# Some Notes about Manometry

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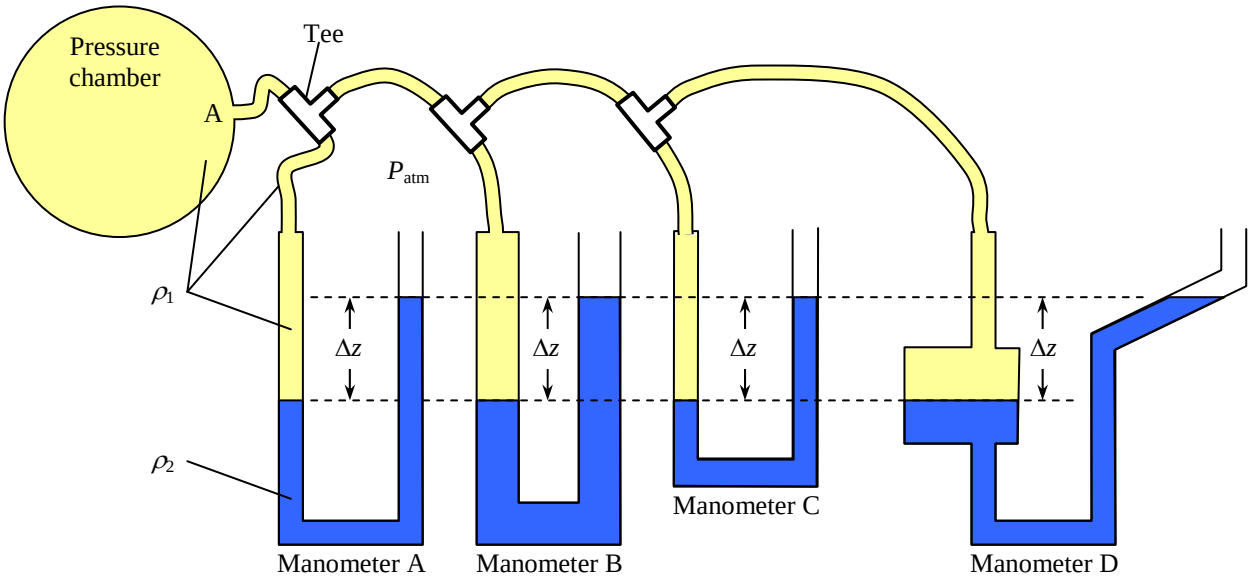
Latest revision: 05 September 2012

**The elevation difference $\Delta z$ in a U-tube manometer does *not* depend on the following:**

1. **U-Tube diameter** (provided that the tube diameter is large enough that capillary effects are negligible). In the sketch below, for a given pressure in the tank, $\Delta z$ is the same in manometers A and B, even though the tube diameter of manometer B is larger than that of manometer A. Note that the amount of manometer liquid in each of the U-tube manometers has been adjusted such that the level of the interface between fluids 1 and 2 on the left side of each manometer is at the same elevation, for direct horizontal comparison.




Why?

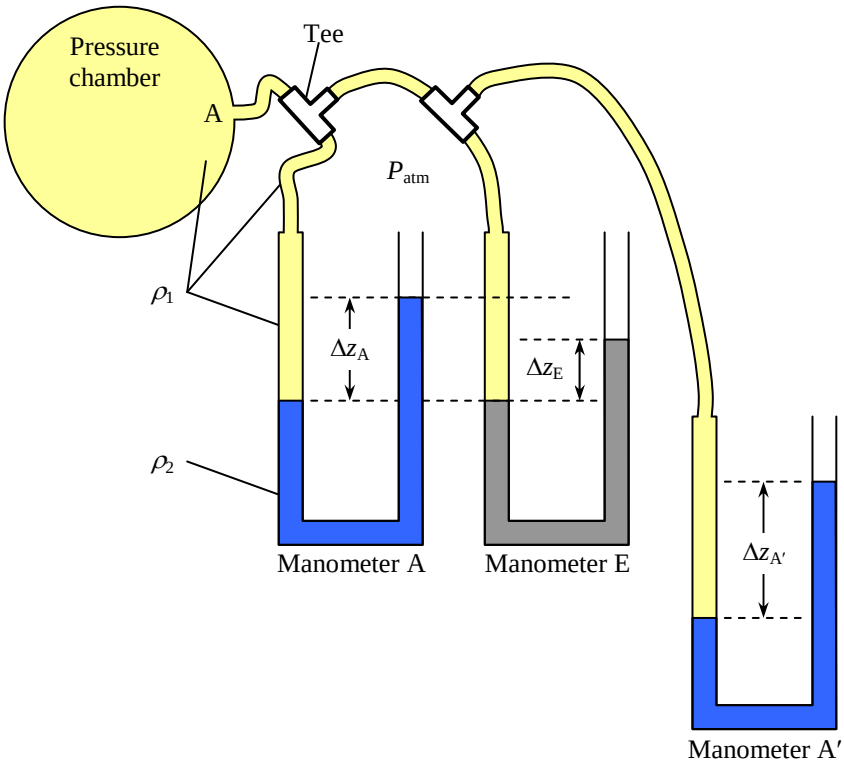
2. **U-Tube length** (provided that the tubes are long enough to include elevation difference $\Delta z$). In the sketch, $\Delta z$ is the same in manometers A and C, even though manometer C is shorter than manometer A.

Why?

3. **U-Tube shape** (again provided that capillary effects are not important and the relative elevation is the same). In the sketch, $\Delta z$ is the same in manometers A and D, even though manometer D is oddly shaped. Can you think of an advantage of the "inclined manometer" configuration of manometer D?

**However, the elevation difference $\Delta z$ in a U-tube manometer *does* depend on the following:**

1. **Manometer fluid**. For example, if we replace the blue manometer fluid in the above sketch with a *higher density* (gray colored) fluid, as in the sketch below, $\Delta z$ would *decrease*. In other words, $\Delta z_E < \Delta z_A$.




Which manometer (A or E) would have better *resolution*?

2. **Vertical location of the manometer**. For example, if we move manometer A to a lower elevation, all else being the same, and ignoring changes in atmospheric pressure (manometer A′ in the above sketch), $\Delta z$ would *increase*, i.e., $\Delta z_{A'} > \Delta z_A$. Why?

*Note*: if $\rho_1 << \rho_2$, then $\Delta z_{A'} \approx \Delta z_A$, regardless of the vertical location of the manometers. This is usually the case, for example, when fluid 1 is a gas, but the effect can be significant if both fluids are liquids.