Gauging Systems Inc.

Definitions Pertinent to Tank Gauging

A

Absolute Temperature
See: Temperature, Absolute.

Absolute Viscosity
See: Viscosity, Absolute.

Accessory Equipment
Any device that enhances the utility of a measurement system, including readouts, registers, monitors, and liquid- or flow-conditioning equipment.

Accuracy
The ability of a measuring instrument to indicate values closely approximating the true value of the quantity measured.

Accuracy Curve of a Volume Meter
A plot of meter factor or K factor or error as a function of flow rate used to evaluate the meter's performance.

Active Leg
A regulator and a nitrogen blanket used to prevent vapor condensation in the vapor space. A top transmitter is required because the regulator is not a perfect controller.

Adjustment (of meter registration)
The operation of bringing a measuring instrument (meter) into a satisfactory state of performance and accuracy.

Air (Gas) Vapor Eliminator (Separator)
A device used to separate and remove gases (air, gas, or vapor) from a liquid to be measured to prevent an error in liquid measurement from having gas included in the measurement as liquid.

Air-Jacketed Thermometer
A glass stem thermometer totally encased in a glass sheath that provides air space between the thermometer and the liquid in which the unit is immersed.

All-Levels Sample
A sample obtained by submerging a stoppered beaker or bottle to a point as near as possible to the draw-off level, then opening the sampler and raising it at a rate such that it is approximately three-fourths full as it emerges from the liquid. An all-levels sample is not necessarily a representative sample because the tank volume may not be proportional to the depth and because the operator may not be able to raise the sampler at the variable rate required for proportional filling. The rate of filling is proportional to the square root of the depth of immersion.

Allowable
The amount of crude oil that can be taken from an oil field as set by regulation, having the effect of law.

Alternative Innage Gauge
The innage obtained by subtracting the measured distance between the surface of the liquid in the tank and the reference point from the official reference height of the tank.

Alternative Ullage Gauge
The ullage obtained by subtracting the measured height of the liquid in the tank from the official reference height of the tank.

Ambient Conditions
The conditions (pressure, temperature, humidity, etc.) of the medium surrounding an object such as the case of a meter, instrument, transducer, etc.

Ambient Temperature
The temperature of the surrounding medium such as the atmosphere

Antenna
The cone-shaped metal part of a radar level gauge that directs the radar signal toward the material being measured. The antenna also receives signals reflected from the material's surface.

Ambient Air Density
The density of air at the tank side on which the pressure sensors are mounted.

Ambient Air Temperature
The representative temperature of the ambient air at the tank side on which the hydrostatic tank gauging (HTG) pressure sensors are mounted.

Amplifier
A device for increasing the magnitude of a quantity such as an electrical measurement signal. An amplifier use includes increasing a transmitted or received measurement signal for purposes that include operation of indicating, counting, recording, and controlling devices or another instrument that receives the transmitted signal; (also see preamplifier).

Analog Output
Transducer output that is a continuous fraction of the measurand.

Analog Signal
A signal that varies continuously in amplitude rather than in discrete steps.

Anchor Weight
A weight installed in a tank to which the guide wires or cables for an automatic tank gauge float are attached to hold them taut and plumb.

Angle-Stem Thermometer
A glass stem thermometer in which the tail is bent at an angle to the stem so that the tail can be mounted in a horizontally disposed thermowell, leaving the scale vertical for greater ease of reading/

API
The American Petroleum Institute, founded in 1919, was the first oil trade association to include all branches of the petroleum industry.

API Gravity
A term used by the petroleum industry to express the relative density of petroleum liquids. API gravity is measured by a hydrometer instrument having a scale graduated in degrees API. The relationship between API gravity and relative density (Formerly called specific gravity) is as follows:

$$API\ Gravity\ at\ 60\ °F = \frac{141.5}{Relative\ Density\ 60/60°F} - 131.5$$

Apparent Compressibility
See: Compressibility, Apparent.

Argument, Mathematic
The independent variable *X* for a function *F(X)* and the values of the independent variable in a numerical table, such as for angles in a table of trigonometric functions of the numbers in a table of logarithms.

Armored Case (thermometer)
A study metal case in which a glass stem thermometer can be placed to minimize the risk of breakage of the thermometer in use.

ASU

The abbreviation for Average Sensing Unit – an accessory to a custody transfer level measurement system. The ASU receives multiple temperature sensor input readings, averages the appropriate temperature readings (from the submerged sensors), and sends the average temperature input to the level device.

Atmosphere (atm)
A standard unit of pressure equivalent to a column of mercury 760 millimeters high at 0 °C under a gravitational acceleration of 980/665 centimeter-gram-second (cgs) units. The pressure exerted by 101.325 kilopascals of 0 °C (32 °F) mercury (equivalent to 14.696 pounds per square inch absolute).

Atmospheric Pressure
See: Pressure, Atmospheric.

Attenuation
The reduction in the level of a quantity, such as the intensity of a wave, over an interval of a variable, such as the distance from a source.

Automatic Gauging Tape
The flexible measuring or connecting element that is used to measure the liquid level in tanks by the automatic gauge method.

Automatic Sampler
A device used to extract a representative sample from the liquid flowing in a pipe. The automatic sampler generally consists of a probe, sample extractor, flow meter, controller, and sample receiver.

Automatic Sampling System
A system that consists of stream conditioning, an automatic sampler, and sample mixing and handling.

Automatic Tank Gauge
An instrument that automatically measures and displays liquid levels or ullages in one or more tanks either continuously, periodically, or on demand.

Automatic Temperature Compensator
A meter accessory device enabling a meter that is measuring volume at stream temperature to register the equivalent volume at a reference or base temperature.

Automatic Vessel Tank Gauging System
A system that automatically measures and displays liquid levels or ullage in one or more vessel tanks on a continuous, periodic, or on-demand basis.

Auxiliary Meter Equipment
Equipment (such as a strainer, air separator, or flow conditioner) installed in conjunction with a meter to protect or improve the performance of the meter. Auxiliary equipment does not include instrumentation and accessories driven by the meter's output rotation or pulses.

Average Area
In HTG applications, the average area of a tank is used for calculating density and is expressed as volume per level (example: bbl./ft., liters/meter, gallons/ft., etc.).

B

Back Pressure
The operating pressure measured downstream from a measuring device.

Back Pressure Valve
See: Valve, Back Pressure.

Balanced Remote Seal System
A situation where the remote seal system is the same on both the high and the low-pressure side of a transmitter.

Ballast
Water taken on when a vessel is empty or partially loaded to increase draft so that the propeller is properly submerged, and stability and trim are maintained.

Barrel (bbl.)
A unit of quantity for oil equal to 42 U.S. gallons or 9,702.0 cubic inches.

Baseline
The fore and aft reference line at the upper surface of the flat plate keel at the centerline for flush shell plate vessels, or the thickness of the garboard strake above that level for vessels having lap seam shell plating.

Basic Sediment and Water (BS&W)
Archaic. *See: Sediment and Water.*

Batch
A parcel of a single petroleum liquid consigned separately in a pipeline.

Battery or Bank of Meters
An installation of meters having two or more meters connected in parallel.

Baumé
An indication of specific gravity in degrees. Baumé is calibrated in accordance with, or according to, either of two arbitrary hydrometer scales for liquids lighter than water, or for liquids heavier than water.

Bellows
A pressure sensing element of cylindrical shape whose walls contain deep convolutions that cause the length of the bellows to change when pressure is applied.

Bias
Any influence on a result that produces an incorrect approximation of the true value of the variable being measured. Bias is the result of a predictable systematic error.

Bi-directional Meter
A meter that can measure flow from either direction.

Bilge Radius
The radius of the rounded portion of the vessel's shell that connects the bottom to the sides.

Bill of Lading (BOL)
A document by which a carrier acknowledges having received in good order and condition (or the reverse) certain specified goods consigned to him by some shipper and binds himself to deliver those goods in similar condition, unless the perils of the sea, fire, or enemies prevent him, to the consignees of the shippers at the point of destination on their paying him the stipulated freight.

Blind (Blanking Device)
A circular metal disc that is installed in a pipeline by fastening it between flanges to prevent flow in the pipeline.

Boring Sample
A sample of the material contained in a barrel, case, bag, or cake that is obtained from the chips created by boring boles into the material with a ship auger.

Bottom Guide Wire Anchor
A bar welded to the bottom of a tank to which guide wires or cables for the float of an automatic tank gauge are attached.

Bottom Sample
A spot sample collected from the material at the bottom of the tank, container, or line at its lowest point. In practice, the term has a variety of meanings. As a result, it is recommended that the specific sampling location [for example, 6 inches (15 centimeters) from the bottom] should be specified when using this term.

Bottom Water Sample
A spot sample of free water taken from beneath the petroleum contained in a ship or barge compartment or a storage tank.

Bourdon Tube
A pressure sensing element consisting of a twisted or curved tube of noncircular cross section that tends to be straightened by the application of internal pressure.

Breadth, Extreme
The maximum breadth of the hull measured to the outside surfaces of the side shell plating or to the outside of the guards, if fitted.

Brix
The determination of sugar concentration by density measurement.

Bubble Point
When the pressure is lowered on a liquid held at a constant temperature, the pressure at which the first bubble of vapor forms is the bubble point. Bubble point pressures are higher at high temperatures.

Build-up
The coating of process material, from liquids or solids, on the capacitance probe. The build-up may be wet, dry, conductive, or non-conductive.

Bulb
The temperature sensing (detecting) element of a temperature measuring device.

Bulkhead
The vertical partition walls that subdivide the interior of a vessel into compartments or rooms.

C

Calibration
The process of adjusting, or of measuring the performance of a device.

Calibration (of a container)
The process or procedure of determining the exact volume capacity or partial capacities of a standard capacity measure, a tank prover, or a piper prover.

Calibration (of an instrument)
The process or procedure of adjusting an instrument, such as a meter, so that its indication or registration is in satisfactorily close agreement with a reference standard. Meter proving data may be used either to calibrate the meter or to calculate a meter factor.

Calibration (of a prover)
The procedure for determining the volume of a prover.

Calibration Adjuster (meter)
See: Meter Calibration Adjuster.

Calibration Curve (meter)
A curve or graph that expresses the relationship between the true values of the quantity measured and corresponding values indicated by the meter.

Calibration Table (tank)
See: Capacity Table.

Calibration, Tank
Bottom calibration of a tank is either the determination of the tank volume below the strike plate, which is zero on the tank gauge table, or the quantity of liquid contained in a tank below the gauge point. The following terms are related to tank calibration:

> **Measurement Calibration Method, Tank**
> The method of tank calibration in which volume capacities are calculated from external and/or internal measurements of the tank dimensions.
>
> **Liquid Calibration, Tank**
> The method of tank calibration in which the capacities are determined by filling into (or withdrawing from) the tank accurately determined volumes of liquid.
>
> **Over-calibration, Tank**

A tank is said to be over-calibrated when its actual capacity is less than that shown on its calibration table or by its capacity indicator.

Under-calibration, Tank
A tank is said to be under-calibrated when its actual capacity is greater than that shown by its calibration table or capacity indicator.

Camber
The arching or rounding up transversely of the vessel's deck

Capacitance
An electrical term referring to the property of an electric nonconductor that permits the storage of energy as result of electrical displacement when opposite surfaces of the nonconductor are maintained at a difference of potential. The unit of capacitance is the Farad.

Capacitance Probe
A device that senses the different dielectric constants of oil and water or oil and air.

Capacitance Transmitter
A device consisting of a set of electronics for the capacitance probe that outputs a calibrated signal proportional to level or interface level.

Capacitive Span
The amount of capacitance increase sensed by a capacitance probe, with a specific probe and a specific level change.

Capacity
The volume of a container or tank filled to a specific level.

Capacity Indicator (on a proving tank)
A device fitted to a proving tank that indicates the position of the liquid surface in relation to the reference mark corresponding to the nominal capacity of the proving tank, thus enabling the determination of its liquid contents.

Capacity, Nominal (of a tank)
The nominal capacity is the designated volume of a container.

Capacity Table
A table often referred to as a tank capacity table or calibration table, showing the capacities of or volumes in a tank for various liquid levels measured from the reference gauge point.

Capsule
A pressure sensing element consisting of two metallic diaphragms (usually circular) that are joined around their peripheries.

Cargo Quantity Option Certificate
A certificate signed by vessel and shore representatives acknowledging the amount of cargo intended to load. Generally, most product cargos have a tolerance based on either supplier, receiver, or vessel capabilities. Each party involved with the loading shall agree to the quantity amount to be loaded.

Cavitation
The formation and collapse of vapor cavities (bubbles) in a liquid that result from a sudden decrease and increase in pressure. Collapse of the cavities causes large impulsive pressures in the vicinity of the cavity. Cavitation can occur and cause mechanical damage to adjacent surfaces in meters, valves, pumps, and pipes at locations where flowing liquid encounters a restriction or change in direction.

CDS
The abbreviation for Configuration Data Sheet. A detailed survey form that identifies all the data needed to fully configure a device.

Check Valve
See: Valve, Check.

Choke

A device that is placed in a pipe to restrict flow.

Clearance Sample
A spot sample taken with the inlet opening of the sampling apparatus 4 inches (10 centimeters) [some regulatory agencies require 6 inches (15 centimeters)] below the bottom of the tank outlet. This term is normally associated with small tanks (100 barrels or less), commonly referred to as lease tanks.

Clingage
The liquid film that adheres to the inside surface of a container after it has been emptied.

