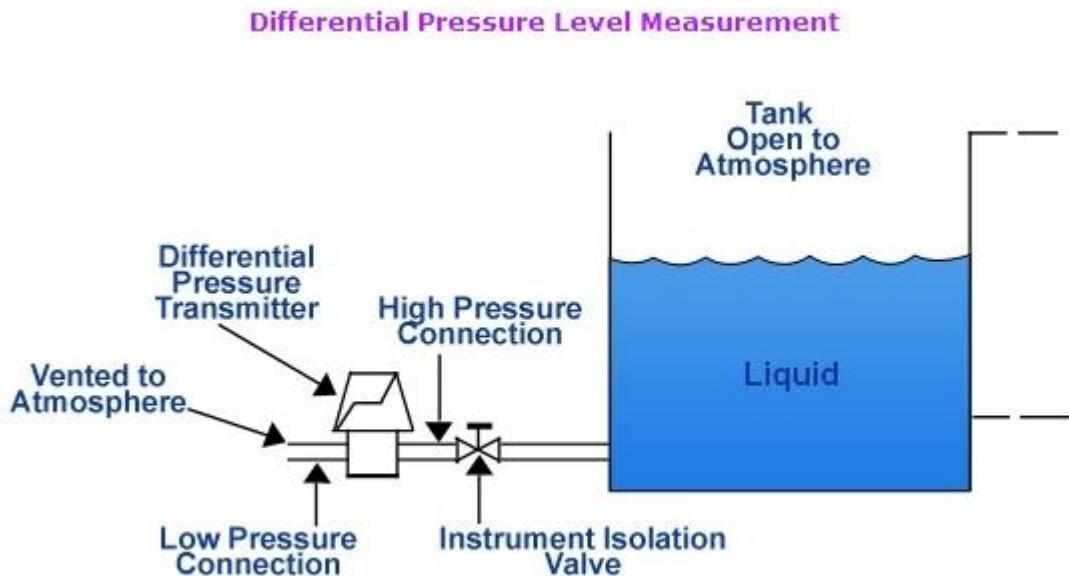


Differential Pressure Level Measurement

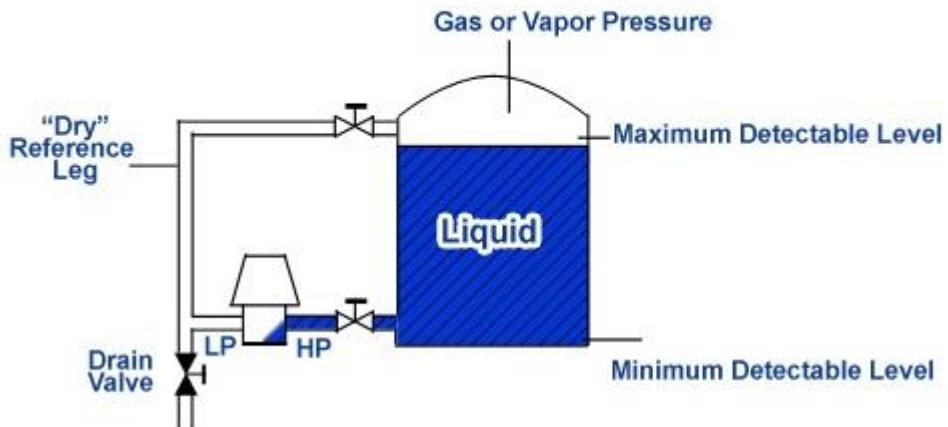
Differential pressure level measurement technique makes use of a **differential pressure detector** which is installed at the bottom of the tank whose level is to be detected. The liquid inside the tank creates pressure which is comparatively higher than the reference atmospheric pressure. This pressure comparison is performed via the Differential pressure detector. A standard differential pressure transmitter connected to an open tank is shown in the figure below.



Dry Leg

The weight of the vapors found above the fluid in the tank is considered to be insignificant whereas, the pressure in the vapor area is quite considerable; hence it can not be disregarded and usually transmitted to the low pressure end of the differential pressure cell. This type of pressure connection is known as a **dry leg**. It is primarily used in situations where liquid vapors are non-corrosive, non-plugging, and have low condensation rates at ordinary working temperatures. "A dry leg enables the d/p cell to compensate for the pressure pushing down on the liquid's surface, in the same way as the effect of barometric pressure is canceled out in open tanks."^[4] It is recommended to maintain a dry reference leg since buildup of condensate or other fluids have tendency to introduce errors in the level measurement results. A typical closed tank dry reference leg is shown in the figure below.

Closed Tank Dry Reference Leg



Wet Leg

In situations where the vapors of the process fluid tend to condense at standard ambient temperatures or happen to be corrosive and unsteady, the reference leg can not be kept dry. It must be then filled with an inert liquid to produce a **wet reference leg**. For a wet reference leg, it is always suggested that the chosen filling liquid must have a low thermal expansion rate. In case of wet reference legs following two factors should be carefully noted:

1. The specific gravity of the filling liquid and the height of the reference column are required to be correctly evaluated. Besides, the differential pressure cell ought to be lowered corresponding to the hydrostatic head of the same column.
2. A sight flow indicator should be mounted above the wet leg in order to get visual indication of the height of the reference leg.

A typical closed tank wet reference leg is shown in the figure below.



"Either method (wet or dry) assures a constant reference leg for the d/p cell, guaranteeing that the only variable will be the level in the tank. The required piping and valving must always be provided on both the tank and the reference leg side of the d/p cell, so that draining and flushing operations can easily be performed."

Advantages

Following are the major advantages associated with techniques of level measurement using differential pressure.

- Differential pressure based level sensors can be easily mounted or retrofitted to the surface of the vessel.
- To carry out maintenance and testing, these sensors can be provided with block valves for isolating them carefully from the process liquid.
- They can be easily applied in level measurement applications such as total level in separator vessels where other level measurement devices are not feasible owing to the extensive changes in material formation experienced in the upper state.

Disadvantages

Use of differential pressure transmitters includes few drawbacks too, which are mentioned below:

- Errors can get introduced in the measurements if the density of the process fluid varies because of reasons such as temperature variations or change of process. Hence, the density of the process must always be maintained constant in order to get accurate results.
- Differential pressure transmitter works well with clean liquids only. Besides, it necessitates two vessel penetrations for its operation, out of which one is installed near the vessel base where leakage happens.
- Their use is always avoided with liquids such as paper pulp stock since they result in solidification upon rise in their concentrations.