Common hydronic components... explained

By George R. Carey

During this past season of seminars we presented, there was still some confusion in the field regarding some common hydronic topics we take for granted. For example, when the subject of pressure reducing valves was discussed, there was some question as to the appropriate setting. The valve's only responsibility is to ensure the hydronic system is completely filled and pressurized with water. The setting is determined by the height of the building, assuming, of course, the mechanical room is located in the basement. All you have to do is measure from the location of the valve up to the highest piece of radiation in the building in feet. Then divide this number by 2.31 feet. The answer will be the pressure setting required in the basement (where the PRV is located) to fill the entire system all the way to the top.

The next step is to add 4 psi to whatever pressure was required to fill the system. The reason for that addition is because you want to make sure the water located in the highest point of the system is under pressure. This is to ensure that any automatic high vents located at the top of the system will work.

If you were to forget to add the additional 4 psi, the water located at the top of the system would be at 0 psi. Any air bubbles at the high point would have a difficult time escaping through the vent because there would be no pressure differential across the vent's orifice. By adding that additional 4 psi, you are providing the pressure differential needed to encourage good air venting through the vent.

Ideally, the best location to place a pressure reducing valve is to pipe it into the line connected to the expansion tank. Usually, the tank is piped below the air separator (diaphragm) or directly above (plain steel compression). This connection is known as the "point of no pressure change" and is an ideal location for the fill valve.

Did you know most reducing valves come factory set at 12 psi? Why? Because 90% + valves are installed in two-story buildings, and when you do the math, you will see that 12 psi provides precisely enough pressure to fill the system to the top with an additional 4 psi left over.

Another component that is surrounded in a bit of confusion is the expansion tank. Now, everyone knows why they are needed…to have a place for the water to go when it is heated and expands. Without this, the pressure would rise rapidly, causing the relief valve to blow and dump gallons of water onto the floor. Some of the confusion occurs when the discussion of sizing comes up. Over the years, some of the diaphragm manufacturers produced sizing tables for the industry. And to make things easy, they based these tables on the Btu/h capacity of the system as the key to selecting the appropriate tank.

What the tables don't tell you is they are making certain assumptions about water content of that particular system with that many Btus. If you have ever seen these tables, you'll notice three or four columns listing different model numbers for the same Btu/h capacity. The reason for this is because of water content, which is what really determines expansion tank sizing.

A system with 100,000 Btu/h can require various tank sizes based upon whether the radiation is copper baseboard, cast iron radiator or fan coil. And the reason for that is the amount of water contained; a cast iron radiator holds a lot more water than copper baseboard…and copper baseboard holds more water than a fan coil.

If one system has 100 gallons of water and another equivalent Btu/h system holds 10 gallons, when they both heat up, obviously the system with 100 gallons will have more expanded water. It will need a larger expansion tank.

This leads to the other factor that affects expansion tanks: temperature change. Normally, a system is filled with cold water (40-50°F) and depending upon the aquastat setting or reset control range, the water is heated up to a certain temperature. This change in temperature also affects the amount of expanding water—the higher the setting, the greater the expansion. So, in addition to the water content, you need to know the temperature range to properly size the tank. On most of those sizing tables, at the very bottom, in small print, you'll find the tanks are based upon 40°F fill temperature and 200°F maximum setting.

The final piece of information needed to solve the sizing puzzle is the pressure range the system will see. There are two pressures you need to know and both are easily established. The first pressure you need to establish is the system's required fill pressure. As we said earlier in the article, the fill pressure setting is based upon the height of the building plus an additional 4 psi for positive pressure. Note this fill pressure setting also plays an important role in establishing the pre-charged air pressure setting in the diaphragm expansion tanks. It is very important to match the pre-charge air pressure setting in the tank to the fill pressure setting. In sizing diaphragm tanks, the idea is to have no water in the expansion tank until the system water is heated and this is accomplished with a proper pre-charge setting.

The other pressure you need to know in sizing a tank properly is the relief valve setting. The higher the relief setting, compared to the system's fill pressure, the smaller the tank. As the fill pressure setting increases (due to a taller building), the larger the expansion tank should be. This is because, with a higher fill valve setting, the system pressure is getting closer to the relief valve's setting before you even heat the water. So there is a smaller range for the system's pressure to rise before the relief valve setting is reached. To accommodate this limitation in pressure range, a larger overall expansion tank is required. Referring to those sizing tables, the small print at the bottom also references tank sizing based upon a system fill pressure of 12 psi and a relief valve setting of 30 psi. If your system has a different fill pressure and/or relief valve setting, the sizing table will be inaccurate.

If you have a question or are experiencing a problem job with an expansion tank, you should contact your local supply house or manufacturer's representative to help size the proper tank. Relief valves constantly relieving (or popping) is one sign of an expansion tank problem. In a future article, we will discuss the proper location of these tanks and how they can create or solve a system air problem.

If you have any questions or comments, e-mail me at gcarey@fiainc.com or call me at FIA. 1-800-423-7187.

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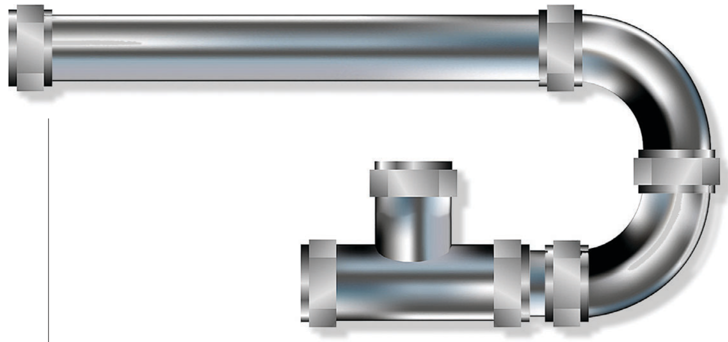

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