Closed Gauging System
A method of obtaining measurements of the tank contents without opening the tank. This may be accomplished by using automatic tank gauges or by taking measurements through a pressure/vapor lock standpipe. This type of gauging is done extensively on vessels with inert gas systems.

Closed System Gauging Unit
Closed gauging system measurement equipment specially designed to be used with a specific type of standpipe/vapor lock. The unit may have a single purpose such as taking temperature, ullages, water cuts or samples, or may be a combined unit capable of performing all necessary measurement functions.

Closed Tank
A tank that is not open to atmospheric pressure. It may be either pressurized or evacuated of pressure.

Closing Gauge
The measurement in a tank after a delivery or receipt.

Coalescer
A device used to cause the separation and removal of one fluid from another such as removal of water from a petroleum liquid.

Coefficient of Expansion Adjuster (meter)
An accessory device for a meter that is used with an automatic temperature compensator. The coefficient of expansion adjuster regulates the magnitude of temperature compensation consistent with the coefficient of thermal expansion of the liquid being metered.

Commercial Gauger
Commercial organizations and individuals who measure, gauge, or sample merchandise. “Public Gauger” has been used to denote a type of commercial gauger dealing mainly with petroleum and petroleum products. “Public gaugers” are commercial gaugers and are subject to the regulations in 19 *Code of Federal Regulations* Part 151.

Commercial Laboratory
Commercial organizations and individuals who analyze merchandise, i.e., determine its composition and/or characteristics through laboratory analysis.

Compensation
Provision of a supplemental device, circuit, or special materials to counteract known sources of error.

Composite Meter Factor (CMF)
A meter factor used for meter applications where the gravity, temperature, and pressure remain constant during the ticket period.

Composite Spot Sample
A blend of spot samples mixed in proportion to the volumes of material from which the spot samples were obtained.

Compressibility (liquid)
The change in volume per unit of volume of a liquid caused by a unit change in pressure at constant temperature.

Compressibility, Apparent
The algebraic sum of the actual compressibility of a liquid and the volume change per unit of volume of the confining container caused by a unit change in pressure at constant temperature.

Compressibility Factor

The ratio of the actual volume of gas at a given temperature and pressure to the volume of gas when calculated by the ideal gas law.

Concentric Shield
A circular plate surrounding a probe. It is sometimes used with capacitance probes to provide a second capacitance plate. This is done when: the measurement is made in nonmetallic tanks, in metal tanks without straight walls, or when the distance between the capacitance plates needs to be minimized.

Condensate Reservoir, Automatic Tank Gauge
A device situated at the base of an automatic tank gauge to collect and drain off condensate from within the tape conduit.

Conductive
The ability of a material to transmit the flow of electricity. Usually measured in micromhos. It is the reciprocal of resistance.

Conductor, Shielded
Single or multiple conductors surrounded by a flexible metal shield for the purpose of preventing spurious signals from being carried on the shielded conductors.

Configuration
The process of downloading information into a device that that determines how it operates. Configuration includes a completed customer configuration data sheet (CDS) and the CDS data that has been downloaded into the device.

Contain
A standard capacity measure is calibrated “to contain” by a procedure that begins with the internal surfaces of the vessel dry and free of the calibrating liquid. *See: Deliver.*

Continuous Level
An on-line measurement of a material throughout its entire space. The level of the process material is indicated at any point.

Continuous Sample
A sample obtained from a pipeline in such a manner as to give a representative average of a moving stream. This sample may be collected on a continuous basis or intermittently and proportional to time or flow.

Control Chart
A chart of successive meter factors (or relative meter errors) general plotted as a function of time. It is used to evaluate meter stability and to determine when meter performance has departed from its normal range.

Conventional Tank
A tank of a shape commonly used in the petroleum industry that is not constructed to withstand any appreciable pressure or vacuum in the vapor space.

Core Sample
A spot sample of uniform cross-sectional area taken at a given height in a tank.

Counter, Factoring
An electronic counter (register) capable of expressing metered volume. The counter includes selective means for automatically applying the meter factor.

Counter, Meter
A counting device, electrical or mechanical, coupled to the meter measuring element to register the indicated volume passed through the meter.

Counter-Printer, Computing
A counter-printer with selective means for setting the price per standard unit of measurement and to compute the total price for a quantity of product delivered.

Counterweight
A device that exerts force or tension on the tape or cable to hold connecting elements tight.

Course Tank
One circumferential ring of plates in a tank. *See: Storage Tank.*

Critical Zone
A term used to define the liquid level in a floating roof type storage tank from the point where floating of the roof begins to the point where the roof is fully floating. Sometimes known as the "inaccurate zone" or "partially floating region." The critical zone is identified on the tank calibration tables where appropriate.

Critical Zone Height
The upper limit of the critical zone; the level at which one or more of the floating roof or floating cover legs first touch the tank bottom.

Crude Oil
A mixture of hydrocarbons that existed in liquid phase in underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

Crude Oil Truck Driver (COTD)
Assumes the driver is also the gauger. However, it should be recognized that these duties may be separated between two individuals, such as a person who only drives the tank truck and a gauger who is responsible for measurement and testing.

Crude Oil Washing (COW)
See: Washing, Crude Oil.

Cup Case Thermometer
A holder for a mercury-in-glass thermometer incorporating a small metal container in which the bulb of the thermometer is inserted, and which serves to contain a small volume of the liquid.

Custody Transfer Measurement
Provides quantity and quality information used for the physical and fiscal documentation of a change in ownership and/or a change in responsibility for commodities.

Cut
The oil level on the tape or bob or the water level marking on a tape or bob coated with water indicating paste. "Tanking a cut" is taking a measurement of the oil or water level.

D

Datum Plate
A level metal plate located directly under the reference gauge point to provide a fixed contact surface from which liquid depth measurement can be made.

Datum Point
The point from which all measurements for the calibration of the tank are related.

Dead Legs
Sections of pipe that, by design, do not allow for the flow of material through them.

Deadrise
The transverse rise of the vessel's bottom from the keel to the bilge.

Deadwood
Any tank fitting, appurtenance or structural member which affects the capacity of the tank. Deadwood is positive if it increases tank capacity or negative if it decreases capacity.

Degrees of Freedom
The number of independent resolutions used in estimating standard deviation.

Deliver
A standard capacity measure is calibrated "to deliver" by a procedure that begins with the internal surfaces of the vessel wetted with the calibrating liquid. *See: Contain.*

Delivery
The volume delivered through a meter during a metering operation or upon completing fluid movement into or out of a tank. A "batch" or tender may also be called a delivery. *See: Batch.*

Delivery, Meter
A volume of delivered liquid that is measured by a meter.

Delivery, Over- or Under-
The amount by which the true volume that has passed through the meter exceeds or is less than the indicated volume registered by a meter. *See: Error, Absolute.*

Density
The density of a quantity of a homogeneous substance is the ratio of its mass to its volume. The density varies as the temperature changes and is therefore generally expressed as the mass per unit of volume at a specified temperature.

Density, Absolute
The density of a solid or liquid substance at a specified temperature is the mass of the substance occupying unit volume at the specified temperature. Density as so defined is sometimes referred to as "true density" or as "density in vacuo." When reporting density, the units of mass and volume used and the temperature of the determination must be stated (for example, grams per milliliter at *t* °C).

Density Correction
A method for correcting density to standard or reference conditions. API 2540 is the standard for petroleum products. If the product is non-petroleum, a polynomial is derived from a product density versus a temperature table of approximately 20 points.

Density, Relative
The ratio of the mass given volume of liquid at 15 °C (or other standard temperature, such as 60 °F) to the mass of an equal volume of pure water at the same temperature. When reporting results, explicitly state the standard reference temperature (for example, relative density (15/15°C).

Depth, Molded
The vertical distance from the baseline to the underside of the deck plating at the side, measured at the mid-length of the vessel.

Detector, Prover
A device that indicates the passage of a displacer in a prover. *See: Transducer.*

Detector Signal
A contact closure change, or other signal, that starts or stops a prover counter/timer and defines the calibrated volume of the prover.

Deviation
Any departure from a true value.

Dial
The part of an indicating device, such as a meter counter, that contains the scale or scales.

Dial Indicator
A pointer and fixed number dial reading in calibrated instruments.

Diaphragm
A sensing element consisting of a thin, usually circular, plate that is deformed by pressure applied across the plate.

Dielectric
A nonconductor of direct electric current; an insulator.

Dielectric Constant
The ratio of conductivity of a material to that of a vacuum. A unitless value representing a material's influence on an electric field.

Dielectric Material
The insulating material between the plates of a capacitor.

Differential Pressure

See: Pressure, Differential.

Differential Pressure Valve
See: Valve, Differential Pressure.

Digit
A numerical character used to represent one of the integers smaller than the radix or base (for example, in decimal notation, one of the characters 0 to 9).

Digital
Numerical data existing in the form of digits.

Digital Signal
A signal that varies in discrete steps rather than continuously.

Dimension
A geometric element in a design, such as length, angle, etc., or the magnitude of such a quantity.

Dip
A term that designates the depth of liquid in a storage tank. *See: Innage and Outage (Ullage).*

Dip Hatch, Tank
See: Gauge Hatch, Tank.

Dip Point, Tank
See: Gauge Point, Tank.

Dip Rod, Stick
See: Gauge Rod, Stick.

Dip Weight, Bob
See: Gauge Weight (Bob).

Dipper Sample
A sample obtained by placing a dipper or other collecting vessel in the path of a free-flowing stream to collect a definite volume from the full cross section of the stream at regular time intervals for a constant time rate or at time intervals varied in proportion to the flow rate.

Discrimination
The ability to sense and record a value of a parameter to the specified increments.

Displacement Meter
A meter in which the measuring element measures a volume of liquid by mechanically separating the liquid into discrete quantities of fixed volume and counting the quantities in volume units.

Displacer
A level measurement technology using a precisely sized float that when immersed in a fluid will be buoyed up by a force equal to the weight of the fluid displaced. A change can be detected by this proportional change in apparent weight.

Displacer, Prover
A spherical or cylindrical object that is a component part of a pipe prover that moves through the prover pipe. The displacer has an elastic seal that contacts the inner pipe wall of a prover to prevent leakage. The displacer is caused to move through the prover pipe by the flowing fluid and displaces a known measured volume of fluid between two fixed detecting devices.

Dissolved Water
Water in solution in petroleum and petroleum products.

Draft
The depth of a vessel below the waterline measured from the surface of the water to the bottom of the vessel's keel.

Draft, Extreme

The depth of the vessel below the waterline measured vertically from the waterline to the lowest projection portion of the vessel.

Draft, Molded
The depth of the vessel below the waterline measured vertically from the baseline to the waterline.

Draft Marks
The vertical column of numbers on each side of the vessel at each end and sometimes amidships to indicate the distance from the lower edge of the number to the bottom of the keel.

Drain Sample
A sample obtained from the draw-off or discharge valve on a storage tank. Occasionally, a drain may be the same as a bottom sample, as in the case of a tank car.

Drainage Time for a Capacity Standard
A fixed time for completing the draining of a field standard test measure that is calibrated on a "to deliver" basis, as described on the Report of Calibration by the calibrating agency.

Drift
An observed change, usually uncontrolled, in meter performance, meter factor, etc., that occurs over a period.

Dry Leg
The use of tubing (possibly heat traced and insulated to keep the product in a vapor state) running from the vapor space to the low side of the installed pressure transmitter(s). The transmitter(s) are used in the differential pressure mode. This method allows the transmitters to be calibrated with a lower pressure span. No top transmitter is needed, although one could be used to monitor the vapor pressure.

Dual Meter Counter Shifter
An arrangement for connecting two (or more) meter counters to enable shifting the registration from one counter to another.

E

Electromagnetic Spectrum
The classification of electromagnetic waves by frequency and wavelength.

Electromagnetic Wave
An electromagnetic wave in which both the electric and the magnetic fields vary periodically, usually at the same frequency.

Electromechanical
Refers to equipment comprising both mechanical and electrical components such as electromechanical valves, electromechanical counters, etc.

Eliminator
An air, gas-vapor eliminator device used in a pipeline in conjunction with a meter to separate and remove air or vapor entrained in liquid to prevent its entry into the meter and erroneous measurement as liquid.

Elevation
A term used to indicate that the lower calibrated value of the span of a pressure transmitter is not based at zero differential pressure, but below zero. Thus, zero is elevated. Example: a span of -10 to +50 inches H^2O is elevated.

Emergent Stem Correction, Thermometer
See: Total Immersion Thermometer.

Emulsion
An oil/water mixture that does not readily separate.

Entrained Water
Water suspended in the oil. Entrained water includes emulsions but does not include dissolved water.

Environmental Conditions

External conditions (such as shock, vibration, and temperature) to which a meter, transducer, instrument, etc., may be exposed to during shipping, storage, handling, and operation.

Environmental Measurement
Identifies and quantifies releases into the environment by actual testing and modeling.

Equatorial Circumference of a Spherical Tank
The circumference of the horizontal great circle at the equator of a spherical tank.

Equilibrium Pressure (Saturated Vapor Pressure)
See: Pressure, Equilibrium.

Equilibrium Vapor Pressure
See: Pressure, Equilibrium.

Equivalent Dip/Innage (Gauge), Tank
The equivalent dip is the depth of liquid in a tank corresponding to a given ullage. It is obtained by subtracting the observed ullage from the height of the ullage reference point above the dip point on the bottom of the tank.

