

Hydrocarbon management

HM 0

Hydrocarbon management terms and definitions

2nd edition



HYDROCARBON MANAGEMENT
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FOREWORD

The EI Hydrocarbon Management Committee (HMC) is responsible for the production and maintenance of standards and guidelines covering various aspects of static and dynamic measurement of petroleum.

The HMC is made up of the chairs and vice chairs of the hydrocarbon management (HM) subcommittees, comprising international experts in the fields of cargo inspection, marine transportation, refineries, marketing and distribution and upstream hydrocarbon management.

The EI maintains liaison with parallel working groups of the American Petroleum Institute's Committee On Petroleum Measurement, and other organisations concerned with quantitative measurement in other countries and in other industries.

The EI Hydrocarbon Management Guidelines (formerly Petroleum Measurement Manual and Petroleum Measurement Papers) are widely used by the petroleum industry and have received recognition in many countries by consumers and the authorities. In order to promote international good practice the EI works via the British Standards Institute to develop standards through the International Standards Organisation's technical committee TC-28; Petroleum Products and related products of synthetic or biological origin, and its sub committee TC28/SC2; Measurement of petroleum and related products.

A full list of hydrocarbon management guidelines is available on request from the Energy Institute.

The EI hydrocarbon management guidelines are recommended for general adoption but should be read and interpreted in conjunction with safety, environmental, weights and measures, customs and excise and other regulations in force in the particular country in which they are to be applied. Such regulatory requirements have precedence over corresponding clauses in the EI document except where the requirements of the latter are more rigorous, when its use is recommended. Users should also consider contractual constraints imposed by any other interested party.

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1 INTRODUCTION

1.1 BACKGROUND

The EI Hydrocarbon Management Committee has identified the need to produce an agreed set of definitions for terms frequently used in EI petroleum measurement guidance. There is a fundamental requirement for consistency of definitions and to ensure such definitions conform with internationally accepted ISO definitions wherever possible.

Most EI codes contain a glossary of terms (or terms and definitions section) giving definitions for specific terms used in the text and clarification of their meaning for the particular subject and context. However, because EI measurement glossaries are spread over many publications, instances have arisen of variations in the wording for a particular definition used in several different codes. The aim of this document is to prevent such occurrences in future publications.

The definitions represent an attempt to draw together all the essential metering and statistical terms used for both static and dynamic measurement. Where definitions are in line with ISO standards, the ISO reference is given.

Where more than one term is given for the same definition, the first one listed is preferred.

1.2 USE OF THESE TERMS AND DEFINITIONS

EI committees developing or revising HM documents should use the terms and definitions presented here, in accordance with the following policy:

All key terms used in a particular document should be contained in the glossary of the document concerned. Where applicable, these will be taken from HM 0.

Terms and definitions not contained in HM 0 may be used.

Interpretation of any document will be based on the terms contained in its glossary, which will take precedence over HM 0.

New terms, which committees/work groups consider to have application across a number of topics or to be in general use should be submitted to HMC for addition to HM 0.

Similarly, if committees/work groups find that there is a need to modify a term or its definition then recommendations should be submitted to HMC for consideration.

2 TABLE OF TERMS AND DEFINITIONS

Term	Definition	Reference
Absolute error	See <i>error</i> .	*
Accuracy	Closeness of agreement between the result of a measurement and the (conventional) true value of the measurement. The quantitative expression of accuracy should be in terms of uncertainty. Good accuracy implies small random and systematic errors. Note: The use of the term 'precision' for accuracy should be avoided.	*
Additive	A chemical added to crude oil or product in order to alter its properties.	
Additive injection ratio	Volume of product per unit volume of additive at the required level of additive injection.	
Aerating	Introduction of fresh air into a tank with the object of removing inert gases and to increase the oxygen content to about 21 % by volume so as to ensure a breathable atmosphere.	
Air (or vapour) eliminator	Device designed to separate air or gases from a liquid stream before it passes through a meter.	
Aircraft fuelling equipment (AFE)	Equipment which is used to handle aviation fuels on an airfield and which includes: <ul style="list-style-type: none"> – aircraft refuellers; – hydrant dispensers; – defuellers, and – cabinet dispensers. 	
Aircraft refuellers	Vehicles that carry a cargo of aviation fuel and which are capable of refuelling an aircraft. Most vehicles of this type may also defuel aircraft.	
All-levels sample	See <i>sample - all-levels</i> .	
Allocation	Determination of the quantity of products belonging to each user when processed together in a co-mingled system.	
Ambient temperature	Environmental temperature.	
Approved equipment	Equipment of a design that has been approved by an appropriate authority such as a governmental agency, classification society or other accredited authority. Such an authority will have certified the particular equipment as safe for use in a specified hazardous atmosphere.	
Asphaltenes	Wax free component of crude oil, bitumen or coal, insoluble in heptane but soluble in hot benzene.	

Term	Definition	Reference
Audit	Inspection of a system against specific criteria (such as design, installation, operation and maintenance).	
Automatic tank gauge (ATG)	Instrument which automatically measures and displays liquid levels or ullages in one or more tanks either continuously, periodically, or on demand.	
Automatic tank thermometer (ATT)	Instrument that automatically measures and displays the temperature of the contents in a tank continuously, periodically, or on demand.	
Automatic temperature compensation (ATC)	Adjustment and registration, by means of a mechanical or electronic device forming part of the metering system, of the volume measured by the meter at metering conditions of temperature to the equivalent volume at standard temperature.	
Average temperature	Average temperature of a liquid in a container is the mean calculated from temperatures taken from at least three points in the container.	
Ballast	Water taken on board when a vessel is empty or partially loaded/discharged to increase draught so that the propeller is fully immersed, stability and trim are maintained, and stresses minimised.	
Ballast – clean	Ballast contained in cargo tanks that have been crude oil washed and thoroughly water washed. It may be discharged to sea and meets MARPOL requirements.	
Ballast – departure	Ballast taken on board prior to departure. If loaded into tanks that have previously contained cargo it may contain traces of oil and be termed dirty ballast.	
Ballast – heavy weather	Additional ballast loaded into cargo tanks to enable the vessel to maintain a safe sea-going condition under extreme weather conditions.	
Ballast – segregated	Ballast that is contained in dedicated ballast tanks serviced by dedicated ballast pumps and lines with no permanent connection to the cargo system.	
Base volume	See <i>volume – base</i> .	
Batch (meter proving)	Set of consecutive proving runs that are deemed necessary to derive both (1) a mean value of meter factor or K-factor suitable for subsequent use and (2) a range of individual values that can be used as an indication of the repeatability of the measurements.	
Batch (product or cargo)	Identified quantity of product, the quality of which is covered by a single certificate of quality or certificate of analysis.	*

