PETRO TAG™ 400 - TECHNICAL NOTE

TEMPERATURE CORRECTED VOLUME

PETRO TAG utilizes a novel form of Hydrostatic Tank Gauging (HTG) technology to measure the contents of liquid storage tanks accurately and consistently. Standard HTG systems use transducers mounted at strategic locations on the tank to measure in-tank pressures. The mass, density, height and volume of fluid in the tank can be derived from the measured pressures. Unfortunately, each of the transducers has its own characteristics and ages in a unique way.

This means that systems must be finely tuned and calibrated at installation and periodically after.

PETRO TAG systems use only a single pressure transducer for up to 16 tanks. In-tank pressures are "transmitted" to the transducer via pneumatic hoses. This effectively eliminates the need for precision tuning and ongoing calibration. The system is calibrated only once, at installation time. The single pressure transducer also offers increased accuracy for the measurement of height and temperature corrected volume.

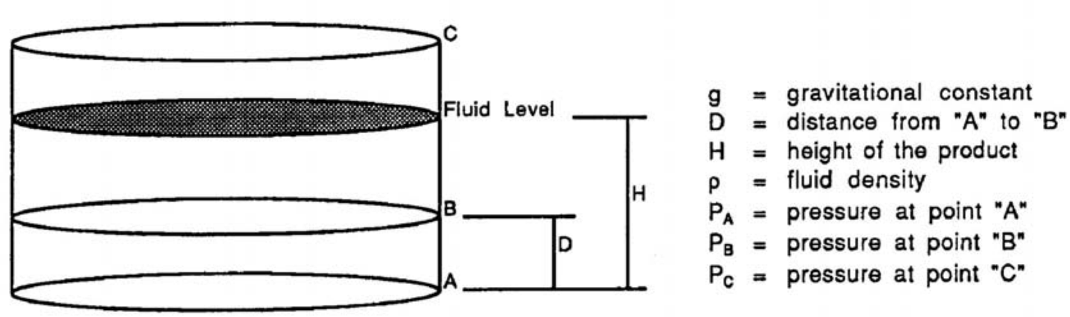
PETRO TAG's unique measuring technology has been patented in the United States and Canada. Other patents are pending. PetroTAG accurately measures current volume (see Theory of Operation). The analysis below outlines how the system achieves accurate temperature corrected volume measurements.

API standard 2540 defines a volume correction factor (VCF) for (15 +Δ)°C as

$VCF = e^{-\alpha \cdot \Delta(1+0.8 \cdot \alpha \cdot \Delta)}$

Where α is a function of product type and product density ρ.

To use this formula PETRO TAG measures the fluid density (ρ).



$\Delta P=\rho g \Delta H$ (1)

The standard equation (1) above states the relationship between pressure and the height of a column above it. Consider the simple upright cylindrical tank shown in the figure above. Equation (2) shows that the pressure at the bottom of the tank is given by the sum of atmospheric pressure and the pressure created by fluid above point "A".

$PA=\rho gH+PC$ (2)

Similarly, the pressure at point "B" which is part-way up the tank is given by equation (3).

$PB=\rho g(H-D)+PC$ (3)

Subtracting equation (3) from equation (2):

$PA-PB=\rho gD$ (4)

Equation (4) can be rewritten as

$$\rho = \frac{PA-PB}{gD}$$

At installation time, the product type is programmed into the PetroTAG. When a measurement is taken, the measured temperature and density are used to calculate the appropriate α and from that a new VCF.
The temperature corrected volume is then calculated as VCF x (measured volume)

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