Error
Various terms related to error are as follows:

Error, Absolute
The difference between the result of a measurement and the true value of the measured quantity as determined by means of a suitable standard device.

Error Curve
A curve or graph that represents the error of a measuring device such as a pressure gauge as a function either of the quantity measured or of any other quantity that has an influence on the error.

Error, Measurement
The discrepancy between the result of the measurement and the value of the quantity measured. The value of the quantity measured is a comparison value equal, according to the case, to the true value of the quantity, the accepted true value, and the arithmetic mean of a series measurement.

Error Observation
The error committed by the observer when reading the indication of an instrument (meter), graduated scale, etc. It is sometimes called an experiment error.

Error, Precision of Measurement
The degree of conformity to each other of measurements repeated under specified conditions irrespective of whether they are close or far from the true value.

Error, Random
An error that varies in an unpredictable manner in absolute value and in algebraic sign when many measurements of the same value of a quantity are made under effectively identical conditions.

Error, Relative
The quotient of the absolute error divided by the true value of the measured quantity. This fraction multiplied by 100 gives the relative error as a percentage.

Error and Repeatability of Measurements
The closeness of the agreement between the results of successive measurements of the same quantity carried out by the same method, under the same environment, by the same observer, with the same measuring instruments, in the same laboratory, and at short intervals of time.

Error and Reproducibility of Measurements
The closeness of the agreement between the results as measurements of the same quantity where the individual measurements are made by different methods with different measuring instruments, by different observers in different laboratories, or with the same instruments used under different conditions after intervals of time that are long compared with the duration of a single measurement.

Error, Systematic

An error that, during several measurements, made under the same conditions, and of the same value of a given quantity, either remains constant in absolute value and sign or varies according to a definite law when the conditions change. Thus, it causes bias.

Excess Flow Valve
See: Valve, Excess Flow.

Expansion (Expansibility) Factor
A multiplying factor used to correct the calculated flow rate for the reduction in fluid density that a compressible fluid experiences when it passes through an orifice because of the increased fluid velocity and the decreased static pressure.

Expansion Thermometer
A type of thermometer using a known third order coefficient of expansion of either a solid, a liquid, or a gas to provide indication in terms of degrees of temperature.

Expansion Trunk (Dome)
A trunk extending above a space used for the storage of liquid cargo and providing space for the thermal expansion of the liquid without overflowing.

Externally Actuated Sampler
A device that is operated by a power source other than the fluid being sampled (for example, an electric or pneumatic motor).

Extrapolation
Any process by which the value of a function is estimated for a value of the independent variable outside of the range of in which the function has been determined. *See: Function, Argument.*

F

Farad
The basic metric unit of electrical capacitance measurement.

Feature
An individual characteristic of a part, such as screw-thread, taper, slow, etc.

Figure, Numerical
An arithmetic value expressed by one or more digits.

Filling Density
The percent ratio of the weight of the liquid in a tank to the weight of water that the tank will hold.

Filter
See: Strainer.

Filter, Electrical
A circuit used to eliminate or reduce certain waves or frequencies while leaving others relatively unchanged.

Filter, Separator
See: Coalescer.

Flange Taps
The position of a pair of tapholes. The upstream tap center is located 1 inch (2.54 centimeters) upstream of the nearest plate face, and the downstream tap center is located 1 inch (2.54 centimeters) downstream of the nearest plate face.

Flash
The sudden vaporization of a liquid caused by rapid decrease in pressure and/or increase in temperature.

Flash Point
The minimum temperature to which a product must be heated for the vapors emitted to ignite momentarily in the presence of a flame when operating under standardized conditions.

Flashing

The continuing process by which a liquid is caused to flash.

Float, Automatic Tank Gauge
A liquid level detecting element floating at the liquid surface in a tank that moves in a vertical direction to follow the change in liquid level.

Float Guide Wires, Automatic Tank Gauge
Solid wires or flexible cables used to guide the travel of an automatic gauge float.

Float Well, Tank
An enclosure built into the roof of a floating-roof tank to contain and guide the float of an automatic tank gauge.

Floating Cover
A lightweight covering of either metal or plastic material designed to float on the surface of the liquid in a tank. Alternatively, a floating cover may be supported by a float system so that it is just above the free-liquid surface. The device is used to minimize the evaporation of volatile products in a container.

Floating Roof Mass
The manually entered value of the floating roof mass inclusive of any mass load on the roof.

Floating-Roof Sample
A spot sample taken just below the surface to determine the API gravity of the liquid on which the roof is floating.

Floating-Roof Tank
A tank in which the roof floats freely on the surface of the liquid contents except at low levels when the weight of the roof is transmitted by its supporting legs to the tank bottom.

Floating Screen
A lightweight metal or plastic covering that is arranged to float on the surface of a liquid in a container to retard its evaporation.

Floatation Level
The depth of submergence of a buoyant automatic gauge float in a liquid of known density or weight.

Flow Meter Discrimination
A measure of the smallest increment of change in the pulse output of a flow meter as it relates to the actual volume being measured.

Flow Proportional Sample
A sample taken from a pipe such that the rate of sampling is proportional, throughout the sampling period, to the flow rate of the liquid in the pipe.

Flow Range
The range between the maximum and the minimum flow rates of a meter, generally determined by the limits of acceptable error. *See: Meter Flow Rate, Maximum and Minimum*

Flow Rate
The quotient of a volume or mass of liquid passing a point in a line per unit of time.

Flow Rate Calculation Period
The time between flow rate and calculation updates.

Flow Straightener
A length of straight pipe containing straightening vanes or the equivalent that is installed at the inlet of a flow meter to eliminate swirl form the liquid from entering the meter and causing measurement errors.

Fluid
Gas or liquid, or a mixture of gas and liquid.

FMCW
The abbreviation for Frequency Modulated Continuous Wave. In radar level terminology, it refers to a continuous radio sine wave that is generated with a changing (modulated) frequency to improve accuracy.

Formula Based
A calculation based on the dimensions of the tank to determine the volume of a tank at a certain level.

Free Water (FW)
The water that exists as a separate phase.

Free Water Level
The level of any water and sediment that exist as separate phases from the product and lie beneath the product.

Frequency
The number of repetitions of a periodic process in a unit of time.

Frequency Converter
An electronic instrument for converting frequency (pulse train) to a proportionate analog signal.

Frequency, Electrical
The number of repetitions (cycles) of a periodic signal (for example, pulses, alternating voltage, current, etc.) occurring in a time of one second. The number of repetitions (cycles) that occur in a one-second period is expressed as hertz (for example, 60 Hz).

Frequency Output
An output in the form of frequency, which varies as a function of the applied measurand (for example, angular speed and flow rate).

Frequency Range
The measured values over which a meter or other measuring instrument is intended to measure. The range is specified by its upper and lower limits.

Full Trim
The sensor trim function in which two accurate, end-point pressures are applied, and all output is linearized between them. A gull trim is not performed on HTG transmitters.

Function, Mathematic
A mathematical expression describing the relationship between variables. The function tanks on a definite value or values when special values are assigned to certain other quantities, called the arguments, or independent variables of the function. *See: Argument, Mathematic.*

G

Gamma
The high energy electromagnetic waves like x-rays. The most common type of radiation used in nuclear level devices.

Garboard
The strake or shell plating adjacent to the keel plate on a vessel.

Gas Eliminator (Separator)
See: Air Eliminator.

Gas Lock (Pressure), Tank
A device fitted to the gauge hatch on a pressure tank that enables manual gauging and sampling without loss of vapor.

Gathering
The process of transferring the custody of crude oil or gas in the field from one party to another by performing various measurements and quality tests.

Gauge Board
Traditional technique for measuring tank level. A buoyant float resting on a liquid surface is mechanically connected to an indicator mounted on the side of the tank.

Gauge Glass
A glass tube or metal housing with a glass window that is connected to a container to indicate the level of the liquid contents.

Gauge Hatch, Tank

The opening in the top of a tank through which gauging, and sampling operations are carried out. *See: Dip (Gauge) Hatch.*

Gauge Head, Automatic Tank Gauge
The housing of the automatic tank gauge that may include the indicator and transmitter.

Gauge Point, Tank
The point on the bottom of a container that the gauge weight touches during the gauging and from which the measurements of the oil and water depths are taken. The gauge point usually corresponds with the datum point; but, if not, the difference in level between the datum point and the gauge point must be designated in the capacity table.

Gauge Pressure
See: Pressure, Tank

Gauge Pressure Sensor
A sensor that uses the ambient atmospheric air pressure as the pressure reference.

Gauge Rod, Stick
A rigid length of wood or meal that is provided with a scale for measurement and usually graduated in units of volume.

Gauge Tape
A graduated metal tape used for measuring the depth of liquid in a tank.

Gauge Tester (Automatic Tank Gauge)
See: Operation Checker, Automatic Tank Gauge.

Gauge Weight (Bob)
A weight (plum bob) that is attached to a metal gauge tape and is of sufficient weight to keep the tape taut and of such shape as to facilitate the penetration of any sludge that might be present on the datum plate of a tank.

Gauge Well
See: Guide Poll.

Gauging
A process of measuring the height of a liquid in a container.

Gauging (Innaging, Dipping, Sounding)
A process to determine the depth of liquid in a tank, which is measured from the surface of the liquid to the tank bottom or to a fixed datum plate.

Gauging (Outaging, Ullaging)
A process to determine the volume of available space in a container unoccupied by contents. Hence, ullaging is a method of gauging the contents of a tank by measuring the distance from the surface of the liquid to the reference gauge point.

Generator
The unit within a radar gauge that produces an electromagnetic wave.

Grab
The volume of sample extracted from a pipeline by a single actuation of the sample extractor.

Grab Sample
For a solid, it is a sample obtained by collecting equal quantities from parts or packages of a shipment of loose solids so that the sample is representative of the entire shipment. For a liquid, it is a sample collected at a specific location in a tank or from a flowing stream in a pipe at a specific time.

Graduate, Laboratory
A glass measuring cylinder, usually graduated in milliliters.

Graduated Neck (Prover)
The section of reduced cross-sectional area at the top and/or bottom of a prover tank having viable graduations to enable measuring small incremental volumes.

Gravity Compensator
A double index scale against which a fixed reference pointer may be moved to correct for variations in relative density from a base point computed for water at 60 °F (15 °C). The compensator is marked in both relative density and API gravity units.

Gravity Selector, Meter
See: Coefficient of Expansion Adjustment, Meter.

Grease Sample
A sample obtained by scooping or dipping a quantity of soft or semiliquid material from a package in a representative manner.

Great Circle
The path on the surface of a sphere-type tank defined by the intersection of a plane surface that includes the center of the sphere.

Gross Heating Value
The number of kilojoules (BTU's) evolved by the complete combustion, at constant pressure, of one standard cubic meter (foot) of gas [the temperature of the gas, air, and products of combustion being at 60 °F (15 °C)] and all the water formed by the combustion reaction being condensed to the liquid state.

Gross Observed Volume (GOV)
See: Volume, Gross Observed.

Gross Standard Volume (GSV)
See: Volume, Gross Standard.

Gross Standard Weight (GSW)
The total weight of all petroleum liquids and sediment and water (if any), excluding free water, determined by applying the appropriate weight conversion factors to the gross standard volume.

Guards
Heavy round pipes running longitudinally and welded to the outside of the side shell plating of a vessel to act as fenders.

Guide Poll
A device: usually in the form of a cylindrical vertical tube, used in floating-roof tanks to prevent rotation of the roof.

Gunwale
The intersection of the deck plating with the side shell plating of a vessel. A gunwale may be a tee connection or a radius connection.

H

Half Siding
The flat, horizontal section of the bottom shell plating measured from the centerline of the vessel to the edge of the flat keep plate.

Hatch
An opening in the top of a tank providing access for gauging, cleaning, or other purposes.

Head Effect

A change in pressure exerted by the fill fluid column due to a change in a fluid's density. This happens when the ambient temperature of the capillary changes.

Head Mass
The total measured mass between the HTG bottom sensor and the top of the tank.

Head Pressure
The pressure in a tank due to the weight of the product liquid in the tank. It does not include the vapor pressure in a pressurized tank.

Head Space

The space inside the tank, above the bottom HTG sensor. Product and in-tank vapor are present in the head space.

Headlog (in river craft of a rectangular shape)
The structural member at the extreme end between the rake shell plating and the deck.

Heat Trace
A method used to keep the tank and transmitter flanges at a constant temperature. Mainly used with viscous products.

Heel Space
The space inside the tank, below the bottom HTG sensor.

Hertz
A unit of frequency used to measure electromagnetic waves in cycles per second.

High Vapor Pressure Liquid
See: Pressure.

Hog
The distortion of a ship's form due to stresses in which the bow and stern drop below their normal positions relative to the midship portion of the vessel.

Homogeneous
When a fluid composition is the same at all points.

Host System
A control system, VAX, or personal computer that receives data from the AIM via MODBUS communications protocol.

Hot Tap
A method for installing a flange connection on a tank without taking the tank out of service.

Hydrostatic
The measurement of the pressure or force/area exerted by a column of liquid.

HTG Reference Point
A stable reference point from which the HTG sensor positions are measured.

Hydrostatic Tank Gauging
A method of direct measurement of liquid mass in a storage tank based on measuring static pressures caused by the liquid head about the pressure sensor.

Hysteresis
The difference between the indications of a measuring instrument when the same value of the quantity measured is reached by increasing or decreasing the quantity.

I

Identification Inscriptions of a Measuring Instrument
All the words, letters, and marks carried by a measuring instrument indicating its origin, destination, operation, characteristics, method of use, etc.

