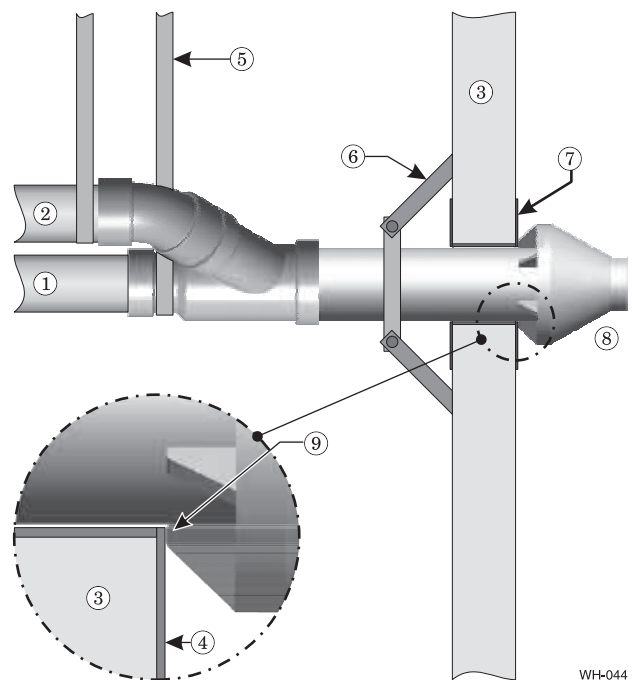
**▲WARNING** If using AL29-4C stainless vent pipe, use the vent pipe manufacturer's PVC adapter if connecting to a PVC concentric vent attachment.

5. After the assembly has been positioned in the opening and all supports have been attached, install a bird screen (purchased separately if not included with the kit) and rain cap as follows:
  - a. Place the bird screen on the end of the inner pipe as in Figure 44, page 40, or per concentric kit instructions for polypropylene kits.
  - b. Cement the rain cap in place as shown.

**Figure 30** Termination location — concentric termination — multiple boilers — clearance from vent of one to air intake of the next



**Figure 31** Installing and supporting the concentric sidewall vent assembly



### LEGEND

1 Vent pipe	6 Wall brace, by installer, (or see vent pipe mfg's instructions)
2 Air pipe	7 Thimble, by installer
3 Wall	8 Rain cap
4 Outer thimble plate	9 Rain cap ribs must butt against outer thimble plate or wall opening
5 Supports every 5 feet or per vent pipe mfg's instructions	

# DIRECT VENT — Sidewall with W-M vent/air plate

## Allowable vent/air pipe materials & lengths

**⚠ WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

1. Locate the termination such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 22, page 23.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler vent and air connections and at the vent termination. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler and at the vent and air terminations. (The air pipe must be PVC or CPVC.)

## Determine termination location

1. The vent/air cap must be installed as shown in Figure 35, page 33.
2. The termination must comply with clearances and limitations shown in Figure 24, page 26.
3. Locate the termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

## Multiple vent/air terminations or termination adjacent to other appliance terminations

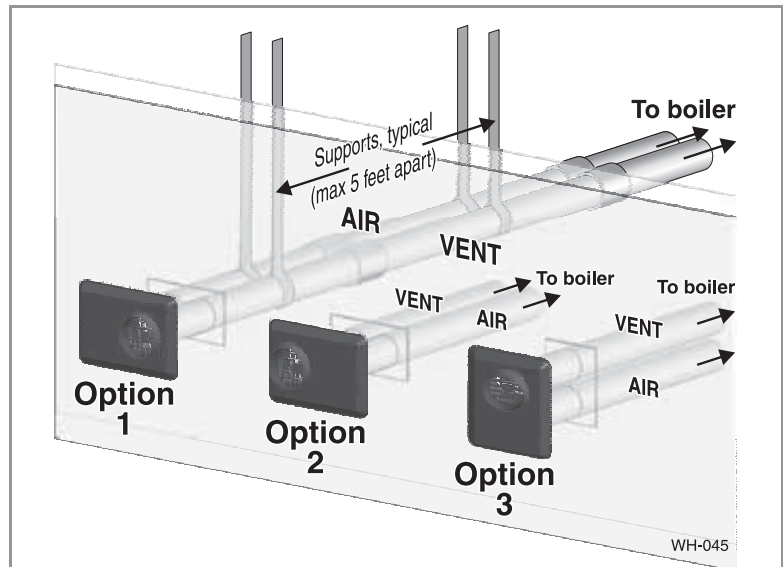
1. When terminating multiple ECO boilers, terminate each vent/air connection as described in this manual.

**⚠ 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 as shown in for U. S. installations. For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.
3. The air inlet of a ECO 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.

**⚠ WARNING** For terminations of other appliances, provide at least the clearance shown. The installation must also comply with the manual for the other appliances.

Figure 32 INSTALLATION — W-M sidewall vent/air plate



Vent/air pipes and vent/air can be oriented as option 1, 2, or 3. DO NOT mount with plate vertical and vent outlet down.

- Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.** **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected sidewall location.
- Step 3** Make sure the selected sidewall termination location complies with Figure 24, page 26. (Multiple boiler sidewall plates must also comply with Figure 33, page 33.)
- Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required.
- Step 5** Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.
- Step 6** Prepare the sidewall penetrations and secure the sidewall plates as instructed in this section. See "Install Weil-McLain vent/air cap" on page 33.
- Step 7** The Weil-McLain plate termination must be installed before piping from the boiler to the termination.
- Step 8** Install vent and air piping between the boiler and the vent/air termination plate. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. See page 41 for general guidelines.
- Step 9** Install pipe supports every 5 feet on both the horizontal and vertical runs, or per vent pipe manufacturer's instructions. **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 10** Install a hanger support within 6 inches of any upturn in the piping, or per vent pipe manufacturer's instructions. **Polypropylene** **AL29-4C S.S.** See notices at left.



**⚠ WARNING** **USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Sidewall with W-M vent/air plate *(continued)*

## Install Weil-McLain vent/air cap

**⚠ WARNING** **ADAPTERS** — Use adapters if using other than 3-inch PVC or CPVC. This is required for different materials (polypropylene or AL29-4C stainless steel) or if using 2-inch pipe.

**NOTICE** The inside and outside cover plates are stamped to identify the exhaust (vent) and intake (air) openings. Make sure to orient the plates correctly.

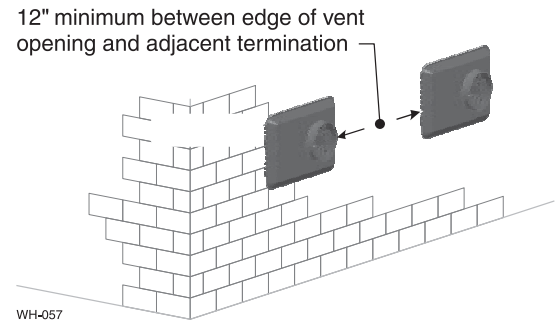
1. Locate termination opening and avoid obstructions:
  - a. Use the template supplied with the termination kit.
  - b. Locate the template on the outside building surface where the penetration is to be made.
  - c. Make sure there will be no obstructions that might prevent proper placement of the termination.
  - d. Use the template to mark the locations for the four mounting holes, flue pipe and air pipe. Level the template with a level.

**⚠ WARNING** For the Weil-McLain plate, the template must be level to ensure the flue and air pipe will be side-to-side, as shown in Figure 34. Failure to comply could result in severe personal injury, death or substantial property damage.

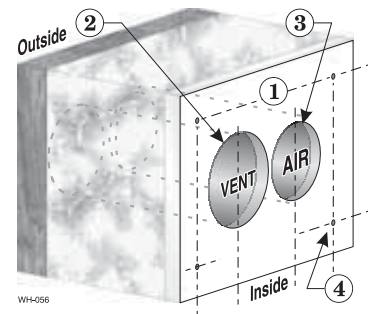
- e. Cut holes in the wall as shown in Figure 34, using the location marks made with the template. For best results, use a small-diameter, long drill bit to drill centering holes for the flue and air pipe openings. Then drill the large openings from both the inside and outside.
- f. The flue pipe and air pipe may be run through a rectangular cutout (as marked on the template) in lieu of two separate holes if desired.
2. Drill holes for the screws or plastic anchors to secure the outside plate. Install the outside plate and mount the termination on the plate (temporarily).
  - a. Cut the flue pipe so the extension through the wall will cause the vent pipe to fully extend into the termination socket.
  - b. Cut the air pipe so the extension through the wall will butt the air pipe against the stops inside the termination.
  - c. Temporarily slide the flue and air pipes through the opening(s). Slide the inside wall plate over the two pipes and into position on the inside wall.
  - d. Position the inside plate so the flue pipe and air pipe slope downward slightly toward the boiler (1/4" per foot).
  - e. Mark the four (4) mounting holes for the plate.
  - f. Remove the vent and air pipe, drill the four mounting holes, and mount the inside plate.
3. Test fit the vent/air termination on the vent pipe. Make sure the vent pipe fully penetrates the termination socket and the air pipe butts against the interior stops.
4. Apply silicon RTV sealant to the interior of the vent termination and slide onto vent pipe. Rotate slightly to spread the silicon to ensure a tight seal around the vent pipe.
5. Secure the termination in place using the four (4) #10 x 1/2" sheet metal screws and lock washers (see Figure 35).

**NOTICE** Vent/air pipes and W-M vent/air plate can be oriented in any of the configurations shown in Figure 32, page 32.

**Figure 33** Adjacent terminations — OUTSIDE VIEW — clearance from air inlet to exhaust from another appliance

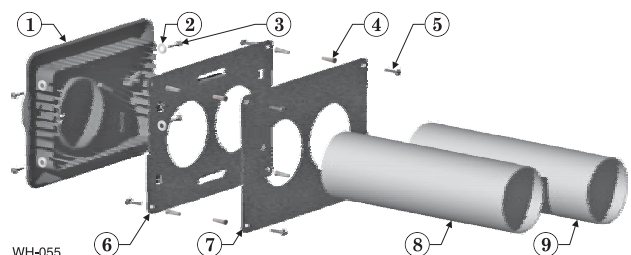


**Figure 34** Hole preparation in wall — INSIDE VIEW (use template provided)



- 1 Inside wall
- 2 Drill: 3½" diameter for 3" air pipe; locate using template provided
- 3 For combustible materials, drill: 4" diameter for 3" vent pipe  
For noncombustible materials, drill 3½" diameter for 3" vent pipe  
Locate opening using template provided
- 4 Drill mounting screw holes using template provided

**Figure 35** Termination assembly — INSIDE VIEW Weil-McLain vent/air cap and plates



- |                                     |   |
|-------------------------------------|---|
| 1 Vent termination (3")             | 6 Outer mounting plate                      |
| 2 Lock washer, #10 (4)              | 7 Inner mounting plate                      |
| 3 Sheet metal screw, #10 x 1/2" (4) | 8 Vent pipe (butt to screen in termination) |
| 4 Plastic wall anchor (8)           | 9 Air pipe (butt to stops in termination)   |
| 5 Sheet metal screw, #10 x 1¼" (8)  |   |

# DIRECT VENT — Vertical with separate pipes

## Allowable vent/air pipe materials & lengths

**▲WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

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 22, page 23.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler vent and air connections. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition piece at the boiler vent connection. The air piping must be PVC or CPVC. Provide a 3" PVC transition piece at the boiler air connection if using 2" air piping.

## Determine termination location

1. The air and vent terminations must be installed as shown in Figure 36.
2. The terminations must comply with clearances and limitations shown in Figure 24, page 26.
3. Locate the 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.

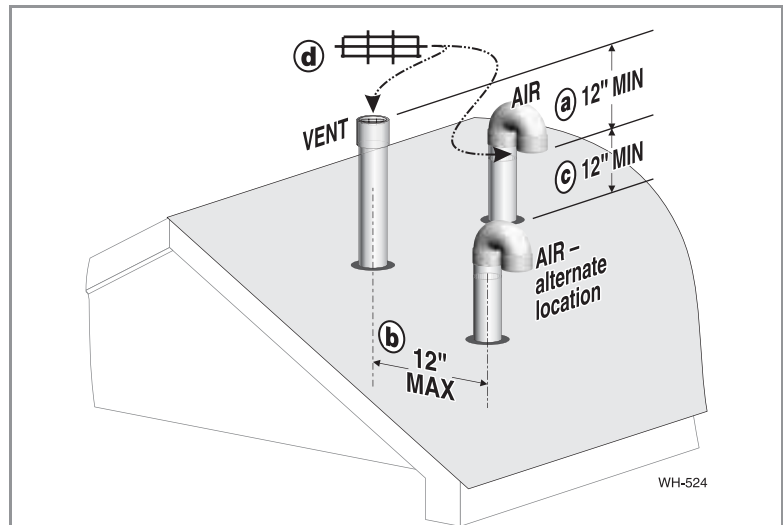
## Multiple vent/air terminations

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

**▲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 37, page 35). For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.
3. The air inlet of a ECO boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

**Figure 36** Separate pipes vertical termination



### Terminate vent and air pipes such that:

- a **AIR INTAKE** IS AT LEAST 12 inches below vent outlet
- b **AIR INTAKE** IS NO FURTHER than 12 inches away center to center
- c **AIR INTAKE** IS AT LEAST 12 inches above roof or snow line
- d **Vent and air terminations are fitted with bird screens**

- Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.** **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected sidewall location.
- Step 3** Make sure the selected vertical termination location complies with Figure 24, page 26. (Multiple boiler terminations must also comply with Figure 37, page 35.)
- Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required. Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.
- Step 5** Prepare the vertical penetrations and secure penetration components as instructed in this section. See "Prepare roof penetrations" on page 35 and "Termination and fittings" on page 35.
- Step 6** The air piping must terminate in a 180-degree return bend or **down-turned elbow** as shown above. The vent piping must terminate in a **coupling pointed upward** as shown above.
- Step 7** Install vent and air piping between the boiler and the vertical terminations. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. Install pipe supports every 5 feet on both the horizontal and vertical runs. Install a hanger support within 6 inches of any upturn in the piping. See page 41 for general guidelines. Also comply with vent pipe manufacturer's instructions. **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 8** Insert the vent and air piping through the vertical penetrations and secure the termination fittings.
- Step 9** Maintain clearances shown above. Vent and air terminations must be fitted with a bird screen as shown.



### ▲WARNING

**USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Vertical with separate pipes *(continued)*

Polypropylene AL29-4C S.S. See notices on previous page.

## Prepare roof penetrations

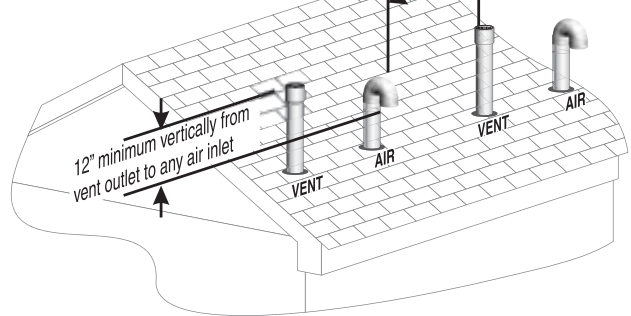
1. Air pipe penetration:
  - a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
  - a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole at least 0.4" larger than the vent pipe diameter.
  - b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes no closer than the minimum spacings shown in Figure 26, page 28.
4. Follow all local codes and vent pipe manufacturer's instructions 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. Follow all vent pipe manufacturer's instructions.

## Termination and fittings

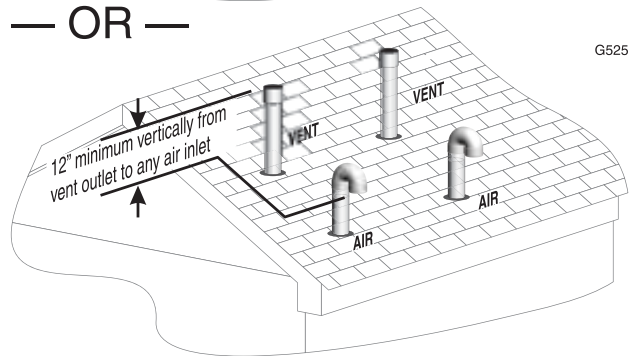
1. Prepare the vent termination elbow and the air termination elbow (Figure 36, page 34) by inserting bird screens. Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
2. The air piping must terminate in a down-turned 180-degree return bend as shown in Figure 36, page 34. Locate the air inlet pipe no further than 12 inches 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 36, page 34. The top of the coupling must be at least 12 inches 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 12 inches apart (center to center) and with the vent termination at least 12 inches above the air intake.
4. Maintain the required dimensions of the finished termination piping as shown in Figure 36, page 34.
5. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

**Figure 37** Terminations for multiple boilers

12" minimum between edge of air intake pipe and adjacent vent pipe from another boiler



— OR —



**WARNING** Also maintain maximum distances between the vent and air pipes for each boiler as shown in Figure 26, page 28.

# DIRECT VENT — Vertical concentric

## Allowable vent/air pipe materials & lengths

1. The concentric termination kit must be purchased separately.

**▲WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

2. Locate the termination such that the total air piping and vent piping from the boiler to the termination will not exceed the maximum length given in Figure 22, page 23.
3. This termination requires a 45-degree elbow that is not supplied with the termination kit. The maximum vent/air pipe lengths include allowance for this elbow.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transitions at the boiler vent and air connections and at the termination if using a 3" PVC concentric vent kit. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition at the boiler vent connection. Air pipe must be PVC or CPVC. Provide a 3" PVC transition at the boiler air connection if using 2" air pipe. Provide transition pieces to PVC at the vent and air pipe termination connections.

## Determine termination location

Locate the concentric vent/air termination using the following guidelines:

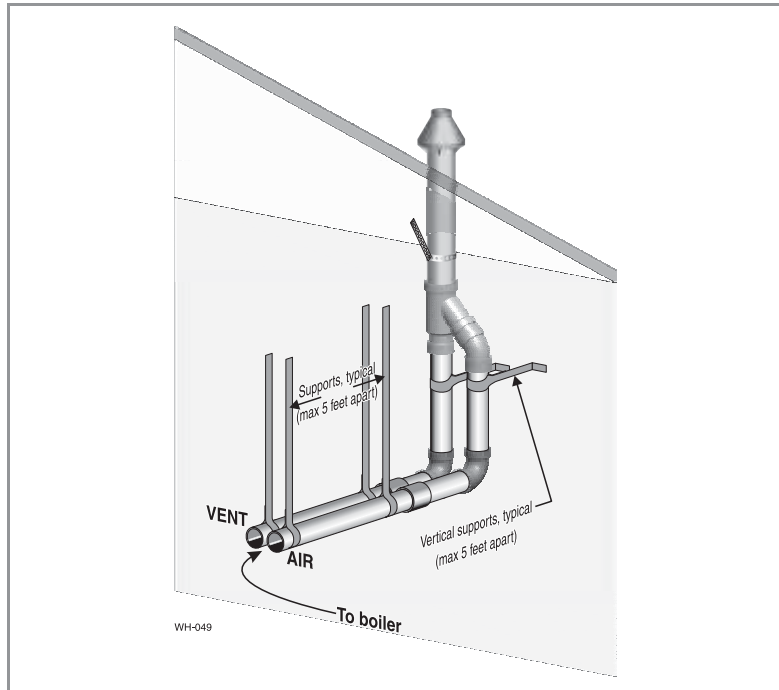
1. The concentric vent/air assembly must terminate as shown in Figure 40, page 37
2. The termination must comply with the clearances and limitations shown in Figure 24, page 26.
3. Locate the termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.
4. For Canadian installations, follow requirements of CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.

## Multiple vent/air terminations

1. When terminating multiple ECO boilers, install the concentric vent/air termination assemblies as described in this manual.

**▲WARNING** All vent outlets must terminate at the same height to avoid possibility of severe personal injury, death or substantial property damage.

Figure 38 INSTALLATION SEQUENCE — Concentric vertical



**Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.** **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected sidewall location.

**Step 3** Make sure the selected vertical termination location complies with Figure 24, page 26. (Multiple boiler concentric terminations must also comply with Figure 39, page 37.)

**Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required.

**Step 5** Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.

**Step 6** The concentric termination must be assembled and installed before piping from the boiler to the termination.

**Step 7** Prepare the vertical penetration(s) — assemble the concentric termination kit and secure the penetration components as instructed in this section. Provide the supports indicated and mount the termination assembly. See "Prepare roof penetrations" on page 37 and "Mount concentric termination" on page 37. **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 8** Install vent and air piping between the boiler and the concentric vent/air termination. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. See page 41 for general guidelines.

**Step 9** Install pipe supports every 5 feet on both the horizontal and vertical runs. **Polypropylene** **AL29-4C S.S.** See notices at left.

**Step 10** Install a hanger support within 6 inches of any upturn in the piping. **Polypropylene** **AL29-4C S.S.** See notices at left.



**▲WARNING**

**USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Vertical concentric *(continued)*

**Polypropylene AL29-4C S.S.** See notices on previous page.

2. Place roof penetrations to obtain minimum clearance of 12 inches between the edges of adjacent vent pipes of other boilers for U. S. installations (see Figure 39).
3. For Canadian installations, provide clearances required by CSA B149.1 or B149.2 Installation Code and a ULC S636 compliant vent kit.
4. The air inlet of a ECO 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.

## Prepare roof penetrations

1. Roof penetration hole:
  - a. Cut a clearance hole to clear the termination outside diameter as prescribed in the kit instructions.
  - b. Insert a galvanized metal thimble in the vent pipe hole.
2. Follow all local codes for isolation of vent pipe when passing through floors, ceilings and roofs.
3. Provide flashing and sealing boots sized for the concentric termination outside diameter.

## Mount concentric termination

1. Assemble the vent termination as described for concentric terminations, on page 40.
2. Mount the termination as shown in Figure 40.
3. Support the concentric vent/air termination at the roof penetration as shown in Figure 40 or per concentric kit instructions.
  - The supports/bracing used must support the termination assembly to prevent vertical slippage or sideways movement.
  - The clamps used on the outside of the termination pipe must not cut into the pipe or contain sharp edges that could cause a crack to form.

**⚠ WARNING** The vent and air piping must be securely supported, and must not rest its weight on the boiler fittings. DO NOT drill or screw into either the vent pipe or air pipe. Failure to properly support the vent and air piping could result in vent piping damage, resulting in possible severe personal injury, death or substantial property damage.

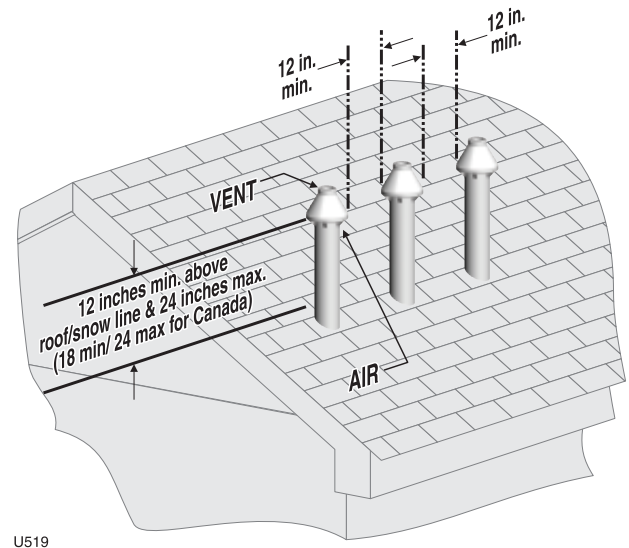
**⚠ WARNING** When inserting the partially-assembled termination kit through the roof penetration, wrap plastic or other protection over the end of the exposed assembly to prevent debris from entering the pipes. If the air passages become blocked, the boiler will not operate. Once the rain cap has been cemented to the assembly, there is no way to correct the problem. The assembly would have to be replaced if it were cut to be removed and cleaned. Altering the assembly in any way could result in severe personal injury or death due to toxic flue product emissions.

**⚠ WARNING** If using AL29-4C stainless vent pipe, use the vent pipe manufacturer's PVC adapter if connecting to a PVC concentric vent attachment.

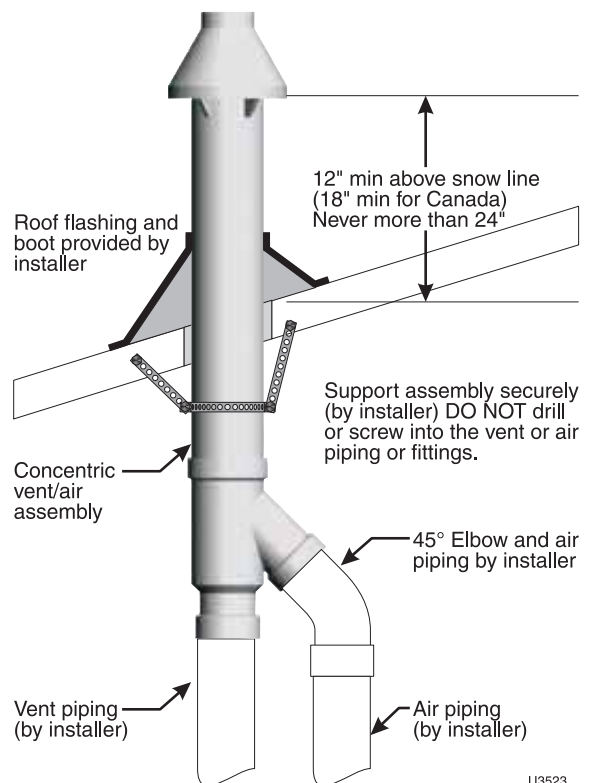
**⚠ WARNING** Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe.

4. After the assembly has been positioned in the roof opening and all supports have been attached, install a bird screen (purchased separately if not included with the kit) and rain cap as follows:
  - a. Place the bird screen on the end of the inner pipe as in Figure 44, page 40, or per kit instructions for polypropylene kits.
  - b. Cement the rain cap in place.

**Figure 39** Vertical termination — 3" PVC concentric — single or multiple boilers



**Figure 40** 3" PVC concentric termination supports



U3523

# DIRECT VENT — Vertical vent /sidewall air

## Allowable vent/air pipe materials & lengths

**⚠ WARNING** Use only the vent materials and kits listed in Figure 23, page 24. Provide pipe adapters if specified.

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 22, page 23.

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC-to-PP transition pieces at the boiler vent and air connections. PP adapter must have smooth, straight section of pipe to insert in to the boiler vent and air connections and must fit and seal tightly. PP adapters with their own seal which would interfere with the internal seal of the boiler vent or air connections must not be used. Refer to page 115 for a list of compliant adapters. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition piece at the boiler vent connection. The air piping must be PVC or CPVC.

2. For 3" to 2" transitions, must use appropriate vent material. For polypropylene or stainless steel must use approved suppliers transitions.

## Prepare roof penetration

1. 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.
  - b. Insert a galvanized metal thimble in the vent pipe hole.
2. Follow all local codes for isolation of vent pipe when passing through floors, ceilings and roofs.
3. Provide flashing and sealing boots sized for the vent pipe and air pipe.

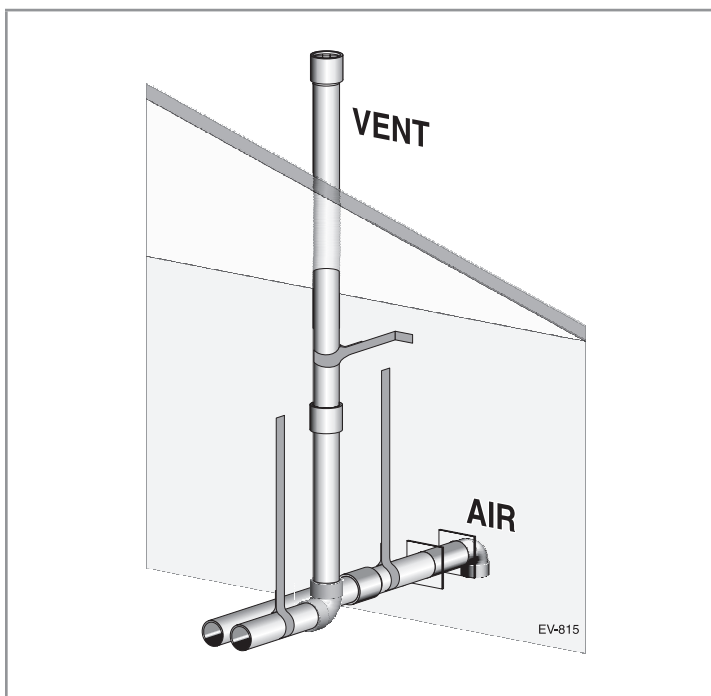
## Vent termination and fittings

1. Prepare the vent termination coupling by inserting a bird screen. Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
2. Maintain the required dimensions of the finished termination piping as shown in Figure 42.

## Multiple vent terminations

1. When terminating multiple ECO boilers, terminate each vent/air connection as described in this section.
2. Place adjacent terminations at least 6 inches apart.
3. For Canadian installations, provide clearances required by Natural Gas and Propane Installation CAN/CSA B149.1 or B149.2 Installation Code.

**Figure 41 INSTALLATION SEQUENCE — Vertical vent/sidewall air**



- Step 1** Read and follow all instructions in this manual. **DO NOT proceed with vent/air installation until you have read page 22 through page 27.** **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 2** Install the boiler in a location that allows proper routing of all vent and air piping to the selected locations.
- Step 3** Make sure the selected vertical termination location complies with Figure 24, page 26.
- Step 4** Use only the vent materials listed in Figure 23, page 24. Provide pipe adapters where required. Vent piping and air piping lengths must not exceed the values shown in Figure 22, page 23.
- Step 5** Prepare the vertical penetration (vent) and sidewall penetration (air) and secure penetration components as instructed in this section.
- Step 6** The air piping must terminate in a 90-degree **down-turned elbow** as shown above. The vent piping must terminate in a **coupling pointed upward** as shown above.
- Step 7** Install vent and air piping between the boiler and the air and vent terminations. Slope horizontal piping downward toward the boiler at least 1/4 inch per foot. Install pipe supports every 5 feet on both the horizontal and vertical runs. Install a hanger support within 6 inches of any upturn in the piping. See page 39 for general guidelines. Also comply with vent pipe manufacturer's instructions. **Polypropylene** **AL29-4C S.S.** See notices at left.
- Step 8** Insert the vent and air piping through the penetrations and secure the termination fittings.
- Step 9** Maintain clearances shown in this section. Vent and air terminations must be fitted with bird screens as shown.



**⚠ WARNING**

**USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# DIRECT VENT — Vertical vent /sidewall air *(continued)*

## Determine location for air inlet elbow

1. The air inlet of an ECO boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent appliance terminations.
2. Locate the air inlet elbow (termination) using the following guidelines.
3. The air piping must terminate in a down-turned elbow as shown in Figure 43.
  - a. Apply the configuration on the left side of Figure 43 unless the terminations would fail to meet minimum clearance to grade or snow line.
  - b. Apply the configuration on the right side of Figure 43 when the terminations need to be raised higher to meet clearance to grade or snow line.
  - c. The air pipe may run up the side of the building, as shown. 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.
4. You must consider the surroundings when terminating the air connection:
  - a. Make sure there are no obstructions for air flow. DO NOT locate the termination where plants could grow and cause obstruction to air flow.
  - b. Do not locate the terminations where wind eddies could affect performance or cause recirculation with exhaust from other appliances, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards or other recessed areas.
  - c. Locate the air inlet termination at least 12 inches below and 12 inches horizontally from any appliance or building vent outlet.
5. 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.