Term	Definition	Reference
Bias	See <i>systematic error</i> .	
Bill of lading	Document issued on behalf of the cargo supplier which states the quantity of material delivered to a vessel.	
Biodiesel; B100	Fuel comprised of alkyl esters of long chain fatty acids derived from vegetable oils or animal fats.	
Black oils	Petroleum products containing residual components which make them dark in colour.	
Blended biodiesel	Diesel fuel which is a blend of biologically derived components (e.g. FAME or FAEE) and mineral diesel. The percentage of biological component is often designated in the grade name e.g. B15 indicates 15 % biological component.	
Bottom sample	See <i>sample – bottom</i> .	
Bottom sediment	See <i>sediment</i> .	*
Bottom wash	Crude oil washing operations restricted to the lower parts of the tank bulkheads, internal structures and bottom of tanks. This can only be carried out by vessels equipped with programmable tank washing machines.	
Calibrated volume	See <i>volume – calibrated</i> .	
Calibration	Set of operations which establish, under specified conditions, the relationship between the values indicated by a measuring device and the corresponding known values obtained using a traceable reference measurement standard with a defined measurement uncertainty.	***See ISO VIM:2007 section 2.39 for a more detailed definition
Calibration table; capacity table; tank capacity table; tank table	Table showing the capacities of, or volumes in, a tank corresponding to various liquid levels measured from a reference point.	*
Calorific value	Amount of heat released by a given volume of a gas at reference pressure and temperature when completely burnt in an excess of air at the same pressure and temperature as the gas. The superior, or gross, calorific value is the amount of heat given out by a specified volume of gas when the water produced by the combustion is condensed. The inferior, or net, calorific value is the amount of heat given out by a specified volume of gas when the water produced by the combustion remains in the gaseous phase.	

Term	Definition	Reference
Cargo inspectors	Persons who, by reason of their knowledge and practical experience in the field of bulk oil cargo measurement and analysis, are competent to provide reports and recommendations on matters relating to the quantity and quality of bulk petroleum product cargoes.	
Cavitation	Phenomenon following flashing where the pressure recovers above the vapour pressure and the vapour bubbles collapse.	*
Chemical gas	Classification of gases derived from or allied to the petroleum industry as described in Ch. 19 of the IGC Code, either in a mixture or essentially pure form, maintained in a liquid state by the reduction of temperature and/or application of pressure.	
Clearance sample	See <i>sample – clearance</i> .	
Clingage	Residue material which adheres to the surfaces of tank walls, roof and structures, within empty or part-empty tanks.	
Combined standard uncertainty (U_c)	Standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or covariance of these other quantities weighted according to how the measurement result varies with changes in these quantities.	**
Commercial parties	Parties with a commercial interest in the commodity being measured. Usually the owner/ seller and/or buyer.	
Commingling	Loading of different batches of cargo into the same tank, without cargo homogenization by deliberate circulation through cargo pumps and pipelines.	
Compact prover	Specific design of <i>small volume prover</i> .	
Composite sample	See <i>sample – composite</i> .	
Confidence level	Probability that the true value will lie between specified confidence limits, assuming negligible systematic error. Note: This is generally expressed as a percentage, e.g. 95 %.	****
Confidence limits	Lower and upper limits within which the true value is expected to lie with a specified probability, assuming negligible systematic error.	****
Control chart	Graphical technique of statistical control in which measurements are plotted against time in order to assist in the monitoring of ongoing measurements.	

Term	Definition	Reference
Control chart – cumulative sum; CUSUM	Control chart on which accumulated values of the variable are plotted and straight lines fitted to the points. Where changes in slope of the fitted lines occur, they indicate the possible occurrence of 'events' which may merit investigation.	
Control chart – moving average	Control chart, often used to monitor any long-term drift in meter factor readings, on which are plotted the averages of successive measurements. The average is usually based on either five consecutive readings or 10. The first reading is dropped and a new reading incorporated in the 'moving average'.	
Control chart – Shewhart	Chart (first developed by Walter A Shewhart) on which confidence limits, based on a probability of 95 % or 99 %, are drawn and values of a variable plotted and monitored. Note: If the values lie within the chosen limits, the system may be considered to be in control.	
Control limits	Limits applied to a control chart to establish whether the scatter of the data is due entirely to random influences. Note: When associated with 95 % confidence levels, they are termed 'inner' or 'warning' limits (if all the data lie within these limits then the measurement system can be said to be in control). When associated with 99 % confidence levels they are termed 'outer' or 'action' limits and are used to detect any outliers which may indicate that the measurement system is out of control.	
Conventional true value	Value attributed to a particular quantity and accepted sometimes by convention, as having an uncertainty appropriate for a given purpose. Note 1: 'Conventional true value' is sometimes called assigned value, best estimate of the value, conventional value or reference value. 'Reference value', in this sense, should not be confused with 'reference value' in the sense used in the note to (the term 'reference conditions'). Note 2: Frequently, a number of results of measurements of a quantity are used to establish a conventional true value.	ISO VIM 1993:1-20
Cool-down	Process of lowering the temperature in a cargo tank to achieve appropriate loading temperatures, prevent undue stress on the tank and minimise excessive cargo evaporation/flashing.	

Term	Definition	Reference
Coriolis meter	Flowmeter which uses the interaction between the mass flow of the fluid and the oscillations of the vibrating conduits for mass flow metering purposes. Note: The Coriolis meter can also be used as a continuous density meter.	
Correction factor	Numerical factor by which the uncorrected result of a measurement is multiplied to compensate for systematic error. Note: Since the systematic error cannot be known perfectly, the compensation cannot be complete.	*
Critical zone	Level range, close to the bottom of a floating roof tank, in which there are complex interactions and effects as the floating roof comes to rest on its legs. Note: The zone is usually clearly marked on tank capacity tables. Measurements for custody transfer purposes should not be made within it.	*
Crude oil washing (COW)	Use of a high-pressure stream of crude oil cargo to dislodge or dissolve clingage and sediments from the bulkheads, bottom and internal tank structures of a vessel during the discharge operation.	
Cutter stock	Diluent material used for tank washing, acting as a solvent or viscosity reducer to enable better recovery of ROB. It may be heated.	
Deadwood	Any tank fitting which affects the capacity of a tank.	*
Density	Mass divided by volume. Note 1: When reporting the density, the unit of density used, together with the temperature and pressure, shall be stated. The standard reference temperature for international trade in petroleum and its products is 15 °C but other reference temperatures may be used for legal metrology or other purposes (60 °F is used in the USA). The standard reference pressure is 101,325 kPa however 100 kPa is sometimes used. Note 2: The preferred unit is the kilogram per cubic metre, but provision is also made for use of the gram per millilitre.	*
Density (relative); Relative density	Density of the fluid divided by the density of a reference fluid both at stated conditions. The reference fluid is frequently water but may be the product at a stated standard condition. Note: This term replaces the former 'specific gravity'.	