Impact Pressure
See: Pressure, Impact.

Inactive Shield
See: Concentric Shield.

Independent Inspector
A person or organization of persons, acting independently, but on behalf of, one or more parties involved in the transfer, storage, inventory, or analysis of a commodity for purposes of determining the quantity, and/or quality of a commodity. They may also be assigned to the calibration of various measurement instruments and/or storage tanks ashore or on vessels.

Independent Surveyor
Often synonymous with "independent inspector" but usually implying a person or organization capable or total quantity and quality inspection, in addition to being capable of providing calibration of shore, truck, rail, and marine vessels; meter proving; and physical properties determinations.

Independent Tank
A tank whose boundaries are not part of the hull structure of a barge.

Index
A fixed or movable part of a measuring instrument's indicating device (such as, pointer, liquid surface, recording stylus, etc.) whose position with reference to the scale marks indicates the value of the measured quantity.

Indicated Volume
See: Volume, Indicated.

Indicating Instrument
A measuring instrument in which the value of the measured quantity is visually indicated but is not recorded.

Inert Gas
A gas that does not react with the surroundings.

Inerting
The process of pressurizing the vapor space of a vessel with an inert gas blanket (usually exhaust gas) to prevent the formation of an explosive mixture; a procedure used to reduce the oxygen content of a vessel's cargo spaces to sufficiently low concentrations at which combustion cannot be sustained by contained gases or vapors. For inerting, nitrogen, carbon dioxide, or the ship's exhaust are often used.

Innage
See: Gauging (Innaging, Dipping, Sounding)

Innage Bob
See: Gauge Weight (Bob)

Innage Volume
The observed volume of product, sediment, and water calculated from the innage level and the tank capacity table.

Input
A signal received by a device

Inspector
A person assigned to determine the quantity and/or the quality of a commodity.

Installation Temperature
The temperature of a tank at the time the sensor mounting measurements are taken. The HIU compensates for any changes in sensor monitoring due to the thermal expansion of the tank based on the expansion coefficient of the tank material. For an insulated tank the installation temperature equals the product temperature. For an uninsulated tank the installation temperature equals the air temperature plus the product temperature, divided by two.

In-Tank Vapor Density
The density of the gas or vapor (mixture) in the ullage space at the observed conditions (product temperature and pressure).

Integral Hull Tank
A tank whose boundaries are the bottom, side, deck, or bulkhead of the vessel hull.

Instrument, Measuring
An instrument that serves to transform the quantity measured or related quantity into an indication of equivalent information.

Integrating
Providing an output that is a time integral function of the measurand.

Interface

The contact surface between two boundaries of liquids or the commingling of products adjacent to each other in a pipeline; a means for coupling unlike equipment or functions so that they may communicate and work in unison.

Intermediate Container
The vessel into which all or part of the sample from a primary container/receiver is transferred for transport, storage, or ease of handling.

Intermediate Gears
A system of gears that transmits rotary motion.

Intermittent Sample
A pipeline sample withdrawn by equal increments at a rate of less than one increment per minute.

International System of Units (SI)
A coherent system of units of measurement founded on the following seven base units: the meter, unit of length; the kilogram, unit of mass; the second, unit of time; the ampere, unit of electric current; the kelvin, unit of thermodynamic temperature; the candela, unit of luminous intensity; and the mole, amount of substance.

Interpolation
A process by which an appropriate value is placed between tabulated values of a function.

Interpulse Spacing
Variations in meter pulse width/space, normally expressed in percent.

Inventory Level
The term associated with the accurate level measurements needed for inventory management and/or custody transfer applications. Usually, the accuracy of these measurements needs to be better than ±1/8" or ±3 mm. *See: Process Level.*

Isentropic Exponent
A thermodynamic state property that establishes the relationship between an expanding fluid's pressure and density as the fluid flows through an orifice plate bore.

Isokinetic Sample
Sampling in such a manner that the linear velocity of the liquid through the opening of the sampling probe is equal to the linear velocity of the liquid in the pipeline at the sampling location and is the same direction as the bulk of the liquid in the pipeline approaching the sampling probe.

K

K Constants
Correction coefficient used for calculating product expansion due to changes in temperature.

L

Lagging Edge
The positive-to-negative transition of an electric signal.

Laminar Flow
A smooth flow of fluid in which no cross flow of fluid particles occurs between adjacent streamlines. The transition from smooth uniform laminar flow to turbulent flow generally occurs as the Reynolds number increases from about 2,300 to 4,000 or more.

Leading Edge
The negative-to-positive transition of an electric signal.

Length (of a tank barge)
The distance measured on the centerline between the head log plates at each end of a barge tank.

Length between Perpendiculars
The distance on the summer load waterline from the fore side of the stern to the aft side of the rudder post or stern post.

Letter of Protest (Notice of Apparent Discrepancy)
A letter issued by any participant in a custody transfer citing any condition with which issue is taken. This serves as a written record that a particular action or finding was questioned at the time of occurrence.

Level
The height of a column of liquid or solid material.

Level Switch
A level switch is used to protect the tank from overfilling. It is typically located near the top of a tank so that when the product submerges its contacts, the level switch will activate a controlled to shut off the flow of product into the tank.

Line Circulation
Petroleum or other liquid delivered through a pipeline system into a receiving vessel or tank to ensure that the section of pipeline from the source tank to the receiving tank is full to minimize the amount of air in the pipeline.

Line Displacement
An operation to replace previous material in a pipeline.

Line Drop
Opening (venting to atmosphere) a vessel's piping system to allow, to the extent possible, its drainage into a tank or tanks where the material may be gauged and accounted for.

Line Press (Pack)
The recorded difference in a tank's gauges taken both while the tank's valve or valves are closed (offline) and while they are open (online) into a closed system. All downstream valves of the line section to be pressed are open while the terminating valves remain closed. The term also refers to the act of performing this operation.

Linear Meter Range
The flow range over which the meter factor does not deviate from specified limits.

Linearity of a Meter
The ideal accuracy curve of a volume meter is a straight line denoting a constant meter factor. Meter linearity is expressed as the total range of deviation of the accuracy curve from such a straight line between the minimum and maximum recommended flow rates.

Liquid
See: Fluid.

Liquefied Petroleum Gas (LP-Gas) (LPG)
Gas that is predominantly butane and propane separated from natural gasoline or natural gas and sold in liquid form as fuel – commonly known as bottled gas, tank gas, or LP-gas.

List (Heel)
The leaning or inclination of a vessel expressed in degrees port or degrees starboard; the transverse deviation of a vessel from the upright position, expressed in degrees.

List Correction
The correction applied to the volume or gauge observed in a vessel's tank when the vessel is listing if liquid is in contact with all bulkheads in the tank. List correction may be accomplished by referring to the list correction tables for each of the vessel's tanks or by mathematical calculation.

Load on Top (LOT)
Defined as both a practice and a procedure. Practice: The act of commingling onboard quantity with cargo being loaded. Procedure: The shipboard procedure of collecting and settling water and oil mixtures resulting from ballasting and tank cleaning operations (usually in a special slop tank or tanks) and subsequently loading cargo on top of and pumping the mixture ashore at the discharge port.

Lock-In Thermometer
A dial indicating temperature instrument having an automatic locking device for the indicator. This feature ensures that the indication cannot change until the reading has been taken and the instrument reset.

Loss Control Measurement

The systematic review and analysis of all measurements that provide for inventory control by establishing baseline measurements against which to judge loss control efforts.

Low Vapor Pressure Liquid
See: Pressure, Low Vapor Pressure Liquid

Lower Sample
A spot sample from the mid-point of the lower one-third of the tank contents (five-sixths of the liquid depth below the top surface).

M

Marine Custody Transfer (MCT)
A custody transfer activity involving marine tank vessel(s). Loading, discharging, or lightering a ship or barge is a marine custody transfer.

Marine Custody Transfer Measurement (MCTM)
The measurement activity involving a marine custody transfer (MCT).

Mark-space
A communications method used by traditional tank measurement devices. The baud rate is approximately 200 bits per second. The maximum wiring distance is 10,000 feet (3,048 meters).

Mass
An absolute measure of quantity of matter. Mass is defined in terms of a standard mass, and therefore the mass of an object is simply a multiple of the mass standard. The mass of an object remains constant regardless of its location. The metric unit of mass is the kilogram (kg).

Mass, Apparent
The weight of an object in air, compared with a mass standard.

Mass (effective)
Mass calculated with buoyancy effects.

Mass, Standard
A precise standard whose volume, density, cubical coefficient of thermal expansion, and mass have been determined by the National Institute of Standards and Technology (NIST).

Mass Standard, Apparent
A precise standard whose density and apparent mass have been determined by a high-precision commercial laboratory, as compared with its primary standards. Apparent mass standards are calibrated by primary mass or primary apparent mass standards, which in turn have been certified by National Institute of Standards and Technology (NIST).

Mass (true)
Mass calculated without buoyancy effects.

Master Meter
A meter that is proved using a certified prover and then used to calibrate other provers or prove other meters.

Maximum Loading Gauge (Stop Gauge)
The maximum permissible gauge measurement to which a rail tank car shall be loaded [according to Interstate Commerce Commission (ICC) regulations).

MCAP
An abbreviation for MODBUS Communication and Power protocol. MCAP is the power and communication connection between the HIU and the AIM. The proprietary Manchester Encoded MODBUS communications are superimposed on the power lines.

Measurand
A physical quantity, property, or condition that has been or is to be measured.

Measured Variable

The physical quantity, property, or condition that is to be measured. Common measured variables are temperature, pressure, rate of flow, thickness, velocity, etc.

Measurement

The following terms pertain to different categories of measurement:

Measurement, Base Unit of

A unit of measurement of one of the base quantities. Example: The meter is the base unit of length in the International System of Units. The derived units of this system, such as units of velocity, force, electrical potential, etc., originate from the meter, together with the other base units.

Measurement, Reference Conditions of

The temperature and pressure conditions to which a measured volume is to be corrected. The temperature to which the volume measurements are to be corrected is 60 °F or 15 °C. The reference pressure should be designated and can be atmospheric pressure, the absolute vapor pressure of the liquid being measured at 60 °F or 16 °C, or some other pressure that has been agreed upon by parties involved with the measurement.

Measurement, Standard Condition of

The standard pressure and temperature to which measurements should be referred. These are 1 bas (101.325 kPa)/cm^2 and 15 °C for the SI metric system, and 14.73 lb./in.^{2} and 60 °F for the United States' and British systems.

Measurement, Standard Units of Volume

The standard units of volume are the cubic meter, U.S. gallon and the British imperial gallon.

Measurement, System of Units of

A set of base and derived units corresponding to a particular group of quantities. Example: centimeter-gram-second (cgs) system, meter-kilometer-second ampere (MKSA) system, International System of Units (SI).

Measurement, Unit of

The value of a quantity conventionally accepted as having a numerical value of one. The unit of measurement of a quantity is fixed to make quantitative comparison possible between different values of this same quantity.

Measurement, Unit Symbol

A conventional sign designating the unit of measurement. Examples: m = symbol of meter, g = symbol of gram, A = symbol of ampere.

Measuring Chamber

The portion of a displacement meter that contains the measuring element.

Measuring Element

The potion of a displacement meter that moves within the measuring chamber to divide the liquid into measured segments as the liquid passes through the meter; the rotating member of a turbine meter commonly referred to as the rotor.

Measuring Range

The range of values of the quantity to be measured for which the indications of a measuring instrument, obtained under the normal conditions of use and in a single measurement, should not be affected by an error exceeding the maximum permissible error.

Merchantable Oil

A term applied to liquid hydrocarbons that are judged to be acceptable for custody transfer to a carrier. The oil is settled and contains no more than a set amount of suspended sediment and water (S&W) and other impurities.

Meter

A device used to measure fluid flow.

Custody Transfer Meter

A meter designed, installed, and operated to meet the requirements for custody transfer measurement. Within most companies, this refers to any meter used to account for fluids purchased, sold, or custody transferred to or from any facility where a change in ownership and/or responsibility for materials occurs.

Displacement Meter
A meter in which the measuring element measures a volume of liquid mechanically separating the liquid into discrete quantities of fixed volume and by counting the quantities in volume units.

Turbine Meter
A meter in which the measuring element is a multiblade rooter that rotates with a velocity proportional to the mean velocity of the fluid stream. Measured volume is registered by counting the rotor revolutions.

Meter Accuracy Factor
When applied to volume meter proving results, this term means specifically the number obtained by dividing the volume registered by the meter by the actual proving volume. It is thus the reciprocal of the meter factor.

Meter Bank
Fluid meters coupled in parallel, the sum of which represents the total fluid measured.

Meter Calibration Adjuster
A device to enable adjusting the meter register to indicate true volume within acceptable tolerance.

Meter Case
The outer potion of a meter that enclosed the measuring chamber and other working parts.

Meter Characteristic
An expression of the relationship between the volume of a given liquid indicated by a meter register and the actual volume of that liquid that passed through the meter for the corresponding period.

Meter Combinator (Accumulator)
A device or system for accumulating the registration of two or more meters in order that their total may be shown on a single readout device.

Meter Factor
A dimensionless term obtained by dividing the gross standard volume of liquid passed through the meter (as measured by a prover during proving) by the corresponding meter indicated volume at standard conditions. For subsequent metering operations, the throughput or gross measured volume is determined by multiplying the indicated volume registered by the meter times the meter factor.