## Multiple air terminations

1. When terminating multiple ECO boiler air connections, terminate each air connection as described in this manual.
2. Place wall penetrations to obtain minimum clearances as instructed in this manual.
3. Place adjacent air inlets for multiple ECO boilers at least 6 inches apart.
4. For Canadian installations, provide clearances required by Natural Gas and Propane Installation CAN/CSA B149.1 or B149.2 Installation Code

## Prepare wall penetrations

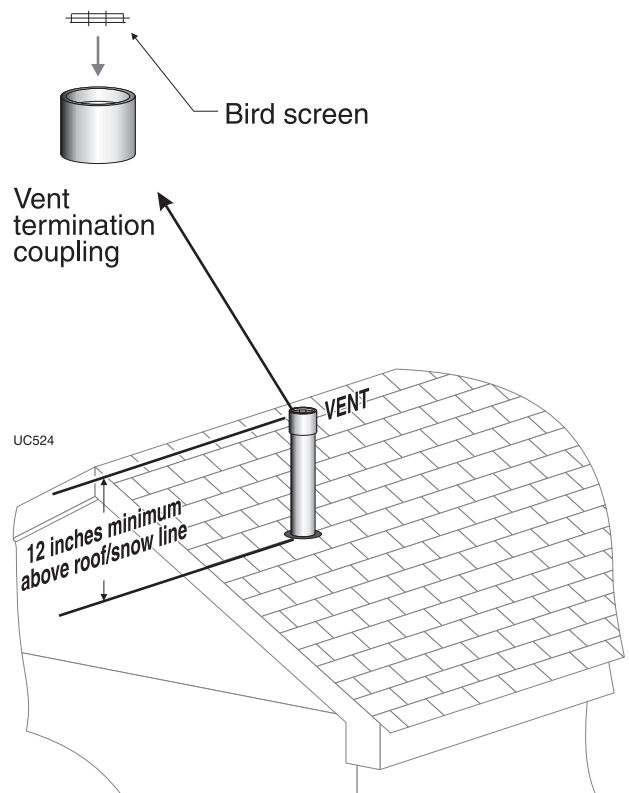
1. Air pipe penetration:
  - a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Seal exterior openings thoroughly with exterior caulk.

## Termination and fittings

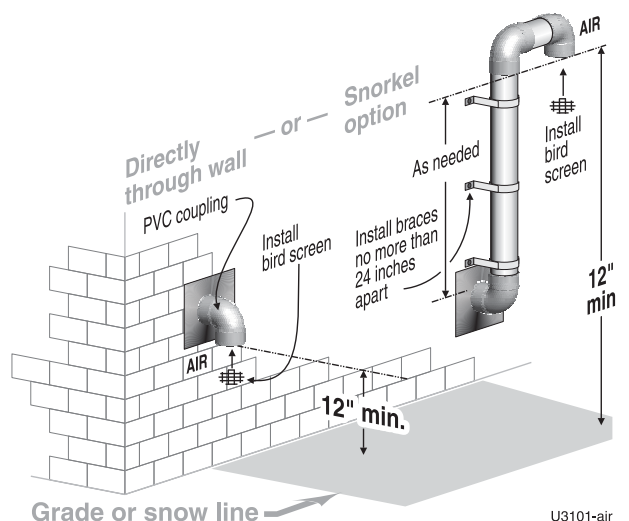
1. Prepare the air termination elbow (Figure 43) by inserting a bird screen. Bird screens must be purchased separately. See the parts list at the end of this manual for part numbers.
2. Use metal plates (by installer) at inside and outside penetrations using the method shown in Figure 28, page 29.

**NOTICE** If extending the air pipe out from the wall, install a coupling on each pipe. Mount the piping with the coupling flush with the outer plate.

**Figure 42** Vent termination (through the roof) for direct vent: vertical vent / sidewall air



**Figure 43** Sidewall air inlet (termination) for direct vent: vertical vent / sidewall air



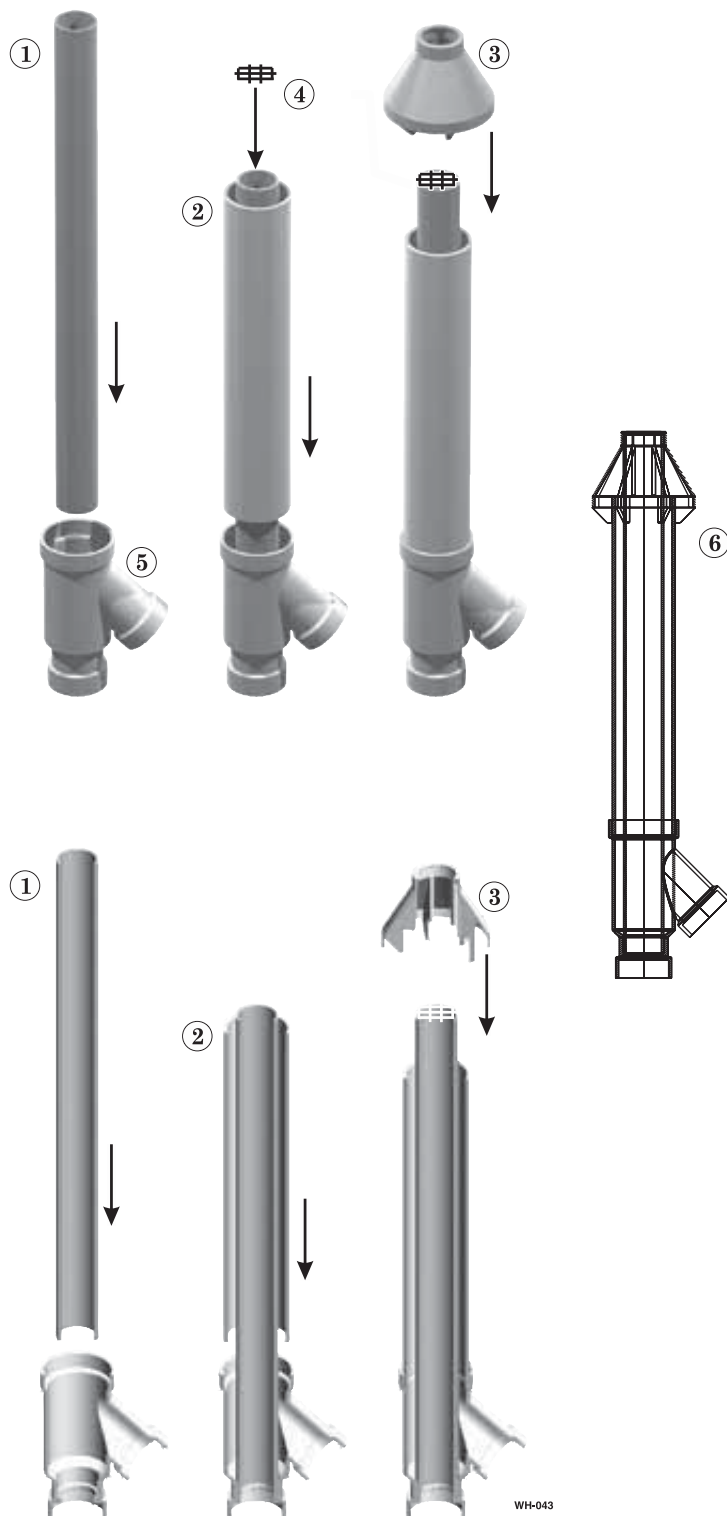
U3101-air

# Concentric termination, typical *(sidewall or vertical)*

**Figure 44** PVC concentric termination assembly — DO NOT attach the rain cap until the termination has been inserted through the roof or wall and all supports have been installed. See LEGEND at right. See kit instructions for details of polypropylene kits.

## LEGEND for Figure 44

- |                           |                       |
|---------------------------|-----------------------|
| 1 — Inner PVC pipe (vent) | 4 — Bird screen       |
| 2 — Outer PVC pipe (air)  | 5 — Y fitting         |
| 3 — Rain cap              | 6 — Finished assembly |



## Assembling concentric termination

- Follow all instructions provided with the concentric termination kit. The following are general guidelines for information only.
- See Figure 44 for the typical assembly of a concentric termination assembly.
- Prepare the bird screen, item 4 (purchase separately if not included with the kit). Cut the bird screen to size if required. If the bird screen must be trimmed, cut the bird screen to fit the outside diameter of the PVC inner pipe supplied with the termination kit.
- Partially assemble the vent termination kit in the sequence shown in Figure 44, or per the concentric kit instructions.

### ⚠ WARNING

**DO NOT** install the rain cap and bird screen until the assembly has been inserted through the roof (or sidewall) and all supports have been installed. Follow instructions to cover the end of the assembly with plastic before inserting through the roof penetration to prevent debris from blocking the air passages.

### ⚠ WARNING

If necessary, you can shorten the lengths of the inner and outer pipes for a shorter finished assembly. But you must ensure the pipes butt correctly at both ends. Failure to properly assemble the concentric termination can result in flue gas recirculation, causing possible severe personal injury or death.

### Polypropylene

For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transitions at the boiler vent and air connections and at the termination if using a PVC concentric vent kit. Install a locking collar at every joint.

### AL29-4C S.S.

For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition at the boiler vent connection. Air pipe must be PVC or CPVC. Provide a 3" PVC transition at the boiler air connection if using 2" air pipe. Provide transition pieces to PVC at the vent and air pipe termination connections.

# Vent and air piping and boiler connections

## Follow termination instructions

1. Read and follow all instructions for the termination type used before proceeding with this page. Follow all instructions provided by vent pipe manufacturer.

**▲WARNING** Use only materials from the manufacturers listed in Figure 23, page 24.

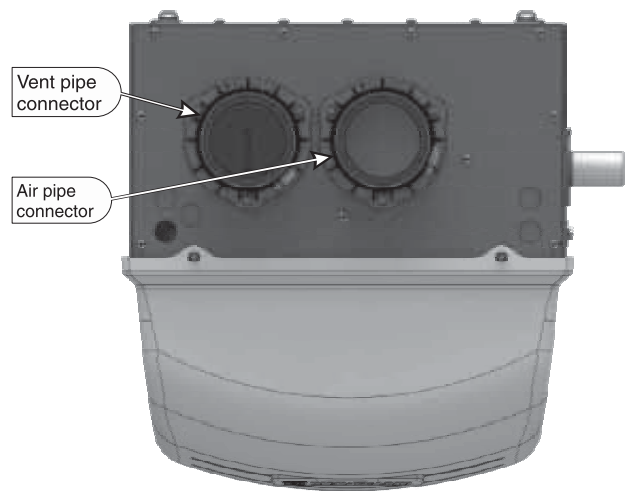
## Installing vent and air piping

**Polypropylene** For polypropylene applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide 3" PVC transition pieces at the boiler vent and air connections, and also at the termination if using the W-M termination plate. Provide 2" or 3" PVC transitions at the termination if using a PVC concentric vent kit. Install a locking collar at every joint.

**AL29-4C S.S.** For AL29-4C vent pipe applications, comply with any additional requirements in the vent system manufacturer's instructions. Provide a 3" PVC transition piece at the boiler vent connection. Air piping must be PVC or CPVC. Connect to the boiler air piping only with 3" PVC (use a transition piece for 2" air pipe). Provide 3" PVC connections at the termination if using the W-M termination plate. Provide 2" or 3" PVC transitions at the termination if using a PVC concentric vent kit.

1. Work from the boiler to vent or air termination. Do not exceed the lengths given in the previous pages for either the air or vent piping.
2. See Figure 45 for attaching vent (and air) pipes at the boiler. Connections must be 3" PVC or CPVC only — use transitions if needed to adapt to other material or size (2").
3. Cut pipe to required lengths.
4. Dry assemble entire vent or air piping to ensure proper fit before assembling any joint.
5. Maintain minimum clearance of  $\frac{3}{16}$  inch between vent pipe and any combustible wall or material.
6. Seal wall or floor penetration openings following local code requirements.
7. Assembling PVC or CPVC: (**Polypropylene** **AL29-4C S.S.** — follow pipe manufacturer's instructions for preparation and assembly)
  - a. Deburr inside and outside of pipe ends.
  - b. Chamfer outside of each pipe end to ensure even cement distribution when joining.
  - c. Clean all pipe ends and fittings. Dry thoroughly.
  - d. For each joint:
    - Handle fittings and pipes carefully to prevent contamination of surfaces.
    - Apply primer liberally to both joint surfaces — pipe end and fitting socket.
    - While primer is still damp, lightly apply approved cement to both surfaces in a uniform coating.
    - Apply a second coat to both surfaces. Avoid using too much cement on sockets to prevent cement buildup inside.
    - With cement still wet, insert pipe into fitting, twisting  $\frac{1}{4}$  turn. Make sure pipe is fully inserted.
    - Wipe excess cement from joint. Check joint to be sure a smooth bead of cement shows around the entire joint.

**Figure 45** Boiler vent and air connections



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**▲WARNING** **ADAPTERS** — Use adapters if using other than 3-inch PVC or CPVC. This is required for different materials or if using 2-inch pipe.

1. Use ONLY 3" PVC or CPVC pipe at boiler connections.
2. Clean and deburr inside and outside of both ends of air and vent pipes. Chamfer boiler end of vent pipe for ease of insertion.

**▲WARNING** The vent pipe end must be smooth and chamfered to prevent possible damage to sealing gasket in vent pipe adapter.

3. Inspect vent or air adapter (above) — verify no obstructions or foreign objects inside.
4. Loosen clamp screw.
5. Measure  $3\frac{1}{2}$  inches from end of pipe and make a mark with felt-tip pen.
6. Loosen adapter clamp screw.
7. Apply small amount of silicon grease to end of pipe to ease insertion.
8. Insert pipe into adapter.
9. Slide pipe down until the  $3\frac{1}{2}$ -inch mark is reached.

**▲WARNING** Do not apply excessive force or bend the adapter or flue/air pipe when inserting. The adapter or seal could be damaged. If any portion of the vent or air system is damaged, it must be replaced.

10. Secure vent or air pipe by tightening the adapter clamp securely. Do not overtighten.
11. The seal is accomplished with the internal gasket. The clamp is only to hold the pipe in place.



**▲WARNING** **USE SWEEP ELBOWS FOR ALL VENT AND AIR PIPING** — DO NOT use short radius elbows for vent or air piping. Boiler performance could be affected.

# 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

### Use piping unions near boiler

**NOTICE** Install piping unions near boiler outlet and return to facilitate future service requiring heat exchanger removal.

### Additional controls, if required

**NOTICE** The control uses temperature sensors to provide both high limit protection and modulating temperature control. **The control's high limit function requires manual reset.** 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 control 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 the control external limit circuit terminals.

**⚠ WARNING** **Low temperature materials** — If using temperature-limited materials (such as PEX tubing) in system piping, it is recommended to protect the system with limit controls that are wired to the controls external limit circuit.

2. See instructions beginning on page 60 for wiring information.
3. If using a manual reset limit control or wiring in the manual reset circuit, set ECO control boiler limit at least 20°F less than the external manual reset limit (i.e., set ECO control no higher than 180°F for a 200°F external limit, for example).

### Separate low water cutoff

1. A separate 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 Control module.
2. The Control's integral protection is accepted in many jurisdictions as meeting the requirement for low water protection. See page 63 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 60 for wiring additional limit controls.

### Back flow preventer

1. Use back flow preventer in the cold water supply piping if required by local codes.

## System/zone pipe sizing

### (Baseboard, convectors or cast iron radiators ONLY)

1. For residential space heating applications (other than radiant heating or unit heaters) ONLY, you can use the sizing suggestions in Figure 46.

**Figure 46** Suggested pipe sizing for system headers and zone piping — RESIDENTIAL with baseboard, convectors or cast iron radiators ONLY (20°F temperature rise)

ECO Model	System header
70/110	1" or larger
155	1¼" or larger
Recommendations are based on a 20°F temperature drop through the system.	
Suggested maximum load per zone	
Copper pipe and baseboard size	Maximum recommended feet of baseboard
¾"	67
1"	104
Size zone circulators to handle the required flow and head loss for each zone.	

## System water piping methods

### Direct connection piping to boiler

**NOTICE** It is recommended, but not required, to use primary/secondary piping to the boiler. Using primary/secondary piping will provide the most efficient and reliable operation of the boiler and the heating system.

### Installations using direct connection piping layout should:

1. Read the NOTICES and guidelines beginning on to determine if the system is eligible for this piping strategy.
2. If eligible, reference suggested piping layouts on pages 46 and 47.
3. Use primary/secondary piping if system ineligible.

# Direct Connect System Piping

## Primary/secondary piping to boiler

Using primary/secondary piping will provide the most efficient and reliable operation of the boiler and the heating system.

1. Use information beginning on page 47 to size pump for proper flow through the ECO boiler.
2. Reference suggested piping layouts on pages 53-55.

### NOTICE

Some installations can be piped in numerous other ways that will work equally as well as the suggestions here.

## Verify the application will work:

### NOTICE

For systems requiring a higher flow than that recommended in Figure 47 – DO NOT use a direct connect piping layout. Design system using a primary/secondary piping layout using guidelines starting on page 47.

### NOTICE

Systems zoning with circulators must use primary/secondary piping layout using guidelines starting on page 47.

## Check system flow rate

To determine whether direct connection will provide suitable flow for the intended application, refer to Figure 41.

4. The minimum temperature drop across the heat exchanger is 20°F. Using flow rates higher than the maximum listed in Figure 41 is NOT RECOMMENDED.
5. Design zoning to ensure minimum flow rate is maintained under any call for heat condition that could see full input rate (High Fire).

### NOTICE

Systems using a modulating pump may operate below the minimum flow rates listed in Figure 47 only if the boiler is operating at a reduced firing rate (low fire) when doing so. A pump that modulates based on the system Delta T ( $\Delta T$ ) would provide such operation assurance by varying flow with firing rate.

Use a primary/secondary piping layout if the total flow through the ECO's heat exchanger will be higher than the maximum listed in Figure 47.

## Check system pipe design

Only systems with a single system pump zoned with zone valves may use the direct connect system piping methods shown here.

### NOTICE

Any system zoned with zone valves must include a by-pass pressure regulator. Failure to comply may reduce pump life.

## Expansion tank location

Figure 48 and Figure 50 show typical installation of the system expansion tank. It is highly recommended that you locate the air separator and expansion tank as shown in the suggested piping drawings on page 47 and page 48.

Ensure that the expansion tank size will handle boiler and system water volume and temperature. See tank manufacturer's instructions and ratings for details. Additional tanks may be added to the system if needed to handle the expansion. These tanks may be installed by connecting to tees in the system piping.

### CAUTION

**Undersized expansion tanks** cause system water to be lost from the relief valve and makeup water to be added through the fill valve. Eventual boiler failure can result due to excessive make-up water addition. Always locate the cold-water fill connection at the expansion tank. Never locate this elsewhere.

## Diaphragm- or bladder-type tank:

Refer to Figure 48 for suggested piping when using a diaphragm- or bladder-type expansion tank.

Install an automatic air vent on top of the air separator, per separator manufacturer's instructions.

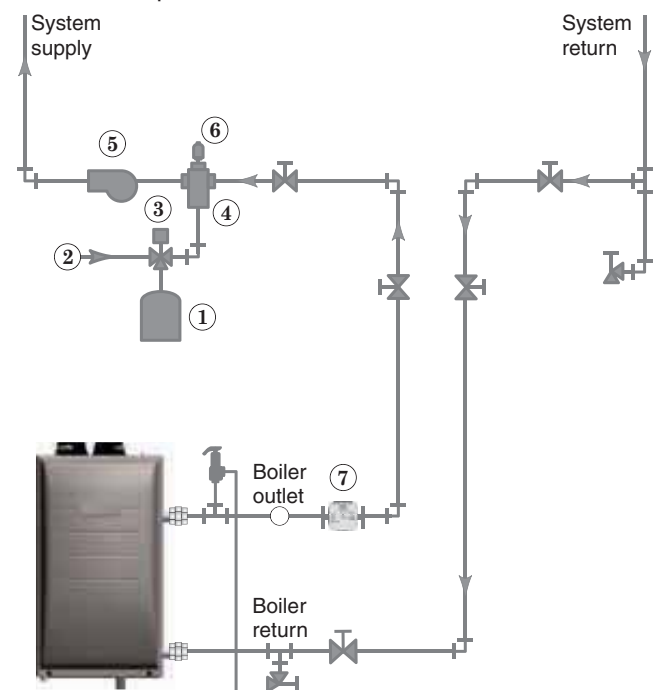
### NOTICE

**Diaphragm- or bladder-type expansion tank—**Control fill pressure with the tank air charge pressure. Always check pressure and charge tank with tank removed from system to be sure reading is accurate. Boiler relief valve is set for 30 PSIG. Operating pressure of system, after temperature expansion above cold fill pressure, should not exceed 24 PSIG to avoid weeping of relief valve.

**Figure 47** Maximum and minimum flow rates through boiler heat exchanger

ECO Model	MAXIMUM flow rate through boiler	MINIMUM flow rate through boiler
70	6.5 GPM	3.0 GPM
110	10.0 GPM	5.0 GPM
155	14.5 GPM	7.0 GPM

**Figure 48** Piping to diaphragm- (or bladder-) type expansion tank



- ① Diaphragm-type expansion tank
- ② Make-up water supply
- ③ Fill valve, typical
- ④ Air separator
- ⑤ System circulator
- ⑥ Automatic air vent
- ⑦ Low Water Cut-Off (If used)

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# Direct Connect System Piping *(continued)*

## Closed-type expansion tank:

**CAUTION** DO NOT use a closed-type tank if connecting to a water heater that is equipped with an automatic air vent.

Figure 50 shows suggested piping when using a closed-type expansion tank, in which the air is directly in contact with tank water.

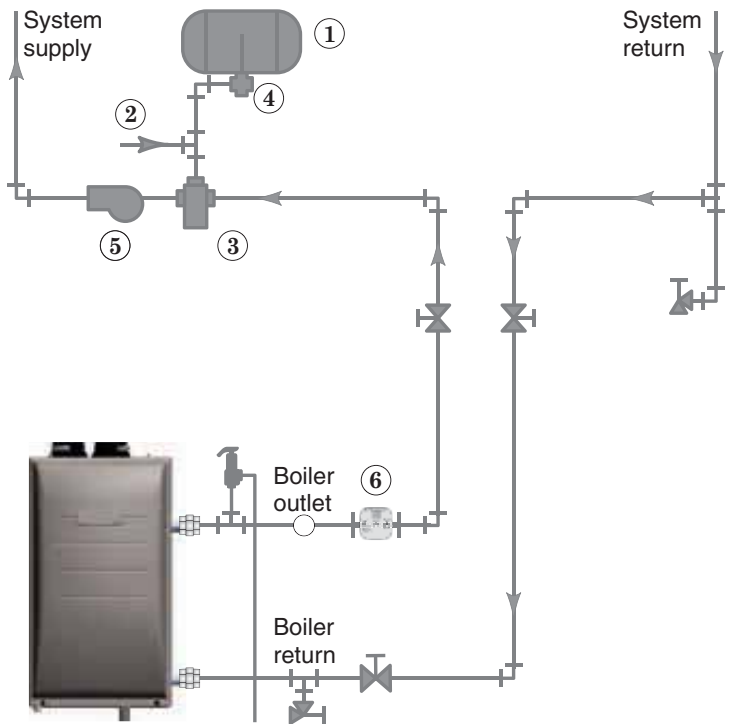
Connect piping ( $\frac{1}{2}$ " or  $\frac{3}{4}$ " ) from the air separator outlet to the tank fitting. Slope any horizontal piping a minimum of 1 inch per 5 feet of horizontal pipe.

Always use a **tank fitting** such as the B&G Tank-trol or Taco Taco-trol (shown). The fitting reduces gravity flow of water in the piping to the tank, avoids air bubbling through the tank water, and provides the proper fill height in the tank

**CAUTION** Correct all leaks in the system or tank piping. Leaks allow air to escape from the system and will cause water-logging of the tank. This will result in water loss through the boiler relief valve due to over-pressurization. **NEVER** use an automatic air vent in a system equipped with a closed-type expansion tank. The air removed from the system will cause water-logging of the expansion tank.

**NOTICE** Closed-type expansion tank—Follow tank manufacturer's instructions for filling the tank. Typical tank sizing provides for approximately 12 PSIG when the tank is filled to the normal level and system water is cold. Note that boiler relief valve is set for 30 PSIG. Operation pressure of system, after temperature expansion above cold fill pressure, should not exceed 24 PSIG to avoid weeping of relieve valve.

**Figure 50** Piping to closed-type expansion tank

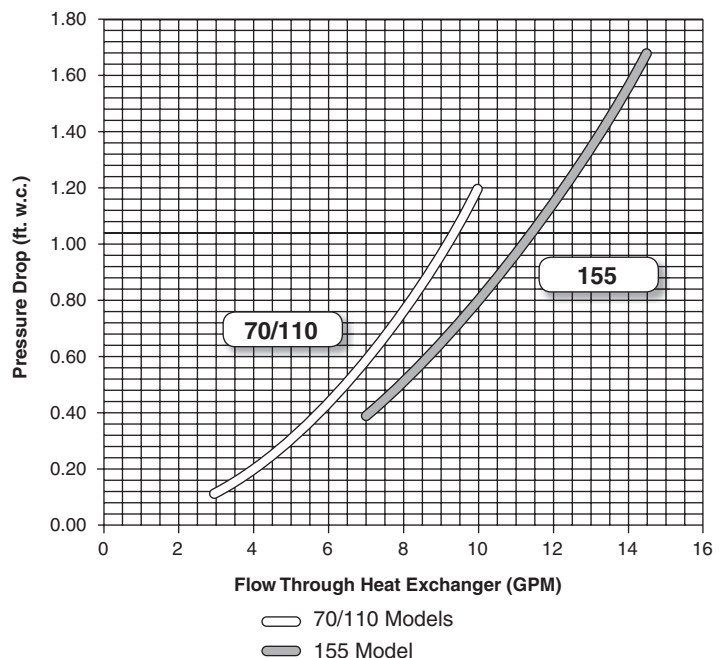


- ① Closed-type expansion tank
- ② Make-up water supply
- ③ Air separator
- ④ Tank fitting
- ⑤ System circulator
- ⑥ Low Water Cut-Off (If used)

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**Figure 49** Pressure drop through ECO heat exchanger (graph and table)

ECO 70 or 110		ECO 155	
Flow Rate (GPM)	Head Loss (ft. w.c.)	Flow Rate (GPM)	Head Loss (ft. w.c.)
3.0	0.11	7.0	0.39
5.0	0.30	9.0	0.65
6.5	0.51	11.0	0.97
8.0	0.77	13.0	1.35
10.0	1.20	14.5	1.68



# Direct Connect System Piping *(continued)*

## System water piping methods

### Head loss through boiler piping

1. See Figure 49 for the head loss through the boiler.

Use boiler head loss values to size pump after determining other piping head loss values.

### System circulator

1. Install a system circulator as shown in the piping diagram in the Direct Connect System Piping section on page 47.
2. This circulator must be supplied by the installer.

### System circulator flow rates

1. Size circulators based on the flow rate required to achieve the temperature rise or drop.
2. You can closely estimate the required flow 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:

1. Consider a system loop for a system with total heating input 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.

### System circulator head requirement

1. The circulator must be capable of delivering the required flow against the head loss that will occur in the boiler piping.
2. Determine the pipe size needed and the resultant head loss using accepted engineering methods.

## Install relief valve

1. Install relief valve in 1" x 1" x 3/4" (for 70/110) or 1 1/4" x 1 1/4" x 3/4" (for 155) reducing tee piped from boiler supply (Figure 8, page 14).
2. Pipe the relief valve only as shown, in the location shown.
3. 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:**

Install relief valve **ONLY** with the spindle vertical, as shown in illustrations in this manual.

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. Locate away from the top of the boiler.

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.

# Direct Connect System Piping *(continued)*

## ZONE VALVE zoning – direct connection (Shown with optional DHW piping)

See Figure 51.

1. This configuration is for zone valve systems that qualify to use direct connection piping based on the criteria on page 43 only. If system does not qualify, pipe using primary/secondary piping. See pages 48-53 for piping suggestions and guidelines.
2. Systems zoned with zone valves **MUST** use a by-pass pressure regulator (Taco 3196 shown).
3. Install a system circulator (supplied by installer) capable of delivering the proper flow and head as shown.

### Expansion Tank required

1. Provide a system expansion tank following the guidelines on page 43 or page 44.
2. **DO NOT** use a closed-type tank if connecting to a water heater that is equipped with an automatic vent.

### Domestic Hot Water (DHW) tank, if used

1. DHW direct connection—Pipe from the near-boiler piping to the DHW tank's boiler connections as shown.
2. DHW as zone—A DHW tank can be connected as a zone if a DHW tank is **NOT** already connected to the boiler. To provide DHW priority operation, use a zone controller. See notices on page 63 to ensure compliance with the 2007 Energy Act.
3. DHW Priority operation—The ECO control turns off space heating to the HEAT zones during domestic water heating calls on the DHW input. The MAX ON TIME setting can be adjusted to limit how long this occurs. Set the MAX ON TIME to "0" to disable domestic priority. See page 74 for setting instructions.
4. If **NOT** connecting a water heater, do not use the DHW input or DHW Circulator output on the ECO control.

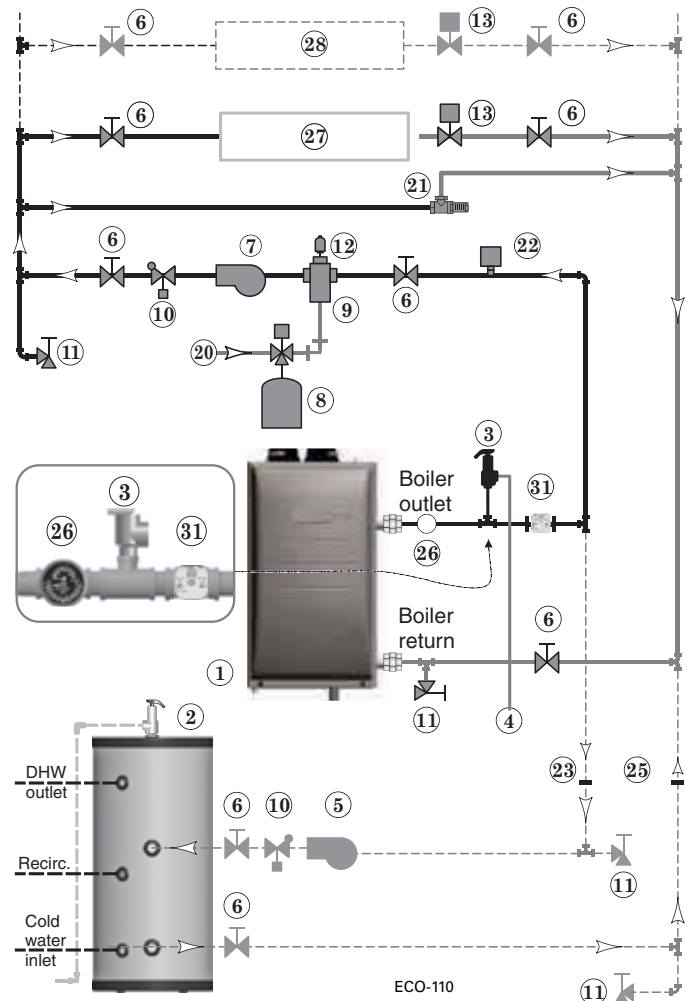
#### NOTICE

Overriding the Outdoor Reset function by connecting space heating zones to inputs and outputs intended for DHW applications may violate **Section 303 of the 2007 Energy Act**. See page 127 for compliance information and exemptions.

### Controlling the Zones

1. The ECO control can be used to control space heating only, domestic water heating only, or both. Refer to field wiring, beginning on page 60, for instructions on wiring to zone valves.
2. The boiler and zone valves can also be operated by a Weil-McLain WMZV zone controller.

