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Phone: (800) 589-6120 - Fax: (248) 354-3710
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January 23rd 2012 ~ Monday Morning Minutes:

Expansion and Compression Tanks – Part 9
Differences in Compression Tank and Expansion Tank Formula.

by Norman Hall

Now we understand the difference between expansion and compression tanks as described in the R. L. Deppmann Monday Morning Minutes of 1-9-12 and 1-16-12. What happens to the formula results when comparing these two types of tanks? In part 1 of this series, we introduced the formula for tank sizing. The denominator of the equation was:

$$(P_a / P_f) - (P_a / P_o)$$

P_a = The initial pressure in the tank before any fluid is introduced (Absolute PSIA)--- P_f = The cold fill pressure in the tank before heating or cooling (Absolute PSIA)--- P_o = The final or maximum pressure your design requires in the tank after heating (Absolute PSIA)

When you use a plain compression tank with no bladder or diaphragm, the initial pressure is 0 PSIG or 14.7 PSIA. When you use a bladder or diaphragm tank, the initial pressure should be equal to the fill pressure at the tank location. This means the tank has to be charged on the air side to the proper fill pressure before being filling the tank. **The engineer must schedule the design fill pressure so that the contractor knows what the tank charge needs to be set at prior to filling the system.**

Let's see what happens. In a bladder tank the fill pressure and initial pressure are the same. The denominator of the formula becomes**: $(1-(P_f/P_o))$**

Example 1: Let's assume we have a 5 story building heating system with a system elevation of 60 feet and a design of 180°F with a 30°F ΔT. Let's assume our maximum pressure at the tank is 50 PSIG or 64.7 PSIA. What is the denominator if we have the tank on the lowest level? Looking back at past MMM, we know this results in a fill pressure of 30 PSIG or 44.7 PSIA.

For a Bladder Tank: $(1-(P_f/P_o)) = (1-(44.7/64.7)) = .309$
For a Compression Tank: $(Pa/ P_f)-(Pa/ P_{o)} = ((14.7/44.7)-(14.7/64.7)) = .102$

Since the number above is in the denominator of the tank sizing formula, the bigger the number, the smaller the tank. The bladder tank will require less tank volume than the compression tank. This could result in a lower cost installation.
Example 2: Let's use the same system but now put the tank at the top of the system in the penthouse. Now the numbers change. The fill pressure will be 12 PSIG (it could be 4 PSIG at the very top but the fill valve comes standard at 12 PSIG) and let's make the maximum pressure 20 PSIG so the initial pressure at the bottom of the system remains 50 PSIG. The denominator now becomes:

For a Bladder Tank: $(1-(P_f/P_o)) = (1-(26.7/34.7)) = .23$
For a Compression Tank: $(Pa/ P_f)-(Pa/ P_{o)} = ((14.7/26.7)-(14.7/34.7)) = .126$

Next week we look some selections and costs.