Term	Definition	Reference
Density (relative; ideal gas); ideal gas relative density	Ratio of the molecular mass of the gas to that of air. It is a constant value irrespective of temperature and pressure.	
Detectors	Devices that sense precisely, by direct or indirect means, the displacer each end of the prover's calibrated volume. Note: For small volume provers the detectors are usually mounted externally for measuring the distance travelled by the piston rod connected to the internal displacer.	*
Dip; (USA 'innage' or 'gauge')	Depth of a liquid in a tank.	*
Dip – average	Average depth of liquid in a tank, including any free water when present, calculated as the arithmetic mean of the repeat measurements obtained.	
Dip – average water	Average depth of any free water in a tank, calculated as the arithmetic mean of the repeat measurements obtained.	
Dip – equivalent	Depth of liquid in a tank corresponding to a given ullage, obtained by subtracting the observed ullage from the reference height.	
Dip-hatch; gauge-hatch	Opening in the top of a tank through which gauging and sampling operations are carried out.	*
Dip-plate; datum-plate; dipping datum-plate	Striking-plate positioned below the dip-hatch. Note: Its position should not be affected by bottom or wall movements.	*
Dip point; dipping datum-point	Point on the dip-plate which the dip-weight touches during gauging and from which the measurements of the oil and water depths are taken. Note: The dip point usually corresponds with the datum-point, but when this is not so the difference in level between the datum-point and the dip point has to be allowed for in the calibration table (see <i>dip-plate</i>)	*
Dip-rod; Dip-stick	Rigid length of wood or metal usually graduated in units of volume or length, for measuring quantities of liquid in a tank.	*
Dip-tape; gauging tape	Graduated steel tape used for measuring the depth of oil or water in a tank, either directly by dipping or indirectly by ullaging.	

Term	Definition	Reference
Dip-weight	Weight attached to a steel dip-tape, of sufficient mass to keep the tape taut and of such a shape as to facilitate the penetration of any sludge that might be present on the dip-point or the dip-plate.	*
Displacement meter; PD meter; positive displacement meter	Meter which measures the volume flowing in a closed conduit by dividing it into discrete quantities by means of a close-fitting or semi-rotary assembly in the meter body. Note: The quantity passing through the meter is a function of the number of operating cycles of the assembly.	*
Displacer (tank gauging)	Surface-detecting element which is suspended from a level gauge and moves in a vertical direction to follow the change in liquid level.	*
Displacer (provers)	Sphere or a piston which sweeps out the calibrated volume of a pipe prover.	
Dissolved water	Water contained within the oil forming a solution at the prevailing temperature.	
Drain sample	See <i>sample – drain</i> .	
Drain time; Draining time	Time required to drain a primary or secondary volumetric measure according to its calibration certificate.	*
Drying	Process of removing moisture using ambient or heated inert gas with a suitable dew point.	
Dynamic slip	Meter error at reduced flowrate (typically 20 % of maximum operating flow rate).	
Electronic correction factor (ECF)	Multiplier applied in a flow computer to the meter factor (MF) to linearise the performance of the meter, having a nominal value of unity (1). Typically: Measured litres = input pulses x MF x ECF.	
Electronic head	Electronic device fitted to a flowmeter that has real-time data-processing capability and enables correction factors to be applied continuously to the meter output registered by the device.	*
Emergent stem error correction	Correction applied to the reading of a liquid-in-glass thermometer where its insertion is less than that under which it was calibrated.	
Emission factor	Value representing the mass of CO ₂ emitted as a result of producing energy from the fuel, kg/TJ. For offshore operations, this may also be reported in simple mass units – te CO ₂ per te fuel.	

Term	Definition	Reference
Error	Result of a measurement minus the (conventional) true value of the measurand. Note 1: The term relates equally to – the indicated measured quantity - the uncorrected result - the corrected result. Note 2: The known parts of the error of measurement may be compensated by applying appropriate corrections. The error of the corrected result can only be characterised by an uncertainty. Note 3: 'Absolute error', which can have a positive or negative value, should not be confused with absolute value of an error, which is the modulus of an error.	
Error (relative)	Error divided by the true value of the measurand. Usually expressed as a percentage.	
External-loop sampler	Sampler with piping external to the main pipeline through which part of the flow is diverted, so that the place at which the grab is extracted is outside the main pipeline.	
FAEE	Fatty acid ethyl esters derived from vegetable oils or animal fats with ethanol.	
FAME	Fatty acid methyl esters derived from vegetable oils or animal fats with methanol.	
Filling limit	Maximum liquid volume that can be safely loaded in a cargo tank as per the Gas Codes expressed as a percentage of the total volume of the tank.	
'First foot' sample	See <i>sample – first foot</i> .	
Fiscal regime	Laws governing the amount of tax payable to Government as a result of an Operator's production from an oil or gas field.	
Fixed roof tank	Normally a vertical cylindrical storage vessel with either a conical or dome-shaped roof. The tank may be of the non-pressure or freely-vented type or it may be of the low pressure type.	
Flashing	Formation of vapour when the local pressure at a point within the liquid falls below the saturated pressure of the liquid at the operating temperature.	
Float	Sensor, floating on or in the liquid in a container, which moves in a vertical direction to follow the changes in liquid level.	
Floating cover; internal floating cover; floating deck (internal)	Lightweight cover of either metal or plastics material designed to float on the surface of the liquid in a tank. Note: The cover rests upon the liquid surface. The device is used to retard evaporation of volatile products in a tank.	*

Term	Definition	Reference
Floating roof correction; roof displacement	Volume correction required for the effect on liquid level caused by the displacement action of the floating roof of a floating roof tank. It is derived by dividing the weight of the floating roof or cover by the density of the liquid at measured conditions.	
Floating roof tank; external floating roof tank	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 taken through its supports by the tank bottom.	*
Flow conditioner	Device inserted in a conduit to reduce the straight length needed to obtain a regular velocity distribution.	*
Flow conditioning	General term describing methods for eliminating the effect of irregular velocity distribution (swirl and asymmetry) in the pipework upstream of the meter.	*
Flowmeter	A flowmeter usually consists of a primary flow device which produces a signal proportional to the rate or quantity of flow, and a secondary device or devices to convert the signal into a more usable form for final display. Flowmeters are categorised by their theory of operation into differential pressure, velocity, area and force, and/or by the applied technology used, such as orifice, turbine, vortex, ultrasonic, magnetic, etc.	*
Flying-start and -stop	Procedure which involves obtaining the opening and closing meter readings of the proof whilst the meter is in operation and flow continues at the proving rate.	*
Four-way valve	High-integrity flow-reversing valve used with many bi-directional pipe provers.	
Free water	Water that exists as a separate layer within a tank. Note: Typically it lies beneath the oil.	*
Full cycle washing	Crude oil washing operation in which the complete cargo tank is washed.	
Gas to C4	Abbreviation for the percent mass of hydrocarbon gases at normal temperature and pressure from C1 to C4 inclusive, present in crude oil.	
Gasoline-finding paste	See <i>product-finding paste</i> .	
Gassing-up	Process of replacing an inert atmosphere in a tank with the vapour from the next cargo to a suitable level to allow cooling down and subsequent loading.	