**Figure 51** ECO 70/110/155 Zone valve zoning direct connection (system circulator provides flow for system)



#### NOTICE

Connect zone valve end switches to HEAT input. Connect system circulator to HEAT Circ. output.

#### CAUTION

Use isolation relays if connecting 3-wire zone valve end switches to the HEAT input.

### LEGEND for Figure 51

- 1 ECO wall mount boiler
- 2 Indirect Water Heater, if used
- 3 Relief valve, supplied with boiler, field piped — **MUST** be piped to boiler supply connection — see page 14 for information
- 4 Relief valve piping to drain — see page 45
- 5 DHW circulator
- 6 Isolation valves
- 7 System circulator
- 8 Expansion tank, diaphragm type, if used
- 9 Air separator
- 10 Flow/check valves
- 11 Purge/drain valves (one drain valve shipped loose with boiler)

- 12 Auto air vent
- 13 Zone valves
- 14 Primary/secondary connection (tees no more than 12 inches apart)
- 15 Expansion tank, closed type, if used (some chiller systems may use a diaphragm-type expansion tank)
- 16 Water chiller
- 17 Check valve
- 18 Y-strainer
- 19 Balancing valve
- 20 Make-up water supply – Use applicable codes to determine if backflow preventers, pressure reducing valves, and fill valves may be required

**Note:** This is a common legend for all piping diagrams. Not all items listed appear in every figure.

- 21 By-pass pressure regulator, **REQUIRED** for zone valve systems unless other provision is made
- 22 High limit temperature control
- 23 DHW tank boiler water supply connection, when used
- 24 Zone circulator
- 25 DHW tank boiler water return connection, when used
- 26 Pressure/temperature gauge, supplied with boiler, field piped
- 27 Heating circuits
- 28 Additional heating circuits, if any
- 29 Boiler circulator, if any
- 30 Mixing valve, if any
- 31 Low Water Cut-Off (If used)

# Primary/Secondary System Piping

## Expansion tank location

Figure 52 and Figure 53 show typical installation of the system expansion tank. It is highly recommended that you locate the air separator and expansion tank as shown in the suggested piping drawings on pages 51-53.

Ensure that the expansion tank size will handle boiler and system water volume and temperature. See tank manufacturer's instructions and ratings for details. Additional tanks may be added to the system if needed to handle the expansion. These tanks may be installed by connecting to tees in the system piping.

**CAUTION** **Undersized expansion tanks** cause system water to be lost from the relief valve and makeup water to be added through the fill valve. Eventual boiler failure can result due to excessive make-up water addition. Always locate the **cold-water fill connection** at the expansion tank. Never locate this elsewhere.

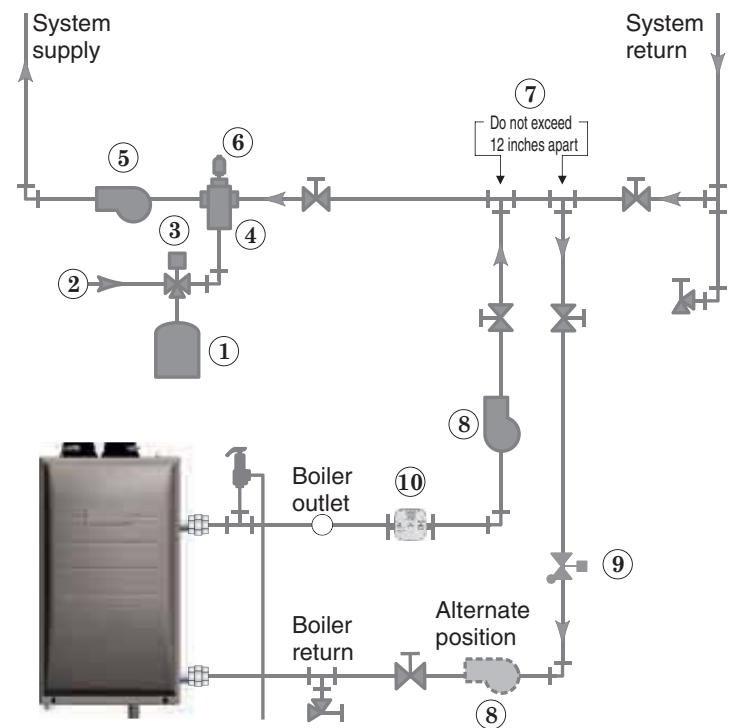
## Diaphragm- or bladder-type tank:

Refer to Figure 52 for suggested piping when using a diaphragm- or bladder-type expansion tank.

**NOTICE** **Diaphragm- or bladder-type expansion tank**—Control fill pressure with the tank air charge pressure. Always check pressure and charge tank with tank removed from system to be sure reading is accurate. Boiler relief valve is set for 30 PSIG. Operating pressure of system, after temperature expansion above cold fill pressure, should not exceed 24 PSIG to avoid weeping of relief valve.

Install an automatic air vent on top of the air separator, per separator manufacturer's instructions.

**Figure 52** Piping to diaphragm (or bladder) expansion tank



- |                                 |                                |
|---------------------------------|--------------------------------|
| ① Diaphragm-type expansion tank | ⑦ Primary/secondary connection |
| ② Make-up water supply          | ⑧ Boiler circulator            |
| ③ Fill valve, typical           | ⑨ Flow/check valve             |
| ④ Air separator                 | ⑩ Low Water Cut-Off (If used)  |
| ⑤ System circulator             |                                |
| ⑥ Automatic air vent            |                                |

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# Primary/Secondary System Piping *(continued)*

## Closed-type expansion tank

**CAUTION** DO NOT use a closed-type tank if connecting to a water heater that is equipped with an automatic air vent.

Figure 53 shows suggested piping when using a closed-type expansion tank, in which the air is directly in contact with tank water.

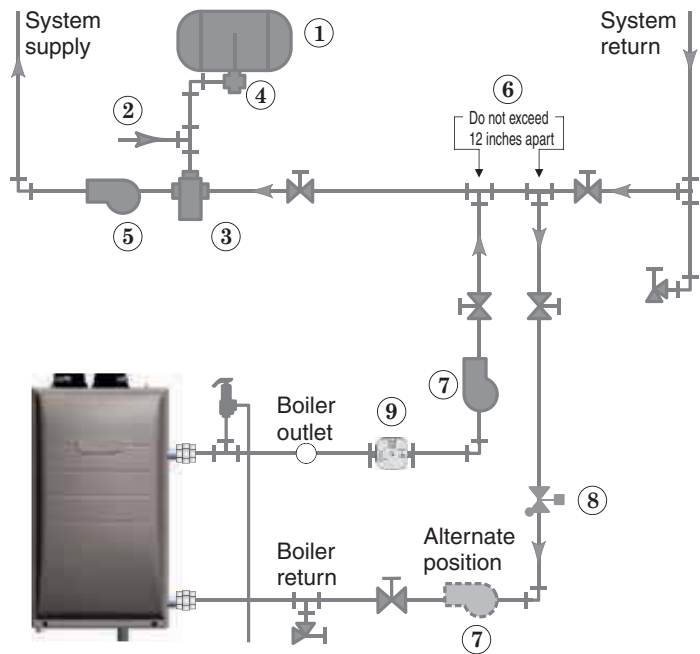
Connect piping ( $\frac{1}{2}$ " or  $\frac{3}{4}$ " ) from the air separator outlet to the tank fitting. Slope any horizontal piping a minimum of 1 inch per 5 feet of horizontal pipe.

Always use a **tank fitting** such as the B&G Tank-trol or Taco Taco-trol (shown). The fitting reduces gravity flow of water in the piping to the tank, avoids air bubbling through the tank water, and provides the proper fill height in the tank.

**CAUTION** **Correct all leaks** in the system or tank piping. Leaks allow air to escape from the system and will cause water-logging of the tank. This will result in water loss through the boiler relief valve due to over-pressurization. **NEVER** use an automatic air vent in a system equipped with a closed-type expansion tank. The air removed from the system will cause water-logging of the expansion tank.

**NOTICE** Closed-type expansion tank—Follow tank manufacturer's instructions for filling the tank. Typical tank sizing provides for approximately 12 PSIG when the tank is filled to the normal level and system water is cold. Note that boiler relief valve is set for 30 PSIG. Operation pressure of system, after temperature expansion above cold fill pressure, should not exceed 24 PSIG to avoid weeping of relieve valve.

**Figure 53** Piping to closed-type expansion tank



- |                              |                                |
|------------------------------|--------------------------------|
| ① Closed-type expansion tank | ⑥ Primary/secondary connection |
| ② Make-up water supply       | ⑦ Boiler circulator            |
| ③ Air separator              | ⑧ Flow/check valve             |
| ④ Tank fitting               | ⑨ Low Water Cut-Off (If used)  |
| ⑤ System circulator          |                                |

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# Primary/Secondary System piping *(continued)*

## System water piping methods

### Near boiler piping

1. Connect boiler to system only as shown in Figure 52, page 47 and Figure 53, page 48. The primary/secondary piping shown ensures the boiler loop will have sufficient flow.
2. Select a boiler loop temperature rise from Figure 54. The table indicates the flow and head loss characteristics at that temperature rise and suggests potential circulators. Circulators of other brands not listed (Wilo, Armstrong, B&G) are acceptable if they meet the flow and head requirements of the design.

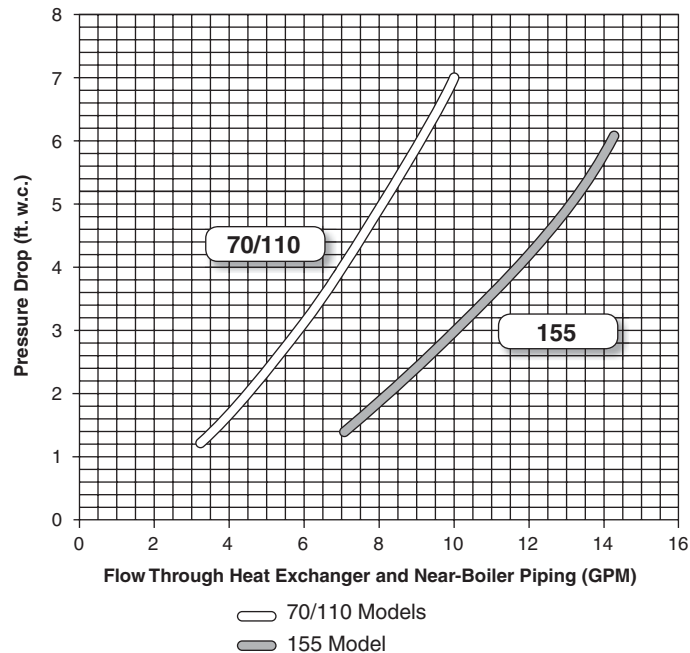
**NOTICE**

Verify that the boiler loop piping matches closely with the listed criteria in the **NOTICE** below. If near boiler piping is different, calculate head loss separately using heat exchanger pressure drop information from Figure 49, page 44 and match to an appropriate pump.

**NOTICE**

The pressure drops shown are for near boiler piping as illustrated in Figure 52, page 47 and Figure 53, page 48 with 20 feet of straight piping.

**Figure 55** Estimated head loss of boiler loop piping and recommended circulators.



**Figure 54** Estimated head loss of boiler loop piping and recommended circulators.

ΔT (°F)	Flow (GPM)	HEAD (ft. w.c.)	Circulators						
			Taco (Standard)	Taco (3-speed)	Grundfos	Wilo	B&G (Standard)	B&G (3-speed)	Armstrong
Model 70 (70,000 Btu/hr)									
20	6.5	3.6	007 *	007 (Lo)*	UPS 15-58 (Spd 1)	Star S 21 FX (Spd 2)*	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 2)*
30	4.3	2.0	007 *	007 (Lo)*	UPS 15-58 (Spd 1)*	Star S 21 FX (Spd 1)*	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 1)*
40	3.3	1.3	007 *	007 (Lo)*	UPS 15-58 (Spd 1)*	Star S 21 FX (Spd 1)*	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 1)*
Model 110 (110,000 Btu/hr)									
20	10.1	7.1	007	0015 (Med)	UPS 15-58 (Spd 3)*	Star S 21 FX (Spd 3)*	NRF-22	NRF-25 (Spd 1)	Astro 230 (Spd 3)
30	6.7	3.8	007 *	007 (Lo)	UPS 15-58 (Spd 1)	Star S 21 FX (Spd 2)*	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 2)*
40	5.1	2.5	007 *	007 (Lo)*	UPS 15-58 (Spd 1)*	Star S 21 FX (Spd 1)	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 1)*
Model 155 (155,000 Btu/hr)									
20	14.3	6.1	007	0015 (Hi)	UPS 15-42F (Spd 3)	Star S 21 FX (Spd 3)	NRF-22	NRF-25 (Spd 3)	Astro 250 (Spd 3)
30	9.5	2.7	007 *	007 (Med)	UPS 15-58 (Spd 2)*	Star S 21 FX (Spd 2)	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 2)*
40	7.2	1.5	007 *	007 (Lo)*	UPS 15-58 (Spd 1)*	Star S 21 FX (Spd 1)	NRF-22*	NRF-25 (Spd 1)*	Astro 230 (Spd 1)

\* Due to the low pressure drop of the heat exchanger, these pumps should be throttled in order to achieve the listed flow rate.

# Primary/Secondary System piping *(continued)*

## System circulators and zone circulators

1. Install a system circulator or zone circulators as shown in the piping diagrams in the Primary/Secondary System Piping section in this manual. These circulators must be supplied by the installer.

## System or zone circulators flow rates

1. Size circulators based on the flow rate required to achieve the temperature change you 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:

1. 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.**

## System or zone circulator head requirement

1. The circulator must be capable of delivering the required flow against the head loss that will occur in the piping.
2. Determine the pipe size needed and the resultant head loss using accepted engineering methods.

## Install relief valve

1. Install relief valve in 1 " x 1 " x ¾" (for 70/110) or 1 ¼" x 1 ¼" x ¾" (for 155) reducing tee piped from boiler supply piping tee (Figure 8, page 14).
2. Pipe the relief valve only as shown, in the location shown.
3. 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:**

Install relief valve ONLY with the spindle vertical, as shown in illustrations in this manual.

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. Locate away from the top of the boiler.

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.

# Primary/Secondary System piping *(continued)*

## ZONE VALVE zoning — primary/secondary

(Shown with optional DHW piping)

See Figure 56.

1. This configuration is for zone valve systems using a boiler loop connected as a secondary circuit off of a primary system loop. Systems whose flow characteristics do not comply with those listed in must pipe the boiler loop as a secondary circuit as shown.
2. Systems zoned with zone valves **MUST** use a by-pass pressure regulator.
3. Install a system circulator (supplied by installer) capable of delivering the proper flow and head as shown.

### Expansion Tank required

1. Provide a system expansion tank following the guidelines on page 47 or 48.
2. **DO NOT** use a closed-type tank if connecting to a water heater that is equipped with an automatic vent.

### Domestic Hot Water (DHW) tank, if used

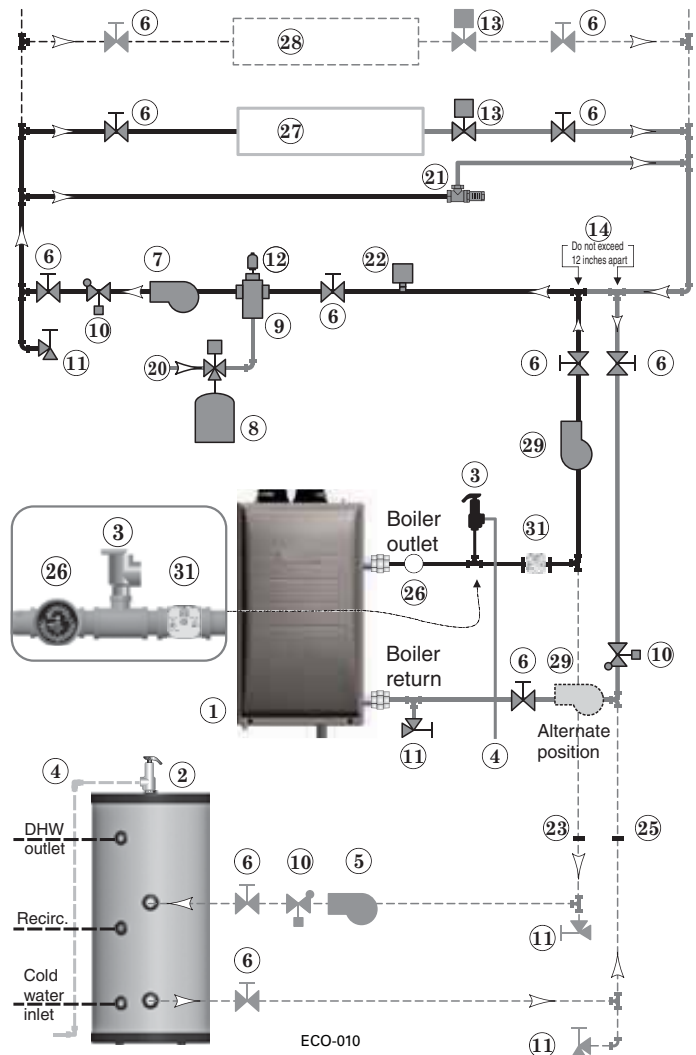
1. DHW direct connection—Pipe from the near-boiler piping to the DHW tank's boiler connections as shown.
2. DHW as zone—A DHW tank can be connected as a zone if a DHW tank is **NOT** already connected to the boiler. To provide DHW priority operation, use a zone controller. See notices on page 63 to ensure compliance with the 2007 Energy Act.
3. DHW Priority operation—The ECO control turns off space heating to the HEAT zones during domestic water heating calls on the DHW input. The MAX ON TIME setting can be adjusted to limit how long this occurs. Set the MAX ON TIME to "0" to disable domestic priority. See page 74 for setting instructions.
4. If **NOT** connecting a water heater, do not use the DHW input or DHW Circulator output on the ECO control.

**NOTICE** Overriding the Outdoor Reset function by connecting space heating zones to inputs and outputs intended for DHW applications may violate **Section 303 of the 2007 Energy Act**. See page 127 for compliance information and exemptions.

### Controlling the Zones

1. The ECO control can be used to control space heating only, domestic water heating only, or both. Refer to field wiring, beginning on page 60, for instructions on wiring to zone valves.
2. The boiler and zone valves can also be operated by a Weil-McLain WMZV zone controller.

**Figure 56** Zone valve zoning — primary/secondary connection — a system circulator is required



**NOTICE** Connect zone valve end switches to HEAT input. Connect system circulator to HEAT Circ. output.

**CAUTION** Use isolation relays if connecting 3-wire zone valve end switches to the HEAT input.

### LEGEND for Figure 56.

- 1 ECO wall mount boiler
- 2 Indirect Water Heater, if used
- 3 Relief valve, supplied with boiler, field piped — **MUST** be piped to boiler supply connection — see page 14 for information
- 4 Relief valve piping to drain — see page 50
- 5 DHW circulator
- 6 Isolation valves
- 7 System circulator
- 8 Expansion tank, diaphragm type, if used
- 9 Air separator
- 10 Flow/check valves
- 11 Purge/drain valves (one drain valve shipped loose with boiler)

- 12 Auto air vent
- 13 Zone valves
- 14 Primary/secondary connection (tees no more than 12 inches apart)
- 15 Expansion tank, closed type, if used (some chiller systems may use a diaphragm-type expansion tank)
- 16 Water chiller
- 17 Check valve
- 18 Y-strainer
- 19 Balancing valve
- 20 Make-up water supply — Use applicable codes to determine if backflow preventers, pressure reducing valves, and fill valves may be required

**Note:** This is a common legend for all piping diagrams. Not all items listed appear in every figure.

- 21 By-pass pressure regulator, **REQUIRED** for zone valve systems unless other provision is made
- 22 High limit temperature control
- 23 DHW tank boiler water supply connection, when used
- 24 Zone circulator
- 25 DHW tank boiler water return connection, when used
- 26 Pressure/temperature gauge, supplied with boiler, field piped
- 27 Heating circuits
- 28 Additional heating circuits, if any
- 29 Boiler circulator, if any
- 30 Mixing valve, if any
- 31 Low Water Cut-Off (If used)

# Primary/Secondary System piping *(continued)*

## Circulator zoning – primary/secondary (Shown with optional DHW piping)

See Figure 57.

1. This configuration is for circulator-zoned systems using a boiler loop connected as a secondary circuit off of a primary system loop. Systems zoned with circulators must pipe the boiler loop as a secondary circuit as shown.
2. Install a separate circulator (supplied by installer) for each zone capable of delivering the proper flow and head as shown.

### Expansion Tank required

1. Provide a system expansion tank following the guidelines on page 47 or 48.
2. **DO NOT** use a closed-type tank if connecting to a water heater that is equipped with an automatic vent.

### Domestic Hot Water (DHW) tank, if used

1. DHW direct connection — Pipe from the near-boiler piping to the DHW tank's boiler connections as shown.
2. DHW as zone—A DHW tank can be connected as a zone if a DHW tank is **NOT** already connected to the boiler. To provide DHW priority operation, use a zone controller. See notices on page 63 to ensure compliance with the 2007 Energy Act.
3. DHW Priority operation—The ECO control turns off space heating to the HEAT zones during domestic water heating calls on the DHW input. The MAX ON TIME setting can be adjusted to limit how long this occurs. Set the MAX ON TIME to “0” to disable domestic priority. See page 74 for setting instructions.
4. If **NOT** connecting a water heater, do not use the DHW input or DHW Circulator output on the ECO control.

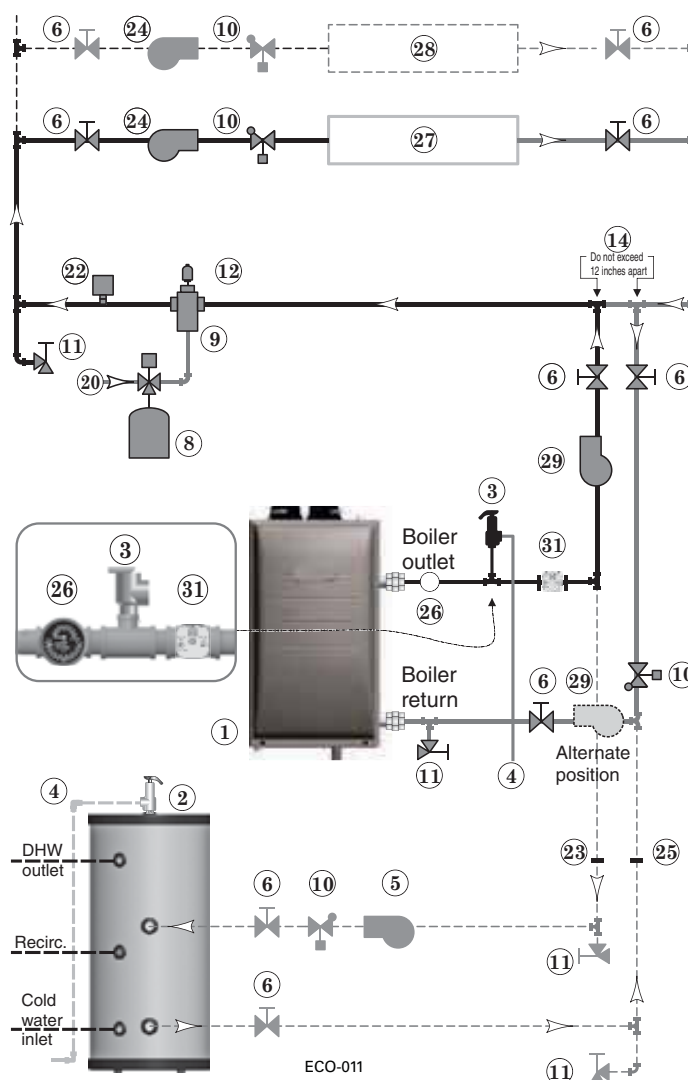
### NOTICE

Overriding the Outdoor Reset function by connecting space heating zones to inputs and outputs intended for DHW applications may violate **Section 303 of the 2007 Energy Act**. See page 127 for compliance information and exemptions.

### Controlling the Zones

1. The ECO control can be used to control space heating only, domestic water heating only, or both. Refer to field wiring, beginning on page 60, for instructions on wiring to circulators.
2. The boiler and circulators can also be operated by a Weil-McLain WMCR zone controller.

**Figure 57** Circulator zoning plus optional DHW piping



### LEGEND for Figure 57 and Figure 58

- 1 ECO wall mount boiler
- 2 Indirect Water Heater, if used
- 3 Relief valve, supplied with boiler, field piped — **MUST** be piped to boiler supply connection — see page 14 for information
- 4 Relief valve piping to drain — see page 50
- 5 DHW circulator
- 6 Isolation valves
- 7 System circulator
- 8 Expansion tank, diaphragm type, if used
- 9 Air separator
- 10 Flow/check valves
- 11 Purge/drain valves (one drain valve shipped loose with boiler)

- 12 Auto air vent
- 13 Zone valves
- 14 Primary/secondary connection (tees no more than 12 inches apart)
- 15 Expansion tank, closed type, if used (some chiller systems may use a diaphragm-type expansion tank)
- 16 Water chiller
- 17 Check valve
- 18 Y-strainer
- 19 Balancing valve
- 20 Make-up water supply – Use applicable codes to determine if backflow preventers, pressure reducing valves, and fill valves may be required

**Note:** This is a common legend for all piping diagrams. Not all items listed appear in every figure.

- 21 By-pass pressure regulator, **REQUIRED** for zone valve systems unless other provision is made
- 22 High limit temperature control
- 23 DHW tank boiler water supply connection, when used
- 24 Zone circulator
- 25 DHW tank boiler water return connection, when used
- 26 Pressure/temperature gauge, supplied with boiler, field piped
- 27 Heating circuits
- 28 Additional heating circuits, if any
- 29 Boiler circulator, if any
- 30 Mixing valve, if any
- 31 Low Water Cut-Off (If used)

# Primary/Secondary System piping *(continued)*

## Circulator zoning – Multiple temperature zones with primary/secondary

(Shown with optional DHW piping)

See Figure 58.

1. This configuration is for circulator-zoned systems with **high- and low-temperature heating zones** using a boiler loop connected as a secondary circuit off of a primary system loop. Systems zoned with circulators must pipe the boiler loop as a secondary circuit as shown.
2. Install a separate circulator (supplied by installer) for each zone capable of delivering the proper flow and head as shown.

### Expansion Tank required

1. Provide a system expansion tank following the guidelines on page 47 or 48.
2. **DO NOT** use a closed-type tank if connecting to a water heater that is equipped with an automatic vent.

### System setup and settings

1. Hi-temp emitters may be baseboards, radiators, fan coils, or heat exchangers.
2. Add a mixing device (Figure 58, item 30) to help ensure supply water temperature will not exceed the maximum allowable for the radiant system.
3. Heating zone supply water temperature settings should be selected for the hi-temp zones. The mixing device regulates supply temperature to the lower-temp zones.

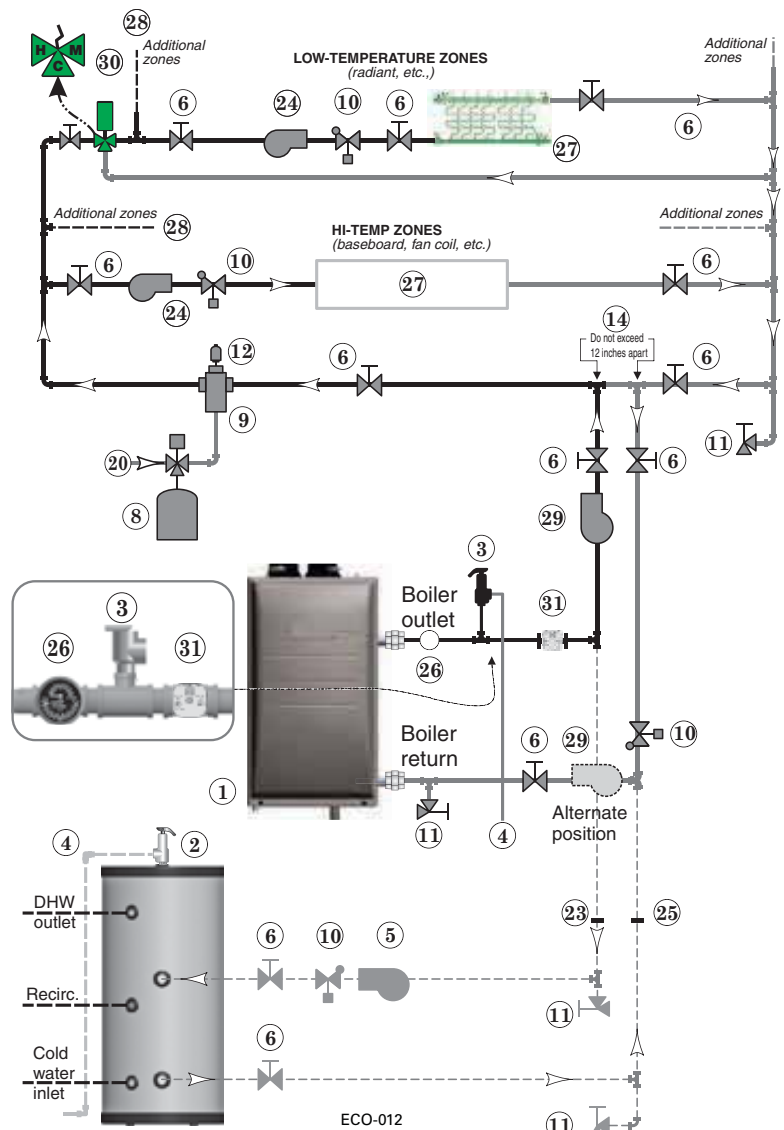
### Domestic Hot Water (DHW) tank, if used

1. DHW direct connection—Pipe from the near-boiler piping to the DHW tank's boiler connections as shown.
2. DHW as zone—A DHW tank can be connected as a zone if a DHW tank is **NOT** already connected to the boiler. To provide DHW priority operation, use a zone controller. See notices on page 63 to ensure compliance with the 2007 Energy Act.
3. DHW Priority operation—The ECO control turns off space heating to the HEAT zones during domestic water heating calls on the DHW input. The MAX ON TIME setting can be adjusted to limit how long this occurs. Set the MAX ON TIME to "0" to disable domestic priority. See page 74 for setting instructions.
4. If **NOT** connecting a water heater, do not use the DHW input or DHW Circulator output on the ECO control.

#### NOTICE

Overriding the Outdoor Reset function by connecting space heating zones to inputs and outputs intended for DHW applications may violate **Section 303 of the 2007 Energy Act**. See page 127 for compliance information and exemptions.