Meter Flow
A device used to measure the fluid volume under dynamic conditions.

Meter Flow Rate, Maximum
The maximum rate of flow recommended by the meter manufacturer or authorized by a regulatory body. The maximum rate is determined by considerations of accuracy, durability, pressure drop, repeatability, and linearity.

Meter Flow Rate, Minimum
The minimum rate of flow recommended by the meter manufacturer or authorized by a regulatory body. The minimum rate is determined by considerations of accuracy, durability, repeatability, and linearity.

Meter, Nonrotating
Any metering device for which the meter pulse output is not derived from mechanical rotation as driven by the flowing stream.

Meter Performance
A general expression for the relationship between the volume registered by a meter and the true volume that passed through the meter. The term may refer to meter error, meter factor, meter accuracy, etc.

Meter Proof
The multiple passes or roundtrips of the displacer in a prover for the purposes of determining a meter factor; to establish a meter factor by comparing meter throughput to a prover of known volume.

Meter Proving

The procedure required to determine the relationship between the volume of liquid passing through a meter at one set of conditions and the indicated volume at those same conditions.

Meter Pulse Continuity
The deviation of the interpulse period of a flow meter, expressed as a percentage of a pull pulse period.

Meter Readings
The instantaneous display of the number of units of volume or equivalent thereof, read directly from a meter register.

Meter Slippage
See: Slippage, Meter.

Meter Tube
The straight sections of pipe, including all segments that are integral to the orifice plate holder, upstream and downstream of an orifice plate.

Meter, Turbine (with electrical output)
A flow measuring device in which the action of the fluid stream passing through the device turns a bladed turbine and produces an electrical output signal having a frequency proportional to the turbine speed.

Microwave
A comparatively short electromagnetic wave between 1 mm and 1 meter in length. Microwaves are used by radar devices to detect the surface of a material.

Middle Sample
A spot sample collected from the middle of the tank contents halfway between the bottom and liquid level of the tank (one-half of the depth of the liquid below the liquid's surface).

Minimum Pipeline Velocity
The velocity that exists at the lowest operating flow rate, excluding those rates that occur infrequently or for short time periods (less than 5 minutes).

MODBUS®
A communications protocol developed by Gould-Modicon to distribute digital communications between a host system and a field device.

Molded Dimensions
The dimensions of a vessel to the molded lines.

Molded Lines
The lines defining the geometry of a hull as a surface without thickness.

Molded Volume
The volume of a compartment without deduction for internal structure or fittings.

Multidrop
A communications method where several transmitters are connected to a single communications transmission line.

Multiple Tank Composite Sample
A mixture of individual samples or composites of samples that have been obtained from several tanks or ship/barge compartments containing the same grade of material. The mixture is blended in proportion to the volume of material contained in the respective tanks or compartments.

N

NBS
National Bureau of Standards. Renamed in 1989. *See: NIST.*

Negator Motor
The Negator is a strip of flat spring stainless steel that has been given a curvature by continuous heavy forming at the constant radius so that, in its relaxed or unstressed condition, it remains in the form of a tightly wound spiral. This form permits a compact mounting within the gauge head. The stainless steel Negator motor eliminates counterweight and cable assembly.

Net Standard Volume (NSV)
See: Volume, Net Standard.

Net Standard Weight (NSW)
The total weight of all petroleum liquids, excluding sediment and water and free water, determined by deduction the S&W weight from the Gross Standard Weight (GSW).

Newtonian Fluid
A liquid whose viscosity is unaffected by the kind of magnitude of motion or agitation to which it may be subject if the temperature remains constant.

NIST
National Institute of Standards and Technology. Formerly the National Bureau of Standards (NBS).

Noise (electrical)
An unwanted component of a signal that obscures the information content; any spurious voltage or current arising from external sources and appearing in the circuit of a device.

Nominal
Describes a value assigned for the purpose of convenient designation, existing in name only.

Nonconductive
The ability of a material to resist the flow of electrons. *See: Conductive.*

Noncontact
An instrument that does not touch the process but may require an opening in the tank wall to function. Ultrasonic and radar are noncontact devices.

Nonintrusive
An instrument or sensor that may require an opening in the tank wall and may meet the process but does not disrupt the flow or movement of the process. A pressure transmitter and HTG system are examples of nonintrusive devices because they do not protrude in the process.

Noninvasive
An instrument or sensor that does not have any contact with the product, nor does it require an opening in the tank wall. Nuclear is a noninvasive device. Radar is noninvasive if it uses a window.

Nonpressure Tank
A tank of conventional shape intended primarily for the storage of liquids at or near atmospheric pressure.

Nozzle Sample
A sample obtained from a gasoline pump nozzle that dispenses product from a storage tank at a retail outlet or a wholesale purchaser-consumer facility.

Nuclear/Nucleonic
A method of measuring level or density with the use of radioactive source emitting gamma rays. Low level gamma energy is beamed through the walls of a tank. The process level blocks the energy transmission, and a detector measures the energy received on the opposite side of the tank. The amount of energy is proportional to the level.

O

Observed Reference Height
The distance measured from the tank bottom or datum plate to the established reference point.

Observed Values
Hydrometer readings observed at temperatures other than the specified reference temperature. These values are only hydrometer readings and not density, relative density, or API gravity at that temperature.

Offset
When using the optical reference line method for calibrating tanks, the measurement observed through the optical device on the horizontal scale of the traversing magnetic slide at each vertical station.

Off-Specification Product/Cargo

Refined products or other cargo that does not meet normal quality requirements and therefore require special handling and restraints to assure separation from specification products/cargo.

Official Numbers (Volumes)
Those values which are used to determine the Marine Custody Transfer volumes. Such values would be those volumes reported on the Bill of Lading, certificate of shore receipts, vessel ullage reports, and quality analysis reports. The actual numbers to be used as well as the method of obtaining them are usually detailed in an appropriate marine custody transfer contract.

Onboard Quantity (OBQ)
Refers to materials present in a vessel's cargo tanks, void spaces, and/or pipelines before the vessel is loaded. Onboard quantity includes a combination of water, oil, slops, oil residue, oil/water emulsions, sludge, and sediment.

Open Gauging Method
This is a method of obtaining measurements of the tank contents through an open gauge hatch. This is the traditional method of performing static measurements.

Open Tank
A tank that is not pressurized. Atmospheric pressure is seen by the product surface.

Opening Gauge
The measurement in a tank before a delivery or receipt.

Operating Conditions
See: Environmental Conditions.

Operation Checker (automatic tank gauge)
A device used to check for free movement of the gauge mechanism

Orifice Plate
A thin plate in which a circular concentric aperture (bore) has been machined.

Orifice Plate Coefficient of Discharge
The ratio of the true flow to the theoretical flow, which is applied to the theoretical flow equation to obtain the actual (true) flow of an orifice meter.

Orifice Plate Holder
A pressure-containing piping element, such as a set of orifice flanges or an orifice fitting, used to contain and position the orifice plate in the piping system.

Oscillator
An electronic device that generates a signal at a preset frequency determined by the values of certain constants in its circuits.

Outage (Ullage)
The volume of available space in a container unoccupied by contents. Ullaging is a method of gauging the contents of a tank by measuring the distance from the surface of the liquid to the top of the tank. *See: Gauging (Outage, Ullage).*

Outage Bob
See: Gauge Weight.

Outlet Sample
A spot sample taken with the inlet opening of the sampling apparatus at the level of the bottom of the tank outlet (fixed or floating).

Outlier
A result that differs considerably from the main body of results in a set.

Output
A signal transmitted from a device.

Over-Ranging
A term, when applied to metering, indicating that the maximum permitted flow rate of the meter is being exceeded.

P

Parameters
The values that characterize and summarize the essential features of measurements.

Partial Immersion Thermometer
A thermometer that is used for measurement with a specific length of the bulb and stem immersed in the liquid, thus leaving the scale above the surface for ease of reading.

Partial Pressure
See: Pressure, Partial

Performance Curve
See: Accuracy Curve and Error Curve.

Petroleum
A substance, generally liquid, occurring naturally in the earth and composed mainly of mixtures of chemical compounds of carbon and hydrogen with or without other nonmetallic elements such as sulfur, oxygen, and nitrogen. The compounds that compose petroleum may be in the gaseous, liquid, or solid state, depending on their nature and on the existent conditions of temperature and pressure.

Pickup, Meter
A device for converting meter rotor movement into an electrical output signal. *See: Transducer.*

Picofarad
One-trillionth farad (10^{-12} farad). Common unit used in calculation and discussion of capacitance values occurring in level applications.

Pin Height
The lower limit of the critical zone; the level at which the floating roof or floating covers rests fully on its legs.

Pipe Taps
The position of a pair of tapholes to measure flowrate via differential pressure across an orifice plate. The upstream tap center is located at two and one-half times the published inside pipe diameter upstream of the nearest plate face, and the downstream tap center is located at a distance eight times the published inside pipe diameter downstream of the nearest plate face.

Pipeline
A section of pipe used for the transfer of fluid.

Point Indication
Yes/No indication of attained level.

Point Level
The term associated with detection of the pressure or absence of material at a specific level height.

Polar Circumference of a Spherical Tank
A circumference measured through the north and south poles of a sphere.

Positioning Wire or Cable
Solid or stranded wire or cable that connects the float to the tape or that drives the dial indicator or transmitter.

Pour Point
The lowest temperature at which oil will remain liquid.

Power Mixer
A device that uses an external source of power to achieve stream conditioning.

Preamplifier
A device used to increase the amplitude of faint signals so that they may be transmitted effectively.

Precision
Possessing high resolution and good repeatability; the degree to which data within a set cluster together.

Pre-Set Instrument (for measuring)
A measuring instrument fitted with a device that automatically terminates the measurement when it reaches a value fixed in advance.

Pressure
The amount of force exerted on a unit of area. The following terms pertain to different categories of pressure:

Absolute Pressure
The pressure reference to a perfect vacuum as zero pounds per square inch absolute.

Ambient Pressure
The pressure of the surrounding medium, such as the liquid in a pipeline or of the atmosphere.

Atmospheric Pressure
The pressure exerted by the weight of the atmosphere. At sea level, the pressure is approximately 14.7 pounds per square inch 9101 kilopascals), often referred to as 1 atmosphere, atmospheric pressure, or pressure of one atmosphere.

Back Pressure, Turbine Meter
The pressure that is measured four pipeline diameters downstream from the turbine flowmeter under operating conditions, expressed in N/m^2.

Differential
The static pressure difference determined in orifice measurement typically measured between the upstream and downstream flange, pipe, or other taps of an orifice meter.

High Vapor Pressure Liquid
A liquid which, at the measurement or proving temperature of the meter, has a vapor pressure that is equal to or higher than atmospheric pressure. *See: Low Vapor Pressure Liquid.*

Low Vapor Pressure Liquid
A liquid which, at the measurement or proving temperature of the meter, has a vapor pressure that is less than atmospheric pressure. *See: High Vapor Pressure Liquid.*

Pressure, Equilibrium
The pressure at which a liquid and its vapor are in equilibrium at a given temperature.

Pressure, Gauge
Pressure measured relative to atmospheric pressure taken as zero.

Pressure, Impact
Pressure exerted by a moving fluid on a place perpendicular to its direction of flow. It is measured in the direction of flow.

Pressure Lock
A manually operated semiautomatic gauging device that is self-enclosed and used for the prevention of vapor losses in the gauging of atmospheric pressure, variable vapor space, and high-pressure tanks.

Pressure Loss (Drop)
The differential pressure in the flowing fluid stream (which will vary with flow rate) between the inlet and outlet of a meter, flow straightener, valve, strainer, lengths of pipe, etc.

Pressure, Partial
The pressure that is exerted by a single gaseous component of a mixture of fluids.

Pressure, Reid Vapor
The vapor pressure of a fluid at 100 °F (37.8 °C, 311 °K) as determined by test method ASTM D 323, *Test Method for Vapor Pressure of Petroleum Products (Reid Method)*.

Pressure, Static
Pressure in a fluid or system that is exerted perpendicular to the surface on which it acts. In a moving fluid, the static pressure is measured at right angles to the direction of flow.

Pressure, Velocity

The component of the pressure of the moving fluid that is due to its velocity and is commonly equal to the difference between the impact pressure and the static pressure. *See: Pressure, Impact and Pressure, Static.*

Pressure Actuated Thermometer
A thermometer in which the pressure developed by thermal changes in the thermometric filling medium actuates an indicating or recording device calibrated in terms of degrees of temperature.

Pressure Sensor Effective Center
The point on the sensor from which the hydrostatic pressure head is measured.

Pressure Transmitter
A device commonly used for measuring level in process applications. It uses the principle that the measured hydrostatic pressure is equal to the height of the fluid multiplied by its specific gravity. In HYG applications the pressure transmitter provides the HIU with a pressure measurement (by means of the HART protocol). One transmitter is used per tank if the density is constant. A second transmitter is used if the density needs to be measured. A third transmitter located at the top of the tank is used to measure head (vapor) pressure.

Pressure-Type Tank
A tank specially constructed for the storage of volatile liquids under pressure. Such tanks are spheroidal, spherical, hemispheric ally ended, or of other special shapes.

Primary Container/Receiver
A vessel in which all samples are initially collected. Examples of primary sample containers include glass and plastic bottles, cans, core-type thief, and fixed and portable sample receivers.

Primary Element (Primary Detector)
See: Sensing Element.

Primary Sample Receiver (Receptacle)
A fixed or portable container into which all sample grabs are collected.

