

# Open Expansion Configuration for Single or Parallel Boilers



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Conceptual Description

Open Expansion

**BioHeat USA, INC.  
CONCEPTUAL DESCRIPTION**

**OPEN EXPANSION CONFIGURATION FOR SINGLE OR PARALLELED BOILERS**

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**RATIONALE**

In most installations, BioHeat USA heating boilers are not required to comply with the construction standards of the ASME Boiler and Pressure Vessel Code. However, heating boilers installed in commercial, institutional, and public buildings usually are required to comply with this ASME code. BioHeat USA heating boilers are designed, constructed, and pressure tested to exacting European standards (CEN 303-5) which, unfortunately, are not recognized in North America. BioHeat USA boilers are not ASME certified. The solution, when required, is to install these boilers in an open expansion configuration.

Installing BioHeat USA boilers in an open expansion configuration is recognized as a simple and safe alternative to the ASME rated boiler requirement.

**WHAT IS OPEN EXPANSION?**

In an open expansion configuration, the piping loop which includes the boiler (s) is topped by a column of water which is capped by a tank vented to the atmosphere. The water column maintains static pressure on the boiler (s) and piping loop. In the unlikely event that a boiler overheats, the excess volume of water created is released first into the vented tank and then to a drain. The boiler and piping loop cannot be over-pressurized.

**DETAILED DESCRIPTION OF THE OPEN EXPANSION CONFIGURATION**

In an open expansion configuration, a heat exchanger is frequently used to physically separate the boiler primary piping loop (where heat is produced) from the secondary loop containing the heating loads (where heat is consumed). The secondary loop is a conventional closed expansion system, where operating pressure is maintained by a pressure reducing station connected to feed-water at line pressure and a closed, un-vented expansion tank.

The primary piping loop connects the boiler supply and return to the heat exchanger. This loop includes its own circulator and a bypass tempering valve (which maintains minimum boiler return water temperature). Static pressure is maintained on the primary loop by means of a column of water located above it. A single vertical pipe is teed off the high point of the primary piping loop and connected to an elevated open expansion tank. The expansion tank is equipped with a sight glass, a vent to atmosphere, an overflow drain, and a feed-water connection through a normally-closed valve.

When the primary loop is filled with water, the water column is also filled to a set level in the expansion tank. This level can be monitored with the sight glass and maintained by manually adding feed-water periodically. As the primary loop water temperature increases and decreases due to boiler operation, water volume in the primary loop expands or contracts, causing change in the water level in the tank. Because of the overflow drain on the tank, excess volumes of primary loop water which would be created when the boiler overheated will be dumped to the drain. Boiler over-pressurization cannot occur.

**GENERAL DESIGN GUIDELINES**

1. The water level in the expansion tank should be set at least ten feet above the high point of the primary loop. (For every ten feet of water column height, the pressure at the bottom of the water column will increase by 4.33 psi).
2. The pipe connecting the expansion tank and the primary loop should be teed off at the primary loop high point, if possible. It is best if the connecting pipe has a continuous rise from the primary loop to the tank, to promote venting of the loop into the tank. This connecting pipe should be ¾ inch at minimum. (The tank vent and drain pipes should be similarly sized). No flow restrictions (valves, flow checks, flow control devices, etc.) should be installed in the connecting pipe.
3. Only a single pipe should connect the primary loop to the expansion tank. If more than one pipe is used, flow may be induced in the tank. This can result in oxygenation of the water in the tank and may cause boiler corrosion.
4. As a rule, the total expansion tank volume should be greater than twenty percent\* of the total primary loop water volume (boiler included) (\*use ten percent for primary loops with large volumes). This will allow the tank to be half full when the primary is cold and three-quarters full at operating temperature. (Maximum and minimum water levels in the tank should be set within the operating range of the sight glass).
5. The port on the expansion tank for the atmospheric vent should be high enough that it could never be covered with water during a normal heating cycle. If the vent port is submerged, air in the tank is trapped and expansion water is forced out the vent port. Normal practice is to vent at the top port for the sight glass.
6. The tank should be lined, coated, or made of corrosion resistant material (corrosion can occur inside the tank). It need not be a pressure rated vessel and should be vertical rather than horizontal, if possible.
7. All aspects of the primary loop and expansion tank (including the drain and vent) should be installed in heated spaces.
8. It is good practice to keep the primary loop as simple and compact as possible. All piping and the heat exchanger should be located at the same level as the boiler (s) and in close proximity to them.
9. Consideration should be given to appropriate warning and identification signage for expansion loop components at the tee point off the primary loop and at the expansion tank location.
10. Monitoring and maintaining (manually) of the expansion tank water level should be included in the weekly maintenance of the boiler (s).

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