**Figure 58** Circulator zoning with high- and low-temperature heating zones

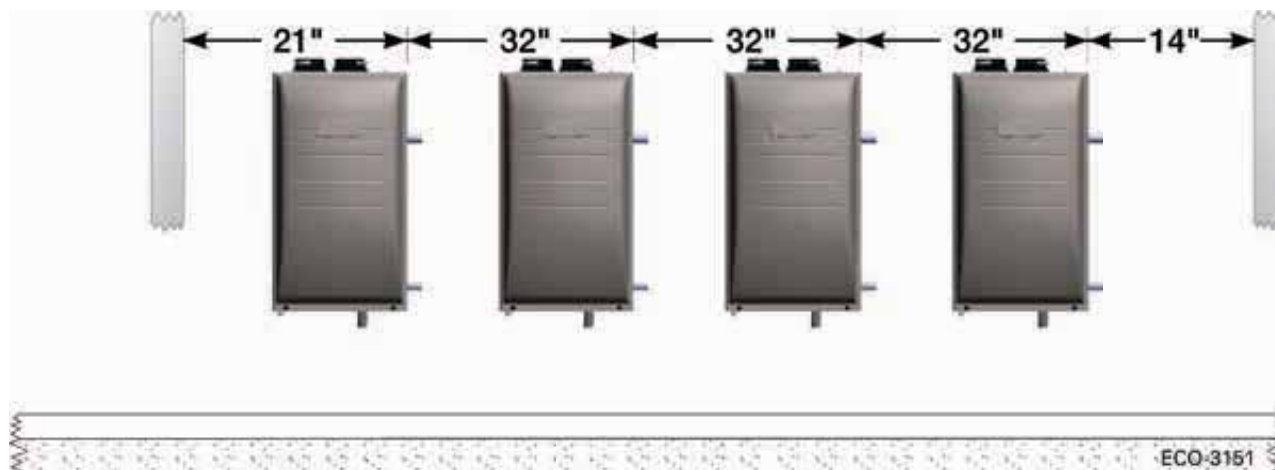


### Controlling the Zones

1. The ECO control can be used to control space heating only, domestic water heating only, or both. Refer to field wiring, beginning on page 60, for instructions on wiring to circulators.
2. The boiler and circulators can also be operated by a Weil-McLain WMCR zone controller.

# Multiple boiler installations

**Figure 59** Side-to-side mounting of multiple ECO boilers



## Placing multiple boilers

1. Locate multiple boilers with spacings shown in Figure 59.
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 9. Also follow local codes.
3. Provide a minimum 30-inch walkway in front of the boilers to ensure accessibility.
4. Uncrate, assemble and mount boilers according to instructions in this manual.
5. Provide clearance for installation of venting, air piping, expansion tank, primary circulator and other accessories.



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

**MIN. AREA = TOTAL MBH INPUT DIVIDED BY 2**

Example: A multiple boiler system with (6) ECO 155 boilers has a total input of  $6 \times 155 = 930$  MBH (930,000 Btuh). The required duct cross sectional area is:

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

## Manifolded combustion air option

1. Multiple ECO boilers can use a common combustion air manifold.
  - a. Provide minimum clearance to adjacent vents and grade/snow line as shown in Figure 60.
  - b. Provide minimum free area in duct (adjusted for louver restriction) of **1 square inch per 2,000 Btuh** total boiler input (or see Figure 133, page 128).
  - c. If combustion air damper is used, wire to boilers to prevent operation except after damper has opened.



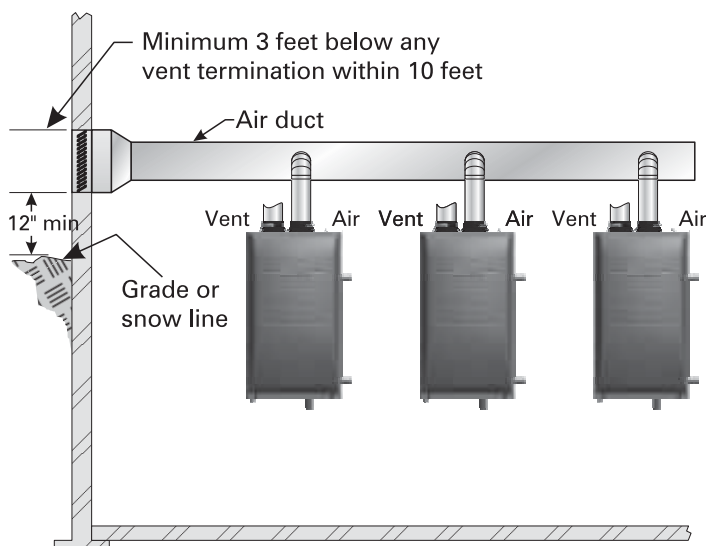
ONLY air piping can be combined. DO NOT use combined vent piping. Flue gas leakage and boiler component damage can occur. Failure to comply could result in severe personal injury, death or substantial property damage.



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 133, page 128 for minimum cross sectional area of combined air ducts.

**Figure 60** Manifolded combustion air option



# Multiple boiler installations *(continued)*

## Sequencing multiple ECO boilers

1. Use a multiple-boiler controller, such as the Weil-McLain BCP, BMC or BSC, to sequence boilers. Locate temperature sensors as required in the controller manual.

## Easy-Fit® piping installation

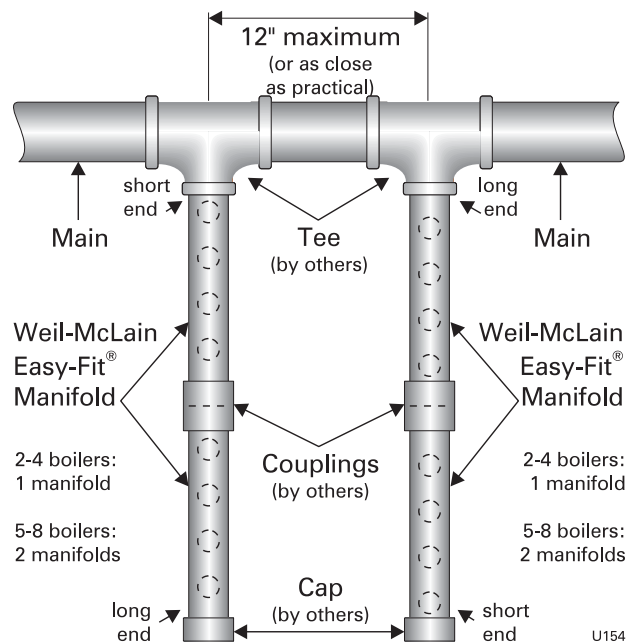
1. Main header and Easy-Fit® Manifold pipe sizing.
  - a. Size system piping as required for the flow.
  - b. Install tees or crosses in the system piping for Easy-Fit® manifolds as shown in Figure 61 or Figure 62. Size manifolds to handle total connected boiler output as shown.
2. Provide connections 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 61.
  - b. Use either tees (Figure 61) or crosses (Figure 62) 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 61 and Figure 62.
  - 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.

**NOTICE** It is recommended to pipe to boilers such that the first boiler connection off the return manifold is piped to the furthest connection on the supply manifold from the main header. See Figure 63, page 56 and Figure 64, page 57 for example.

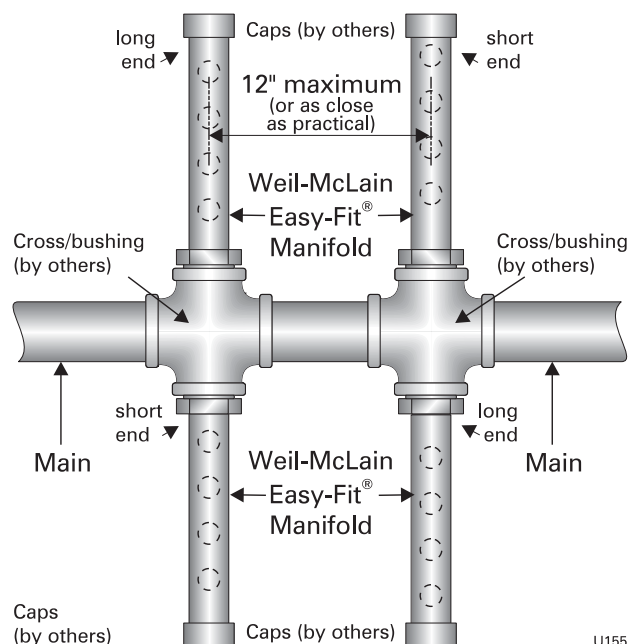
5. Install an isolation valve on the supply and return of each boiler as shown in the piping diagrams in this manual. Some local codes may require the use of individual water level controls and limits on each boiler because isolation valves are installed.
6. Install main system air eliminator and primary 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 61 and Figure 62 show details of Easy-Fit® manifolds.
  - b. Figure 63, page 56 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.
9. If desired, other primary/secondary piping arrangements can be used.

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

**Figure 61** Single-sided EZ-Fit Header connection

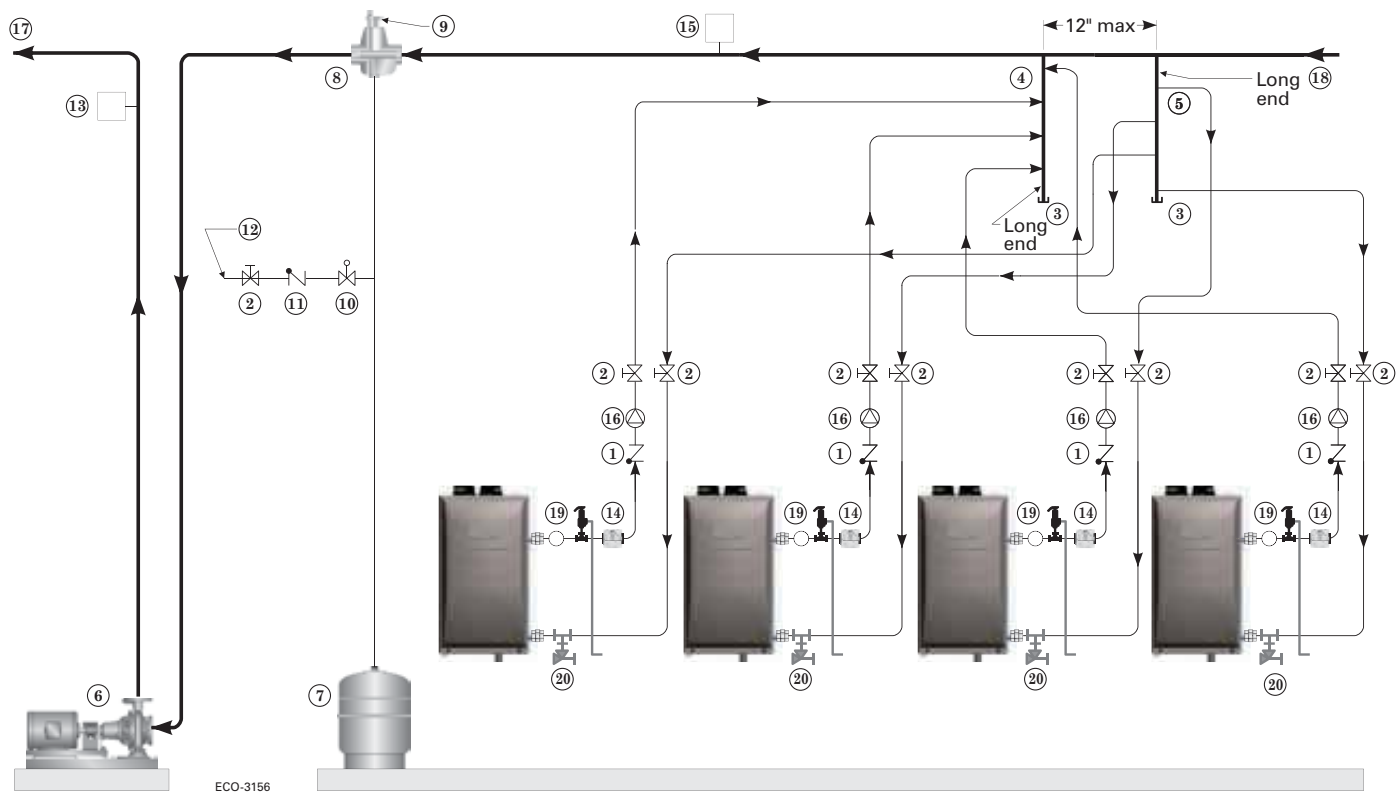


**Figure 62** Double-sided EZ-Fit Header connection



# Multiple boiler installations *(continued)*

**Figure 63** Piping schematic — typical piping for multiple ECO boilers, using Weil-McLain Easy-Fit manifolds



## Legend for Figure 63

- |   |   |
|---|---|
| 1 Flow/check valve  | 11 Check valve or backflow preventer, as required by applicable codes                   |
| 2 Isolation valves (when used)                              | 12 Cold water supply  |
| 3 Cap   | 13 Supply water temperature control (when used)   |
| 4 Easy-Fit® Manifold (supply) — layout and size per page 55 | 14 Low water cutoff (when used)   |
| 5 Easy-Fit® Manifold (return) — layout and size per page 55 | 15 Water flow switch (when used)  |
| 6 Primary circulator  | 16 Boiler circulators   |
| 7 Expansion tank (diaphragm type)                           | 17 System supply  |
| 8 System air eliminator                                     | 18 System return  |
| 9 System automatic air vent                                 | 19 Boiler P/T gauge, relief valve and discharge piping, installed per ECO Boiler Manual |
| 10 Pressure reducing valve                                  | 20 Purge/drain valve  |

# Multiple boiler installations *(continued)*

## DHW tank piping with multiple ECO boilers

### DHW direct connection—single tank

1. If BTUH output of a single boiler is sufficient for the DHW tank/demand, pipe the indirect water heater to the last boiler in the firing sequence. This will allow the previous boilers to continue space heating while the last boiler delivers DHW priority.
2. Pipe from the near-boiler piping to the DHW tank's boiler connections as shown in Figure 56, page 51.
3. Connect the DHW tank aquastat directly to the DHW input on the last boiler in the sequence.

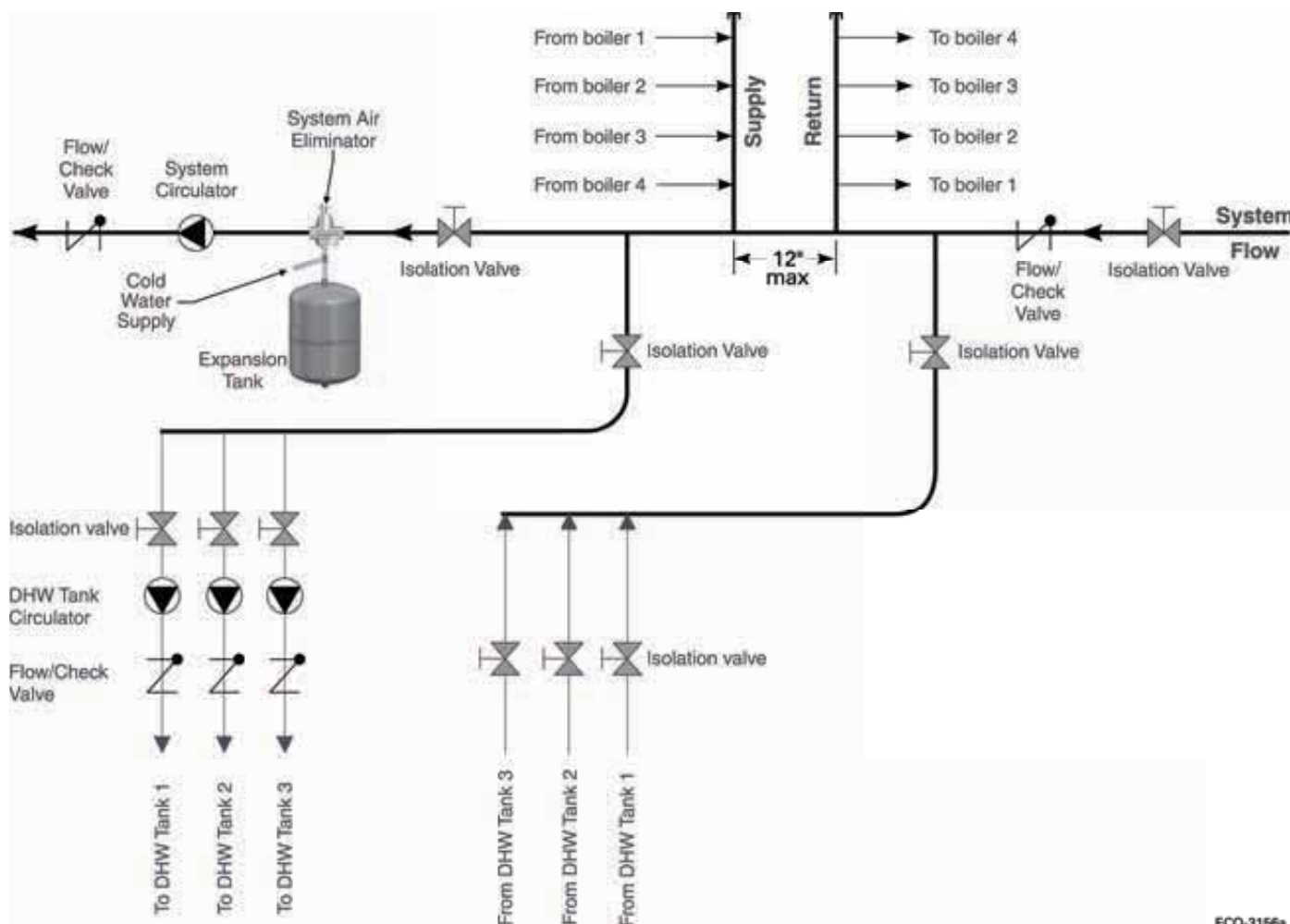
**NOTICE**

When using a multiple-boiler control with lead boiler rotation, it is recommended that the boiler connected to the DHW tank is always set as the last boiler to operate in the sequence so that space heat can be maintained during times of DHW demand.

### DHW tanks as zone—multiple tanks

1. If using multiple DHW tanks or multiple banks of tanks, pipe the tanks to the primary system loop with a secondary connection as shown in Figure 64.
2. DHW tanks are zoned with circulators as shown.
3. DHW circulators should be controlled with a Weil-McLain WMCR zone controller.
4. If DHW priority is required, use separate zone controllers for DHW and space heating. Connect the isolation switch output of the DHW zone controller to the DHW input of the multiple boiler control (Weil-McLain BCP, BMC, or BSC).

**Figure 64** Piping layout—typical piping for multiple boilers (4-boiler system shown) with DHW storage heaters grouped as zone in secondary loop off primary system loop



ECO-3156a

# Install condensate line

## Prepare condensate trap assembly

1. Remove the condensate trap kit from the accessories bag.
2. See Figure 65. The left image shows the complete condensate trap kit.
3. Remove the flexible drain tube nut, item 2.
4. Push the flexible tube gasket ring (item 3) onto the end of the flexible tube (item 1) as shown in Figure 65. The tube should extend through the gasket about ¼ inch.
5. Insert the flexible tube and gasket into the drain fitting. When in position, the offset edge of the gasket ring will rest on the shoulder of the drain fitting as shown in Figure 65, detail 6.
6. Secure the flexible tube in place by screwing on the nut, item 2. Finger tighten securely.

## Install the condensate trap assembly

1. Insert the condensate trap ball, Figure 65, item 5 into the trap body (item 4).

**WARNING** The condensate trap ball **MUST** be in place in the condensate trap assembly to prevent possible flue gas leakage through the condensate drain system.

2. Loosen the top nut on the trap body.
3. Slide the trap assembly onto the boiler condensate outlet. Firmly hand tighten the upper nut to secure the condensate trap in place.
4. Place the condensate bracket around the top nut and align the slot and hole with the holes in the bottom plate. Push the slotted rivet nuts through the bracket hole and slot into the holes in the cabinet.

## Condensate drain system

1. **Install condensate drain by connecting tubing or PVC pipe to the flexible drain line. Run the drain tubing or piping to a floor drain or condensate pump.** The flexible drain line will fit in a ¾" PVC coupling. Run minimum ½" PVC for the piping to drain or condensate pump.

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

2. Select a condensate pump (if used) that is approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The pump should have a minimum capacity of 2 GPH for the ECO 70, 3 GPH for the ECO 110, or 4 GPH for the ECO 155.
3. When sizing condensate pumps, make sure to include the total load of all appliances 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 manner, condensate can exit from the boiler tee, resulting in potential water damage to property.

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

### WARNING

The condensate trap and bracket must be in place during all operation. Make sure the trap is securely attached to the condensate outlet and that the condensate discharge line is in good condition and installed per this manual. Failure to comply could result in severe personal injury, death or substantial property damage.

Figure 65 Condensate trap assembly

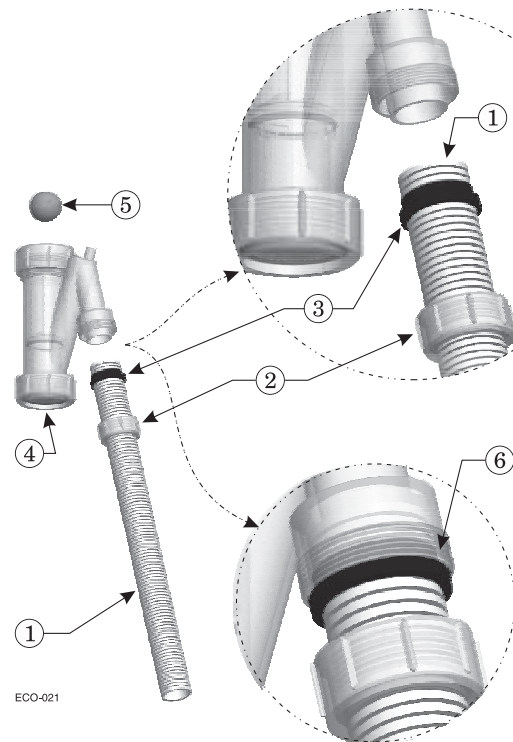
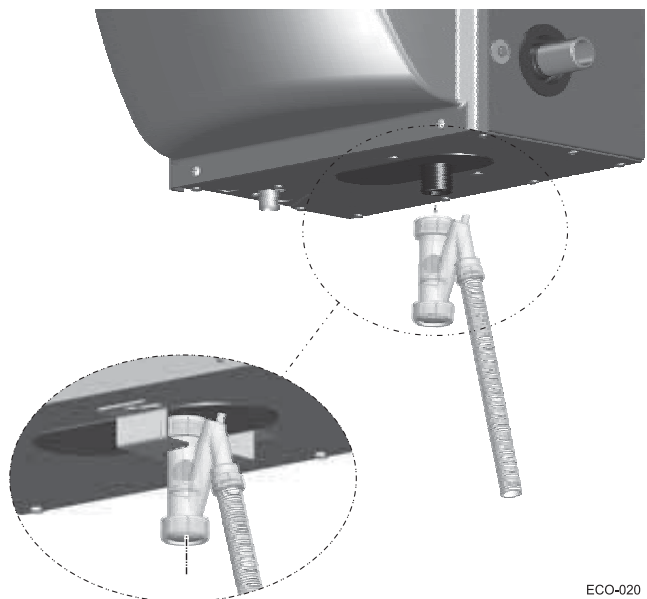


Figure 66 Condensate trap connection



## Gas piping

**▲WARNING** ECO boilers are shipped ready to fire natural gas ONLY. You must install the propane orifice if the boiler will be connected to propane. See page 15. Failure to comply could result in severe personal injury, death or substantial property damage.

### Connecting gas supply piping

1. Remove jacket door and refer to Figure 67 to pipe gas to boiler.
  - a. Place a pipe wrench on the gas line inside the jacket when tightening the gas line assembly to the boiler gas connection (item 1).
  - b. Install steel pipe fittings and factory-supplied gas cock as shown in Figure 67. All pipe fittings are supplied by the installer. The gas cock is shipped loose with the boiler.
  - c. In Canada — The gas shut-off valve (item 2) must be identified by the installer.
2. 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.

3. Connect gas supply piping to the ½" NPT gas cock (item 2).
4. Support gas piping with hangers, not by boiler or its accessories.
5. Purge all air from gas supply piping.
6. Before placing boiler in operation, check boiler and its gas connection for leaks.
  - a. During any pressure testing at less than 13" (330 mm) w.c., close the gas shutoff valve and disconnect system gas piping. At higher test pressures, disconnect boiler and gas valve from gas supply piping.

**▲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.

**▲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. 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.

### Gas pipe sizing

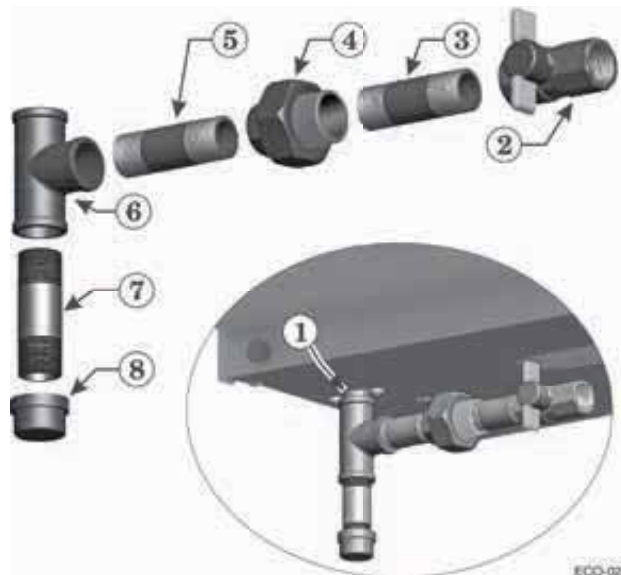
1. See page 21 for gas line sizing information.

### Check gas pressure at inlet to boiler

1. See Figure 93, page 84 (ECO 70), Figure 94, page 85 (ECO 110) or Figure 4, page 86 (ECO 155) 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 67** Connect gas supply piping



- 1 Boiler gas supply connection, ½" NPT male
  - 2 T-handle gas cock, ½" NPT, shipped loose with boiler
- ALL OF THE FOLLOWING ARE SUPPLIED BY THE INSTALLER:**
- 3 Nipple, ½" NPT
  - 4 Union, ½" NPT
  - 5 Nipple, ½" NPT
  - 6 Tee, ½" NPT
  - 7 Nipple, ½" NPT x 4", for drip leg
  - 8 Cap, ½" NPT

2. For natural gas or propane, the pressure required at gas valve inlet pressure port (verify minimum gas pressure when all gas appliances are in operation):
  - a. Maximum: 13" (330 mm) w.c. with no flow (lockup) or with boiler on.
  - b. Minimum gas pressure, with gas flowing (verify during boiler startup, while boiler is at high fire) :
    - ECO 70: 3½" (89 mm) w.c.;
    - ECO 110: 3½" (114 mm) w.c.;
    - ECO 155: 3½" (89 mm) w.c.
  - c. Nominal gas pressure: 11.0" (279 mm) w.c.
3. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 13" (330 mm) w.c. at any time. Adjust lockup regulator for 13" (330 mm) w.c. maximum.

# Field wiring

**⚠ 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, ANSI/NFPA 70 – latest edition 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.

## ECO boiler wiring

### Connecting terminals

All field wiring is made through the six colored connectors (shipped loose with boiler) directly to the control module. Line voltage, 120 VAC, terminals are on the top of the control module. Low voltage, 24VAC, terminals are on the bottom of the control module.

### Wire entrances

Wire entrance knockouts are provided on the top the boiler cabinet:

1. Line voltage— three (3) knockouts on the top right of the cabinet (Line In, DHW Circ., Heat Circ.).
2. Low voltage— two (2) knockouts on the top right of the cabinet.
3. Display wiring—a single knockout on the right side of the cabinet.

**⚠ WARNING** Installer MUST use a strain relief through jacket knockouts. Failure to do so can cause severe personal injury, death or substantial property damage.

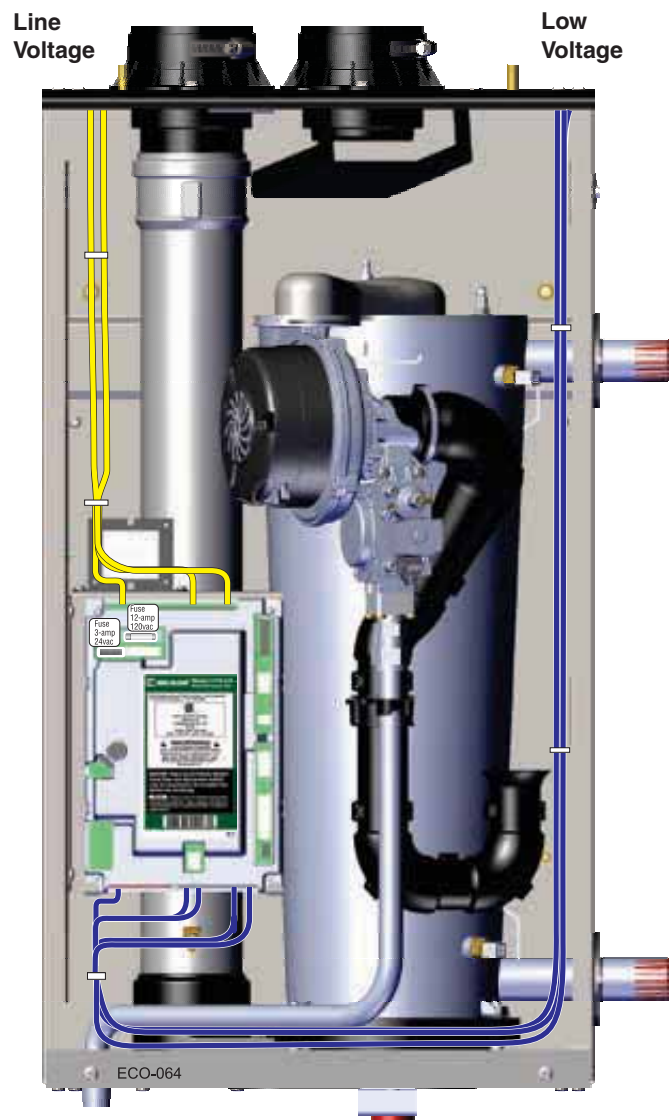
**⚠ WARNING** Installer MUST SEAL all electrical entrances using a sealed strain relief or a strain relief sealed with duct seal putty or silicone. Sealing the entrances prevents the boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other gas appliances. Failure to seal entrances could result in severe personal injury, death or substantial property damage.

### Wire routing in the cabinet

#### Line voltage:

1. Install 4 of the wire tie bases to the holes on the left side interior of the cabinet.
2. Line voltage should be wired from the top left electrical entrances following the left side of the cabinet.
3. Wires should be bundled together and secure with the provided wire ties to the wire tie bases located on the left side wire chase. Two sets of bases are provided, one for line in and one for the circulator outputs. Route wires in front of the transformer then into terminal blocks.
4. Strip end of wire no more than 1/8" to avoid exposing uninsulated wire.
5. It is recommended to install an On/Off service switch in a junction box mounted near the boiler. Installation must meet all National and local electrical codes.

**Figure 68** Field wiring overview (see Figure 73, page 64 and Figure 74, page 65 for detailed schematic and ladder wiring diagrams) ECO -110 shown



# Field wiring *(continued)*

## Low voltage:

1. Mount low voltage wire grommet to desired low voltage knockout.
2. Thermostat, aquastat, limit devices, and outdoor temperature sensor wire pairs should be routed through the grommet.
3. If routed through the bottom left knockouts, wires should be connected directly into the corresponding terminal block.
4. If routed through the top right knockouts, wires should be bundled together along the right side wire chase. Install a wire tie base on each of the two bent tabs along the right side to allow attachment of the provided wire ties.
5. Low water cutoff (optional) should be routed following the instructions in step 3 or 4 above depending on entrance location. Provide strain relief and a seal at cabinet entry.
6. Bundle all wires together with provided wire ties.
7. After wires are attached to the control terminal blocks. Make sure wires are properly sealed in the cabinet electrical entrances.

## Connecting the display wire harness

1. The display wire harness (shipped loose with boiler) is a long, grey wire with a 4-pin connector on each end.
2. Remove the grommet from the hole in the right side of the boiler jacket show in Figure 6, page 12. Route the harness through the hole so that the push-in strain relief clips are inside the cabinet and the grommet attached to the cable is outside the cabinet.
3. Connect the 4-pin connector on the inside of the boiler jacket to pin P9 on the control.

### NOTICE

Do not force the connector on to the pin. Connector should only connect one way. If connector does not easily slide on the pin, ensure connector is oriented properly. If connector is forced or connected improperly, damage to the circuit board could result.