Term	Definition	Reference
Gating	Initiation and cessation of pulse totalisation in a counter, e.g. by pipe prover detectors.	*
Gauged volume (also gross measured volume)	Volume of oil including total water and total sediment at measured conditions but without adjustment for the volume displaced by the floating roof (where applicable).	
Gauging	Process of taking all the necessary measurements in a tank in order to determine the quantity of liquid which it contains. Note 1: In the French language, the term <i>jaugeage</i> also covers all the measurement operations made to measure the tank capacity up to one or several level(s).	
Gauging – closed	Process of taking measurements within a tank under closed conditions which do not permit the release of any liquid or vapour to atmosphere.	
Gauging – open	Process of taking manual measurements within a tank via an open gauge hatch or gauging access point. Note: When the tank ullage space is pressurised, it will normally be necessary to use other (closed or restricted) procedures to avoid de-pressurising the tank and the consequent loss of volatile organic compounds (VOCs).	
Gauging – restricted	Process of taking measurements within a tank using equipment which is designed to reduce substantially or minimise the vapour losses that would occur during open gauging, but where the equipment is not completely gas-tight.	
Gauging access point	Opening at the top of a tank through which gauging and sampling operations are carried out. Note: In the case of open operations, the gauging access point will normally be a gauge hatch. In the case of closed or restricted operations, the gauging access point will normally be a vapour lock valve.	
Gauging device (portable electronic)	Portable instrument employing electronic or electrical sensor(s) for the measurement of liquid level, temperature and/or water interface. Note: Other, optional measurements such as density may also be provided.	

Term	Definition	Reference
Gauging reference point; reference gauge point; upper datum; dipping reference point; upper reference datum; upper reference point	Point clearly marked on the gauging access point or on a plate suitably located just above or below the gauging access point, to indicate the position (and upper datum) from which measurements shall be made.	
Grab	When a sampler operates intermittently, repeatedly taking a small part from the whole volume of interest, then each small part is called a grab and the sum total of all the grabs is the sample.	
Gross calorific value (GCV)	Quantity of heat produced by combustion at constant pressure and under 'normal' conditions (i.e. to 0 °C and under a pressure of 1,013 mbar) with the water produced by combustion in the liquid state. Also known as 'higher' or 'superior' calorific value. This effectively means that the latent heat of vaporisation of water is recovered as useful energy.	
Gross observed volume (GOV)	Volume of oil including dissolved water, suspended water and suspended sediment but excluding free water and bottom sediment, at measured conditions. Note 1: This may be either the volume in a tank or the difference between the volumes before and after a transfer. Note 2: The acronym GOV is generally used rather than the full term.	*
Gross standard volume (GSV)	Volume of oil including dissolved water, suspended water and suspended sediment but excluding free water and bottom sediment, calculated at standard conditions. Note 1: This may be either the volume in a tank or the difference between the volumes before and after a transfer. Note 2: The acronym GSV is generally used rather than the full term.	*
Gross volume (GV) – dynamic	Indicated volume multiplied by the meter factor appropriate to the liquid and flowrate, without correction for temperature and pressure.	*

Term	Definition	Reference
Gross weight-in-air	Weight of oil including dissolved water, suspended water and suspended sediment but excluding free water and bottom sediment. Note: Since, by definition, all commercial weights are 'in air', the term is only included for sake of clarity and general usage.	
Gross weight-in-vacuo	Used as mass for most practical purposes. However, for true mass, the effects of gravity need to be considered.	
High viscosity crude oil	Crude oil which due to its viscosity alone requires heating during transportation, COW or discharge. These types of crude oil generally have a high aromatic content and may have the designation aromatic crude oil.	
Hydrant dispenser	Self-propelled or towable vehicle that is used to refuel aircraft but which requires an external supply of aviation fuel.	
Identification marks	Marks on a dip-tape that record the temperature and tension at which the tape was calibrated. Note: Other marks may include the total length of the tape and/or its conformance with a Standard.	
Indicated depth	Reading on an indicator, or that displayed by a liquid level gauge.	
Inert gas (IG)	Non-flammable gas or gas mixture used to render the vapour space above the cargo non-flammable.	
Inerting	Process of purging and/or displacing a potentially flammable mixture from a cargo tank or other space with inert gas.	
Inhibitors	Compound (usually organic) that retards, controls, or stops an undesired chemical reaction, such as corrosion, oxidation, or polymerisation.	
Injector cycle	One complete operation of the additive injector. For a shuttle injector, this comprises a forward and reverse stroke of the injector piston initiated by receipt of one control pulse.	
Injector stroke	Swept volume or distance in one direction of the piston of a shuttle injector.	
In-line blending system	Ratio-controlled additive injection system with full feed-back and continuous corrective action. A flowmeter in the main product line provides the master signal which is adjusted for the blend ratio and is the set flow rate for a secondary control loop in the additive feed line, which comprises a meter, flow controller and control valve.	
In-line sampler	Sampler with mechanical parts inside the pipeline so that the place at which the grab is separated from the whole is in the pipeline.	

Term	Definition	Reference
In-transit loss; in-transit difference	Difference between the total calculated volume immediately after a loading and the total calculated volume before discharge.	*
Isokinetic sampling	If, at the point at which the sample separates from the main flow, the velocities of both the sample and the main flow are equal, then the sampling is said to be isokinetic.	
K coverage factor (k)	Numerical factor used as a multiplier of the combined standard uncertainty in order to obtain an expanded uncertainty: k is typically in the range 2 to 3.	
K-factor	Number of pulses generated by a meter while a unit of volume is passing through it.	*
Laminar flow	Where the motion of the fluid particles is along the pipe axis and the friction factor is related to the flowrate.	
Letter of protest (LOP); notice of apparent discrepancy (NOAD)	Letter issued by any participant in a custody transfer citing any condition with which issue is taken. Note: This serves as a written record that the particular action or finding was questioned at the time of occurrence.	*
Linearity factor	Factor used in monitoring the degree of non-linearity of a PD or turbine meter measuring capsule when fitted with an electronic head. Linearity factor (LF) is calculated as follows: $LF = ((F100-F20)/F100) \times 100 \%$ <p>where:- F20 is final meter factor, K factor or error at 20 % flowrate F100, is final meter factor, K factor or error at 100 % flowrate</p> <p>Note: Some meter manufacturers adopt the inverse convention for this factor.</p>	
Linearity (meter)	The change in performance (meter factor, K factor or error) over a stated range of flows.	*
Liquefied natural gases (LNG)	Liquefied hydrocarbon gas composed predominantly of methane, usually maintained in a liquid state by refrigeration.	

