Installing Small Condensing Boilers

Precise installation can diminish maintenance dilemmas

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The previous article in this series ("Selecting Small Condensing Boilers," May) focused on the selection and sizing of small condensing boilers, both floor-standing and wall-hung models with inputs of up to 500,000 Btuh. Proper installation is equally important to mitigate maintenance problems, maintain the warranty, and increase the performance of what is an important investment. Examining installation parameters also is an essential part of the design process, as it ensures the units selected fit the application.

Generally, installations must be completed by qualified and licensed personnel. Installations also must adhere to applicable codes and any local amendments as well as the manufacturer's installation and operating instructions. Some of the most frequently applicable codes are:

- American National Standards Institute Z223.1, *National Fuel Gas Code*.
- American Society of Mechanical Engineers Standard CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*.
- National Fire Protection Association (NFPA) Standard 70, *National Electrical Code*.

This article will discuss installation considerations that should be made when installing a boiler:

- Location.
- Venting.
- Condensate drainage.
- Gas piping.
- Heating-system piping and pumping.
- Wiring.
- High-altitude operation.

LOCATION

Location relates to the physical size of equipment, the ability to maintain service clearance and clearance to combustibles, and the ability to properly vent combustion products. Location also includes the installation of the proper foundation pad if the boiler is floor-mounted.

Make certain the proposed boiler location meets the manufacturer's requirements. Also, be sure the manufacturer's conditions regarding any environmental limitations, such as water vapor, humidity, temperature, or installation in an area subject to flooding, are met. If these regulations are not followed, the warranty may be voided.

VENTING

Venting is a critical facet of boiler installation. Generally, horizontal and vertical venting are permitted, but each has its own set of regulations. Check the manufacturer's requirements on vent size and maximum equivalent length of venting allowed, as well as horizontal vs. vertical length restrictions. Also, all vent piping must be supported properly per code and the manufacturer's recommendations. Vent clearance and termination locations also must be adhered to. Some condensing boilers use polyvinyl-chloride (PVC) or chlorinated-polyvinyl-chloride (CPVC) venting, while some use stainless-steel venting. If your project is a retrofit of an existing condensing boiler, be sure to check that the new boiler venting type will match the existing venting. Remember, condensing boilers cannot vent into materials subject to corrosion or deterioration, such as galvanized steel or chimneys. Also, boilers must be vented independently. Venting should slope back to the boiler ¼ in. per foot to contain any condensate and ensure condensate does not collect in the venting system.

CONDENSATE DRAINAGE

Plan for proper condensate drainage. Condensate is acidic and should be piped directly to a drain per the manufacturer's instructions and code requirements. Consider neutralizing condensate before it dumps into a drain to avoid corrosion of the drain system. This process may be required by local code. Also check with your municipality or local gas company to determine if disposal of combustion condensate is permitted.

The following instructions must be taken into consideration when constructing a condensate system:

- Do not run condensate lines outside. A frozen or blocked drain will cause condensate to fill the combustion chamber. This will result in a no-heat condition—because the unit will shut down—and can cause damage to components.
- Never use copper, steel, or galvanized piping in the construction of a condensate system.
- When a condensate pump is used or required, select a pump that is designed for the duty.

GAS PIPING

Use flexible gas pipe if accepted by local codes. The gas valve and blower cannot support the weight of piping. This holds true for all boiler fittings. All

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parts of a plumbing system should be supported independently from the boiler.

If rigid piping is used, ensure that the gas valve does not support any weight or run the risk of blower vibration and damaged components. Install an equipment shut-off valve and a 6-in. dirt leg (Figure 1). The shut-off valve must be listed by a nationally recognized testing laboratory.

If a boiler is shipped "ready to fire" on natural gas, but will be connected to propane instead, a propane orifice must be installed. Ensure proper line pressure is being supplied to the boiler.

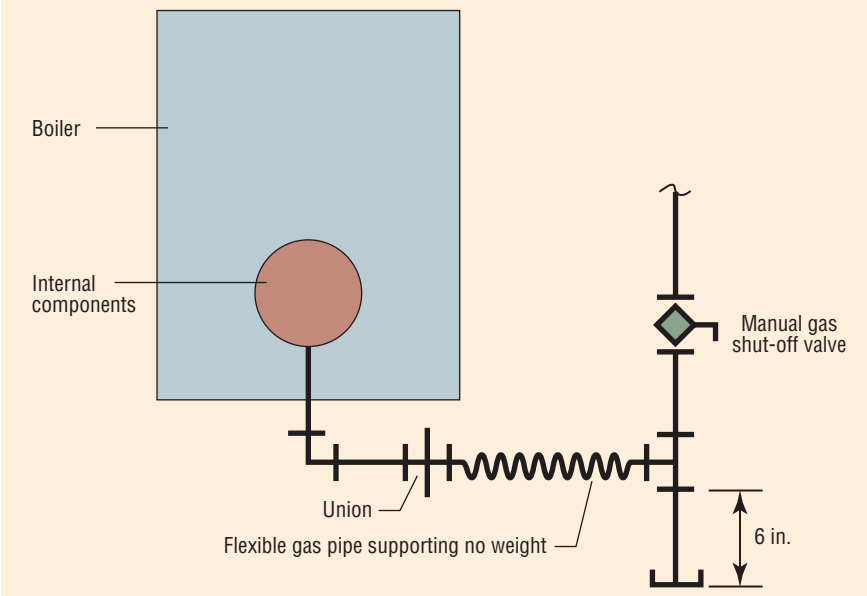

FIGURE 1. Boiler gas piping.