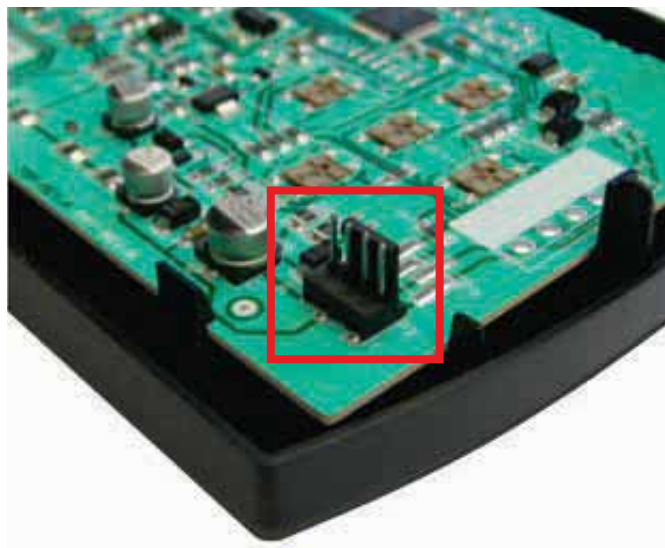
4. Push the strain relief clips into the extra holes provided on the two bent tabs along the right side of the boiler. You may need to push the wire harness or other low voltage wires out of the way to access the holes.
5. Find the grommet that is attached to the display wire harness. Insert the grommet into the hole on the right side of the boiler cabinet. Ensure grommet seals around both the cabinet and the wire.
6. If using a junction box, install a wire clamp or strain relief to one of the knockouts.
7. Unsnap the back plastic cover from the display housing. Mount back plastic cover to the display bracket, wall or junction box depending on installation. Screws for mounting to the display bracket are provided.

### NOTICE

Ensure that the small, square hole in the corner of the back plastic is located in the bottom right corner when mounted. This provides room to connect the display harness, see Figure 70 at right).

8. Route wire depending on display location:
  - a. Display bracket—bundle wire behind the display bracket and use a provided wire tie to neatly collect the extra wire length. Leave enough wire to reach through bottom right hole in the back plastic cover.

**Figure 69** Back of display circuit board - 4-pin terminal



- b. Drywall or plaster—fish the wire through the wall or through scoring in drywall and through the large, square hole in the back of the display backing. Ensure wire does not fall back into wall.
  - c. Junction box—route wire through the previously installed clamp or strain relief. Gather extra wire length inside the box and tighten clamp to provide strain relief. Route wire through the large square hole in the back plastic cover.
9. Turn over the front half of the display so that the circuit board is visible. Connect the 4-pin connector of the wiring harness to the 4-pin terminal shown in Figure 69.
  10. Fit the front display plastic to the back display plastic. Clip the two halves together and ensure they are firmly secure. The buttons should be located below the display screen (see Figure 70).

**Figure 70** Proper orientation of display when mounted



## Field wiring *(continued)*

### Line voltage wiring (120 VAC)

Make the following line-voltage connections, some of which depend on your system and how the ECO control will be programmed. The call outs below refer to Figure 71.

#### P1 120VAC Power input

1. Provide and install a fused disconnect or service switch (15-ampere rated recommended) as required by applicable codes.
1. Connect minimum **15-ampere, 120VAC** power wiring to green, 3-pin terminal block as shown in Figure 71.
2. If possible, provide a surge suppressor in the supply power line. This will reduce the possibilities of ECO control damage due to line surges.
3. Must wire ground to this terminal to provide boiler grounding.

#### P2 DHW Circulator Output, 120VAC - pins 1,4,7

1. The ECO boiler control provides dedicated 120VAC outputs for one DHW zone (priority) and one heating zone.
2. Control setup requires that DHW tank be controlled from DHW Input/Output terminals to ensure post-pumping functionality.

#### NOTICE

Always connect the DHW circulator to the DHW Circ. Output to ensure post-pumping functionality.

3. DHW Circ. Output cannot be used to control a central heating zone. It bypasses the outdoor reset function.

#### P2 HEAT Circulator Output, 120VAC - pins 2,5,8

1. Control setup requires this output to:
  - a. Provide 120VAC to a system circulator (such as on a zone valve system with system circulator).
  - b. Provide 120VAC to a boiler loop circulator (in primary/secondary piping).
  - c. Provide post-pumping functionality (built in to ECO control) to prevent lockout due to temperature over shoot.

#### NOTICE

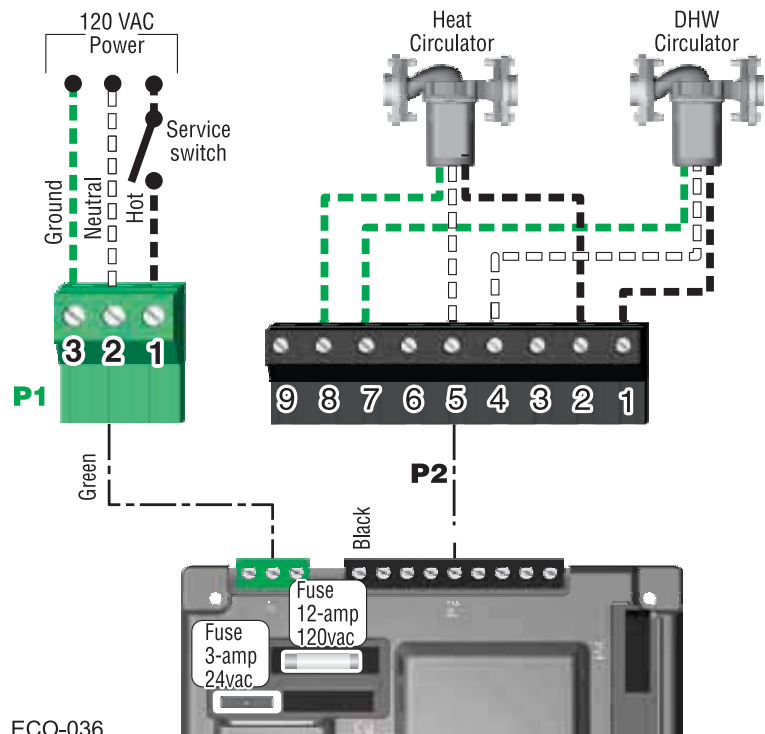
Always connect the system circulator (direct connect) or boiler circulator (primary/secondary) to the HEAT Circ. Output to ensure post-pumping functionality.

2. The ECO control will activate HEAT Circ. Output if the Heat thermostat or input device calls for heat, after DHW heating (if used) is satisfied.

#### WARNING

Do not connect more than one (1) circulator to the boiler circulator terminals. Connecting more than one (1) circulator can damage the control. If an additional circulator is needed use an isolation relay for the additional circulator.

**Figure 71** ECO line voltage input and output connections (120VAC)



#### WARNING

Output circuits are 120VAC. If an output is to operate a low voltage circuit, use an isolation relay.

#### WARNING

**CIRCULATOR POWER** — 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 ECO circulator terminals.

#### NOTICE

**WIRING INFORMATION** — See Figure 68, page 60 for wiring connection locations. See Figure 73, page 64 for the complete schematic wiring diagram. See Figure 74, page 65 for the complete ladder wiring diagram.

# Field wiring *(continued)*

## Low voltage wiring (24 VAC)

Make the following low-voltage connections, some of which depend on your system and how the ECO control will be programmed. The call outs below refer to Figure 72.

The control provides inputs for one DHW zone (priority) and one heating zone.

### P11 DHW input (DHW circuit only)

**NOTICE**

**Only use the DHW input when the system uses a DHW tank or other Domestic Hot Water production device. Do not use as a heating zone.**

1. Control requires that DHW tanks be controlled from **DHW Input** if domestic water priority is required.
2. ALWAYS connect DHW aquastat or isolated relay contacts from a DHW device to the DHW input. Depending on system design, a zone control may be necessary.

**NOTICE**

**Unless system is exempt based on the criteria listed on page 127, installer must provide external controls that distinguish between Aquastat (DHW) and thermostat (HEAT) calls for heat if external controls are needed.**

### P15 HEAT input (central heating)

1. Use **HEAT** input to:
  - a. Connect the thermostat for a space heating zone.
  - b. Connect end switch wire (must be ISOLATED contacts) to start boiler on a call for space heating.
  - c. Connect system control input for space heating call for heat (ISOLATED contact only).

The ECO control will activate the 120VAC **HEAT Circ.** output if the **HEAT** thermostat or input device calls for heat, after DHW heating is satisfied.

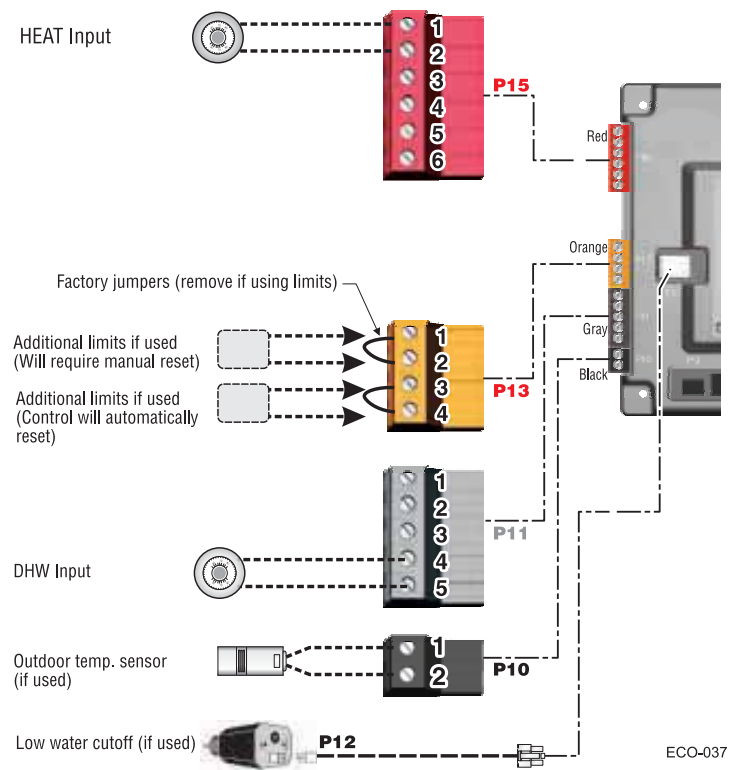
### P10 Outdoor temperature sensor (for outdoor reset)

1. The ECO control provides programmable options if using an outdoor temperature sensor. This sensor is supplied with the boiler. **The outdoor sensor must be installed unless specifically exempted in the Energy Act statement on page 127.**
2. Mount the outdoor sensor on an exterior wall, shielded from direct sunlight or flow of heat or cooling from other sources. The wire outlet on the sensor must be oriented DOWN to prevent water entry.
3. Connect the sensor leads to the black, 2-pin terminal block, as shown in the wiring diagrams. Thermostat wire can be used to connect the sensor.

### P13 External limits (will cause manual reset when opened) - pins 1, 2

1. Connect isolated contacts of external limits in series across pins 1 and 2 of the orange, 4-pin terminal block to cause the ECO control to lock out (requiring manual reset) if the limit opens. The limit must close and the control must be re-started using the procedure given in this manual.

**Figure 72** ECO low voltage input and output connections



### P13 External limits (will cause automatic reset when opened) - pins 3, 4

1. Connect isolated contacts of external limits in series across pins 3 and 4 of the orange, 4-pin terminal block to cause the ECO control to shut down the boiler on limit opening, then automatically restart after the limit closes.

### P12 Low water cut-off device (if used)

1. If using the optional kit, remove factory jumper from P12. Insert 4-pin molex connector from kit wire harness into P12.
2. To field wire a non-powered (isolated contact) low water cut-off, clip the factory jumper in the factory installed molex plug, strip the wires and connect to the LWCO's isolated contacts

**⚠ WARNING**

**Thermostats — DO NOT** supply 24-volt power to the thermostat circuits (P11 and P15 in Figure 72) or attempt to supply 24 volts for any other application.

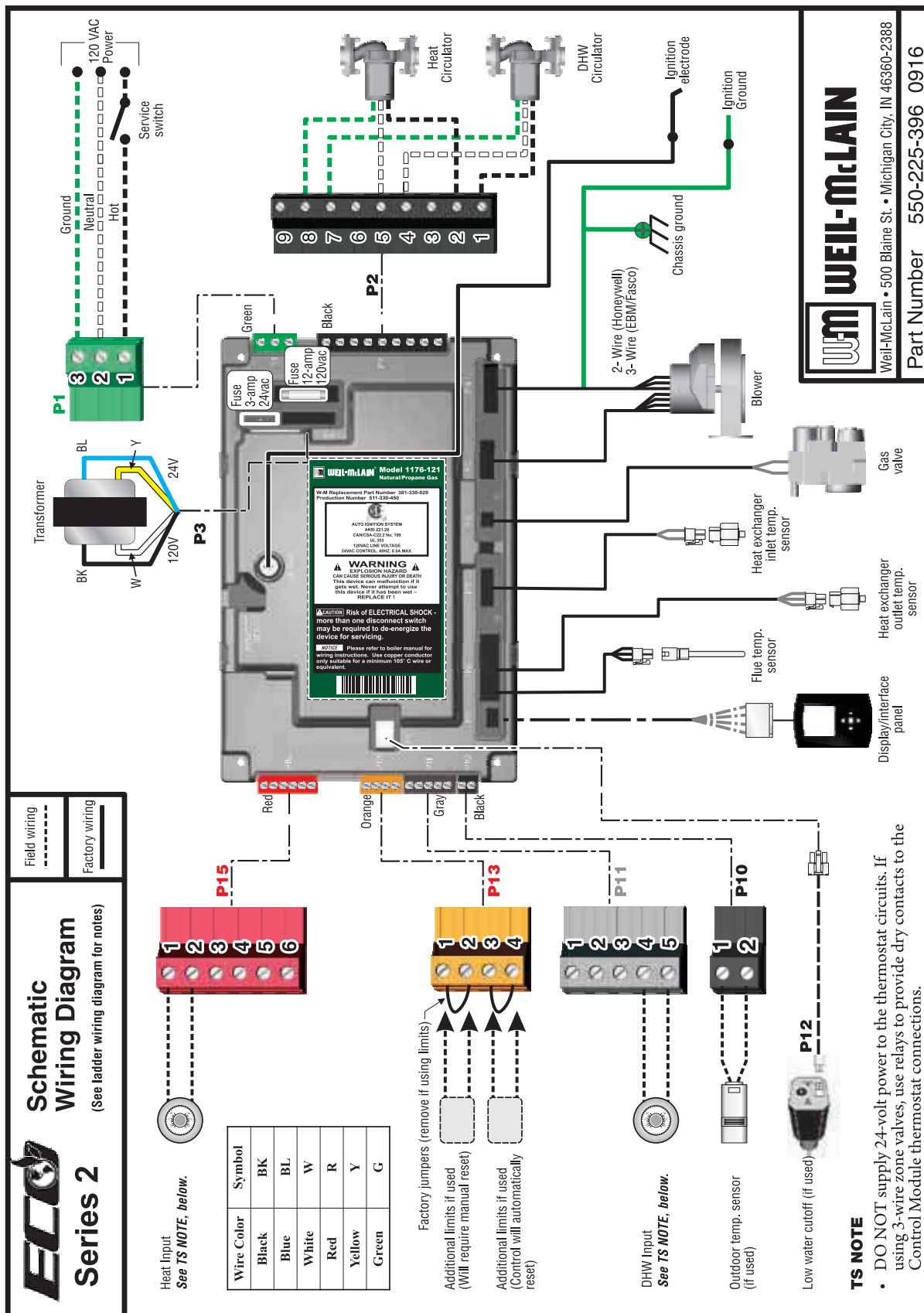
For thermostats that require a continuous 24-volt power source, connect the thermostat power input to “a separate 24V power source.”

**Zone valves —** If using 3-wire zone valves, use relays to provide dry contacts to the ECO control thermostat connections. The zone valve end switches of 3-wire valves carry 24VAC from the valve.

**Thermostat anticipator setting —** 0.1 amps.

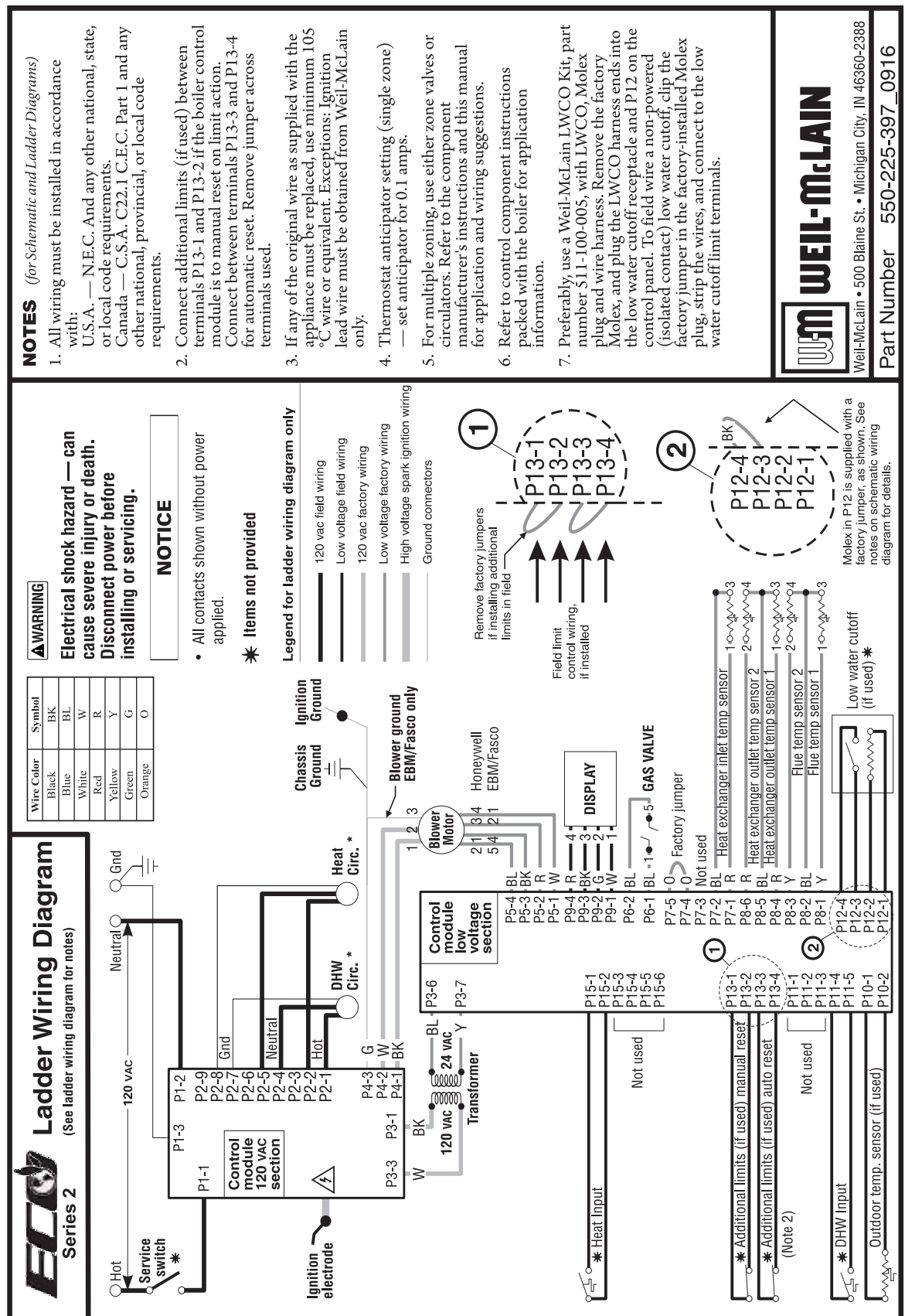
# Wiring diagram — schematic

**Figure 73** Schematic wiring diagram (see Figure 74, page 65 for legend and notes)



# Wiring diagram — ladder

**Figure 74** Ladder wiring diagram (see Figure 73, page 64 for schematic wiring diagram)



# EXPRESS SETUP — using default settings

## ⚠ CAUTION

**MANDATORY CONTROL SETTINGS** — The following settings must be checked and adjusted if necessary: BOILER MODEL and HIGH ALTITUDE in BOILER SETTINGS menu. See instructions on the following pages for menu access and control settings.

1. **The ECO control is set up to supply one DHW input and one HEAT input. Circulator outputs are relays controlled by the boiler control module.**
2. **All ECO boilers MUST utilize the provided outdoor temperature sensor for outdoor reset functionality unless exempt — see page 127.**
3. All heating zones use the same temperature settings (or outdoor reset curve if outdoor sensor is connected — see page 127).
4. DHW input is priority over the HEAT input.
5. DHW temperature settings are separate from heating settings and DHW calls do not use the outdoor reset curve.
6. Default heating settings are for finned tube baseboard only. (Other heat emitter types may require changes in the control setup.)
7. Only one zone thermostat or end switch input is provided. Use zone controllers for multiple zone systems.
8. Some of the default boiler and temperature setting are summarized in Figure 75 below. Verify that these settings are acceptable for the system type.

9. If the system qualifies for direct connect system piping (guidelines on page 43), reference the following pages for piping and control suggestions:
  - a. General guidelines — pages 43-45.
  - b. Zoned with zone valves — page 46.
10. If the system is piped using primary/secondary system piping, reference the following pages for piping and control suggestions:
  - a. General guidelines — pages 47-50.
  - b. Zoned with zone valves — page 51.
  - c. Zoned with circulators (single temp heating) — page 52.
  - d. Zoned with circulators (multi-temp heating) — page 53.

## ⚠ CAUTION

Other control settings may need to be adjusted in order for the control to operate the system most effectively. To ensure proper operation, read all instructions on pages 68-78 before starting up the system. Failure to comply could cause system problems.

**Figure 75** Default boiler and temperature settings (for complete list and details, see instructions and figures on pages 67-78).

Parameter Name	Default setting	Comments
Boiler Model	Factory-set	WARNING: THIS MUST BE SET CORRECTLY FOR SAFE OPERATION. See pages 71 and 72 if not set correctly.
High Altitude	No	WARNING: IF INSTALLED AT ALTITUDES ABOVE 5,500 FEET, CHANGE SETTING. See pages 71 and 72 if not set correctly.
Supply Max (Heat only)	180° F	See page 73 for suggestions based on system type.
Supply Min (Heat only)	130° F	
OD Reset Max (Heat only)	70° F	
OD Reset Min (Heat only)	0° F	
Boiler Supply (DHW only)	185° F	See pages 74-75. Consult tank supplier manual.

# ECO control operation

## ⚠ WARNING

**Temperature settings** — You must ensure that the ECO 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 ECO control external limit circuit. Failure to provide regulation can result in substantial property damage.

## Control features

- ☐ Blower speed modulation to control the ECO boiler's firing rate.
- ☐ Advanced PID response to anticipate system needs based on response to heat input.
- ☐ Robust text display for ease of operation monitoring and troubleshooting.
- ☐ Control of two dedicated inputs for DHW and HEAT respectively.
- ☐ Integral outdoor reset option (see page 127).
- ☐ Dual sensors for boiler outlet temperature and flue temperature, providing redundant protection.
- ☐ Low water cut-off, (field wired or optional kit).
- ☐ Boiler is shipped with an outdoor sensor, allowing outdoor reset operation for maximum boiler efficiency. See page 127.
- ☐ Freeze protection and circulator exercising.

## Sequence of operation

1. Figure 76 is a summary of the operating sequence for the ECO control.
- ☐ The statuses shown appear in the display as the ECO control cycles the boiler.
  - ☐ The display will flash red if a problem has been detected.

## ECO control setup

## ⚠ WARNING

**BEFORE PROCEEDING, perform ESSENTIAL control settings as instructed on page 69.**

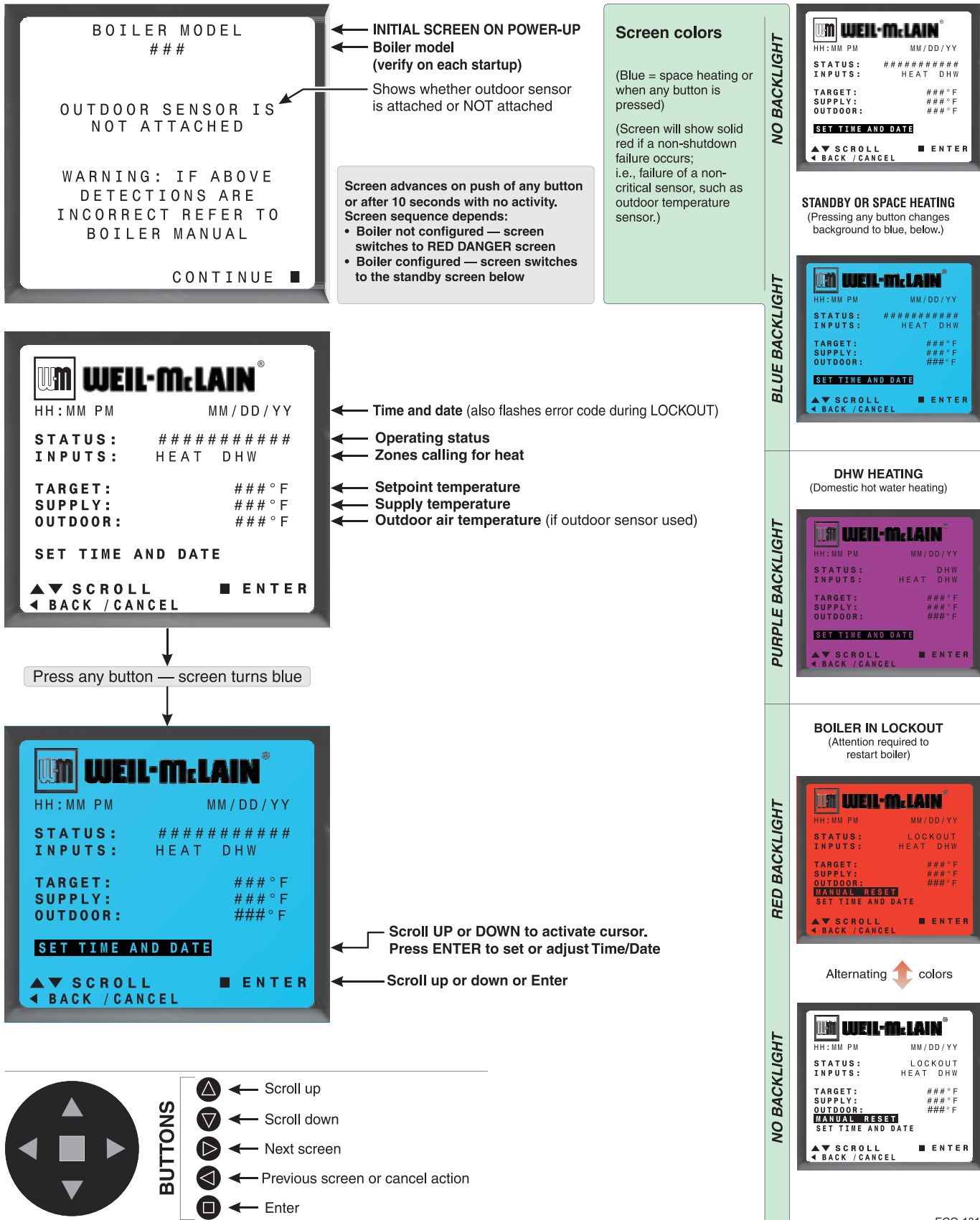
1. See Figure 78, page 70 for an overview of the ECO control menus. This page also gives the location of instruction manual information for each of the main menus.

**Figure 76** Control sequence of operation

Display status text	Control action (also see Figure 77, page 68)
<b>POWER UP</b>	<ul style="list-style-type: none"> <li>Check the boiler model listed on the power-up screen. If it is not correct, turn off the boiler. See page 70 to change setting.</li> <li>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.</li> </ul>
<b>ODT Sensor Notice (Initial Startup ONLY)</b>	<ul style="list-style-type: none"> <li>If no outdoor temperature (ODT) sensor is detected, this screen will appear</li> <li>Boiler must either use the ODT sensor or be exempt (see page 127) to operate.</li> <li>Non-exempt boilers without a detected ODT sensor will not operate.</li> </ul>
<b>Standby</b>	<ul style="list-style-type: none"> <li>Standby — no calls for heat.</li> <li>Backlight will turn off due to inactivity.</li> </ul>
<b>Prepurge</b>	<ul style="list-style-type: none"> <li>Call for heat detected.</li> <li>Display on with BLUE light (HEAT) or PURPLE light (DHW).</li> <li>Start min./max. on timers if more than one system is calling — highest priority starts first.</li> <li>Start circulators for this priority setup.</li> <li>Calculate target temp — If sensor temp is below target temp, begin firing sequence.</li> <li>Blower to ignition speed for prepurge.</li> </ul>
<b>Ignition</b>	<ul style="list-style-type: none"> <li>After prepurge times out, begin ignition cycle</li> <li>Activate gas valve and ignition spark.</li> <li>Continue ignition spark for ignition period</li> <li>Turn off spark and use electrode to check for flame signal.</li> </ul>
<b>HEATING</b>	<ul style="list-style-type: none"> <li>Flame detected.</li> <li>Release boiler to modulation.</li> <li>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.</li> <li>If priority timer times out, switch to next priority and start priority timer.</li> <li>If demand satisfied, go to postpurge.</li> </ul>
<b>DHW</b>	<ul style="list-style-type: none"> <li>Flame detected.</li> <li>Release boiler to modulation.</li> <li>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.</li> <li>If priority timer times out, switch to next priority and start priority timer.</li> <li>If demand satisfied, go to postpurge.</li> </ul>
<b>Postpurge</b>	<ul style="list-style-type: none"> <li>Demand satisfied (temperature reaches target temperature or limit setting).</li> <li>Gas valve off.</li> <li>Blower to ignition speed for postpurge.</li> <li>Return to standby after purge.</li> </ul>
<b>Error/fault</b>	<ul style="list-style-type: none"> <li>Display turns RED due to error or limit event.</li> <li>Flashing display means lockout condition.</li> </ul>
<b>WWSD</b>	<ul style="list-style-type: none"> <li>Warm weather shutdown — the boiler will not be allowed to fire on space heating if the outside temperature is greater than the WWSD setting. DHW operation is not affected by WWSD.</li> </ul>

# ECO control operation *(continued)*

**Figure 77** ECO control display screens and typical navigation



# ESSENTIAL settings



**THE CONTROL SETTINGS LISTED BELOW MUST BE MADE BEFORE STARTING THE BOILER.** Failure to comply could result in incorrect operation of the boiler, causing possible severe personal injury, death or substantial property damage.

**Step 1** Read about menu access and navigation on page 70.



If the boiler model number shown does NOT match the boiler, the selection **MUST** be changed to the correct model number. Failure to comply could result in severe personal injury, death or substantial property damage.

**Step 2** Turn OFF power to the boiler.

**Step 3** Turn off gas supply to the boiler by closing the boiler's manual gas valve.

**Step 7** Navigate to the **BOILER SETTINGS / HIGH ALTITUDE** screen.

**Step 4** Disconnect thermostat input wires from the boiler at the low voltage terminal blocks.

**Step 8** If the boiler is installed at altitude above 5,500 feet, the selection must be changed to **YES**.

**Step 5** Turn ON power to the boiler. Navigate to the **BOILER SETTINGS / BOILER MODEL** screen.



If the boiler is installed at altitude above 5,500 feet, the high altitude selection **MUST** be changed to **YES**. Failure to comply could result in severe personal injury, death or substantial property damage.

**Step 6** Read the boiler model shown on the display.

**Step 9** Continue with recommended settings below.



**THE CONTROL SETTINGS LISTED BELOW SHOULD BE MADE BEFORE STARTING THE BOILER.** These settings provide information about boiler start-up and service. This information will help reduce troubleshooting time and inform technicians working on the equipment about boiler history.