Term	Definition	Reference
Liquefied Petroleum Gas (LPG)	Hydrocarbons, principally propane (C3) and butane (C4), in a mixture or essentially pure form with components ranging from ethane (C2) through normal hexane (C6) maintained in a liquid state by the reduction of temperature and/or application of pressure. A type of natural gas liquid (NGL).	
List	The tilt or inclination of a vessel, expressed in degrees port or starboard away from the vertical.	
List correction	Correction to the observed tank measurement or observed quantity when a vessel is listing, which can be applied provided that liquid is in contact with all bulkheads in the tank. Correction for list may be made by reference to the vessel's list correction tables for each tank or by mathematical calculations.	
Load on top (LOT)	Procedure of comingling the on-board quantity (OBQ) with the cargo being loaded. Note: The OBQ may remain in cargo tanks from the previous voyage or, where water and oil mixtures are collected in a vessel's slop tank during a ballast voyage as a result of water washing of cargo tanks, may comprise oil slops after settled water is decanted.	
Long-term meter error	Scatter of the means of sets of meter factors, carried out over intervals of time i.e. days, weeks, months etc. Note: $U = t_{95, n-1} s(z)$, where $s(z)$ is the standard deviation of the mean meter-factor values.	*
Lower sample	See <i>sample – lower</i> .	
MARPOL	Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973, amended 1992.	
Mass	Absolute measure of a particular 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). 0,001 kg = 1 gram 1 000 kg = 1 metric tonne (tonne)	
Master dip-tape	A calibrated dip-tape or dip-tape/weight combination, traceable to national standards of length, which is normally reserved to measure other tapes.	

Term	Definition	Reference
Measurand	The quantity being measured under the given set of conditions.	
Measurement	Act of determining quantity and/or quality of product.	
Measurement standard	Material measure, measuring instrument, reference material (RM) or measuring system intended to define, realise, conserve or reproduce a unit or one or more values of a quantity to serve as a reference (ISO VIM). A measurement standard is whatever is deemed to be a reference (even though it may not be ideal), and may be a primary standard, secondary standard or tertiary standard or may not even be traceable to a standard.	*, ***
Meniscus	Curved surface of a liquid created by surface tension effects at the point where a solid body is in contact with the liquid surface.	
Meter (multiphase)	Flowmeter designed to measure the flowrate of the individual phases within a multiphase flow. Such meters generally employ several measurement techniques in combination, with significantly higher measurement uncertainty than found in single phase flow.	
Meter factor	Ratio of the actual volume of liquid passed through a meter during proving to the volume indicated by the meter. Note: In practice this is the prover volume divided by the meter reading during proving, each volume being at the same conditions or corrected to the same conditions.	
Meter factor-2	Ratio of the K-factor obtained on proving a meter to the original or nominal (maker's figure) K-factor. Note: Flow computers may use the original K-factor and then apply a meter factor to calculate measured volumes. Alternatively a new K-factor may be used in the calculation and no meter factor applied.	
Meter under test (MUT)	Meter undergoing calibration.	
Metered-shot injector	Injection system that uses a positive displacement flowmeter to control the volume of additive delivered for each injection cycle.	
Metering system	Assembly comprising the flowmeter and all ancillary devices that influence, calculate, register and indicate the quantity of liquid passing through the measurement device.	

Term	Definition	Reference
Method statement	Document describing a working procedure that specifies the steps/actions to be followed to undertake a specific task in a safe and efficient manner.	
Middle sample	See <i>sample – middle</i> .	
Multiphase flow	Flow stream containing a mixture of more than one component, e.g. oil, water and gas.	
Multi-tank composite sample; ship's composite sample	See <i>sample – multi-tank composite; ship's composite</i> .	
Net observed volume (NOV)	Volume of oil excluding total water and total sediment measured at the oil temperature and pressure prevailing. Note 1: This may be either the volume in a tank or the difference between the volumes before and after a transfer. Note 2: The acronym NOV is generally used rather than the full term.	*
Net standard volume (NSV)	Volume of petroleum liquids, excluding sediment and water, corrected to standard conditions of temperature and pressure. Note 1: This may either be the volume in a tank or the difference between the volumes before and after a transfer. Note 2: The acronym NSV is generally used rather than the full term.	*
Net volume – dynamic	Gross volume minus the volumes of water and sediment transferred through the meter. Note: In practice calculation is often made by multiplying the GV by a correction factor derived from the percent volumes of water and sediment present.	*
Net weight-in-air	Weight of oil excluding total water and total sediment. Note: Since, by definition, all commercial weights are 'in air', the term is only included for sake of clarity and general usage.	
Nominal capacity	Designated volume of a container or tank.	
Non-pressure tank	Storage tank designed for operation at atmospheric pressure.	*
Notice of apparent discrepancy (NOAD)	See <i>letter of protest</i> .	
On board blending	Blending of two or more different products in a ship's cargo tank(s) by pumping between tanks or using ship's pumps to circulate within a tank.	

Term	Definition	Reference
On board quantity (OBQ)	Material present in vessel's cargo tanks immediately before the vessel is loaded. On-board quantity may include any combination of water, oil, slops, oil residue, oil/water emulsions, and sediment.	
Open capacity	Calculated capacity of a tank or part of a tank before allowance has been made for deadwood or, if necessary, the floating roof.	
Outage	See <i>ullage</i> .	*
Outlier	Observed value which appears to be inconsistent with the remainder of the set of data.	(ISO 4006)
Outturn	Quantity of a cargo, as measured by the receiving terminal or facility.	
Outturn certificate	Statement issued by a receiving party certifying the outturn.	*
Outturn loss	Difference, in net standard volume, between the quantity shown on the bill of lading and the quantity shown on the outturn certificate. Note: It may be expressed as a volume or as a percentage of the bill of lading quantity.	*
Partial capacity	Capacity of a tank corresponding to a given level.	
Pass	One single movement of the displacer between two detectors in a pipe prover or compact prover.	*
Pipeline (shared)	Pipeline shared by a number of operators, but operated by a single entity. Users generally pay tariffs to the pipeline operator.	
Pour point	Lowest temperature (°C) at which an oil will continue to flow when it is cooled under specified standard conditions.	
Precision	Closeness of agreement between the results obtained by repeating measurements in the same manner of the same parameter or quantity under specified conditions. Note 1: Measurement precision is usually expressed numerically by measures of imprecision, such as standard deviation, variance, or coefficient of variation under the specified conditions of measurement. Note 2: Refer to ISO VIM: 2007, Section 2.15 for a more detailed definition.	***
Primary delivery measure; primary volumetric measure; primary measure	Volumetric standard, traceable to national standards and capable of a high degree of resolution and accuracy, that is calibrated gravimetrically using water, normally by a national standards body.	*

