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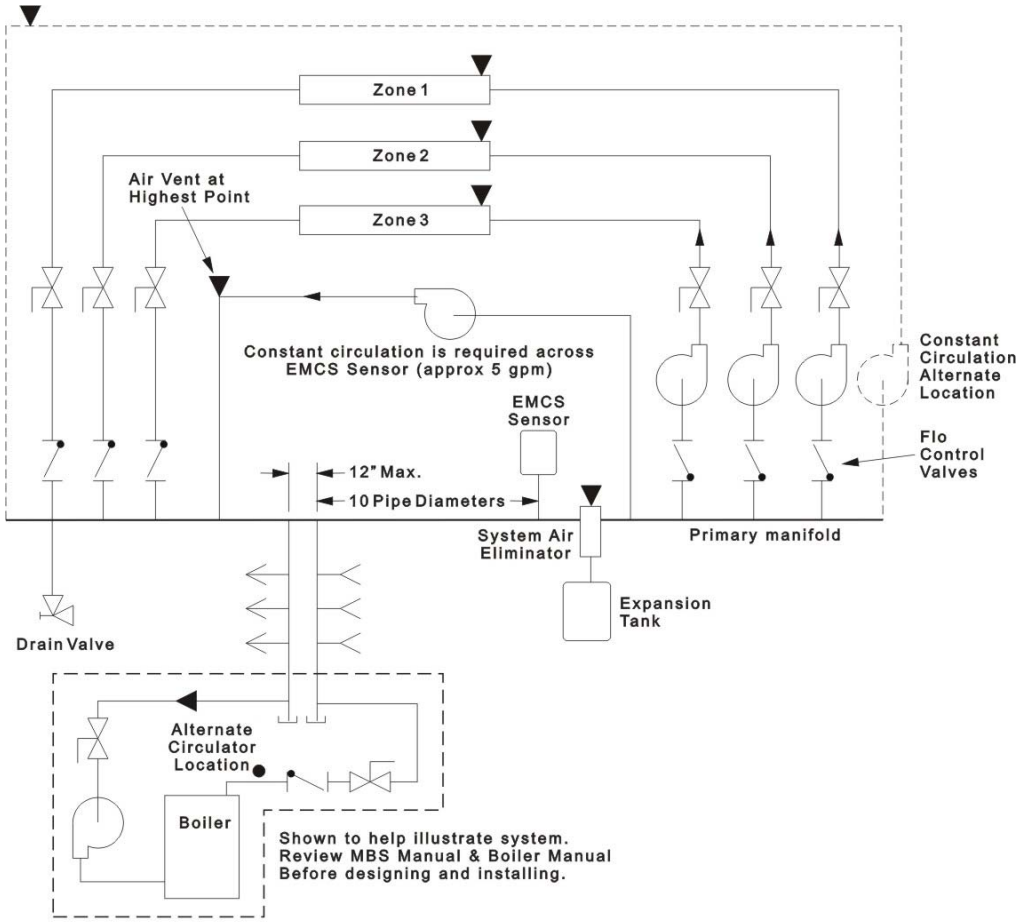
Technical Services Bulletin

Number: SB0205 *(Page 1 of 2)*
Date: November 26, 2002

Subject: *Preventing Thermal Shock in Commercial Cast Iron Boilers*

When installing a cast iron boiler into an application with low return water temperatures, it is important to make provisions to protect the boiler from a thermal shock condition. Typically, this is achieved through the use of by-pass piping with balancing valves or thermostatic three-way valves.

Thermal shock is a rapid and large increase in the thermal stress on a boiler which may cause a crack to form or to propagate. When a commercial system is designed to modulate the system water temperature based on outdoor temperature and provide a nighttime setback of zone temperatures, a situation can arise where even a cast iron boiler may experience thermal shock. The key to preventing thermal shock is proper system piping design. This is generally accomplished by one of two methods: (a) a primary/secondary piping system (recommended by Weil-McLain), or (b) using a three-way mixing valve.



Typical Primary / Secondary piping for Temperature Modulation
Figure 1

Primary/secondary piping (See Figure 1) is the preferred method to modulate the system water temperature because it can never result in cold water entering a hot boiler. The “primary” heating loop runs between the boiler and the “secondary” heating loop. The “secondary” heating loop supplies hot water to the heating zones.

In commercial applications, where a constant source of heat is desired for adequate system control and temperature modulation, a sensor is located in the secondary loop. This

sensor will turn boilers on and off in order to maintain the desired secondary loop temperature. When a zone has a call for heat, the corresponding circulator starts, and the temperature at the sensor will drop. The sensor will turn on a boiler, which will supply hot water to the secondary loop via the primary loop. For more details, see Weil-McLain's "Primary/ Secondary Piping Guide for Single and Multiple Boiler Installations" *(Part No. 550-141-657)*. You can view, download and/or print a copy of this document from Weil-McLain's website. *www.weil-mclain.com*. It's electronic file name is "WM PrimSec Piping Guide.pdf".

Primary/secondary piping protects the boiler from thermal stresses because the system is designed to maintain a high secondary loop temperature (140°F or higher) even during periods of night setback. This will prevent a sudden rush of cool water into a hot boiler. If an idle zone calls for heat (such as first thing in the morning after being setback), a slug of cold water enters the secondary loop's common piping. The cold water mixes with the warm water already in the secondary loop and its temperature rises. The boiler receives some of this water, but it is much warmer that the cold water slug that comes directly from the idle loop. With the mixing action in this piping arrangement, the boiler is better protected from thermal shock.

Although primary/secondary piping is the preferred method for temperature modulation with a cast iron boiler, Weil-McLain recognizes that there are many installations where three-way mixing valves are used to achieve the same results. Proper by-pass piping of Weil-McLain boilers using three-way mixing valves is discussed in more detail in Technical Services Bulletin No. SB0203 dated November 22, 2002.