**Step 1** Navigate to the **CONTRACTOR MENU / SET DATE AND TIME** screen.

**Step 2** Enter current date and time by accessing each screen and setting the data.



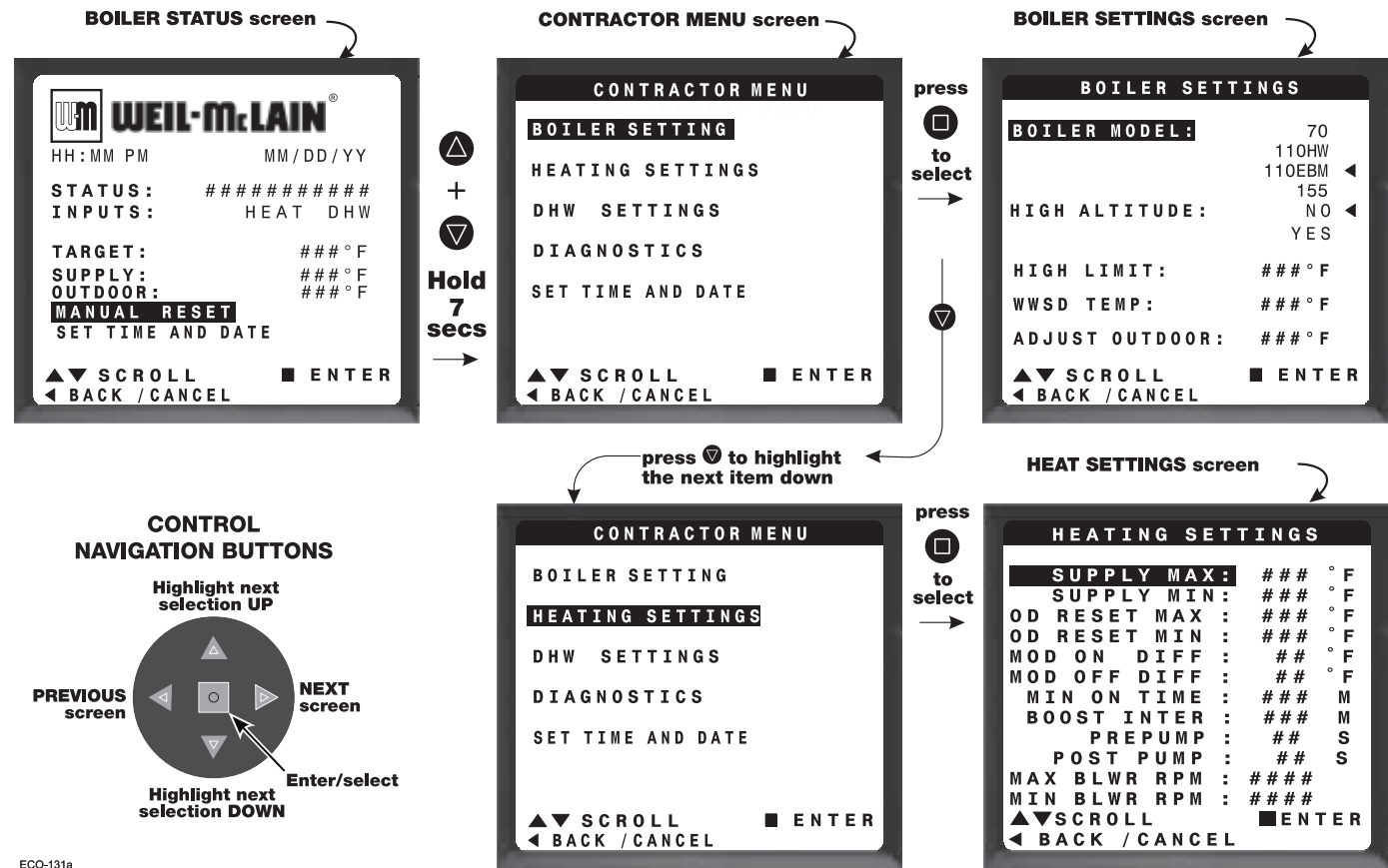
**POWER OUTAGES** — The date and time information will be saved during power interruptions. For interruptions longer than several days, the date and time information may be lost.

**Step 3** Turn off power to the boiler. Reconnect thermostat input wires to the boiler at the low voltage terminal blocks.

**Step 4** To adjust controls settings, proceed to the next page. If settings are complete, proceed with start-up on page 79.

# ECO control settings menus

Figure 78 ECO control menu access — accessing contractor menus



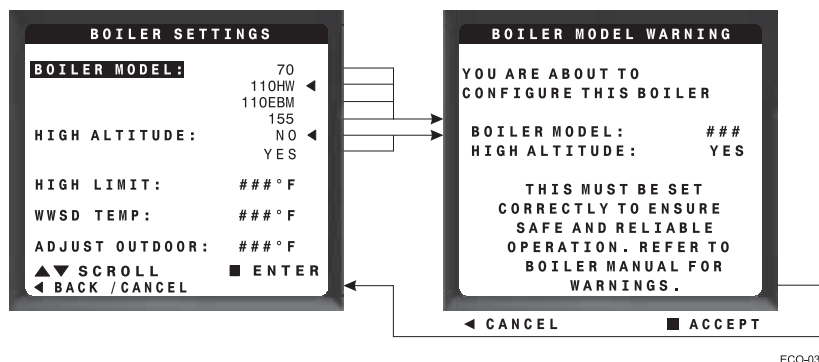
**BEFORE PROCEEDING**, perform essential control settings as instructed on page 69.

## Control menus — OVERVIEW

1. Access contractor menus by pressing and holding the UP and DOWN arrow keys at the same time for 7 seconds.
2. See Figure 78 for the screen sequences up to the BOILER SETTINGS and HEATING SETTINGS menus.
3. Adjust control settings as needed for the central heating and DHW systems supplied by the boiler.
4. Wire the line voltage and low voltage connections as required.

5. The **CONTRACTOR MENU** screen will show:
  - a. **BOILER SETTINGS** — see page 71
  - b. **HEATING SETTINGS** — see page 72
  - c. **DHW SETTINGS** — see page 74
  - d. **DIAGNOSTICS** — see page 76
  - e. **SET DATE AND TIME** — see pages 69 and 78

Figure 79 **BOILER SETTINGS** menu (see Figure 80 for setting values and descriptions)



# BOILER SETTINGS menu

## BOILER MODEL

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

**NOTICE** The 110 model can either be a 110HW or a 110EBM. Earlier models of the 110 (Series 1) boilers used a Honeywell blower and are denoted as 110HW in the Boiler Model selection. The 110 (Series 2) model uses an EBM blower and is denoted as a 110EBM in the Boiler Model selection. This boiler manual is for the 110 (Series 2) model. For older version of the 110 (Series 1) model, please reference the correct boiler manual.

## HIGH ALTITUDE

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

## ODT SENSOR EXEMPT

1. This setting is used to determine if the boiler should operate with and continually detect an outdoor temperature.
2. All boilers must comply with the regulations shown on page 127.
3. If the boiler formerly used an ODT sensor but now has become exempt, contractor may change settings here.

## HIGH LIMIT TEMPERATURE

**NOTICE** The boiler's high limit temperature during normal operation is fixed at 200°F and cannot be changed. The HIGH LIMIT TEMPERATURE setting in the ECO control menu is a temporary setting for test purposes ONLY.

1. If boiler outlet water temperature exceeds this temperature, the ECO control will shut down the boiler and enter lockout. Manual reset is required to restart the boiler.
2. The HIGH LIMIT TEMPERATURE setting will automatically return to 200°F if power is turned off. The boiler will restart when power is restored.
3. Use this control setting only to test the control's high limit function.

## WWSD

1. WWSD stands for "warm weather shutdown." It means the boiler will not be allowed to fire if the outside temperature is greater than the WWSD setting.
2. When the boiler is kept off because the outside temperature is above WWSD, the graphic display will show "WWSD," and the boiler will remain in standby until the outside temperature drops below WWSD temperature.
3. WWSD does not apply to DHW systems.
4. The outdoor sensor must be installed to use this function. **The outdoor sensor must be installed unless specifically exempted in the Energy Act statement on page 127.**

## ADJUST OUTDOOR

1. Use this setting to adjust the outdoor sensor temperature to account for solar or other effects, such as long lead wire, that would cause the sensor to read incorrectly.

**Figure 80 BOILER SETTINGS** menus (see Figure 78, page 70 for access information)

Menu/Item	Units	Low Value	High Value	Default	Comment
Boiler Model	70 110HW 110EBM 155			factory	<b>⚠ WARNING</b> THIS MUST BE SET CORRECTLY FOR SAFE OPERATION. Adjusts blower speeds and flame sense (Startup screen will show "HA" after the model number if high altitude has been selected, below.)
High Altitude	yes or no			no	Adjusts ignition and low fire fan speed (for altitudes above 5,500 feet only).
ODT Sensor Exempt	yes or no			no	Used to determine if boiler should operate with and continually detect an outdoor temperature.
High Limit	°F	50	200	200	If boiler out temperature reaches this temperature, boiler will lockout, which requires a manual reset.
WWSD Temp	°F	Off, 50	100	70	Boiler will not respond to heating calls above this outdoor temp.
Adjust Outdoor	°F (difference)	-10	+10	0	This value plus outdoor sensor reading equals outdoor temp (Use this setting to compensate for solar gain or other factors that cause a shift in sensor temperature.)

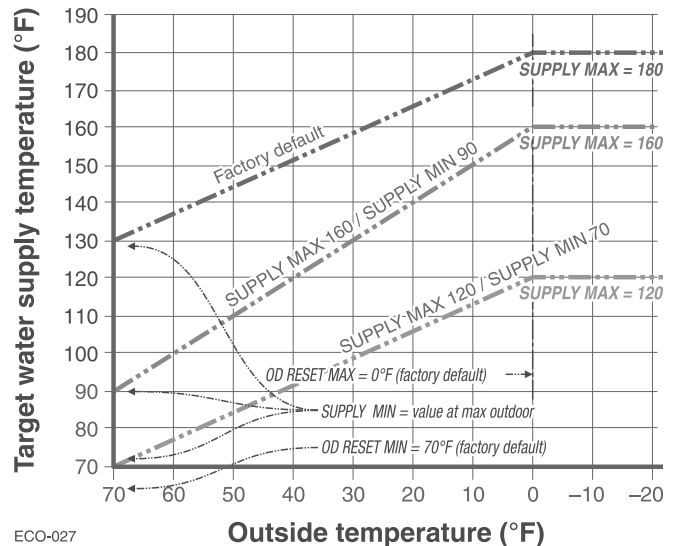
# HEATING SETTINGS menu

**Figure 81 HEATING SETTINGS** menu (see Figure 84, page 74 for setting values and descriptions)

HEATING SETTINGS			
SUPPLY MAX:	###	° F	
SUPPLY MIN:	###	° F	
OD RESET MAX:	###	° F	
OD RESET MIN:	###	° F	
MOD ON DIFF:	##	° F	
MOD OFF DIFF:	##	° F	
MIN ON TIME:	###	M	
BOOST INTER:	##	M	
PREPUMP:	##	S	
POST PUMP:	##	S	
MAX BLWR RPM:	####		
MIN BLWR RPM:	####		
▲▼SCROLL		ENTER	
◀ BACK / CANCEL			

ECO-039

**Figure 82** Typical outdoor reset curves



ECO-027

## HEATING SETTINGS

1. The heating settings menu is for setting control operation during space heating. The settings apply to zones controlled by the HEAT Input/output. See Figure 84, page 74 for a listing of menu parameters.
2. If DHW is used, the settings for control operation during DHW calls are set under the DHW SETTINGS menus (see Figure 86, page 75).

## HEATING DESIGN TEMPERATURES

1. Set desired temperatures for space heating zones. Refer to Figure 83, page 73, for recommended settings based on system type.
2. For an explanation of the target temperatures and associated outdoor temperatures, see Figure 82.

### SUPPLY MAX

1. Set SUPPLY MAX to the required supply water temperature for the system at design maximum heat loss (typically 180°F for finned tube baseboard on new installations).

### SUPPLY MIN

1. SUPPLY MIN should equal the desired minimum supply water temperature for the system.
2. The factory default is 130°F. This could be set as low as 60°F, which would supply “zero heat” when outdoor temperature is 60°F, because supply water temp would equal room temp.
3. See examples in Figure 82.

### OD RESET MAX

1. OD RESET MAX means the outdoor temperature at which the target temperature reaches its minimum (SUPPLY MIN).
2. In the example of Figure 82, this occurs at 70°F (the factory default).

### OD RESET MIN

1. OD RESET MIN means the outdoor temperature at which the target temperature reaches its maximum value (SUPPLY MAX).
2. In the example of Figure 82, this occurs at 0°F outside (the factory default setting).
3. OD RESET MIN should equal the ODT (outdoor design temperature) for the installation’s location.

### MODULATE ON DIFF

1. The temperature must drop this many degrees below target temperature for the boiler to come on when a call for heat is present on HEAT Input.

### MODULATE OFF DIFF

1. While the boiler is firing, as the temperature increases above the target temperature, the boiler firing rate is reduced.
2. At this many degrees above the target temperature, the control will temporarily turn off burner. The burner will be restored when temperature drops below TARGET TEMPERATURE minus MOD ON DIFF.

# HEATING SETTINGS menu *(continued)*

**Figure 83 System Settings Recommended:**

System type	Recommended temperatures			
	SUPPLY MAX Temp	OD RESET MIN Temp	SUPPLY MIN Temp	OD RESET MAX Temp
Fan-coil	190	0	140	70
<b>Finned tube baseboard * (Default settings)</b>	180	0	130	70
Cast iron baseboard	180	0	120	70
Cast iron radiators	180	0	120	70
Radiant – slab on grade	120	0	80	70
Radiant – thin slab	140	0	80	70
Radiant – below floor (staple up)	160	0	90	70
Radiant – above floor (sleeper system)	140	0	90	70

## HEATING TIMES

### MIN ON TIME

1. This is the minimum time the boiler will satisfy the call for space heating before switching back to DHW (if there is still a DHW call).

### BOOST INTERVAL

1. This applies when in outdoor reset mode (outdoor sensor installed — see page 127).
2. The boost timer starts on a call for heat. If the boost interval time passes and the call for heat is still on, the ECO control “boosts” the calculated target outlet water temperature by 10°F.
3. This occurs again if another boost interval elapses.
4. Boost will continue until the set point (target temperature) reaches the SUPPLY MAX setting.
5. The purpose of boost is to compensate for changes in demand not addressed by the reset curve. Typically, set boost to 30 minutes. The factory default is “OFF” — that is, boost is not enabled with default settings.

### PRE PUMP TIME

1. The boiler circulator and zone circulators (if activated by the ECO zone circulator outputs) will start this amount of time before the burner is started.

### POST PUMP TIME

1. The boiler circulator and zone circulators (if activated with the ECO zone circulator outputs) will continue this amount of time after the burner is shut down when the call for heat is satisfied.

## MIN / MAX BLOWER RPM

1. Use to set minimum and maximum boiler inputs by setting minimum and maximum blower RPM.
2. This adjustment can be used to match the maximum boiler output to the maximum heat load. This will reduce boiler cycling and increase boiler/system efficiency.

**NOTICE**

**During combustion testing,** the Maximum rate must be set to the Maximum Rate “High Value” listed in Figure 84, page 74 to allow the boiler to be set to maximum input during high-fire set-up and testing.

# HEATING SETTINGS menu *(continued)*

**Figure 84 HEATING SETTINGS** menu (see Figure 78, page 70 for access information)

Menu/Item	Units	Low Value	High Value	Default	Comment
SUPPLY MAX	°F	60	190	180	Required supply temp. at system design max. load
SUPPLY MIN	°F	60	190	130	Minimum supply temp. for system
OD RESET MAX	°F	50	100	70	Outdoor temp. at which supply target reaches min.
OD RESET MIN	°F	−20	50	0	Outdoor temp. at which supply target reaches max.
Modulate On Diff	°F	2	10	5	Boiler turns on if temperature drops below target minus differential on
Modulate Off Diff	°F	2	10	5	Boiler shuts down if modulates past target plus differential off
Min On Time	minutes	off	240	30	Shortest time boiler will satisfy space heating system before switching to DHW
Boost Interval	minutes	off	240	off	When operating on ODR increases target 10°F when this time expires until reaching MAX
Prepump Time: ### SEC	seconds	0	240	20	Additional time to run circulators longer than standard 10 second time
Postpump Time: ### SEC	seconds	off	240	30	Circulator run time after call for heat ends
MAXIMUM BLOWER RPM					
ECO 70	RPM	1100	4300	4150	Boiler Model specific NOTE: Adjusting boiler firing rate will affect AFUE rating. * See Notice on page 71
ECO 110HW*	RPM	1400	5650	5450	
ECO 110EBM	RPM	1900	7850	7550	
ECO 155	RPM	1300	5500	5300	
MINIMUM BLOWER RPM					
ECO 70	RPM	1100	4300	1100	Boiler Model specific (low value adjusted automatically if HIGH ALTITUDE is selected in control setup)  NOTE: Adjusting boiler firing rate will affect AFUE rating. * See Notice on page 71
ECO 110HW*	RPM	1400	5650	1400	
ECO 110EBM	RPM	1900	7850	1900	
ECO 155	RPM	1300	5500	1300	

## DHW SETTINGS menu

**Figure 85 DHW SETTINGS** menu (see Figure 86, page 75 for setting values and descriptions)

**DHW SETTINGS**

---

**BOILER SUPPLY:**    ### °F

    ON DIFF :        ## °F

    OFF DIFF :        ## °F

**MAX ON TIME :**    ### MIN

    PRE PUMP :        ## SEC

    POST PUMP :        ## SEC

**MAX BLWR RPM :**    #### RPM

**MIN BLWR RPM :**    #### RPM

▲▼ SCROLL            ■ ENTER

◀ BACK / CANCEL

### DHW SETTINGS

1. The DHW SETTINGS menus are for setting control operation during DHW operation. The settings apply **ONLY** to **DHW** Zone (see Figure 85).
2. If DHW is used, the settings for control operation during DHW calls for heat are set under the DHW SETTINGS menus (see Figure 86).

### DHW TEMPERATURES

#### NOTICE

**DHW priority** — The ECO control gives priority to DHW operation. During DHW call for heat, the **central** heating zone output is disabled. This continues until the DHW call ends or the DHW MAX ON TIME has elapsed.

### BOILER SUPPLY

1. The ECO control will regulate boiler firing to provide outlet water at this temperature.
2. For most DHW applications, set this to 190°F. A lower supply temperature can be used, but will reduce the indirect water heater heating capacity.

# DHW SETTINGS menu *(continued)*

## ON DIFF

1. The temperature must drop this many degrees below target temperature for the boiler to come on when a call for heat is present on DHW input.

## OFF DIFF

1. While the boiler is firing, as the temperature increases above the target temperature, the boiler firing rate is reduced.
2. At this many degrees above the target temperature, the control will temporarily turn off burner. The burner will be restarted when temperature drops below TARGET TEMPERATURE minus ON DIFF.

## DHW TIMES

### MAX ON TIME

1. This is the longest time the boiler will continue in DHW mode before switching to space heating (if there is a space heating call).



Setting MAX ON TIME to off will cause the control to never switch to space heating while DHW call for heat is present. This could present a freeze hazard for some installations if the DHW aquastat were to remain closed indefinitely.

## PRE PUMP TIME

1. The DHW circulator will start this amount of time before the burner is started.

## POST PUMP TIME

1. The DHW circulator will continue to run this amount of time after the burner is shut down when the call for heat is satisfied.

## MIN / MAX BLOWER RPM

1. Use to set minimum and maximum boiler inputs by setting minimum and maximum blower RPM.
2. Adjusting the MAX BLOWER RPM down will reduce DHW performance

**Figure 86 DHW SETTINGS** menu (see Figure 78, page 70 for access information)

Menu/Item	Units	Low Value	High Value	Default	Comment
Boiler Supply	°F	60	190	185	Boiler enters manual reset lockout at 200°F
On Diff	°F	2	10	5	Boiler turns on if temperature drops below target minus differential on
Off Diff	°F	2	10	5	Boiler shuts down if modulates past target plus differential off
Max On Time	minutes	off	240	30	Longest time boiler will satisfy DHW call before switching to HEAT input (if present)
Prepump Time: ### SEC	seconds	0	240	20	Additional time to run circulators longer than standard 10 second time
Postpump Time: ### SEC	seconds	off	240	30	Circulator run time after call for heat ends
MAXIMUM BLOWER RPM					
ECO 70	RPM	1100	4300	4150	Boiler Model specific NOTE: Adjusting boiler firing rate will affect AFUE rating. * See Notice on page 71
ECO 110HW*	RPM	1400	5650	5450	
ECO 110EBM	RPM	1900	7850	7550	
ECO 155	RPM	1300	5500	5300	
MINIMUM BLOWER RPM					
ECO 70	RPM	1100	4300	1100	Boiler Model specific (low value adjusted automatically if HIGH ALTITUDE is selected in control setup)  NOTE: Adjusting boiler firing rate will affect AFUE rating. * See Notice on page 71
ECO 110HW*	RPM	1400	5650	1400	
ECO 110EBM	RPM	1900	7850	1900	
ECO 155	RPM	1300	5500	1300	

# CIRCULATOR EXERCISING and FREEZE PROTECTION

## CIRCULATOR EXERCISING

1. The ECO control will automatically start both circulator outputs and run for 10 seconds for each 72-hour period of inactivity.

## FREEZE PROTECTION

1. This function automatically fires the boiler and starts the HEAT circulator when the heat exchanger sensor detects a temperature less than 40°F. The circulator turns off when the temperature rises above 45°F.

# DIAGNOSTIC menu

**Figure 87 DIAGNOSTICS** menu navigation (see Figure 78, page 70 for access information)

Menus	Next screen	Next screen	Next screen	Next screen
<i>Follow information at the bottom of each screen to navigate to next/previous screen or enter/save data</i>				
DIAGNOSTICS	TEMPERATURES	STATUS: ##### BOILER OUT1: ###°F BOILER OUT2: ###°F BOILER IN: ###°F FLUE 1: ###°F FLUE 2: ###°F OUTDOOR: ###°F		
	INPUTS	STATUS: ##### HEAT INPUT 1: ### DHW INPUT 2: ### MANUAL LIMIT: ##### AUTO LIMIT: ##### LOW WTR CUTOFF: ##### BLOWER SPEED: ####RPM FLAME SIGNAL: ###		
	OUTPUTS	STATUS: ##### GAS VALVE: ### CIRCULATOR HEAT: ### CIRCULATOR DHW: ### BLOWER SIGNAL: ###%		
	ERRORS	CONTROL FAULT ### IGNITION RETRIES ###		
		MANUAL RESET CNT ###		
		AUTO RESET CNT ###		
		LOCKOUT HISTORY 1	FAULT NAME: ##### FAULT TYPE: ##### FAULT TIME: HH:MM AM FAULT DATE: MM/DD/YY STATUS: ##### TEMPERATURES INPUTS OUTPUTS	TEMPERATURES INPUT STATUS OUTPUT STATUS
		LOCKOUT HISTORY 2 LOCKOUT HISTORY 3	... SAME AS HISTORY 1 ... SAME AS HISTORY 1	
	SOFTWARE VERSIONS	DISPLAY E#.# MAIN MICRO E#.# SECOND MICRO E#.#		
	MANUAL TEST MODE	STATUS: ##### TARGET: ###°F MODULATION: ###°F BOILER OUT: ###°F BOILER IN: ###°F FLUE: ###°F OUTDOOR: ###°F BLOWER SIGNAL: ###% BLOWER SPEED: ####RPM FORCE RATE AUTO		
	MANUAL RESET	PRESS ENTER TO RESET THE ##### RESET FAULT BELOW: (SCREEN SHOWS ERROR NAME, AND THE TIME AND DATE IT OCCURRED)		

# DIAGNOSTICS menu *(continued)*

**Figure 88** DIAGNOSTICS menu details (see Figure 87, page 76 for access information)

Menu/Item	Units	Low Value	High Value	Default	Comment
TO RESET ALL HISTORY AND COUNTERS TO ZERO:		To reset all history and counters to zero: Enter the DIAGNOSTICS menu. Then press and hold the left and right arrows located below the display. Hold for 3 seconds. This will cause ALL history and counters to be deleted.			
Temperatures					
Status	Text			Data	Current operating status of the boiler: Prepurge, Ignition, Heating or DHW, Post Purge, Warm Weather Shutdown (WWSD), Fault
Boiler Out 1	°F			Data	Temperature of the first sensing element of the boiler's heat exchanger outlet sensor
Boiler Out 2	°F			Data	Temperature of the second sensing element of the boiler's heat exchanger outlet sensor
Boiler In	°F			Data	Temperature of the boiler's heat exchanger inlet sensor
Flue 1	°F			Data	Temperature of the first sensing element of the boiler's flue gas sensor
Flue 2	°F			Data	Temperature of the second sensing element of the boiler's flue gas sensor
Outdoor	°F			Data	Temperature of the remote outdoor air temperature sensor
Inputs					
Status	Text			Data	Current operating status of the boiler: Prepurge, Ignition, Heating or DHW, Post Purge, Warm Weather Shutdown (WWSD), Fault
HEAT Input	on-off			Data	Call for heat status on Heat Input
DHW Input	on-off			Data	Call for heat status on DHW Input
Manual Limit	open-closed			Data	External manual limit on limit terminal block
Auto Limit	open-closed			Data	External auto limit on limit terminal block
Low Wtr Cutoff	open-closed			Data	Low water cutoff device (optional) attached to control terminal P12
Blower Speed	RPM			Data	Feedback from blower sensor
Flame Signal	no units			Data	Number indicating the presence and quality of the flame used to prove flame presence and shut down boiler
Outputs					
Status	text			Data	Current operating status of the boiler: Prepurge, Ignition, Heating or DHW, Post Purge, Warm Weather Shutdown (WWSD), Fault
Gas Valve	on-off			Data	Control's gas valve circuit status
Circulator Heat	on-off			Data	Control's Heat Circulator relay status
Circulator DHW	on-off			Data	Control's DHW Circulator relay status
Blower Signal	% of rate			Data	Control's signal controlling the blower speed
Errors					
Control Fault	#			0	Displays number of control faults
Ignition Retries	#			0	Displays number of ignition attempts boiler is currently on
Manual Reset Cnt	#			0	Displays number of manual reset lockouts since last cleared
Auto Reset Cnt	#			0	Displays number of auto reset lockouts since last cleared
Lockout History 1					Choose this to view the most recent error recorded
Fault Name	text			Data	Displays the name of the fault
Fault Type	text			Data	Displays whether the fault was MANUAL OR AUTO reset
Time	text			Data	Displays the time error occurred
Date	text			Data	Displays the date error occurred
Status	text			Data	Displays the boiler's status when the error occurred
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Lockout History 2					Choose this to view the most recent error recorded
Fault Name	text			Data	Displays the name of the fault
Fault Type	text			Data	Displays whether the fault was MANUAL OR AUTO reset
Time	text			Data	Displays the time error occurred
Date	text			Data	Displays the date error occurred

## DIAGNOSTICS menu *(continued)*

**Figure 89** DIAGNOSTICS menu details (continued) (see Figure 87, page 76 for access information)

Menu/Item	Units	Low Value	High Value	Default	Comment
<b>TO RESET ALL HISTORY AND COUNTERS TO ZERO:</b>		To reset all history and counters to zero: Enter the DIAGNOSTICS menu. Then press and hold the left and right arrows located below the display. Hold for 3 seconds. This will cause ALL history and counters to be deleted.			
Status	text			Data	Displays the boiler's status when the error occurred
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Lockout History 3					Choose this to view the most recent error recorded
Fault Name	text			Data	Displays the name of the fault
Fault Type	text			Data	Displays whether the fault was MANUAL OR AUTO reset
Time	text			Data	Displays the time error occurred
Date	text			Data	Displays the date error occurred
Status	text			Data	Displays the boiler's status when the error occurred
Temperatures	menu			menu	Choose this to view the Boiler Temperatures at the time of the error
Inputs	menu			menu	Choose this to view the status of the Boiler Inputs at the time of the error
Outputs	menu			menu	Choose this to view the status of the Boiler Outputs at the time of the error
Software Versions					
Display	E#.#			Data	Software version of the microprocessor on the display circuit board
Main Micro	E#.#			Data	Software version of the main microprocessor on the control circuit board
Second Micro	E#.#			Data	Software version of the second microprocessor on the control circuit board
Manual Test Mode					
Status	text			Data	Current operating status of the boiler: Prepurge, Ignition, Heating or DHW, Post Purge, Warm Weather Shutdown (WWSD), Fault
Inputs	text	HEAT or DHW		Data	Indicates status of calls for heat on Heating and DHW inputs
Target	°F			Data	Calculated target temperature based on outdoor temp (for Heating input) or the DHW Boiler Supply temperature (for DHW input)
Boiler Out	°F			Data	Temperature of the outlet sensor on the boiler heat exchanger
Boiler In	°F			Data	Temperature of the inlet sensor on the boiler heat exchanger
Flue	°F			Data	Temperature of flue gases
Outdoor	°F			Data	Temperature of outdoor air
Blower Speed	rpm			Data	Blower's feedback to the control
Flame Signal	no units			Data	Number indicating the presence and quality of the flame used to prove flame presence and shut down boiler
Force Rate		Low, Med, High, or Auto		Auto	Used to manually force a rate during a call for heat. Choose auto for normal operation.
Manual Reset					Reset selected condition

## DATE AND TIME menu

**Figure 90** DATE AND TIME menus — navigation (see Figure 78, page 70 for access information)

Set Time and Date					
Year	text			2013	Set year (homeowner or contractor)
Month	text			1	Set month (homeowner or contractor)
Day	text			1	Set day (homeowner or contractor)
Hour	text			12 (AM)	Set hour (homeowner or contractor)
Minute	text			0	Set minute (homeowner or contractor)

# 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.

**▲WARNING** If the system needs to be cleaned, use only Sentinel X400 cleaner, available from Weil-McLain. See Figure 119, page 115 for information. Follow instructions supplied with the X400 cleaner.

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. 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.

### Hardness less than 7 grains

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

### Chloride concentration must be LESS THAN 200 ppm

1. Filling with chlorinated fresh water should be acceptable since drinking water chloride 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 chloride in excess of 200 ppm.

**▲WARNING** Verify that the water chemistry meets the limitations and requirements of all other equipment in the system.

## Antifreeze

1. Use only antifreeze listed by Weil-McLain as suitable for use with ECO Gas Boilers. See Figure 119, page 115 for information.
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 in Figure 131, page 126.
  - 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 24 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 the heat exchanger, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure.

## Purge air from water system

1. Connect a hose to the purge valve (see purge/drain valves, item 11, in piping diagrams beginning on page 51). 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.

# Startup — fill the system *(continued)*

## Freeze protection (if used)

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

**Use only the products listed by Weil-McLain for use with this boiler. See page 115 for information.**

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

**Review the material safety data sheets (MSDS)** are available online. 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.

In addition to antifreeze and inhibitor, use and maintain minimum level of Sentinel X100 inhibitor as directed on this page.

If 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 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.

and proceed with the next zone. Follow this procedure until all zones are purged. Follow the same procedure to purge air from the boiler and its internal piping.

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.

**▲WARNING**

## X100 inhibitor is REQUIRED

1. It is required that the ECO boilers have Sentinel X100 added to the system to prevent damage to the boilers' heat exchanger. Replacement Parts section 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 concentrate into the system, or fill with the X100 in its liquid form, following the instructions on the tube or container.
3. After adding the inhibitor to the system, allow time for the water to circulate and mix. Then check the inhibitor level. Add additional inhibitor if necessary.
4. See separate instructions or Weil-McLain website for suggested guidelines to determine how much inhibitor to use.