Probe
That portion of the sampling system that extends into the pipeline and directs a portion of the fluid to the extractor.

Process Level
The term associated with continuous level measurements in the process industries. Generally, the accuracy requirements of this measurement are not as stringent as with inventory level.

Product Heel Mass
The mass of product below the bottom HTG sensor.

Product Heel Volume
The observed volume of product below the bottom HTG sensor, calculated by subtracting the water volume from the total heel volume.

Product Mass
The sum of the head mass and the product heel mass reduced by the floating roof mass (if applicable) and the vapor mass.

Product Temperature
The temperature of the tank liquid in the region where the HTG measurements are performed.

Profile Testing
A procedure for simultaneously sampling at several points across the diameter of a pipe to identify the extent of stratification.

Propagation
To cause to spread out and affect a greater number or greater area.

Prover, Conventional Pipe
A meter prover having a volume between detectors that permits a minimum accumulation of 10,000 direct (unaltered) pulses from the meter. A conventional pipe prover may be of either the bidirectional or unidirectional type.

Prover, Master-Meter
A meter used as a reference for the proving of another meter. A comparison for the two-meter outputs is the basis of the master-meter method. Displacement or turbine meters may serve as master meters.

Prover, Meter
An open or closed vessel of known volume utilized as a volumetric reference standard for the calibration of meters in liquid petroleum service. Such provers are designed, fabricated, and operated according to the recommendations of API MPMS Chapter 4.

Prover Pass
One movement of the displacer between the detectors in a prover; the volume determined by a displacer traveling between detector switches in a single direction.

Prover Round-Trip
The forward and reverse passes in a bidirectional prover; the volumes determined by a bidirectional displacer traveling between detector switches in one direction and the return direction.

Prover, Small Volume
Meter prover having a volume between detectors that does not permit a minimum accumulation of 10,000 direct (unaltered) pulses from the meter. Small volume provers require meter pulse discrimination by pulse interpolation counter or other techniques to increase the resolution.

Prover, Tank
An open or closed vessel of known capacity designed for the accurate determination of the volume of liquid delivered into or out of it during a meter proving operation.

Proving
The procedure used to determine a meter factor.

Proving Counter, Meter
A counter in which a special gating circuit in the counter is triggered by switches in the proving system to start and stop the counter.

Pulse Generator
A displacement meter accessory coupled to the measuring element and designed to produce a series of electrical pulses whose number is proportional to the volume measured and whose frequency is proportional to the flow rate.

Pulse Interpolation
Anny of the various techniques by which the whole number of meter pulses is counted between two events (such as detector switch closures) and any remaining fraction of a pulse between those two events is calculated.

Pulse Radar
A method of using radar to measure level. The radio signal is generated in pulses and the time-of-flight for the return signal is measured to determine material level.

Pulser
See: Pulse Generator.

Q

Quantity Measured (Metered)
The gross volume metered corrected to agreed reference conditions of pressure and temperature. *See: Measurement.*

R

Radar
An acronym for radio detecting and ranging. A device or system for locating an object by means of super high frequency radio waves. Radio waves are reflected from an object or surface and received, observed, and analyzed by the receiving part of the device, in such a way that characteristics (Such as distance and direction) of the object may be determined.

Radio Frequency (RF)
A band or range of high frequency microwaves.

Rag Layer
A layer that sometimes forms in-between two fluids. Since it is a combination of the two fluids and possibly some vapors, it can create some error in the measurement of the exact location of the interface.

Ramp/Sweep Generator
A device that changes a frequency at a constant rate and incorporates an oscillator that can be programmed to provide an output over a specified frequency range.

Range
The regions between the limits within which a quantity is measured, received, or transmitted. The range is expressed by stating the lower and upper range values, such as 0 °C to 150 °C and 50 m^3/s to 500 m^3/s.

Range of Uncertainty
The range or interval within which the true value is expected to lie with a stated degree of confidence.

Rangeability
The capability of a meter or flow measuring device to operate between the minimum and maximum flow range within an acceptable tolerance. Rangeability is generally expressed as a ratio of a maximum flow to the minimum flow.

Rathole
A hole formed in the center of a bin of dry solid material. Often occurs with fine powders, where air becomes entrapped, and the wall friction causes the material to be trapped as dead space. Ratholing can cause periods of no flow conditions or uncontrolled flooding.

Reading
See: Meter Readings.

Readout
A device that displays umbers or symbols and incorporates electric or electronic features.

Readout Device
A device that indicates or registers the value measured by an instrument in practical units.

Real Gas Specific Gravity
The ratio of the density of the gas under the observed conditions of temperature and pressure to the density of dry air at the same temperature and pressure. It follows that the ideal gas specific gravity is the ratio of the molecular weight of the gaseous mixture to the molecular weight of air.

Receiver
The part of a radar transmitter that receives return signals reflected from the surface of a material or obstructions within a tank.

Receiver Instrument, Meter
An instrument that receives signals from a transmitter.

Record Chart
A strip, disc, or sheet on which the indications of the measuring instrument are marked by a pen in the form of a graph.

Recording Instrument
A measuring instrument that records the value of the measured variable by marking or printing on a removable paper chart, tape, or other suitable recording material.

Reference
Usually, the point on a tank where the level is equal to zero. All sensor mounting heights are measured from the reference point.

Reference Circumference
The circumference of a tank measured by the manual tank strapping method (MTSM) on the bottom ring.

Reference Conditions
The conditions of temperature and pressure to which measured volumes are to be corrected.

Reference Density
The density at the reference temperature.

Reference Depth
The distance from the reference point to the bottom of the tank. Preferably, this distance should be stamped on the fixed benchmark plate or stenciled on the tank roof near the gauging hatch.

Reference Gauging Point
The point where the reference height is determined and from which the ullages/innages are taken; on pressure tank cars, the reference point is a fixed pointer located in the tank car manway housing adjacent to the gauge tube, a point to which all subsequent measurements are related.

Reference Height
The distance from the datum plate or tank bottom to the reference gauge point.

Referent Measuring Instrument (Tank)
A device calibrated to hold or deliver a known volume of liquid.

Reference Offset
When using the optical reference line method for calibrating tanks, the measurement observed on the horizontal scale of the traversing magnetic slide at the vertical station on the bottom plate.

Reference Temperature
The temperature at which actual density and actual volume are referenced to calculate standard density and standard volume. This reference temperature is required for all applications.

Reflectivity
The degree to which an object can reflect light, images, sound waves, or microwaves back to an instrument.

Register
A mechanical device that displays numbers.

Register, Meter
A device that accumulates and displays the indicated volume passed through a meter. *See: Counter, Meter.*

Register, Multimeter
A register that indicates the combined registration of two or more meters.

Registration, Over- or Under-
The amount by which the indicated volume registered by a meter exceeds or is less than the true volume that passed through the meter as determined by means of a suitable standard device. *See: Error, Absolute.*

Reid Vapor Pressure (RVP)
See: Pressure, Reid Vapor.

Relative Density
See: Density, Relative.

Reliability
The ability of an item to operate as specified for an indicated time, often expressed as mean time between failures (MTBF) or mean time to failure (MTTF).

Relief Lines
Sections of pipe that lead to pressure/vacuum relief valve.

Remaining on Board (ROB)
Refers to material remaining in a vessel's cargo tanks, void spaces, and/or pipelines after the cargo is discharged. ROB includes any combination of water, oil, slops, oil residue, oil water emulsions, sludge, and sediment.

Remote Seal
Remote seal systems act as a pressure transport medium between the process and the sensor of a transmitter. Remove seals are used: when it is necessary to isolate the transmitter from the process due to high process

temperature, for corrosive or vicious products, for applications that require the use of sanitary connections, to avoid contamination between batches, or when there is a need to make density or interface measurements. Not recommended for HTG applications because they can add errors.

Remote Seal System
A combination of the remote diaphragm seal, capillary, and fill fluid attached to a transmitter.

Remote Transmission and Telemetering
A separate or integral instrument system, used in conjunction with some other basic measuring means (such as automatic tank gauge), which transmits the basic reading to some place other than the point of measurement.

Repeatability
For metering, the closeness of the agreement between the results of successive measurements of the same quantity carried out by the same method, by the same person, with the same measuring instrument at the same location, over a short period of time. More specifically, the ability of a meter and prover system to repeat its registered volume during a series of consecutive proving runs under constant operating conditions. For a laboratory test method, the difference between successive test results obtained by the same operator, with the same apparatus, under certain operating conditions, on identical test material using the same test method.

Representative Sample
A portion extracted from a total volume that contains the constituents in the same proportions as are present in the total volume.

Reproducibility
For metering, the closeness of the agreement between results of measurements of the same quantity where the individual measurements are made by different methods, with different measuring instruments, by different observers, at different locations after a long period of time; or where only some of the factors listed are different. More specifically, the ability of a meter and prover system to reproduce results over a long period of time in service where the range of variation of pressure, temperature, flow rate, and physical properties of the metered liquid is negligibly small. For a laboratory test method, the difference between two single and independent results obtained by different operators, working in different laboratories, on identical test material using the same test method.

Resistance Thermometer
A thermometer that uses an electrical resistor to detect temperature and electrical means to measure and indicate temperature.

Resolution
The smallest change in the quantity measured to which the instrument will react with an observable change in an analog or digital indication.

Response Time, Thermometer (Thermal Time Constant)
The time required for a thermometer to indicate 63.2 percent of the magnitude of a change in the measured temperature.

Reynolds Number (Re)
The ratio of inertial forces to viscous forces; a measure of turbulence. A parameter that correlates the actual flow profile with the fully developed flow profile established under steady flow of a homogeneous, Newtonian fluid. It is a dimensionless number defined as follows:

$$Re = Du\rho/\mu$$

Where: D = inside diameter of the pipe
u = mean flow velocity
ρ = fluid density
μ = fluid viscosity, all in consistent units

RTD
The abbreviation for Resistance Temperature Detector. A device that predictably changes its resistance when a change in temperature is detected. For HTG applications, an RTD should be located midway between P_B and P_M. The sensor tip should be located a minimum of three feet from the tank shell into the product.

Run, Meter Proving

Any single prover volume measurement in a set of prover volume measurements required to prove a meter.

Run Ticket
The document customarily used to record lease of facility name, location, crude oil quantity and quality test data destination, gauger/witness signatures, etc., applicable to a particular gathering or transfer of custody transaction. *See: Ticket, Measurement.*

Running Sample
A Sample obtained by lowering a beaker on or bottle to the level of the bottom of the outlet connection or swing line and returning it to the top of the oil at a rate such that the beaker or bottle is about three-fourths full when withdrawn from the oil.

Running Start-and-Stop Method (meter proving)
A meter proving method wherein the opening and closing meter readings of the test run are determined at flowing conditions.

S

Sag
The distortion of a barge, or vessel, form due to stresses in which the midship portion of the vessel drops below its normal position relative to the bow and stern.

Sample
A portion extracted from a total volume that may or may not contain the constituents in the same proportions that are present in that total volume.

Sample Container
Receptacle used for storage and transport of the sample.

> **Type I Sample Container**
> A portable sample container used with a centrally located circulation-type sample mixing system. A Jiskoot sample container is an example of a Type I sample container.
>
> **Type II Sample Container**
> A portable sample container such as bottles and cans are considered Type II sample containers. The contents must be shaken by hand or mixed by mechanical agitation.

Sample Controller
A device that governs the operation of the sample extractor.

Sample Extractor
A device that extracts a sample from a pipeline, sample loop, or tank.

Sample Grab
The liquid volume taken from the pipeline by a single actuation of the sample extractor.

Sample Handling and Mixing
The conditioning, transferring, and transporting of a sample.

Sample Loop (Fast Loop/Slip Stream)
A low volume bypass diverted from the main pipeline.

A

Sample Preheater
A device used to heat samples before S&W or API gravity, or related density tests are performed.

Sample Receiver (Receptacle)
A receptacle that is usually part of an automatic sample system to contain the collected sample.

Sample System Proving
A procedure used to validate an automatic sample system.

Sampling

All the steps required to obtain a sample that is representative of the contents of any pipe, tank, or other vessel and to place that sample in a container from which a representative test specimen can be taken for analysis.

Scale
An ordered set of gauge or scale marks together with their defining figures, words, or symbols in relation to which the position of the index is observed when reading an instrument.

Scale Base
The line, actual or implied, that passes through the midpoints of the shortest marks on the scale.

Scale Division
The interval between any two successive scale marks of the scale.

Scale Length
The linear or curvilinear length measured along the scale base between the centers of the terminal scale marks.

Scale Mark
A line or other mark on the scale of an indicating device corresponding to one or more defined values of the quantity measured.

Scale Numbering
The set of numbers marked on a scale either corresponding to the values of the quantity measured, defined by the scale marks, or indicating only the numerical order of the scale marks.

Scale Range
The zone included between the scale marks corresponding to the maximum and minimum values of the scale, the difference between the maximum and minimum values of the scale.

Seal, Capillary, Meter
The liquid seal that reduces slippage between moving parts of a meter.

Seal Unit (automatic tank gauge)
An assembly used to seal the gauge assembly from the tank vapors.

Sediment
Solid materials that may include a combination of sand, ruse, and scale.

Sediment and Water (S&W)
A material, coexisting with yet foreign to a petroleum liquid, that requires a separate measurement for reasons that include sales accounting. This foreign material may include free water and sediment (FW&S) and emulsified or suspended water and sediment (SW&S). The quantity of suspended material (SW&S) present is determined by a centrifuge or laboratory testing of a sample of petroleum liquid. *See: Free Water.*

Selective Tank Remove Gauge
A single receiver used with a remote transmission system that permits the use of one or more tank transmitters so that selective readings can be obtained by switching from one tank to another.