Term	Definition	Reference
Primary device	Device mounted in or on the main conduit which produces a signal with a defined relationship to the flow rate in accordance with known physical laws. The primary device may consist of one or more elements necessary to produce the output signal.	
Primary level measurement system	Calibrated and certified level measurement system designated for the determination of official vessel quantities when used in conjunction with the certified capacity tables of the vessel.	
Principal; client	The company or organisation which has contracted another party (eg an inspector or expeditor) to perform services relating to measurement, sampling, analysis or transfer of a parcel of petroleum or related products. Note: more than one principal may be involved in a contract.	
Product-finding paste; ullage paste; gasoline-finding paste	Paste used to facilitate reading the liquid level on the scale of a dip-tape, dip-rod, ullage-rule or ullage rod when gauging products which are volatile or do not give a clear cut on the gauging device.	
Profile testing	Experimental programme to examine the variation of the property of interest (usually water content in oil) across the diameter (usually vertical) of a pipeline (usually horizontal).	
Programmable logic controller (PLC)	Programmable, electronic device that is used to control a sequence of operational steps in an operating facility.	
Prover	Reference device used to calibrate liquid flowmeters. Flowmeter measurement is compared against a known volume of fluid determined by the prover.	
Prover (pipe); pipe prover	Meter-proving device consisting of a section of pipe in series with the meter and through which the liquid flows during the proving run. Note 1: The pipe is constructed to close tolerances and contains a displacer which sweeps an accurately determinable volume of liquid between the detectors. Note 2: Pipe provers are divided into two types: conventional pipe provers or small volume provers.	*
Proving	Set of operations that establish, under specified conditions, the relationship between the values of quantities indicated by a device and the corresponding values as determined by a traceable reference device (proving system).	

Term	Definition	Reference
Proving run	Operation of comparing the meter under test with a reference device to derive a single determination of the meter factor or K-factor. A number of consecutive proving runs carried out under the same operating conditions are required to obtain an average meter factor or K-factor and a repeatability figure.	
Proving tank	Volumetric standard, normally a secondary measure, and usually consisting of a cylindrical section with a conical top and bottom and a cylindrical neck calibrated either in units of volume or in steps corresponding to fractions of a percentage of the tank volume.	*
Pulse interpolation	Electronic technique for enhancing the resolution of a gated pulse count.	
Radio frequency interference (RFI)	All equipment utilising the emission of radio frequencies require a radio licence. Exceptions apply to very low power equipment operating in certain frequency bands (refer to current Radio Communications Agency Regulations).	***** Refer also to the British Standard, BS 6656
Random error	Result of a measurement minus the mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions. Note 1: Random error is equal to error minus systematic error. Note 2: Because only a finite number of measurements can be made, it is possible to determine only an estimate of random error (VIM 1993: 3-13).	*
Random uncertainty (U_r)	Component of uncertainty associated with a random error. Note 1: Its effects on the mean value can be reduced by taking many measurements. Note 2: The symbol e is sometimes used instead of U to designate uncertainty.	*
Range (during proving, calibration)	Numerical difference between the extreme values of a number of consecutive measurements obtained over a short period of time for the same value of input.	*
Range (device)	Extent of parameters within which a device should perform within specified limits.	

Term	Definition	Reference
Reference conditions of measurement	Conditions of use prescribed for testing the performance of a measuring instrument or for inter-comparison of results of measurements. Note: The reference conditions generally include reference values or reference ranges for the influence quantities affecting the measuring instrument.	*
Reference gauge height; reference height	Distance between the dip datum point and the upper reference point.	*
Reference gauge point	Point from which the liquid depth is measured.	*
Reference gauging	Manual gauging employing equipment and procedures that minimise the gauging uncertainty. Note: Reference gauging is sometimes termed referee gauging.	
Reference meter; master meter	Flowmeter employed to prove other flowmeters. Note: This meter is usually proved over a range of flowrates and on products of varying viscosity in order to derive a number of corrections which can be applied to bring meter readings to standard conditions.	*
Reference standard; transfer standard	A standard, generally having the highest metrological quality available at a given location or in a given organisation, from which measurements made there are derived (ISO VIM). A reference standard is usually a primary standard or a secondary standard.	*, ***
Refrigerated hydrocarbon liquids	Liquids composed predominantly of hydrocarbons, which are stored in a fully refrigerated condition at pressures near to atmospheric.	
Reid vapour pressure (RVP)	Absolute pressure exerted by the gas produced by evaporation from the liquid, as measured by Reid apparatus under the specific conditions of test temperature, vapour/liquid ratio and air saturation.	
Remaining on board (ROB)	Sum of liquid volume and non-liquid volume in cargo tanks just after discharge has been completed, excluding clingage, hydrocarbon vapours and the contents of associated pipelines and pumps. Note: The acronym ROB is generally used rather than the full term.	*

Term	Definition	Reference
Repeatability	<p>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 or process at the same location, over a short period of time. Repeatability characterises the ability of an instrument or measurement process to give indications which are unaffected by random errors. It is usually reported as a total spread and not as a plus/minus deviation from the mean.</p> <p>Note 1: For a more detailed definition see ISO VIM.</p> <p>Note 2: For convenience in the special case of proving a turbine meter with a pipe prover, repeatability is commonly expressed as the difference between the maximum and minimum pulse counts (expressed as a percentage of the mean) for five consecutive tests.</p>	***
Representative sample	<p>Sample having its physical or chemical characteristics identical to the volumetric average characteristics of the total volume from which it is taken.</p> <p>Note: In practice the representative nature of a sample cannot be determined and parties agree to deem a sample which is extracted and prepared in accordance with industry practice as being representative.</p>	
Reproducibility	<p>Closeness of agreement between the results of measurements of the same quantity, performed by different operators, and/or using different equipment and/or at different locations.</p> <p>Note 1: Most frequently applied to laboratory programmes.</p> <p>Note 2: Also occasionally taken to mean the agreement between the results of measurements of the same quantity conducted using the same equipment at the same location, but over a long period of time.</p>	
Resolution	<p>Smallest difference between indications of a displaying device that can be meaningfully distinguished.</p> <p>Note 1: For a digital displaying device, this is the change in the indication when the least significant digit changes by one step.</p> <p>Note 2: This concept also applies to a recording device.</p>	*

Term	Definition	Reference
Restricted gauging	Process of taking measurements within a tank using equipment which is designed to reduce substantially or minimise the vapour losses that would occur during open gauging, but where the equipment is not completely gas-tight.	
Restricted system	Equipment and procedures which allow the contents of a tank to be gauged and/or sampled while minimising the vapour losses which would occur during open gauging, but where the equipment is not completely gas tight.	
Risk assessment	The process of evaluating risks to workers' safety and health from workplace hazards. It is a systematic examination of all aspects of work that considers: <ul style="list-style-type: none"> – what could cause injury or harm – whether the hazards could be eliminated and, if not, – what preventive or protective measures are, or should be, in place to control the risks. 	
Root sum square	Method combining the estimates of standard deviation or uncertainty of a number of independent variables in which the squares of the variables are added and the square root taken of the sum. Note: This method is sometimes termed summing in quadrature.	*
Rotary-tube gauge	Gauging device fitted to horizontal cylindrical pressure tanks, comprising a rotatable dip-tube that detects the liquid surface as the position at which expelled fluid changes phase between liquid and vapour. The rotational angle of the tube is a function of the liquid level.	
Round trip	Movement of the displacer between the detectors of a bi-directional prover that corresponds to a pass in both the forward and reverse directions.	
Round trip volume	Sum of the swept volumes in both the forward and reverse directions in a bi-directional pipe prover.	
Run	Set of consecutive passes that is in any particular case deemed to be necessary to derive a single value of meter factor or K-factor suitable for reporting.	*
Running sample	See <i>sample – running</i> .	
Sample isolation point	Point at which the grab is finally separated from the bulk or bypass flow. It refers to field operations and not to any sub-sampling done in the laboratory.	