## 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 chloride concentrations are acceptable.
3. Verify antifreeze concentration, if 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 a 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.

# Startup — final checks

## **⚠️WARNING** Check for gas leaks

Before starting the boiler, and during initial operation, use a leak detector or smell near the floor and around the boiler for gas odorant or any unusual odor. Remove boiler jacket door and smell the interior of the boiler jacket. **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 circuits

1. Disconnect wires connected to the **DHW and HEAT** thermostat terminals (see Field wiring, beginning on page 60 for low voltage terminal locations and application information). Mark the wires before removing to avoid wiring errors when re-connecting them.
2. Connect a voltmeter across each pair of incoming wires. Close each thermostat, zone valve and relay in the external circuits 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.

**⚠️WARNING** **DO NOT connect the ECO thermostat terminals to 3-wire zone valves.** This could cause ECO control damage.

5. Once the external thermostat circuit wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires.

## Inspect/fill condensate system

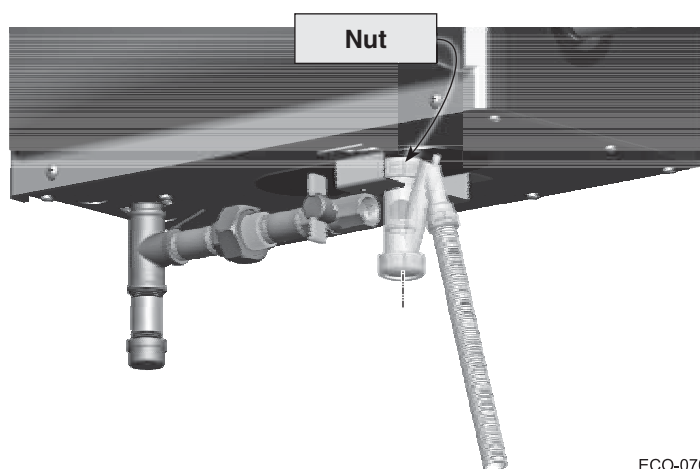
### Inspect/check condensate lines and fittings

Inspect the condensate drain line, condensate PVC fittings and condensate trap. (See page 58 for component locations.)

### Fill condensate trap with water

1. Slide condensate bracket away from trap then loosen the top nut that secures the condensate trap body to the boiler condensate connection (see Figure 91). Pull the trap down to disengage from heat exchanger.

**Figure 91** Disconnect condensate trap assembly to fill trap body with water



ECO-070

2. Pull the trap body forward enough to allow pouring water into the top of the trap.
3. Fill the trap with fresh water until water begins to run into the condensate drain tube.
4. Reattach the trap body by sliding onto the boiler condensate outlet, then retightening the trap body nut then reposition bracket under the nut by sliding the bracket under the plastic rivet in the bottom of enclosure.

**⚠️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. Failure to fill the trap could result in severe personal injury or death.

# Startup — final checks *(continued)*

## Final checks before starting boiler

- ☐ Read the instructions to adjust and set up the control.
- ☐ Verify that the boiler model is set correctly in the 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.
- ☐ Verify that condensate trap is filled with water.
- ☐ Verify electrical connections are correct and securely attached.
- ☐ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

## To start the boiler

1. Apply power to the blower via the service switch.
2. Follow the Operating Instructions, Figure 92, page 83.
3. The control display will show installed sensors when first powered. Make sure the right sensors are detected and the correct boiler model is identified. 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. Are external limit controls (if used) open? Is boiler water temperature above 200°F?
3. Are thermostats set below room temperature?
4. Is gas turned on at meter and boiler?
5. Is incoming gas pressure less than the minimum values given on page 21?
6. Are ECO control settings correct for the application?
7. Is the warm weather shutdown activated?
8. If none of the above corrects the problem, refer to Troubleshooting, beginning on page 95.

## ☐ Check system and boiler

### ☐ Check water piping

1. Check system piping for leaks. If found, shut down boiler and repair immediately. (See WARNING on page 79 regarding failure to repair leaks.)
2. Vent any remaining air from system using manual vents. Air in the system will interfere with circulation and cause heat distribution problems and noise.

### ☐ Check vent piping and air piping

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

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

### ☐ Check gas piping

1. Check around the boiler and inside the boiler jacket for gas odor following the procedure of page 59 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 boiler has been converted for propane. See page 15 for ECO 70, page 17 for ECO 110 or page 19 for ECO 155.

### **▲WARNING**

### **DO NOT attempt to measure gas valve outlet pressure**

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.

ECO boilers are shipped ready to fire natural gas ONLY.

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

## ☐ Check flame & combustion with instruments

1. Initiate a call for heat on one of the thermostat inputs.
2. Access the ECO control installer menus by pressing and holding the UP and DOWN arrow keys for seven seconds.
3. See page 73 and Figure 84, page 74. Make sure the Max firing rate is set to the maximum given in the table. If not, adjust as necessary. Then navigate to DIAGNOSTICS — Manual test mode (see Figure 87, page 76) and force the firing rate to HIGH (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. **Insert combustion analyzer probe** — Remove the flue temperature sensor from the flue pipe and insert a combustion test probe.
6. Test for CO<sub>2</sub> (or O<sub>2</sub>) and for CO. The CO<sub>2</sub> values must comply with Figure 96, page 86. If results are acceptable, proceed to step 7. **IF NOT**, follow the instructions under “Throttle Screw Adjustment” on page 84 or page 86 to set the throttle screw position. See **WARNING** on page 84 upper left.
7. Measure natural gas input:
  - a. Operate boiler 10 minutes. Turn off other appliances.
  - b. At natural gas meter, measure time (in seconds) required to use one cubic foot of gas.
  - c. Calculate gas input:
 
$$\frac{3600 \times 1000}{\text{number of seconds from step b}} = \text{Btuh}$$
  - d. Btuh calculated should approximate input rating on boiler rating label.
8. Use the ECO control display to navigate to Manual test mode (see Figure 87, page 76) and force the firing rate to LOW (low fire).

**CONTINUED AFTER NEXT PAGE**

# Startup — final checks *(continued)*

**Figure 92** Operating instructions (WARNING -Verify that the 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.

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

## 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.

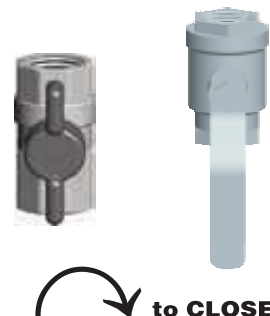
## OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above 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. Locate boiler manual gas valve (in the gas piping connected to the boiler).
5. Turn boiler manual gas valve knob counterclockwise ↺ to OPEN gas supply.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor.
7. If you smell gas, **STOP!** Turn the boiler manual gas valve to OFF. Then follow WHAT TO DO IF YOU SMELL GAS, above. If you don't smell gas, go to step 8, below.
8. Turn ON all electrical power to the appliance.
9. Set thermostat(s) to desired setting.
10. 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.
11. If the appliance will not operate when there is a call for heat and piping is not hot, follow the instructions "To Turn Off Gas To Appliance" below and call your service technician or gas supplier.

### Gas valve **CLOSED**



### Gas valve **OPEN**



## TO TURN OFF GAS TO THE APPLIANCE

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Set room thermostats to lowest setting.</li> <li>2. Turn OFF all electrical power to the appliance.</li> </ol> | <ol style="list-style-type: none"> <li>3. Turn boiler manual gas valve knob clockwise ↻ to close gas supply.</li> </ol> |
|--|---|

550-101-264 (0614)

# Startup — final checks *(continued)*

## ⚠ WARNING

If combustion at either high or low fire is outside the range given in Figure 96, page 86, follow the procedure given on page 84 or page 86 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.

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 as instructed in the previous steps.
11. Use the ECO control display to navigate to Manual test mode (see Figure 87, page 76) and force the firing rate to AUTO (normal operation).
12. Reinstall 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.

## ⚠ WARNING

You must reinstall 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.

## Throttle screw adjustment ECO 70 ONLY

## ⚠ 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 96.

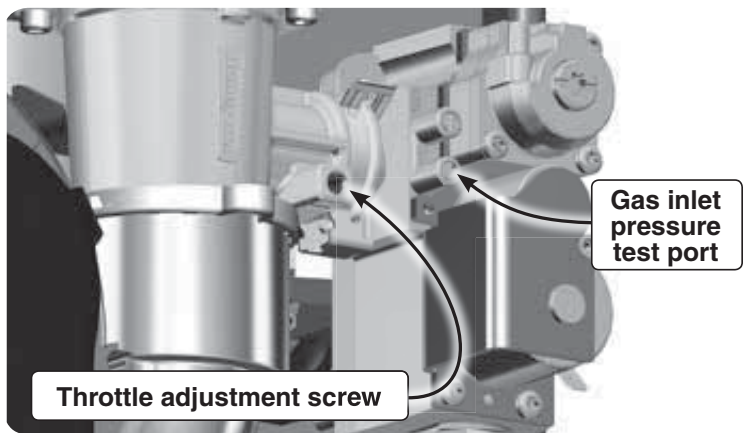
1. Throttle screw adjustment is **only necessary** if specified elsewhere in this manual or if combustion tests indicate the need, as explained under “**Check flame & combustion with instruments**,” page 82.
2. Boiler behavior that might indicate a need to check combustion values at high fire (as per page 82) 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. See Figure 93 for location of the **ECO 70** throttle screw.

## ⚠ CAUTION

Adjust the throttle screw in small movements. Turning the screw too far will cause the adjustment to reverse behavior.

5. See page 73 and Figure 84, page 74. Make sure the Max firing rate is set to the maximum given in the table.

**Figure 93 ECO 70 Throttle screw** (ONLY for use by a qualified technician, using calibrated combustion test instruments)



- If not, adjust as necessary. Then navigate to **DIAGNOSTICS — Manual test mode** (see Figure 87, page 76) and force the firing rate to **HIGH** (high fire). After the boiler has had time to stabilize, take a  $\text{CO}_2$  reading. If result is not acceptable, do the following:
- a. Turn the throttle screw either direction very slightly. Allow the boiler to stabilize and take another  $\text{CO}_2$  reading. Note whether  $\text{CO}_2$  increases or decreases.
  - b. Turn the screw slightly in the direction needed to increase or decrease reading as needed. Allow the boiler to stabilize and take another reading. Continue until  $\text{CO}_2$  is acceptable.
6. 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**. **DO NOT** adjust throttle on low fire.
  7. Consult your local Weil-McLain representative if acceptable results cannot be obtained for both high and low fire.

## Re-check the Maximum and Minimum $\text{CO}_2$ and CO rate

1. Turn off the boiler and then turn it back on and put in Test Mode at maximum. Ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
2. Reduce to minimum and re-check the minimum rate output ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
3. In the event that the  $\text{CO}_2$  and CO cannot be obtained, please contact your Weil-McLain representative.
4. Should you require any assistance during the set up procedure contact your Weil-McLain representative if the problem cannot be addressed with the information provided in this manual.

## ☐ Check ignition system safety shutoff device

1. After the boiler has been installed, turn off the boiler.
2. Shut off the manual gas valve located on the gas line to stop flow of fuel to the boiler.
3. Turn on the boiler. It will start the ignition sequence, but will not light. After some time, the boiler will lockout, the display screen will turn red, and the Control will flash “Ignition Fault”. It means that the boiler tried to ignite without success for five (5) times and went into Lockout mode. This means that the ignition system safety device worked properly.
4. Clear the Lockout condition by selecting “Manual Reset” in the Diagnostic Menu.
5. Open the manual gas valve located on the gas line to resume fuel supply to the boiler.

# Startup — final checks *(continued)*

**⚠ WARNING**

If combustion at either high or low fire is outside the range given in Figure 96, page 86, follow the procedure given on page 84 or page 86 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.

## Throttle screw adjustment ECO 110 ONLY

**⚠ 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 96.

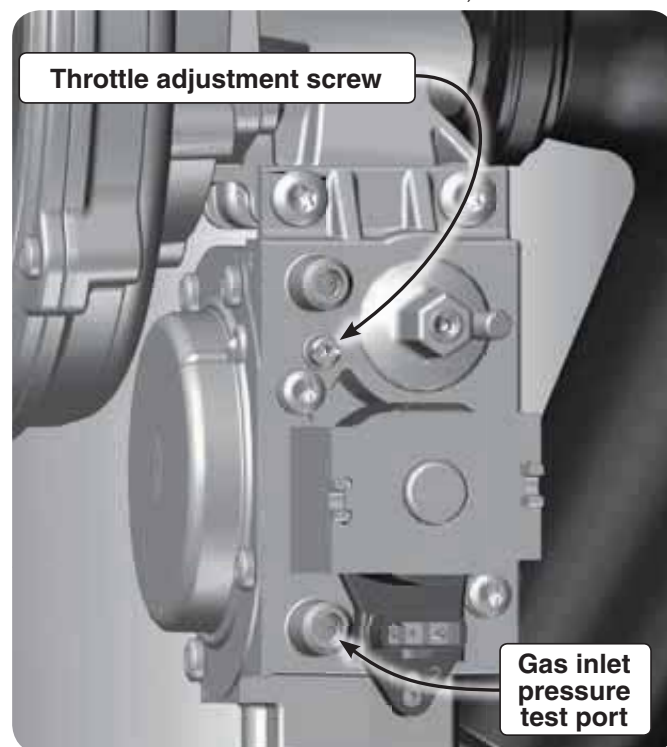
1. Throttle screw adjustment is **only necessary** if specified elsewhere in this manual or if combustion tests indicate the need, as explained under “**□ Check flame & combustion with instruments,**” page 82.
2. Boiler behavior that might indicate a need to check combustion values at high fire (as per page 82) 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. See Figure 94 for location of the **ECO 110** throttle screw.

**⚠ CAUTION**

Adjust the throttle screw in small movements.

5. See page 73 and Figure 84, page 74. Make sure the Max firing rate is set to the maximum given in the table. If not, adjust as necessary. Then navigate to **DIAGNOSTICS — Manual test mode** (see Figure 87, page 76) and force the firing rate to **HIGH** (high fire). After the boiler has had time to stabilize, take a  $\text{CO}_2$  reading. If result is not acceptable, do the following:
  - a. If the  $\text{CO}_2$  is **HIGH**, turn the throttle screw **CLOCKWISE** to lower the input. Allow the boiler to stabilize and take another reading. Continue until the desired  $\text{CO}_2$  value is achieved.
  - b. If the  $\text{CO}_2$  is **LOW**, turn the throttle screw **COUNTERCLOCKWISE** to increase the input. Allow the boiler to stabilize and take another reading. Continue until the desired  $\text{CO}_2$  value is achieved.
6. 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**. **DO NOT** adjust throttle on low fire.
7. Consult your local Weil-McLain representative if acceptable results cannot be obtained for both high and low fire.

**Figure 94** ECO 110 Throttle screw (ONLY for use by a qualified technician, using calibrated combustion test instruments)



## Re-check the Maximum and Minimum $\text{CO}_2$ and CO rate

1. Turn off the boiler and then turn it back on and put in Test Mode at maximum. Ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
2. Reduce to minimum and re-check the minimum rate output ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
3. In the event that the  $\text{CO}_2$  and CO cannot be obtained, please contact your Weil-McLain representative.
4. Should you require any assistance during the set up procedure contact your Weil-McLain representative if the problem cannot be addressed with the information provided in this manual.

### □ Check ignition system safety shutoff device

1. After the boiler has been installed, turn off the boiler.
2. Shut off the manual gas valve located on the gas line to stop flow of fuel to the boiler.
3. Turn on the boiler. It will start the ignition sequence, but will not light. After some time, the boiler will lockout, the display screen will turn red, and the Control will flash “Ignition Fault”. It means that the boiler tried to ignite without success for five (5) times and went into Lockout mode. This means that the ignition system safety device worked properly.
4. Clear the Lockout condition by selecting “Manual Reset” in the Diagnostic Menu.
5. Open the manual gas valve located on the gas line to resume fuel supply to the boiler.

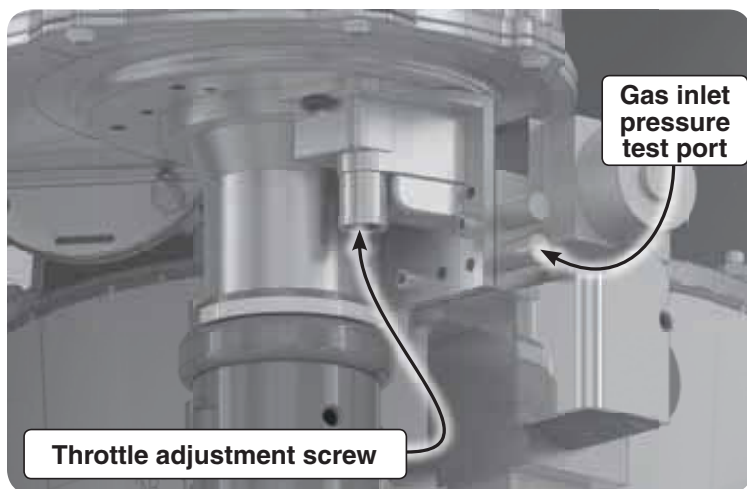
# Startup — final checks *(continued)*

## Throttle screw adjustment ECO 155 ONLY

**⚠ 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 96.

1. Throttle screw adjustment 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 82.
2. Boiler behavior that might indicate a need to check combustion values at high fire (as per page 82) 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. See Figure 4 for location of the **ECO 155** throttle screw.

**Figure 95** **ECO 155** Throttle screw (ONLY for use by a qualified technician, using calibrated combustion test instruments)



**⚠ CAUTION** Adjust the throttle screw in small movements.

5. See page 73 and Figure 84, page 74. Make sure the Max firing rate is set to the maximum given in the table. If not, adjust as necessary. Then navigate to **DIAGNOSTICS — Manual test mode** (see Figure 87, page 76) and force the firing rate to **HIGH** (high fire). After the boiler has had time to stabilize, take a  $\text{CO}_2$  reading.
  - a. If the  $\text{CO}_2$  is **HIGH**, turn the throttle screw **CLOCKWISE** to lower the input. Allow the boiler to stabilize and take another reading. Continue until the desired  $\text{CO}_2$  value is achieved.
  - b. If the  $\text{CO}_2$  is **LOW**, turn the throttle screw **COUNTERCLOCKWISE** to increase the input. Allow the boiler to stabilize and take another reading. Continue until the desired  $\text{CO}_2$  value is achieved.
6. 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**. **DO NOT** adjust throttle on low fire.
7. Consult your local Weil-McLain representative if acceptable results cannot be obtained for both high and low fire.

**Figure 96** Acceptable combustion values — measured values must be within the ranges given below

Boiler model	Fuel	High fire		Low fire	
		% $\text{CO}_2$	CO ppm	% $\text{CO}_2$	CO ppm
<b>70</b>	NG	9.25 +/- 1.0	< 150	9.25 +/- 1.0	< 50
	LP	10.0 +/- 0.5	< 150	10.0 +/- 0.5	< 50
<b>110</b>	NG	9.5 +/- 0.5	< 150	9.0 +/- 0.5	< 50
	LP	10.5 +/- 0.5	< 150	10.0 +/- 0.5	< 50
<b>155</b>	NG	9.25 +/- 1.0	< 150	8.75 +/- 1.0	< 50
	LP	10.25 +/- 0.5	< 150	9.75 +/- 0.5	< 50

- **Values above are with the boiler jacket door removed.** Values will increase about 0.2% once the jacket door is reinstalled.
- **REINSTALL** the boiler jacket door after completing service.
- Values above are for altitudes up to 5,500 feet. For higher altitudes,  $\text{CO}_2$  may be slightly lower and CO slightly higher.
- Low fire  $\text{CO}_2$  should be equal to or less than High fire  $\text{CO}_2$ .

## Re-check the Maximum and Minimum $\text{CO}_2$ and CO rate

1. Turn off the boiler and then turn it back on and put in Test Mode at maximum. Ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
2. Reduce to minimum and re-check the minimum rate output ensuring the  $\text{CO}_2$  setting level has remained unchanged and confirm that CO is within limits.
3. In the event that the  $\text{CO}_2$  and CO cannot be obtained, please contact your Weil-McLain representative.
4. Should you require any assistance during the set up procedure contact your Weil-McLain representative if the problem cannot be addressed with the information provided in this manual.

## □ Check ignition system safety shutoff device

1. After the boiler has been installed, turn off the boiler.
2. Shut off the manual gas valve located on the gas line to stop flow of fuel to the boiler.
3. Turn on the boiler. It will start the ignition sequence, but will not light. After some time, the boiler will lockout, the display screen will turn red, and the Control will flash “Ignition Fault”. It means that the boiler tried to ignite without success for five (5) times and went into Lockout mode. This means that the ignition system safety device worked properly.
4. Clear the Lockout condition by selecting “Manual Reset” in the Diagnostic Menu.
5. Open the manual gas valve located on the gas line to resume fuel supply to the boiler.

# Startup — final checks *(continued)*

## ☐ Check exchanger and vent seals

1. Operate the boiler on HIGH fire.
2. Using an inspection mirror, move the mirror around all heat exchanger joints and vent pipe connections at the top of the boiler and at the connection to the condensate dish.
3. A leak would appear as vapor on the surface of the mirror.
4. If there is any indication of a leak at any joint, immediately shut down the boiler.
  - a. If possible, tighten the retaining screws or nuts (without over-tightening).
  - b. If this does not correct the problem, disassemble the components where the leak appeared. Use the procedures given in the Maintenance section of this manual.
  - c. When disassembling components, inspect gaskets to see if there is damage. Replace any damaged gasket.
- d. Contact your Weil-McLain representative if the problem cannot be addressed with the information provided in this manual.
5. Condensate dish joint
  - a. If the inspection mirror check shows a leak at the condensate dish-to-heat exchanger joint, contact your Weil-McLain representative for instructions to correct the problem.
  - b. If the mirror test does not reveal a leak at the condensate dish joint, but there are signs of weepage or other indications that there might be leakage, follow the procedure for checking the heat exchanger-to-condensate dish seal on page 104.

## Check-out/startup verification

### Adjust and test boiler controls

1. Follow instructions in this manual to set and verify operation of the boiler controls.
2. Follow low water cutoff manufacturers instructions (if used).

### Have the following been done?

- ☐ ECO control set for the correct boiler model?
  - ☐ Installation date and time entered into ECO control?
  - ☐ Boiler and heat distribution units filled with water?
  - ☐ Water chemistry verified per page 79?
  - ☐ Sentinel X100 corrosion inhibitor added and water tested to be within range?
  - ☐ Automatic air vents, if used, opened one full turn?
  - ☐ Air purged from system?
  - ☐ Air purged from gas piping? Piping checked for leaks?
  - ☐ Condensate trap primed and bracket in place?
  - ☐ Propane orifice installed for propane firing and propane conversion label affixed to jacket?
  - ☐ Additional field-installed controls tested as outlined by control manufacturers? (Boiler should be operating and should go off when controls are tested. Verify controls cause automatic reset lockout or manual reset lockout as desired.)
  - ☐ Additional field-installed limit control(s) set to system temperature requirements? Balancing valves and controls adjusted to provide design temperature to system?
  - ☐ Flow adjusted/balanced for each zone of multiple zones systems?
  - ☐ Thermostat heat anticipator (if available) set properly?
  - ☐ Boiler cycled with thermostats (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?
  - ☐ Natural gas input measured? (page 82)
  - ☐ Incoming gas pressure checked by connecting manometer to gas valve ahead of boiler? (Gas pressure must be at least the minimum values given on page 21, with boiler operating at high fire, and no more than 13 inches (330 mm) w.c. with boiler operating or boiler off.)
  - ☐ Observed several operating cycles for proper operation?
  - ☐ Room thermostats set to desired room temperature (and DHW aquastat, if installed, to desired DHW storage temperature)?
  - ☐ All instructions shipped with this boiler reviewed with owner or maintenance person?
- Before leaving:**
- ☐ Fill in **Installation certificate**, page 129.
  - ☐ Fill out the warranty registration card and send to Weil-McLain.
  - ☐ Return instructions to envelope and give to owner or place inside boiler housing.

**▲WARNING** ECO boilers are shipped ready to fire natural gas ONLY. To fire on propane, you must follow the instructions in this manual to install the propane orifice. See page 15 for ECO 70 or page 17 for ECO 110 or page 19 for ECO 155. 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 92, page 83?
- ☐ Burner flame and combustion verified per page 82?
- ☐ ECO control operation for space heating and DHW (if used) verified per this manual?

### NOTICE

Fill out start-up data on the Installation and Service Certificate, page 129.

# Annual startup and general maintenance



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

**Figure 97** Service and maintenance schedules

Service technician (see page numbers indicated for details)		Owner maintenance (see ECO User's Information Manual)	
ANNUAL START-UP (See First-year special inspection)	• Address reported problems . . . . .	Daily	• Check boiler area.
	• Inspect boiler area . . . . .		• Check air openings.
	• Inspect boiler interior & jacket door gaskets. . . . .		• Check pressure/temperature gauge.
	• Clean condensate trap. . . . .		• Verify boiler jacket door is securely in place.
	• Check all piping for leaks . . . . .	Monthly	• Check vent piping.
	• Check air openings . . . . .		• Check air piping.
	• Flue vent system and air piping . . . . .		• Check relief valve.
	• Check water system . . . . .		• Check condensate drain system.
	• Check expansion tank(s). . . . .		• Check automatic air vents (if used).
	• Inspect ignition electrode . . . . .		• Verify that domestic hot water is being supplied to fixtures at the correct temperature.
	• Check ignition wiring. . . . .		
	• Check all boiler wiring . . . . .		
	• Check control settings. . . . .		
	• Perform startup and checks . . . . .		
	• Check low water cutoff service light (if used) . . . . .		
	• Check burner flame . . . . .		
	• Check flame signal. . . . .		
	• Check blower speeds . . . . .	Every 6 months	• Check boiler piping (gas and water)
	• Check flue gas temperature . . . . .		• Operate relief valve.
	• Check boiler relief valve . . . . .		
	• Reinstall jacket door after servicing . . . . .		
	• Review with owner. . . . .		

# Annual startup

## HANDLING CERAMIC FIBER MATERIALS

### REMOVING BURNER GASKET or COVER PLATE INSULATION



The ECO cover plate refractory contain ceramic fiber material.

Ceramic fibers can be converted to cristobalite in very high temperature applications.

The International Agency for Research on Cancer (IARC) has concluded, “Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).”:

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Handle carefully to minimize dust that could be caused by abrasion.
- If replacement is necessary, remove the refractory from the boiler and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

### NIOSH stated First Aid

- Eye: Irrigate immediately
- Breathing: Fresh air.

## FIRST-YEAR SPECIAL INSPECTION

### NOTICE

It is recommended that you obtain a Weil-McLain Boiler Maintenance kit before attempting the first-year inspection, to ensure all parts that may be needed are available. This kit includes a heat exchanger cover plate gasket, burner gasket, new ignitor, and ignitor gasket. See listing in Replacement parts section of this manual. These parts must be on hand when you perform the first-year inspection in the event they must be replaced.



Failure to replace the items above when needed could result in severe personal injury, death or substantial property damage.

1. **No later than 12 months** after the boiler is installed, perform a first-year inspection of the boiler. This should include the following **in addition to routine annual start-up procedures**.
  - a. Inspect the heat exchanger and clean if necessary (see page 105, ECO 70 or 110, or page 111, ECO 155, for access and cleaning procedures).
  - b. Inspect the cover plate refractory and gasket. Replace if not in good condition.
  - c. Inspect the burner and inspect carefully. Clean the burner thoroughly using a vacuum cleaner and compressed air if needed.
  - d. Make sure there is no blockage or accumulation of debris in the burner or the burner ports. Replace the burner if necessary.
  - e. ECO 70 or 110: Check the burner for tightness. Remove the cover plate refractory and tighten the burner mounting screws if needed, following the instructions on page 105.
  - f. ECO 155: Check burner access cover for tightness.
  - g. Make sure to follow the inspection procedure given in “Check exchanger and vent seals,” page 87.
  - h. Disconnect the condensate trap and drain lines. Inspect, then flush thoroughly. Reinstall and refill the trap per page 81.
2. Determine any follow-up maintenance and service needs based on the condition of the heat exchanger and condensate lines.
  - a. If the heat exchanger shows substantial fouling, or if condensate lines show accumulation of sediment, schedule a follow-up service call to perform the first-year inspection again, sooner than the normal twelve months between.
  - b. Heavy fouling of the exchanger or condensate lines indicates possible combustion air contamination. Inspect the air intake area carefully, and remove possible contaminants. See page 22, for products to avoid.



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

## Annual startup *(continued)*

### ⚠ WARNING

The boiler should be inspected and started annually, at the beginning of the heating season, only by a qualified service technician. In addition, the maintenance and care of the boiler designated in Figure 97, page 88 and explained on the following pages must be performed to assure maximum boiler efficiency and reliability. Failure to service and maintain the boiler and system could result in equipment failure.

### ⚠ WARNING

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

## Address reported problems

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

## Inspect boiler area

1. Verify that boiler area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed on page 22 of this manual. If any of these are present in the boiler intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual.

## Inspect boiler interior & jacket door gaskets

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

### ⚠ WARNING

Jacket door gaskets must be intact, and must provide a reliable seal. Replace any damaged gasket.

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

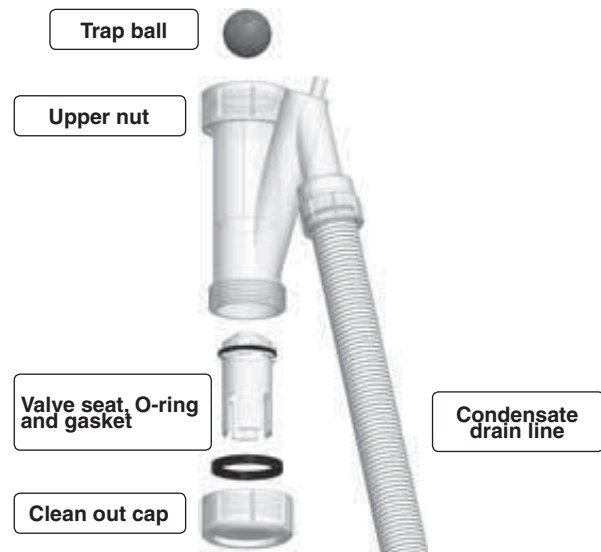
### ⚠ WARNING

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

## Clean condensate trap

1. See Figure 98.
2. Slide bracket off of condensate trap then disconnect top nut that secures the trap body to the boiler condensate connection (see Figure 65, page 58).
3. Remove the clean out cap and remove the trap internal parts as shown.
4. Clean all trap components.
5. Re-assemble trap assembly. Re-install all lower gaskets.
6. Make sure the trap ball moves freely when re-inserted.
7. Fill trap with fresh water by pouring into the top of the trap body. Continue filling slowly until water begins flowing out the condensate drain line. Make sure the trap line is unobstructed and flows freely.
8. Reattach the trap to the boiler condensate outlet. Push the trap up until fully engaged. Then twist the upper nut clockwise to tighten. Check for secure connection. Place bracket under top nut and slide slot over rivet in cabinet, check for secure connection.

**Figure 98** Condensate trap cleaning



## Check all piping for leaks

### ⚠ WARNING

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

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines in the system and in the boiler and correct any problems found.
3. Check gas line using procedure on page 59.

# Annual startup *(continued)*

## Check air openings

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

## Flue vent system and air piping

1. Visually inspect entire flue gas venting system and combustion air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage in accordance with vent manufacturer's instructions. Verify that air inlet piping is connected and properly sealed.

