

Bulk & Terminal Products Div.
Precision Tank Gauges
Mass Measurement
LP gases and NH3



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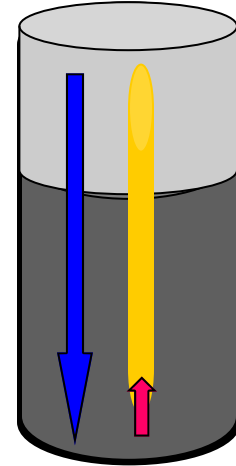
Bulk & Terminal Products Div.
Precision Tank Gauges
Mass Measurement
Refined fuels, oils, and
petro-chemicals

Principles of Using Mass Technology for Tank Gauging

Fueling Technologies chose mass measurement as the foundation for precision gauging of LP Gases, NH₃, chemicals, liquid fuels, and lubricants. Mass (weight) provides the most accurate basis for measuring and reporting inventory. Why?

With refined products mass measurement is unaffected by changes in temperature. The volume changes, but the weight (mass) does not. With pressurized gases Mass includes all the product, both in liquid form and the liquid content in vapor form (which also has weight).

What is FTI's mass measurement technology?



In 287BC Archimedes major contribution to science included his principle that states an object (downward force) immersed (in a fluid) is buoyed upward by a force equal to the weight of the displaced fluid. FTI incorporates this principle (including site specific gravitational force) into our Patented technology. This simple drawing illustrates what happens. The grey color is the fluid in a cylinder (tank). The silver or light gray represents any LP Gas vapors. The gold is our buoyancy tube (probe) suspended from a precision load cell (scale). The blue arrow is the gravitational (downward) force on the buoyancy tube. The red arrow is the upward force of the weight of the displaced fluid (and vapor). A simple explanation of "force" is that it is energy acting on the gauge load cell. Think of it as putting your hand on a solid wall. No matter how hard you press there is no movement of the wall. The "force" is your energy (pressure) applied against the wall. The strain gauge (load cell) measures that force or energy.

The probe buoyancy tube has a very precise known weight. When there is no product in the tank the load cell carries the full weight of the buoyancy tube assembly. As product rises in the tank it reduces the "strain" caused by the weight of the buoyancy tube. The buoyancy tube assembly does not actually move up or down - it's weight exerts downward force on the load cell (strain gauge).

What is the proof of the pudding? How does FTI ensure your gauge is as precise as possible? 3RD PARTY VERIFICATION! We ask our customers to provide a weighed truck load for each tank (bobtail or transport) for us to calibrate against. Handbook 44 (weights and measures) standards for scales requires accuracy within 1/10 of 1%; as compared with the 1% error allowance of bulk meters. We know of no competitor willing to (or able to) meet this degree of 3rd party proven accuracy on each tank probe.

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The use of words carefully chosen can be truthful, but give a misleading impression. Accuracy can be relative depending on the terms used. Below is a sample of actual data comparing a 2% change in level with the amount of actual change in inventory that is based on mass (weight) of the total LPG product in a 30,000 gallon 131" diameter tank. Level is the basis for sonic and radar gauges, as well as ALL float based gauges.

If you are doing 2 million gallons a year, 2% of the throughput is 40,000 gallons. At \$1.50 per gallon (which will continue to rise in cost) is \$40,000. That will rapidly payback the cost of precision gauging, and then continue to reward you for the life of the gauge. In reality, how much product is a 2% change in level in this propane tank? **Would you believe 5.24% in net liquid gallons plus 2.03% in liquid net gallons in the vapor space! Wow, a total of 7.27% of unaccounted for product!**

Tank Level Percentage	Tank level in inches	Gross gallons based on level	Percent of volume change	In LPG products gallons of vapor to account for	Percent of LPG product in vapor phase
50%	65	15491		350	2.26%
52%	67.5	16303	5.24%	331	2.03%

LPG constantly changes phase - from liquid to gas, and back again. A significant amount of liquid product is in vapor form. That product cannot be measured with level type gauges.

Accounting for product in vapor form is not normally a factor for refined fuels (gasoline, diesel, jet fuel, etc) and oils and lubricants. However, in AST tanks there are significant differences in the gross gallons (and therefore level) due to changes in density caused by temperature variations. Again, mass measurement is immune to these variances, and thereby provides the most reliable inventory data.

The Simple Conclusion !

Fueling Technologies Mass measurement is the solution to inventory management!