Sensing Element
The part of the sensor (or detector) that is responsive to the magnitude of the measured quantity.

Sensing Element (thermometer)
That potion of a thermometer that senses and responds to changes of temperature (for example, the bulb of a liquid-in-gas thermometer).

Sensitivity
The ratio of a change in output magnitude to the change of input that causes it after equilibrium has been reached. Sensitivity is expressed as a ratio with the units of measurement of the two quantities stated. The ratio is constant over the range of a linear device. For a nonlinear device, the applicable input level must be stated.

Sensor Trim
The digital trim function that allows adjustment of the digital process variable reading to a precise pressure input. Zero trim and full trim are the two sensor trim functions. Full trim is not done on HTG transmitters.

Servo Gauge

The traditional technique for measuring level. A displacer rests on a liquid surface and is connected via a wire to a detector plate. The detector place drives a servo motor to raise or lower the displacer to keep a constant tension on the wire. The servo motor is attached to a drum that stores an excess measuring wire. Each revolution of the drum is associated with the level of the product.

Servo-Mechanism
An externally powered mechanism activated by the sensing element to provide sufficient power to position the indicator. It generally includes a corrective feedback arrangement.

Settling Tank
A tank or system of piping wherein the velocity of the liquid stream is sufficiently reduced to enable foreign particles or water to settle from the oil.

Sheer
The longitudinal curve of a vessel's decking in a vertical plane. As a result of sheer, a vessel's deck height above the baseline is higher (or lower) at the ends than amidships.

Shell
The plating forming the outer side and bottom skin of the hull.

Shell Full
Designates that a tank is filled to its shell capacity.

SI
International System of Units.

Signal
Information about a variable that can be transmitted.

Signal, Input
A signal applied to a device, element, or system.

Signal, Measured
The electrical, mechanical, pneumatic, or other variable applied to the input of a device. It is the analog of the measured variable produced by a transducer.

Signal-to-Noise Ratio (SNR)
The ratio of the magnitude of the electrical signal to that of the electrical noise.

Single-Tank Composite Sample
A blend of the upper, middle, and lower samples. For a tank of uniform cross section, such as an upright cylindrical tank, the blend consists of equal parts of the three samples. For a horizontal cylindrical tank, the blend consists of the three samples in the proportions shown in Table 2 of API MPMS Chapter 8.1.

Slippage, Meter
The volume of liquid that passes through a meter without causing registration. Meter slippage varies with the flow rate, viscosity, and dimensional changes in the meter that result from variations in temperature and pressure of the measured liquid.

Slops
Oil, oil/water/sediment, and emulsions contained in slop tanks or designated cargo tanks. The mixture usually results from tank stripping, tank washing, or dirty ballast phase separation.

Sludge
A highly viscous mixture that may include oil, water, sediment, and residue.

Small Tank
A crude oil storage tank with a 1,000-barrel or less capacity.

Sounding
See: Gauging.

Specific Gravity (sp gr)
Archaic. *See: Density, Relative.*

Spot (Grab) Sample
A sample taken at a specific location in a tank or from a flowing stream in a pipeline at a specific time.

Stability
The ability of a measuring instrument to maintain its accuracy over a long period of time.

Stand Pipes (Still Pipes or Stilling Wells)
Vertical sections of pipe or tubing extending from the gauging platform to near the bottom of tanks that are equipped with external or internal floating roofs. Stand pipes may also be found on ships and barges.

Standard
A measuring instrument intended to define, to represent physically, or to reproduce the unit of measurement of a quantity (or a multiple or submultiple of that unit), to transmit it to other measuring instruments by comparison. The following terms pertain to the category of measurement standards:

> **International Standard**
> A standard recognized by an international agreement to serve internationally as the basis for fixing the value of all other standards of the given quantity.
>
> **National Standard**
> A standard recognized by an official national decision as the basis for fixing the value, in a country, of all other standards of the given quantity. In general, the national standard in a country is also the primary standard.
>
> **Primary Standard**
> A standard of a particular measure that has the highest metrological qualities in each field. The concept of a primary standard is equally valid for base units and for derived units. The primary standard is never used directly for measurement other than for comparison with duplicate standards or reference standards.
>
> **Secondary Standard**
> A standard, the value of which is fixed by direct or indirect comparison with a primary standard or by means of a reference-value standard.
>
> **Working Standard**
> A standard that, calibrated against a reference standard, is intended to verify working measuring instruments of lower accuracy.

Standard, API
As per API Policy 104, a prescribed set of voluntary rules, conditions, or requirement concerned with the definition of terms; classification of components; delineation of procedures; specification of dimensions; construction criteria, materials, performance, design, or operations; measurement of quality and quantity in describing materials, products, systems, services, or practices; or descriptions of fit and measurement of size.

Standard Air
The accepted density of standard air varies between the U.S., British, and metric systems of measurement. The correct densities have been incorporated in API MPMS Chapter 11.1, “Volume Correction Factors” (also ASTM D 1250 and IP 200).

Standard Brass
Brass of a specified density used in fabricating precision balance weights.

Standard Conditions of Measurement
See: Reference Conditions.

Standing Start-and-Stop Method, Meter Proving
A meter-proving method wherein the opening and closing meter readings of the test run are determined at no-flow conditions.

Static Mixer
A device that utilized the kinetic energy of the moving fluid to achieve stream conditioning.

Static Pressure
See: Pressure, Static.

Stationary Sample Receiver
See: Sample Receiver (Receptacle).

Stepper-Drive
A drive means for remotely located meter accessories.

Step-Over (tank strapping)
A device used in tank strapping for measuring the distance apart along the arc of two points on a tank shell where it is not possible to use a strapping tape directly because of an intervening obstruction, such as a protruding fitting.

Still Pipe
See: Stilling Well

Stilling Well
A large diameter pipe, mounted vertically inside the tank, traveling the entire height of the tank to function as a baffle. It is also known as a gauge well, still pipe, or guide pole. It is used with level gauges that float on the product surface and some top-down noncontact level measurement technologies. The stilling well minimizes the effect of any tank turbulence on the product surface.

Stop Gauge
The final gauge reading for a transfer to or from a short tank or vessel.

Strainer
A device placed upstream of a meter or other equipment to remove from the stream foreign material that is likely to damage or interfere with operation. The strainer element is generally coarser than that or of a filter designed to remove solid contaminants.

Strake
A course or row of shell, deck, bulkhead, or other plating.

Strapping (tanks)
The measurement of the external circumference of a vertical or horizontal cylindrical tank by stretching a steel tape around each course of the tank's plates and recording the measurement.

Strapping Method
Identifies the tank strapping method used for the tank. It uses two methods: strapping table (actual) or formula based (calculated).

Strapping Table
A table (usually create by the manufacturer of the tank) that shows a volume versus level relationship.

Strapping Tape (tank strapping)
A measuring tape grated in units of length and used for taking the measurements for producing a tank calibration or tank gauge table.

Stratification (Density)
The division or settlement of some products into layers, based on their density. The density at the top of the tank can be different from the density at the bottom of the tank. Since the HIU calculates density using the pressure sensed on the bottom and middle transmitters, the density above or below these two transmitters may differ. Density stratification can affect the level and volume calculations but has virtually no effect on mass.

Stratification (Temperature)
The difference in the temperature of products inside the tank that have a higher temperature near the tank shell (due to the sun) than in the middle of the tank. This temperature difference causes the product to expand differently throughout the tank, affecting gross volume and level.

Stream Conditioning
The mixing of a flowing stream so that a representative sample may be extracted.

Streamline Flow
Flow having a Reynolds number less than 4,000. *See: Reynolds Number, Laminar Flow and Turbulent Flow.*

Strike Plate

A plate mounted horizontally on the inside wall near the bottom of the tank. The strike plate is used as a reference point when measuring level by hand dipping. The floor of a tank is not always used as a reference point when hand dipping due to the possible deformation of the tank floor when the product is in the tank.

Suppression
A term used to indicate that the lower calibrated value of the span of the pressure transmitter is not based at zero differential pressure but above zero. Thus, zero is suppressed. Example: A span of +20 to +100 inches H_2O is suppressed.

Surface Sample
A spot sample skimmed from the surface of liquid in a tank.

Surface Sensing Element
The detecting element of a surface sensing automatic tank gauge.

Surge Tank
A vessel used to smooth out the flow in a flowing stream.

Swirl
A qualitative term describing tangential motions of liquid flow in a pipe, tube, or tank.

T

Tail, Thermometer
The ungraduated lower portion of a mercury-in-glass direct-reading thermometer, which does not contain the sensing element.

Tank Average Cross-Sectional Area
The average cross-sectional area between the elevation of the bottom HTG sensor and the innage level over which the hydrostatic pressures are integrated to obtain the mass.

Tank Capacity Table
See: Capacity Table.

Tank Composite Sample
A blend created from the upper, middle, and lower samples from a single tank. For a tank of uniform cross section, such as an upright cylindrical tank, the blend consists of equal parts of the three samples. For a horizontal cylindrical tank, the blend consists of equal parts of the three samples in the proportions shown in Table 2 of API MPMS Chapter 8.1.

Tank Diameter
The inner diameter of the tank. This dimension is always measured horizontally, despite the tank shape. It is the length dimension of a horizontal bullet tank.

Tank Elevation
The elevation of the site where the tank is located. Needed for the HIU to compensate for the effects of air density and local gravity.

Tank Height
The total inside height of the tank. Height is always measured vertically, despite the tank shape. It is the diameter of a horizontal bullet type tank.

Tank I.D.
The name of the tank in text or numerals. The tank I.D. appears on the tag riveted to the top of the HIU (24 characters maximum).

Tank Latitude
The latitude of the site where the tank is located. Needed for HIU to compensate for the effects of air density and local gravity.

Tank Lip
The tank bottom plate on the outside of the tank shell.

Tank Table
See: Capacity Table.

Tank Tag
The HIU instrument number. The tank tag appears on the tag riveted to the side of the HIU (16 characters maximum).

Tank Type
The tank shape that best describes the tank. This is needed for correctly calculating a formula based strapping table. Some examples of different tank types are upright cylinder, horizontal cylinder, sphere, upright bullet, and horizontal bullet.

Tap Sample (Tank-Side Sample)
A spot sample taken from a sample tap on the side of a tank. It may also be referred to as a tank-side sample.

Tape, Automatic Tank Gauge
A metal tape used to connect the liquid level detecting element and the gauge-head mechanism.

Tape Clamp (tank strapping tape)
A quick release that may be fitted around a strapping tape at any convenient position throughout its length.

Tape Positioner (tank strapping tape)
A guide sliding freely along the strapping tape and used to pull and hold the tape in the correct position for taking measurements.

Tapering
The decrease in the strength of a signal between two points or between two frequencies.

Taphole
A hole radially drilled in the wall of the meter tube or orifice plate holder, the inside edge of which is flush and without any burrs.

Temperature, Absolute
The temperature measured from the absolute zero (-273.15 °C).

$$degrees\ Celsius + 273 = degrees\ absoulute\ in\ Kelvin$$

Temperature Error
The measuring error caused by the temperature of a measurement differing from the pertinent reference value.

Temperature Measurement Device
Consists of a sensor, transmission medium, and readout equipment in an operating configuration used to determine the temperature of a liquid for measurement purposes.

Temperature Range, Operating
The range of ambient temperatures, given by their extremes, within which the transducer is intended to operate.

Temperature Sensor
Consists of a sensing element and its housing, if any, and is defined as the part of a temperature device that is positioned in a liquid, the temperature of which is being measured.

Tender
See: Batch.

Test Measures, Field Standard
A vessel fabricated to meet specific design criteria and calibrated by an official agency such as the National Institute of Standards and Technology (NIST) or another NIST-certified, competent laboratory.

Test Run, Meter Proving
See: Run, Meter Proving.

Test Specimen
The representative sample taken from the primary of immediate sample container for analysis.

Thermal Expansion
The amount of expansion of the tank material due to changes in temperature. Usually measured in inch/inches/°C.

Thermistor (Thermal Sensor Resister)
A temperature-sensitive element consisting of a semiconductor such as germanium oxide, whose conductance changes with its temperature. Thermistors are used to make temperature measurements electrically.

Thermocouple
A temperature-sensitive element consisting of a pair of dissimilar metals so arranged that the electromotive force produced by the couple depends upon the difference in temperature between the hot and cold junctions of the metals. The output is measured on a millivoltmeter calibrated in terms of degrees of temperature.

Thermometer
The following terms refer to different types of thermometers:

Complete (Full) Immersion Thermometer
A thermometer that indicates temperature correctly when completely immersed in the material being tested.

Partial Immersion Thermometer
A thermometer that indicates temperature atone correctly when immersed to a specified depth. A mark and/or written distance on the back of each thermometer indicates the proper immersion level.

Reversible Thermometer
A device containing a mercury-in-glass thermometer, which may be inverted after the thermometer has reached thermal equilibrium with the oil in which it is immersed. The inversion of the device breaks the mercury thread, which being disconnected from the sensing element (the bulb) runs down to the other end of the thermometer stem. The instrument is then drawn to the surface and the recorded temperature, which remains unchanged until the instrument is reset, can then be read off the scale.

Total Immersion Thermometer
A thermometer that indicates correctly when immersed to just barely below the reading.

