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Thermal Expansion Tank Sizing: Bell & Gossett Systemwize

Monday Morning Minutes | by Norm Hall, April 23, 2018

In the last R. L. Deppmann Monday Morning Minute we covered some thoughts on the use of code vs. non-code hot water expansion tanks. Why does the system need a thermal expansion tank? How do you size a domestic hot water thermal expansion tank? Bell & Gossett has an online selection program called ESP-Systemwize that will make the selection very easy.

Why are Thermal Expansion Tanks Required?

Why do systems require a tank today? Years ago, plumbing systems did not have a tank. In fact, the term “thermal expansion tank” did not even exist. When a domestic hot water system is heated from a cold start it is completely filled with water. If there is no water being used when it is heated, the pressure will start to increase. Decades ago this was not a problem since the pressure would dissipate into the cold city water supply lines. Today we often use reduced pressure zone type backflow preventers on the cold water supply. These act as check valves. The net result, when there is no demand, is that the system acts like a closed hydronic system which needs an expansion tank. If there is no tank, the relief valve might open due to over-pressurization.

Tanks are often selected using software programs such as the Bell and Gossett ESP-Systemwize selection program. Let's look at the program. (See our instructional video on our latest Monday Morning Minute post.)

It is always valuable to understand what is going on behind the program, so let's start with the formula used for pre-charged tanks and some basic terms.z

$$V_t = \frac{\{(E_w - E_p) \times V_s\}}{(1) - (P_f / P_o)}$$

Vt = The minimum tank volume in gallons

$E_w - E_p$ = The expansion of the water from cold fill to maximum temperature minus the expansion of the pipe. The starting temperature is defaulted to the lowest temperature the system might have before heating

Vs_ = The system volume in gallons

P_f = The cold fill pressure in the tank before heating (also the normal static system pressure). (Absolute PSIA)

P_o = The final or maximum pressure your design requires in the tank after heating (Absolute PSIA). No more than 90% of the relief valve setting

The numerator of the formula, $\{(E_w - E_p) \times V_s\}$ is called the Tank Acceptance Volume. Any tank selected must meet both the acceptance volume and the tank volume.

In the next R. L. Deppmann Monday Morning Minute we will look at applying safety factors in thermal expansion tank sizing as well as troubleshooting issues.