Term	Definition	Reference
Sample – all levels	A sample obtained by submerging the sampling device to a point as near as possible to the draw-off level, or just above any free water if higher, then opening the sampler and raising it at a uniform rate such that it is approximately 70 % to 85 % full as it emerges from the liquid. Alternately, all levels samples may be taken with samplers designed for filling as they pass downward through the liquid.	
Sample – bottom	A spot sample collected from the material at the bottom of the tank, container, or line at its lowest point. Note: In practice, the term bottom sample has a variety of interpretations. It is therefore recommended that the exact sampling location (e.g. 150 mm from the bottom) should be specified when using this term.	
Sample – clearance	A spot sample taken with the inlet opening of the sampling device 100 mm below the bottom of the tank outlet. Note 1: Some regulatory agencies require 150 mm. Note 2: This term is normally associated with small tanks (160 m ³ (1 000 bbls) or less), commonly referred to as lease tanks.	
Sample – composite	Sample obtained by combining a number of individual samples in defined proportions with the aim of obtaining a sample representative of the bulk of the product.	
Sample – drain	Sample obtained from the water draw-off point on a storage tank.	
Sample – first foot	Sample drawn from a vessel tank early during a cargo loading, when the depth of product in the tank(s) is approximately 300 mm, which when examined indicates that the product on board is of satisfactory quality and not contaminated by material from the shore line(s), the vessel line system, or the lower areas of the vessel's tank(s). Note: Regulations concerning the dissipation of static charge normally require the cessation of pumping and a relaxation time of 30 minutes before 'first foot' samples are drawn.	
Sample – lower	Spot sample taken at a level of five-sixths of the depth of liquid below the top surface.	
Sample – middle	Spot sample taken at one-half of the depth of liquid.	

Term	Definition	Reference
Sample – multi-tank composite; ship's composite	Individual samples or composite samples obtained from several tanks or ship/barge compartments containing the same grade of material, mixed in proportion to the volume of each tank or compartment from which they were obtained.	
Sample – running	Sample obtained with an apparatus which accumulates the sample while passing in both directions through the total liquid height, excluding any free water. Note: The apparatus passes through the liquid at such a rate that it is approximately 80 % full as it emerges from the liquid.	
Sample – single tank composite	A blend of multiple samples from a single tank, usually prepared from equal quantities of the upper, middle and lower samples for vertical tanks and from a specified ratio of these samples for horizontal tanks (see ISO 3170; API Ch 8.1).	
Sample – skim (surface)	Spot sample taken from the surface of the liquid.	
Sample – tap	Spot sample taken via a tap, typically located on the side of the shore tank.	
Sample – top	Spot sample obtained 150 mm below the surface of the liquid.	
Sample – upper	Spot sample taken at a level of one-sixth of the depth of liquid below the top surface.	
Sample – zone (core, flow through)	Sample taken as that part of the liquid column which is contained within the whole height of the sampler when it is sealed at a single spot location within a tank.	
Sampling	The process of extracting of a small quantity of product from a pipeline or vessel and placing this in a suitable container from which a test specimen can be taken for subsequent analysis.	
Sampling location	Cross-section of the pipeline where the sampling probe is to be located.	
Sampling point	Point at which the sample is separated from the main flow.	
Scaling factor	Numerical factor which converts the pulse count of a meter to the required units of volume.	*
Secondary barrier	Outer container on a double skinned refrigerated installation, i.e. the container on the outside of the insulation and not in contact with the product under normal conditions.	

Term	Definition	Reference
Secondary device	Device that responds to the signal from the primary device and converts it to a display or to an output signal that can be recognised as a quantity.	
Secondary level measurement system	Calibrated and certified level measurement system available for use as backup to the primary level measurement system should an individual primary level measurement device in a level measurement system not function properly.	
Secondary measure	Volumetric standard for field use that is calibrated by means of a primary measure. Note: Petroleum industry practice may lead to the use of another secondary measure, characterised by a smaller 'intrinsic' uncertainty, to make this calibration.	*
Sediment	<ul style="list-style-type: none"> – Suspended sediment: non-hydrocarbon solids present within the oil but not in solution. – Bottom sediment: non-hydrocarbon solids present in a tank as a separate layer at the bottom. – Total sediment: sum of the suspended and bottom sediment. 	
Segregated ballast tankers (SBTs)	Vessels having sufficient dedicated ballast tanks to enable safe seagoing operations under normal weather conditions. See also Ballast - heavy weather.	
Sensing length	Portion of the measuring element of a mercury in glass thermometer which should be fully immersed in the fluid.	
Sensor	Generic term for a float or other form of surface detecting device. Also temperature measuring or pressure measuring device.	
Shot injection	Batch-operated, discontinuous injection in response to a signal based on units of volume e.g. action of both a shuttle and a metered-shot injector as opposed to a continuous injection system controlled by a flow signal.	
Shuttle injector	Piston-type injector mechanism with a single or double (return) reciprocating action whose stroke delivers a constant swept volume.	
Single tank composite sample	See <i>sample – single tank composite</i> .	
Skim sample (surface sample)	See <i>sample – skim sample (surface sample)</i> .	
Slip tube	Graduated hollow rod fitted into a gas-tight housing, the lower end of which is open to the cargo's contents and the upper end is fitted with a valve.	

Term	Definition	Reference
Slip-tube gauge	Ullage gauging device fitted to pressure tanks, comprising a series of graduated ullage tubes of different lengths that are used to detect the liquid surface as the position at which expelled fluid changes phase between liquid and vapour.	
Slop tank(s)	Tank(s) utilised as a reservoir for COW medium and receipt of tank washings.	
Slops	Material collected after such operations as stripping, tank washing or dirty ballast separation. It may include oil, water, sediment and emulsions and is usually contained in a tank or tanks permanently assigned to hold such material.	
Small volume prover	Pipe prover consisting of a honed cylinder, with a piston rod whose linear movement is measured by external (non-invasive) detectors. Note 1: They are typically of smaller dimensions than the equivalent conventional pipe prover. Note 2: May also be a pipe prover designed or used in such a way as to accumulate less than 10 000 whole unaltered pulses for one pass of the displacer.	*
Sounding-pipe	See <i>still-well</i> .	
Spot sample	Sample taken at a specific location in a tank or from a pipeline.	
Spot temperature	Temperature measured with a device which responds to the temperature in its immediate vicinity.	
Standard conditions; standard reference conditions	Conditions of temperature and pressure to which measurements are referred for standardisation. Note 1: For the petroleum industry, these are usually 15 °C or 20 °C and 101.325 kPa. Note 2: OIML R 117 contains another definition, which is parallel and not contradictory.	*
Standard deviation	Measure of the dispersion of a series of results around their mean, equal to the positive square root of the variance and estimated by the positive square root of the mean square. Note: For a more detailed definition refer to ISO 1998-6.30.051-060	*
Standing-start and -stop	Proving technique in which the flow through the meter and the proving device is started at the beginning and stopped at the end of the proving process.	*
Standard uncertainty	The uncertainty of the result of a measurement expressed as one standard deviation around the (assumed) true value.	