Thermowell
A metal protective socket installed in the well or shell of a liquid container into which the sensing element of a temperature sensing device is inserted.

Thief
An industry term for a bottom closure, core-type sampler used to secure samples from storage tanks.

Thread, Thermometer
A term given to the length of mercury in the capillary of a mercury-in-glass thermometer that indicates the temperature.

Ticket, Measurement
The term used to include expressions such as run ticket and receipt and delivery ticket. It is also used to mean the paper or readouts in a meter station that is automated, remotely controlled, and/or computerized.

Time-of-Flight
The elapsed time from the instant a particle leaves a source to the instant it reaches a detector.

Time Proportional Sample
A sample composed of equal volume grabs taken from a pipeline at uniform time intervals during the entire transfer.

Tolerance
The amount of measurement error that will be allowed. It is a plus or minus value.

Top Sample
A spot sample taken from a tank obtained 6 inches (15 centimeters) below the top surface of the liquid.

Total Calculated Volume (TCV)
See: Volume, Total Calculated.

Total Heel Volume
The observed volume below the bottom HTG sensor, calculated from the bottom sensor elevation and the tank capacity table corrected for observed temperature.

Total Observed Volume (TOV)

See: Volume, Total Observed.

Totalizer
Meter register as pertains to total; for example, the summation of several independent quantities is contained in the totalizer.

Traceability
The relation of a prover or a transducer calibration, through a step-by-step process, to an instrument or group of instruments calibrated and certified by a national or international primary standard.

Traditional Volume
The volume calculated from a strapping table and level measurement.

Transducer
A device that provides a usable output signal in response to a measurement.

Transfer Type
The method by which the product will be transferred to and from the tank – either gross volume, standard volume, level, or mass.

Transmitter
The portion of a remote transmission system that constitutes the sending element.

Trim
Refers to the condition of a vessel in terms of its longitudinal position in the water. Trim is the difference between the forward draft and the aft draft and is expressed by the head or by the stern to indicate the end of the vessel that is deeper in the water.

Trim Correction
The correction applied to the volumes or gauge observed in a vessel's tank when the vessel is out of trim, provided that the liquid is in contact with all bulkheads in the tank. Trim correction may be accomplished by referring to the trim correction tables for each of the vessel's tanks or by calculation.

True Value
The theoretically correct amount. In practice, it is represented by the standard being used for comparison, such as a prover.

True Vapor Pressure
See: Pressure, True Vapor

Tube (Thief) Sample
A sample obtained with a sampling tube or special thief, either as a core sample or a spot sample from a specific point in the tank or container.

Turbine
A bladed rotor flowmeter component that turns at a speed that is proportional to the mean velocity of the stream and therefore to the volume rate of flow.

Turbine Meter
A meter in which the measuring element is a multibladed rotor to which the metered stream imparts a rotational velocity that is proportional to the mean velocity of the stream. Measured volume is registered by rotor revolutions.

Turbulent Flow
In turbulent flow, random eddying flow patterns are superimposed upon the general flow progressing in each direction. The transition from smooth uniform laminar flow to turbulent flow generally occurs as the Reynolds number increases from about 2,300 to 4,000.

Turndown
Field terminology for rejecting a tank's contents based on the gauger's evaluation and analysis.

Two-Phase
A fluid state consisting of a mixture of liquid with gas or solids. Also, a mixture of a gas with solids or with liquid droplets.

U

Ullage
See: Gauging, Outage.

Ullage Hatch, Marine Vessel
See: Gauge Hatch, Tank.

Ullage Paste
A paste that is applied to an ullage rule or dip tape and weight to indicate the level at which the liquid meniscus cuts the graduated portion.

Ullage Pressure
See: Pressure, Equilibrium.

Ullage Volume
The observed volume of the vapor/air mixture in the ullage space, calculated as the difference between the total tank volume and the innage volume.

Ultrasonic
A method of measuring level where a sound pulse is transmitted from the instrument to the surface of the material. The sound pulse is reflected off the surface and the echo are detected by the instrument. The amount of time to return to the instrument is inversely proportional to the level.

Unbalanced Remote
A situation where the remove seal system is different on the high and low seal system sides of a pressure transmitter.

Units of Volume
The usual units of volume for petroleum measurement are cubic meter, liter, imperial gallon, U.S. gallon or barrel (42 U.S. gallons), or cubic feet.

Upper Sample
A spot sample taken at the middle of the upper one-third of the tank contents (a distance of one-sixth of the liquid depth below the liquid's surface).

V

V Constants
Used to calculate vapor density based on product temperature.

Vacuum Breaker
A device used to prevent vacuum from occurring in a tank, vessel, piping, etc.

Valve
The following terms pertain to the category of valve:

Valve, Back Pressure
A valve used to automatically regulate a uniform pressure on the inlet side of such valve.

Valve, Block and Bleed
A high integrity valve with double seals and provision for determining if either seal leaks.

Valve, Check
A valve used to control a selected direction of flow and prevent the liquid flow from reversing in direction.

Valve, Differential Pressure
A valve used to automatically regulate a uniform difference in pressure between two separate locations in a pipeline.

Valve, Excess Flow
A valve used to automatically prevent the liquid flow rate in a pipeline from exceeding a high limit.

Vapor Mass
The mass of vapor in the vapor space. Calculated by the HIU (or SAM) using V constants.

Vapor Point
See: Bubble Point.

Vapor Pressure, Absolute or **True**
See: Pressure, Equilibrium.

Vapor Relative Density
The ratio of molecular mass of vapor (mixture) to that of air (mixture).

Vapor-Tight Tank
A tank of conventional shape intended primarily for the storage of volatile liquids, such as gasoline, and so constructed that it will withstand pressures differing only slightly from atmospheric. Such tanks are equipped with special devices that permit gauging without opening the tank to the atmosphere.

Variable
See: Measurand.

Velocity Pressure
See: Pressure, Velocity.

Vent Hole
The hole near the top of the stilling well that allows air to release as fluid rises in the tube. Ensures that the level within the tube is always equal to the vessel level.

Vented Tank
A tank that is covered but not pressurized. A vent located on top of the tank releases any pressure buildup.

Verification
Periodic or routine performance checks that ensure that operational requirements continue to be met. Verification can be accomplished by comparing information from two or more devices sensing a given variable. An example would be a master thermometer compared to a temperature transmitter output.

Vessel Experience Factor (VEF)
A compilation of the history of the total calculated volume (TCV) vessel measurements, adjusted for onboard quantity (OBQ) or remaining onboard (ROB), to the TCV shore measurements. Separate VEFs should be developed for both load and discharge terminals. Preferably, information used in calculating a VEF should be based on documents that follow accepted industry standards and practices, such as inspection company reports.

Vessel Ratio, Discharge (DVR)
The total calculated volume (TCV) by vessel measurement on arrival, less remaining on board (ROB), divided by the TCV by shore measurement are discharge.

$$DVR = \frac{TCV\ arrival\ volume - ROB}{TCV\ Received\ on\ shore\ at\ dischage}$$

Vessel Ratio, Load (LVR)
The total calculated volume (TCV) by vessel measurement on arrival, less remaining on board (ROB), divided by the TCV by shore measurement at discharge.

$$LVR = \frac{TCV\ sailing\ volume - OBQ}{TCV\ received\ from\ shore\ at\ loading}$$

Vibration Error
The maximum change in operating output, at any measurand value within a specified range, when vibration levels of specified amplitude and range of frequencies are applied to the transducer along specified axes.

Viscosity, Absolute
The measure of resistance to shear per unit of time of a fluid's intermolecular cohesive force.

Viscosity, Kinematic
The ratio of absolute viscosity to density. The SI unit is the square meter per second (m^2/s).

Viscosity, Saybolt Second Universal (SSU)
The efflux time in seconds of 60 milliliters of samples flowing through a calibrated universal orifice under specified conditions.

Viscous Hydrocarbon
Any liquid that requires special treatment or equipment in its handling or storage because of its resistance to flow.

Volume, Gross
The indicated volume multiplied by the meter factor (*MF*) for the liquid and flow rate under which the meter was proved.

Volume, Gross Observed (GOV)
The total volume of all petroleum liquids and sediment and water, excluding free water, at observed temperature and pressure.

Volume, Gross Standard (GSV)
The total volume of all petroleum liquids and sediment and water, excluding free water, corrected by the appropriate volume correction factor (C_{t1}) for the observed temperature and API gravity, relative density, or density to a standard temperature such as 60 °F or 15 °C and corrected by the applicable pressure correction factor (C_{p1}) and meter factor; the gross volume at standard temperature corrected to standard pressure.

$$Gross\ Standard\ Volume = closed\ meter\ reading - open\ meter\ reading \times MF \times C_{t1} \times C_{pl}$$

Volume Indicated
The change in meter reading that occurs during a receipt or delivery.

Volume Meter
A device that when installed in a pipe in which liquid is flowing indicates the volume of liquid that passes through it.

Volume, Net Standard (NSV)
The total volume of all petroleum liquids, excluding sediment and water and free water, corrected by the appropriate volume correction factor (C_{t1}) for the observed temperature and API gravity, relative density, or density to a standard temperature such as 60 °F or 15 °C and corrected by the applicable pressure correction factor (C_{p1}) and meter factor.

Volume, Total Calculated (TCV)
The total volume of all petroleum liquids, sediment, and water, corrected by the appropriate volume correction factor (C_{t1}) for the observed temperature and API gravity, relative density, or density to a standard temperature such as 60 °F or 15 °C and corrected by the applicable pressure correction factor (C_{p1}) and meter factor, plus all free water measured at observed temperature and pressure (gross standard volume plus free water).

Volume, Total Observed (TOV)
The total measured volume of all petroleum liquids, sludges, sediment and water, and free water at observed temperature and pressure.

Vortex
The swirling motion of liquid often encountered as it enters the outlet opening of a container (tank). The vortex (swirl) causes entrainment of considerable quantities of air or vapor with the liquid.

W

Washing, Crude Oil (COW)
The use of a high-pressure stream of the crude oil cargo to dislodge or dissolve clingage and sediment from the bulkheads, bottom, and internal tank structures of a vessel during the discharge operation.

Washing, Water
The use of a high-pressure water stream to dislodge clingage and sediment from the bulkheads, bottoms, and internal structures of a vessel's cargo tanks.

Water, Bottom
Water accumulated at (or sometimes added to) the bottom of the oil in a storage tank.

Water Bottom Level
The level of water at the bottom of a tank.

Water Bottom Volume
The volume of water at the bottom of a tank.

Water/Cut Measurement
The procedure of locating the oil/water interface for the purpose of determining the volume of free water in a shore tank or vessel compartment. It is also used to refer to the line of demarcation of the oil/water interface.

Water Dip
The depth of free water in a container over and above the dip plate.

Water Equivalent (pycnometer)
The water equivalent of a pycnometer at a temperature *t* is the weight in air of pure water contained by the pycnometer at the temperature *t*.

Water Finder (Water Finding Rule)
A graduated rod, usually of metal, to which water-finding paste can be applied. This paste or paper is discolored on contact with water and thus affords a ready means of measuring the depth of water in a tank when the water finder is lowered to the tank bottom.

Water-Finding Paste
A paste containing a chemical that changes color in contact with water. The paste, when applied to a water-finding rule, gives an indication of the level of free water in a container.

Water Volume
The observed volume of free sediment and water, calculated from the free water level and the tank capacity table.

Water Washing
See: Washing, Water.

Wave Guide
The entire path, in a radar gauge, through which the radar signal travels. It includes the coaxial-to-wave guide adapter, the housing-to-flange adapter, and the mounting flange.

Wavelength
A measure, expressed in meters, of the length of each complete electromagnetic wave.

Wedge Formula
A mathematical means of approximating the small quantities of liquid and solid cargo and free water onboard before a vessel is loaded and after its cargo is discharged. The formula is based on cargo compartment dimensions and vessel trim. The wedge formula shall be used only when a wedge exists and when the liquid does not touch all bulkheads of the vessel's tank.

Wedge Tablets
Precalculated vessel tables based on the wedge formula and displayed in much the same way as the vessel innage/ullage tables. Wedge tables are used for small quantities [for examples, onboard quantity (OBQ) and remaining onboard (ROB)] when the liquid does not touch all bulkheads of the vessel's tank.

Weight Scale
A device for determining either the mass or the weight of a body, depending upon the apparatus and procedure employed.

Weigh Tank
A tank used with a weigh and scale that is used for measurement of the liquid contents of the tank.

Weighing
Measuring the net force acting on an object's mass.

Weight (wt.)
The net force exerted on an object's mass compared with a reference standard.

Weight in Air
The weight in air of a substance is its weight in vacuum, reduced by its buoyancy (in air).

Weight of a Measurement
A number that expresses the degree of confidence in the result of a measurement of a certain quantity in comparison with the result of another measurement of the same quantity.

Wet Leg
A filled reference connection between the vapor space area of a tank and the low-pressure side of the transmitter. Wet legs are used when condensation is common and dry legs are impractical. The pressure exerted by the weight of the fluid in the wet leg must be compensated for in the calibration of the transmitter.

Wetter Parts
The portion of an instrument exposed to a process.

Worst-Case Conditions (sampling)
The operating conditions for the sample that represent the most uneven and unstable concentration profile at the sampling location.

Z

Zero Level
Physical material level at which a level instrument is calibrated to indicate either "0%" or "low level."

Zero Measurand Output
The output of a transducer with zero measurand applied.

Zero Trim
A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects, or zero shifts caused by static pressure.