HEATING-SYSTEM PIPING AND PUMPING

Consideration must be given to the capabilities of circulating pumps. Use a primary boiler circulator recommended by the manufacturer, and be sure to verify with the manufacturer whether the boiler pump should pump into or away from the boiler.

Other piping appurtenance considerations include relief valves, air venting, low-water cutoffs (LWCO), and backflow preventers.

A relief valve often is provided with the heating system and should be installed as shown in the manufacturer's diagram. Ensure the discharge of the pressure-relief valve is piped to a location where steam or water will not cause personal injury or appliance and property damage.

Hot-water boilers are designed to operate with airless water in the system. Boilers typically are provided with an air vent located on top of the unit. This air vent is intended to vent the boiler on initial startup. The device will not continuously vent air collecting in the primary loop, and it is not intended to be the primary venting device.

A certified LWCO or flow switch may or may not be provided with the boiler. However, one of these is to be field-installed in any application in which the boiler is located above all radiation or in which it is required by local authorities. Do not install an isolation valve between the boiler and the LWCO. Ensure the water line of the LWCO is at least 6 in. above the top of the boiler (Figure 2).

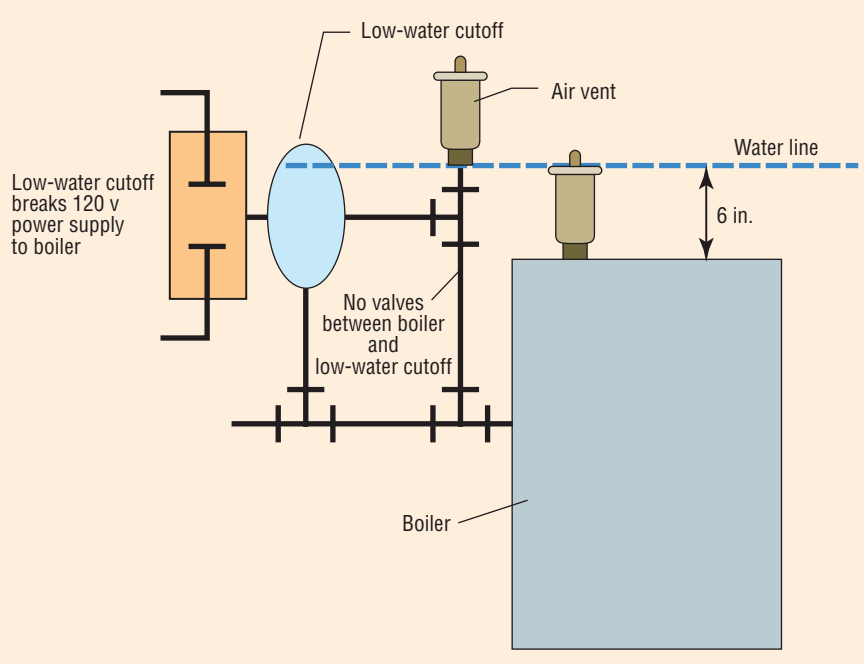

FIGURE 2. Low-water cutoff.

Also, use backflow check valves in cold-water supplies as required by local codes.

Keep the following in mind regarding boiler system piping:

- Do not allow flow through unfired boilers.
- Use closely spaced boiler tees (maximum separation of four times the pipe diameter) for connection to the primary loop so flow in the primary circuit will not create flow in the boiler circuit.
- Other configurations may work, but under no circumstances can a mixing valve be placed in the primary loop because of the low return-water temperatures required for gas condensing and the

possibility of a boiler overheating. If mixing valves are required, (e.g., for multicircuit systems or radiant-heating systems) only three-way mixing valves should be used. Do not use four-way mixing valves with condensing boilers.

Also, understand and follow these general plumbing installation requirements:

- Keep serviceability in mind when installing plumbing around boiler cabinetry.
- Install fittings that will allow the system to be flushed, if needed, during annual checkups.
- All systems must be flushed to remove sediment, flux, filings, etc., in both new and retrofit applications. Failure to do so will seriously damage the boiler, possibly voiding the warranty.
- Add an inhibitor to the system water to prevent limestone and magnetite deposits from forming and to protect the boiler from galvanic corrosion.

Additional system components may be required. Typical high-efficiency, fully condensing systems may require use of a heat exchanger that may not be necessary when using conventional equipment. Condensing-boiler manufacturers usually limit their boilers to a maximum 30- to 50-percent glycol content. Glycol has limited heat-transfer capability. This limitation of glycol percentage safeguards against boilers flashing fluid to steam. One solution includes adding a heat exchanger to separate glycol in the secondary loop from water in the primary (boiler) loop.

A carbon-monoxide detector must be installed in rooms housing boilers. Carbon-monoxide detectors should comply with the latest edition of NFPA Standard 720, *Standard for the Installation of Carbon Monoxide Warning Equipment in Dwelling Units*.

WIRING

Before providing 120 v to a boiler, perform a continuity check between all wires and ground to make sure there are no electrical leaks that could damage the unit control board. Also, perform a polarity check of the line and neutral wires. Line wires must be connected to black wires; neutral wires must be connected to white wires.

ALTITUDE

At elevations greater than 2,000 ft, boiler combustion may need to be checked with a calibrated combustion tester to ensure safe and reliable operation. Derate boiler capacity by the manufacturer's specified percentage for every additional 1,000 ft to account for the effects of less-dense air at higher altitudes.

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