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

## Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (usually around 12 PSIG).
3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure doesn't rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Reinstall caps. Make sure vents do not leak. Replace any leaking vents.
5. Check system water chemistry (pH, hardness and inhibitor level). See page 79.

## Check expansion tank(s)

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools.
2. See page 43 or page 47 depending on system type for information.
3. Tank types
  - **Closed-type** — welded gas tight and located above boiler. Tank is partially filled with water, leaving an air cushion for expansion.
  - Make sure a closed-type tank is fitted with a tank fitting, such as the B & G Tank-trol or Taco Taco-trol. This fitting reduces gravity circulation of air-saturated tank water back to the system and prevents the air from bubbling up through the water as it returns from the system.

- Do not use automatic air vents in systems with closed-type tanks. The air will escape from the system instead of returning to the tank.
  - Eventually, the tank will waterlog and no longer control pressurization. The boiler relief valve will weep frequently.
  - **Diaphragm- or bladder-type** — welded gas tight with a rubber membrane to separate the tank pressurizing air and the water. May be located at any point in the system, but preferably located on the suction side of the system circulator.
  - Systems with this type of expansion tank require at least one automatic air vent, preferably located on top of an air eliminator, as shown in examples in this manual.
4. If relief valve has tended to weep frequently, the expansion tank may be water logged or undersized.
    - a. **Diaphragm- or bladder-type expansion tank** — first, check tank size to be sure it is large enough for the system. If size is too small, add additional tank (or tanks) as necessary to provide sufficient expansion. If tank size is large enough, remove tank from system and check charge pressure (usually 12 PSIG for residential applications). If tank won't hold pressure, membrane has been damaged. Replace tank.
    - b. **Closed-type expansion tank** — tank is most likely waterlogged. Install a tank fitting if not already installed. Then check fill level per fitting manufacturer's instructions. If fill level is correct, check tank size against manufacturer's instructions. Replace with a larger tank if necessary.

## Inspect ignition electrode

1. Remove the ignition electrode from the boiler heat exchanger access cover (see item 23, page 4). (Disconnect the ground wire and ignition cable connected to the electrode.)
2. Remove any white oxides accumulated on the ignition electrode using steel wool. If the ignition electrode cannot be cleaned satisfactorily, replace ignitor with a new one.
3. Reinstall ignition electrode, making sure gasket is in good condition and correctly positioned.

**⚠WARNING** **TORQUE LIMIT** — Use a torque wrench when tightening the two ignition electrode retainer screws. DO NOT exceed 20 inch-pounds.

4. Re-attach the ground wire to the electrode assembly.

# Annual startup *(continued)*

## Check ignition wiring

1. Check ignition cable electrical resistance. A good cable will have resistance between 950 and 1050 ohms. Replace if not acceptable.
2. Inspect boiler ground wire from heat exchanger access cover to ground terminal screw.
3. Verify all wiring is in good condition and securely attached.
4. Check ground continuity of wiring using continuity meter.
5. Replace ground wires if results are not satisfactory.

## Check all boiler wiring

1. Inspect all boiler wiring, making sure wires are in good condition and securely attached.
2. Verify that all connectors are securely inserted.

## Check control settings

1. Use the ECO control display to navigate through all settings. Adjust settings if necessary.
2. Check settings of external limit controls (if any) and adjust if necessary. Adjust as needed to accommodate the system design.

## Perform startup and checks

1. Start boiler and perform checks and tests specified in this manual.
2. Verify cold fill pressure is correct and that operating pressure does not go too high. Adjust water pressure and expansion tank charge pressure as necessary.
3. Complete the check-out procedure on page 87.

## Check low water cutoff service light (if used)

1. If the low water cutoff amber LED is on, the device requires service. Follow the low water cutoff manufacturer's instructions.

## Check burner flame



The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on page 89 of this manual. Failure to comply could result in severe personal injury.

1. Inspect flame through observation window using the procedure on page 82.
2. If flame is unsatisfactory at either high fire or low fire, check combustion values. If combustion is properly adjusted, turn off boiler and allow boiler to cool down. Then remove burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.

3. To access the burner, remove the heat exchanger cover plate following the procedure beginning on pages 105, 108 or 111.
4. If replacing the burner, ensure the burner gasket is in good condition and correctly positioned. Follow all instructions on pages 107, 110 or 112 to reinstall all components.
5. Restart the boiler.
6. Inspect the flame at high and low fire. If flame is still not acceptable, check combustion values. If combustion is properly adjusted, obtain a replacement burner from Weil-McLain.

## Check flame signal

1. Navigate to Diagnostics/Inputs on the ECO control display (see Figure 78, page 70 for navigation instructions and Figure 87, page 76 for the complete Diagnostics menus).
2. The flame signal value must be at least 75 for a ECO 70, or at least 100 for a ECO 110, and at least 160 for the ECO 155. If the flame signal drops below this level, the ECO control will attempt to correct by increasing the blower speed to increase flame signal.

**Figure 99** Flame signal shutdown values

Model ECO	Shutdown flame signal	Model ECO	Shutdown flame signal
70	50	155	150
70 HA	50	155 HA	150
110	80	NOTE: "HA" means high altitude, 5500 feet or more above sea level.	
110 HA	80		

3. A low flame signal may indicate a fouled ignitor or damaged ignitor insulation.
  - a. See "Inspect ignition electrode," page 91 to remove and inspect the ignitor.
  - b. If required, clean the igniter as instructed.
  - c. If cleaning the ignitor does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the ignitor.
4. If flame signal still remains low:
  - a. Inspect the vent and air piping.
  - b. Check combustion values.
  - c. Then inspect the heat exchanger, following the procedures given in this manual for removal and reinstallation of the heat exchanger cover plate and other boiler components (see page 105).
  - d. Clean the exchanger as described in this manual if necessary.

# Annual startup *(continued)*

## Check blower speeds

- For installations at altitudes above 5,500 feet, make sure the control is set up for high altitude in the boiler setup menu. The ECO control automatically adjusts low fire and ignition rates to compensate for high altitude conditions.
- For installations below 5,500 feet, high altitude should NOT be enabled.
- Use the ECO control display to navigate to DIAGNOSTICS/Manual test mode (see Figure 78, page 70 for navigation instructions and Figure 87, page 76 for the complete Diagnostics menus).
- Set the firing rate to LOW (low fire).
- Write down the blower RPM value shown and compare to the value in Figure 100. The value should be no less than the “Minimum setting” and no higher than the Ignition “Factory setting” listed. Low fire rate (and corresponding blower speed) is adjusted in the boiler setup menu.
- Set the firing rate to MED (ignition rate).
- Write down the blower RPM value. It should be within 200 RPM of the value listed in Figure 100.
- Set the firing rate to HIGH (high fire).
- Write down the blower RPM value. It should be within 200 RPM of the value given in Figure 100.
- If any of the values are outside the ranges listed in the previous steps, contact the factory for technical assistance.

**NOTICE**

Minimum and maximum blower speeds can be adjusted within limits, but changing speeds will affect AFUE ratings.

## Check flue gas temperature

- Set the boiler to high fire. Then adjust the ECO control display to view flue gas temperature and boiler return temperature.
- The flue gas temperature should be no more than 50°F higher than the boiler return temperature.
- If the flue temperature is higher than this, shut down the boiler, allow to cool, and follow the procedure starting on page 105 to clean the heat exchanger.

**Figure 100** Firing rates and corresponding blower speeds (low fire, ignition, and high fire) — for altitudes up to 5,500 feet and high altitude (above 5,500 feet)

ECO Model	70			110			155		
	%	RPM	Btu/Hr Note 1	%	RPM	Btu/Hr Note 1	%	RPM	Btu/Hr Note 1
<b>Low fire</b>									
Minimum setting	20	1,100	14,000	20	1,900	22,000	18	1,300	28,000
Factory setting	20	1,100	14,000	20	1,900	22,000	18	1,300	28,000
High altitude	33	1,675	23,000	33	2,890	37,000	33	2,100	52,000
<b>Ignition</b> (“Medium” setting in manual test mode)									
Factory setting	47	3,200	32,900	50	4,130	55,000	47	2,800	72,850
High altitude	62	3,500	43,400	61	4,975	67,500	61	3,500	94,550
<b>High fire</b> (adjust if desired to match maximum system load — High fire % rate = Max heat load / Boiler output) (adjusting speed will affect boiler AFUE rating)									
Factory setting	96	4,150	67,200	96	7,550	105,600	96	5,300	148,800
Maximum setting	100	4,300	70,000	100	7,850	110,000	100	5,500	155,000

Note 1 — The boiler will automatically derate the BTU values listed in this table by 4% per 1,000 feet above sea level.

**NOTICE**

In the USA Input rates are derated 4% for each 1000 ft. above sea level, beyond 2000 ft. in accordance with National Fuel Gas Code, ANSI Z223.1/NFPA 54 – latest edition, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1.

**WARNING**

For elevations above 10,000 feet, please contact Weil-McLain Technical Support for details.

# Annual startup *(continued)*

## Check boiler relief valve

1. Inspect the relief valve and lift the lever to verify flow as in the following warnings, excerpted from a relief valve manufacturer's warning label. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential.
2. Read page 45 or 50 before proceeding further.
3. Follow instructions below or perform procedures per relief valve manufacturer's printed instructions.

### **⚠ WARNING**

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

### **⚠ WARNING**

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

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

## Reinstall jacket door after servicing

### **⚠ WARNING**

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

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

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

## Review with owner

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

# Troubleshooting

## VERIFY PROPER OPERATION AFTER SERVICING

Before calling for troubleshooting assistance, fill in the “**ECO Gas Data Collection Sheet**” (page 130). Record the boiler size and CP number (located on the right side exterior of the boiler jacket).



**Failure to adhere to these guidelines can result in severe personal injury, death or substantial property damage.**

### ELECTRICAL SHOCK HAZARD

**TURN OFF ALL POWER TO THE BOILER WHEN SERVICING.** Internal wiring is still powered when the switch is off.

### DO NOT JUMPER DEVICES

Never jumper (bypass) any device except for momentary testing.

### REINSTALL Jacket door

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

### BEFORE SERVICING or MAKING CONNECTIONS —

**ALWAYS TURN POWER OFF TO THE BOILER TO PREVENT ELECTRICAL SURGES, WHICH CAN DAMAGE BOILER COMPONENTS.**

### LABEL WIRES BEFORE REMOVING

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

### BEFORE TROUBLESHOOTING —

- See Figure 101 for tools and kits recommended for troubleshooting ECO boilers.
- Check for 120VAC (minimum 102VAC to maximum 132VAC) to boiler.
- Check the ECO control's last three lockout histories. (Navigate to the DIAGNOSTICS menus.)
  - See Figure 78, page 70 for navigation instructions and Figure 87, page 76 for the complete Diagnostics menus.
  - In the DIAGNOSTICS menu, scroll down to ERRORS and press the enter key.
  - Record the first four data records and then highlight the history record you want to view.
  - Follow information at the bottom of the screen to navigate through your lockout histories.

**Figure 101** Tools and kits needed for troubleshooting

Tool	Purpose
#2 Phillips screwdriver	Multiple uses
10 mm wrench	To remove heat exchanger cover plate
#20 long-handled Torx driver	To remove burner screws
#T25 Torx driver	To remove gas valve
5/16" Nut driver	To remove air baffle
Multimeter	Measurements on sensors and electrical components
Manometer (Inclined or digital)	Measure the INLET gas pressure to the boiler
Combustion analyzer (Digital preferred)	Combustion testing and boiler adjustments
Contact thermometer	Checking surface temperatures of heat exchanger and pipes
Maintenance kit	ALWAYS have this kit on hand when performing maintenance in case replacement is required.

### Check the following:

- Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for 24VAC between thermostat wire nuts and ground.
- Make sure all external limit controls are either installed (and closed) or temporarily jumpered for testing.
- Make sure that connectors to ECO control are securely plugged in at module and originating control.
- Gas pressures:
  - Maximum: 13" (330 mm) w.c. with no flow (gas valve lockup pressure).
  - Minimum: must be no less than the minimum values given on page 21 while operating on high fire.

# Troubleshooting *(continued)*

## Check control fuses

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

1. Turn OFF power to boiler at external line switch. Then remove the jacket door.
2. Locate fuses using Figure 103.
3. Remove and inspect the two fuses (items 1 and 2, Figure 103).
4. If necessary, replace one or both of the fuses:
  - a. Low voltage circuit fuse is 3-amp fast-blow (Littelfuse 0287003).
  - b. Line voltage circuit fuse is 12-amp fast-blow (Littelfuse 0314012MXP).

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

## Checking temperature sensors

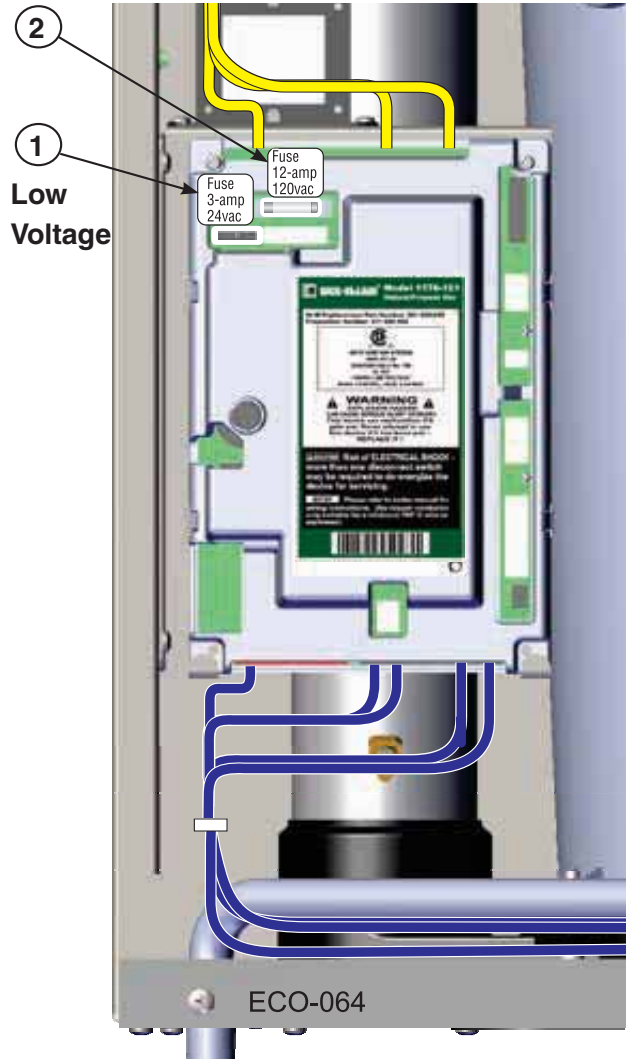
1. The boiler temperature sensors (flue, outdoor, return water and supply water) are all resistance-type devices. Figure 102 shows the correct value for the sensor at various temperatures. For dual sensors, the temperature difference between the sensors must be no more than 10°F.
2. Use the resistance values at 32°F, 60°F, 70°F and 212°F to measure the sensor resistance at known temperatures (ice point, room temperature and sea level boiling point). For ice point and boiling point, insert the sensor in water at that temperature. Use an ohmmeter to read resistance value.
3. To check whether the ECO control is correctly sensing temperature, you can use a resistance decade box. Connect the decade box temporarily in place of a sensor and read the corresponding temperature on the ECO control display. The temperature should be close to the value corresponding to the input resistance.

**Figure 102** Sensor resistance values

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

**Figure 103** Control fuses

### Line Voltage



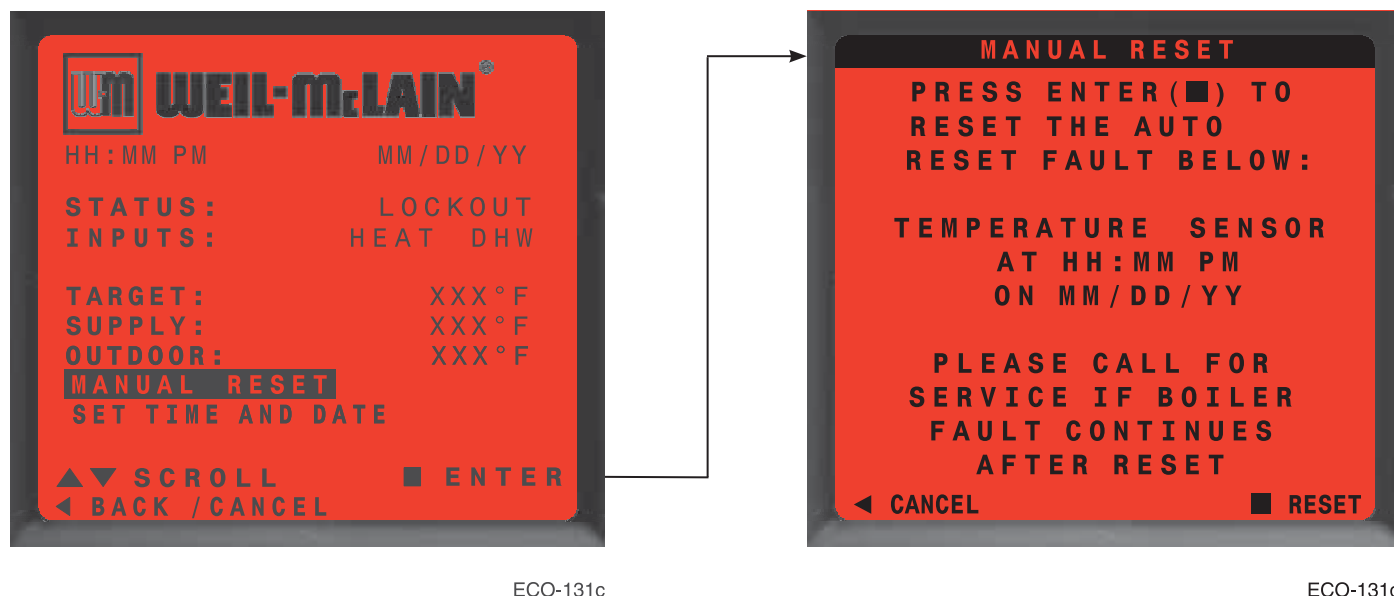
# Troubleshooting *(continued)*

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

## ECO control fault indications

1. The ECO control provided diagnostic information for automatic reset conditions, manual reset conditions, and certain functional warnings. See Figure 78, page 70 for information menu navigation and Figure 87, page 76 for DIAGNOSTIC screen information.
2. Figure 104 shows the screen behavior during an automatic or manual reset condition.
3. Figure 105, page 98 shows the information available on the “ERRORS” screens for diagnosing a fault condition.
4. Figure 106, page 99 lists conditions that will cause the fault screen operations. The reset conditions are listed. Some will reset automatically but others may require the use of the control’s manual reset screen to reset the fault.

**Figure 104** ECO display when a fault occurs—main homeowner screen and manual reset screens shown.



During a fault, the status will change to “LOCKOUT” and the Time & Date line will alternate with the fault name. The line “MANUAL RESET” will appear on the Homeowner screen. This screen can also be accessed from the DIAGNOSTIC menu in the contractor screens.

The “MANUAL RESET” screen will indicate whether the fault was a manual or automatic reset, the fault name, and the time and date it occurred.

Error Type	Screen color	Operation
Manual Reset	Flashing RED	Lockout—will not accept any calls for heat
Automatic Reset	Solid RED	Lockout—will not accept any calls for heat
Warning	Solid RED (on standby only)	Boiler runs during warning condition but may not run as efficiently.

# Troubleshooting *(continued)*

**Figure 105** Troubleshooting suggestions for ECO boilers — **ECO control Error Condition Log**

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

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

## How to read the last 3 lockout histories:

1. Scroll down to "DIAGNOSTICS" and press the enter key (Square Key in center)
2. Scroll down to "ERRORS" and press the enter key (Square Key in center)
3. Scroll down to "LOCKOUT HISTORY #" and press the enter key.
4. Screen should display Error name, type, time, date, and boiler status at time fault occurred.
5. Scroll up or down to highlight other choices and press the enter key to view the details of the boiler's condition when the lockout was recorded.

## How to clear all counters and lockout histories:

1. While on the "ERRORS" screen, hold the Left and Right arrow buttons simultaneously for 3 seconds.

# Troubleshooting *(continued)*

**Figure 106** Troubleshooting suggestions for ECO boilers — **Fault displays, diagnostics and corrective actions**

Display	Condition	Diagnostics	Corrective Action(s)
<b>Nothing shown on display screen and boiler will not respond to call for heat</b>	Control is not receiving 24V power	Check wiring for short circuit or incorrect wiring.	Correct wiring per wiring diagram including connection of transformer to the control module.
		Check 3-amp low voltage fuse on control module shown on page 96.	Replace fuse with proper part found in replacement part section of this manual. If fuse blows again recheck wiring per diagram.
		Check transformer connection to the control module per wiring diagram. Check for 24V output of transformer.	Replace transformer if it is receiving 120VAC, but not outputting 24VAC.
<b>Nothing is shown in display screen and no other boiler components are operating</b>	Control is not receiving 120V power	Check service switch and/or circuit breaker to ensure boiler is turned on.	Turn on service switch to power boiler.
		Is there 120 Volts at the service switch?	Troubleshoot and correct the power supply to the service switch.
		Check for 120 volts at the line voltage terminal block located at P1 on the control module.	Correct wiring to the control module using the wiring diagram in this manual.
		Inspect 12-amp fuse as shown on page 96. Replace if necessary.	Replace the fuse with proper part found in the replacement part section of this manual. If fuse blows again recheck wiring per diagram.
<b>Nothing is shown on display screen, but boiler is operating</b>	Occurs if the communication is lost from the control module to the display.	Check for loose connections and proper pin alignment/engagement on the control module's plug P9 and the back of the display circuit board.	Check for continuity on the wire harness from the display to the control module. See repair parts section for proper replacement part.
		Cycle power off and on using service switch or breaker.	Replace with new display module. See repair parts section for proper replacement part.
<b>TEMP RISE TOO QUICKLY</b>	Occurs if supply water temperature in heat exchanger rises faster than 2°F per second during the first two minutes the burner is on.	Automatically resets after 1 minute delay or using manual reset on display.	Verify water pipe is installed correctly per instructions in this manual.
		Manual reset is necessary after 5 automatic resets have occurred during the same Priority heat demand. Reset using manual reset screen on display.	Verify proper circulator sizing for boiler size and system requirements. Verify circulator connected to correct circulator output on the control module's plug P2. Verify external controls are installed per manufacturer's instructions, all applicable codes, and sound industry practices.
			See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
<b>SUPPLY 58° F &gt; RETURN</b>	Boiler Out temperature has exceeded the Boiler In temperature by more than 58°F	Automatically resets after 30 second delay or using manual reset on display.	Verify water pipe is installed correctly per instructions in this manual.
			Verify proper circulator sizing for boiler size and system requirements. Verify circulator connected to correct circulator output on the control module's plug P2. Verify external controls are installed per manufacturer's instructions, all applicable codes, and sound industry practices.
			See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
<b>RETURN &gt; SUPPLY</b>	Occurs if a return water temperature is greater than the corresponding supply temperature by 10°F or more.	Automatically resets when condition no longer exists.	Verify proper flow direction of the boiler or system circulator. This circulator must be installed to push water through the boiler's return pipe as shown in piping diagrams beginning on . Verify circulator connected to correct circulator output on the control module's plug P2. Verify external controls are installed per manufacturer's instructions, all applicable codes, and sound industry practices.

# Troubleshooting *(continued)*

**Figure 107** Troubleshooting suggestions for **ECO** boilers — **Fault displays, diagnostics and corrective actions**

Display	Condition	Diagnostics	Corrective Action(s)
<b>TEMPERATURE SENSOR</b>	Occurs if a temperature sensor has electrically shorted (SHORT) or has become disconnected (OPEN).	Will automatically reset if the condition clears.	<p>Check all the temperature readings of the boiler on the DIAGNOSTICS - TEMPERATURES menu to determine if any sensors are currently displayed as SHORT or OPEN. Compare this to the boiler temperatures recorded in the DIAGNOSTICS - ERRORS - LOCKOUT HISTORY # - TEMPERATURES during the last several lockout conditions.</p> <p>Determine which sensors are suspect and measure their resistance value and compare it to the values shown in Figure 102, page 96. If the resistance values are incorrect replace the temperature sensor. Refer to repair parts section for proper part number.</p> <p>OUTDOOR TEMP is the optional outdoor air temperature sensor. If this is not being used it will always be shown as NONE. This is normal unless the sensors were installed.</p> <p>Check wire harness for loose connections and pin engagement at sensor connection and the control module. Unplug connection at sensor and at control module and check continuity between ends.</p> <p>If problem persists after checking items above replace control module. Refer to repair parts section for kit number.</p>
	Occurs if dual temperature sensors values have spread by more than 10°F if the burner is on.	Automatically resets when sensors are within 10°F.	Follow procedure above for SHORT and OPEN sensor conditions to properly diagnose sensor. If measured resistance values of sensors convert to temperatures separated by more than 10° F replace the sensor.
<b>FLUE TEMP TOO HIGH</b>	Occurs if flue temperature sensor exceeds 216°F.	<p>Automatic reset occurs if temperature drops below 210°F for 2.5 minutes.</p> <p>Manual reset is required if the temperature rises above 220°F. Reset using manual reset screen on display.</p>	<p>Follow procedure for above for SHORT and OPEN sensor conditions to properly diagnose sensor. In addition inspect heat exchanger combustion chamber and flue ways for abnormal wear or buildup.</p> <p>Inspect vent system for abnormal wear or damage.</p> <p>Contact Weil-McLain Technical Support.</p>
<b>LOW WTR CUTOFF OPEN</b>	Occurs if low water cutoff contacts open.	<p>Automatic reset occurs if contacts are open at least one second, but less than 5 seconds.</p> <p>Manual reset of control module if contacts are open longer than 5 seconds.</p>	<p>Check for low water condition in system. Repair system as necessary refer to piping section of this manual.</p> <p>If low water condition does not exist, check Diagnostics — Inputs screen to view status of Low Water Cutoff. If shown as OPEN check wiring between LWCO and control module. If wiring is correct and functioning, then replace the LWCO.</p> <p>If LWCO option is not installed, check the wiring of the jumper in control module's plug P12.</p>
<b>DISPLAY COMM</b>	Occurs if display communications out for 30 seconds.	Automatically resets when communication is re-established.	Check for a loose connection at the molex plug on the control and connection on the back of the display.
<b>LIMIT OPEN</b>	Occurs if manual or automatic reset limit opens.	Automatic external limit will reset 2½ minutes after external limit device closes.	<p>Is there an external safety device connected? If yes, trouble shoot the external limit to determine and correct the cause that opened the limit. Also check for loose wiring connections.</p>
		Manual limit fault must be reset using manual Reset screen on the display.	<p>Inspect the connector on control module's plug P13.</p> <p>Ensure a jumper is installed across the left two (Pins 1&amp;2) terminals if not using a manual reset external limit.</p> <p>Ensure a jumper is installed across the right two (Pins 3&amp;4) terminals if not using an automatic reset external limit.</p>

# Troubleshooting *(continued)*

**Figure 108** Troubleshooting suggestions for **ECO** boilers — **Fault displays, diagnostics and corrective actions**

Display	Condition	Diagnostics	Corrective Action(s)
<b>HIGH TEMP LIMIT</b>	Boiler temperature sensor reached High Temp Limit setting (no higher than 200°F).	Reset using manual reset screen on display.	Verify that high limit setting is at least 10°F above the supply target temperature (DHW Boiler Supply and Heating Supply Max).
			Verify all isolation valves are open and circulators are connected to the control module properly.
			Verify external controls are installed per manufacturer's instructions, all applicable codes, and sound industry practices.
			Verify water pipe is installed correctly per instructions in this manual.
			Verify proper circulator sizing for boiler size and system requirements.
			See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
<b>FLAME FAULT</b>	Occurs if flame is detected when there should be no flame.	Reset using manual reset screen on display.	Burner may be operating too hot due to incorrect combustion. Inspect flame and conduct combustion test. Force boiler into hi-fire. Check flue gases with combustion analyzer and correct using the maintenance and startup procedure in this manual.
			Verify FLAME SIGNAL value quickly goes to zero on the DIAGNOSTICS - INPUTS screen when the gas valve closes.
			Check for flame at burner via flame current with burner off. Turn boiler off and watch flame through observation port. If flame continues after shutdown replace gas valve and venturi.
<b>GAS VALVE FAULT</b>	The control module has detected a problem with its gas valve output circuit.	Control will automatically retry; lockout if retry unsuccessful; retry 1 hour after lockout — restart if condition cleared, but lockout requiring manual reset if condition still present.  Requires manual reset if control is in lockout.	Check wire harness connections between gas valve and control module.
			Check resistance between control and gas valve.
			Disconnect low-voltage wires connected to the low voltage field-wired connectors. Check all wire leads from system from system for stray voltage. Any voltage in excess of 0.5 volts will cause gas valve fault failures. Correct the cause of stray voltages before reconnecting wires. After correcting problem, check to see if gas valve fault issue is corrected.
			If lockout reoccurs replace control module.
<b>BLOWER FAULT</b>	Blower unable to reach required speed or does not reach 0 RPM when turned off.  NOTICE: <b>ECO</b> 70 or 110 only — The blower will not rotate without a low voltage signal. Unplugging the low voltage blower wire harness will not allow or cause the blower to rotate.	Reset using manual reset screen on display; control module will check again after 1 hour and will automatically restart if condition is corrected.	Check wire harness for loose connections and pin engagement at blower connections and control module. Unplug connection at blower and at control module and check continuity between ends. Blower is connected to both low voltage and line voltage harness.
			Check Diagnostics - Inputs screen with boiler in standby mode and blower not running. If BLOWER SPEED is not 0 RPM replace blower.
			If blower does not rotate during ignition sequence check for 120V power at blower connection. If 120VAC power is present at blower motor and it doesn't start, replace blower. Check power at control module. If 120VAC is not present at control module when boiler is powered, replace control module. Refer to repair parts section.

# Troubleshooting *(continued)*

**Figure 109** Troubleshooting suggestions for **ECO** boilers — **Fault displays, diagnostics and corrective actions**

Display	Condition	Diagnostics	Corrective Action(s)
<b>IGNITION FAULT</b>	Boiler went through 5 ignition attempts and never detected flame.	Automatically resets after 1 hour or can be reset by performing manual reset on boiler.	Check condensate trap for blockage allowing condensate to accumulate inside heat exchanger. Check ignition cable connection.
			Fouled, worn, bent, or faulty igniter. Fouled igniters can be cleaned for additional use with steel wool. Worn or badly fouled igniters should be replaced with the proper repair part. Igniter rods should be parallel with a 3.5 mm (0.236 in) spark gap (70 & 110 models) or a 4.8 mm (0.189 in) spark gap (155 models).
			<b>NOTICE</b> Thin white deposits on the igniter are typical, but brown or black deposits could be the result of flue gas recirculation. Thoroughly inspect the venting system and termination for the possibility of leakage or flue gas feedback into the air line.
			Dirty burner and/or heat exchanger will cause high back pressure and poor ignition. Follow procedure in maintenance section of this manual to clean burner and heat exchanger. Visual inspection of flue ways may not be sufficient to diagnose condition.
			Check combustion settings on high and low fire and adjust per setup instructions if necessary.
			Check incoming gas pressure with boiler off and at high fire. Adjust within limits on rating label.
			Verify correct boiler model is selected in control and high altitude is selected for installations 5,500 feet above sea level.
			Check ignition cable resistance. Should measure 1000 Ohms (+/- 50 Ohms).
			Check for flue pipe and intake pipe restrictions or blockage.
			Check burner fasteners and gaskets.
			Check venturi gaskets and proper propane orifice.