Term	Definition	Reference
Static slip	Volume of product passing through a meter at very low flowrates without registering, over a period of one minute. Normally expressed as a percentage of the maximum rated flow rate of the meter.	
Still-well; still-pipe; dip tube; dip pipe; sounding-pipe; stilling well	Vertical pipe built into a tank to contain the liquid-level-detecting element in order to reduce measurement errors arising from liquid turbulence, surface flow, or agitation of the liquid.	*
Striker plate	Curved metal plate having the same radius as the tank shell and located directly under the gauging reference point to provide a fixed contact surface from which liquid level measurements are made.	
Stripping	Removal of the final contents of a cargo tank using equipment additional to the main cargo pumps.	
Suction level sample (outlet sample)	Sample taken at the lowest level from which liquid hydrocarbon is pumped from the tank.	
Superintendent; loss control consultant; cargo expeditor; client representative; charterers representative	Individual engaged to oversee a cargo transfer operation, usually on behalf of one of the contracting parties.	
Suspended sediment	See <i>sediment</i> .	
Suspended water	Water contained within the oil that is finely dispersed as small droplets. Note: It may over a period of time, either collect as free water or become dissolved water, depending on the conditions of temperature and pressure prevailing.	*
Swirl	Condition of flow in which the liquid flowing through the pipework upstream of a meter rotates and fluctuates in velocity relative to the average flowrate. Note: Flow conditioning is one method employed to eliminate this undesirable effect.	*
Systematic error (bias)	Mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions minus the true value of the measurand. Note 1: Systematic error is equal to error minus random error. Note 2: Because only a finite number of measurements can be made, it is possible to determine only an estimate of random error.	*, ***(ISO VIM 1993: 3-13)

Term	Definition	Reference
Systematic uncertainty (<i>Us</i>)	Component of uncertainty associated with a systematic error. Note 1: Its effect cannot be reduced by taking many measurements. Note 2: The symbol <i>e</i> is sometimes used instead of <i>U</i> to designate uncertainty.	*
Tank capacity, 100 %	Total volume enclosed by a tank. The vapour volume is determined by subtracting the liquid volume from the 100 % tank capacity.	
Tank reference height:	Height between the dipping datum-point and the tank upper reference datum.	
Tap sample	See <i>sample – tap</i> .	
Tape	Graduated metal ribbon or wire.	
Thermowell	Metal pocket which protrudes through the wall of a pipe or tank and holds the sensing element of a temperature measuring device.	*
To contain	Mode of calibration and use of a volumetric standard measure designed to contain a precise, known liquid volume when filled from its 'empty' condition. The empty condition, described on its calibration certificate, may be a dry condition or a wet condition achieved by pre-filling, emptying and draining for a prescribed time.	
To deliver	Mode of calibration and use of a volumetric standard measure designed to deliver a precise, known liquid volume when emptied from its full condition and drained in accordance with conditions specified on its calibration certificate.	
Top sample	See <i>sample – top</i> .	
Total calculated volume (TCV)	Gross standard volume plus the free water measured at the temperature and pressure prevailing. Note: The acronym TCV is generally used rather than the full term.	*
Total immersion thermometers	Thermometers that have been designed and calibrated to be used with the thermometer bulb and liquid column immersed such that whatever the temperature only about 1 mm of the liquid column protrudes.	
Total observed volume (TOV)	Volume of oil including total water and total sediment, measured at the oil temperature and pressure prevailing. Note 1: This may be either the volume in a tank or the difference between the volumes before and after a transfer. Note 2: The acronym TOV is generally used rather than the full term.	*

Term	Definition	Reference
Total sediment	See <i>sediment</i> .	
Total water	Sum of all the dissolved, suspended and free water in a cargo or parcel of oil.	
Traceability	Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties. Note 1: The concept is often expressed by the adjective traceable. Note 2: The unbroken chain of comparisons is called a traceability chain.	*, *** (VIM 1993:6-10)
Trim	Difference between the fore and aft draught of the vessel. Note: When the aft draught is greater than the forward draught, the vessel is said to be trimmed by the stern. When the aft draught is less than the forward draught, the vessel is said to be trimmed by the head.	*
Trim correction	The correction applied to the observed gauge or observed quantity when a vessel is not on an even keel, provided that the liquid is in contact with all bulkheads in the tank. Correction for the trim may be made by referencing trim tables for each tank or by mathematical calculation.	
True value	Value consistent with the definition of a given particular quantity. Note 1: This is a value that would be obtained by a perfect measurement. Note 2: True values are by nature indeterminate. Note 3: Although VIM recommends the indefinite article 'a', rather than the definite article 'the' in conjunction with 'true value' because there may be many values consistent with the definition of a given particular quantity, it is widely in use in the petroleum industry to speak of 'the true value'.	*, *** (Adapted from VIM 1993:1-19)
True vapour pressure (TVP)	Absolute pressure exerted by the gas produced by evaporation from a liquid, when the gas and liquid are in equilibrium at the prevailing temperature.	
Turbine meter	Meter which provides a pulsed output at a frequency proportional to the angular velocity of a bladed rotor mounted in the meter body and driven by the fluid flow. Note: The output is proportional to the volumetric flowrate of the fluid.	*
Turndown ratio	Effective flow range over which the meter factor is linear.	*

Term	Definition	Reference
Type A evaluation	Method of evaluation of uncertainty by the statistical analysis of a series of observations.	
Type B evaluation	Method of evaluation of uncertainty by means other than the statistical analysis of a series of observations.	
United Kingdom Continental Shelf (UKCS)	Area of sea bed and subsoil, beyond the territorial sea, over which the UK exercises sovereign rights of exploration and exploitation of natural resources.	
Ullage; (USA – 'outage')	Distance between the surface of a liquid in a tank and the gauging reference point on the top of the tank. Note: The term can also describe the capacity of a tank not occupied by the liquid (strictly 'ullage space').	*
Ullage hatch; ullage port; ullage plug	Marine terms for a manual gauge-hatch fitted with a heavy duty cover.	
Ullage paste	See <i>product-finding paste</i> .	
Ullage reference point	See <i>gauging reference point</i> .	
Ullage-rod; ullage-stick	Rigid length of wood or other material, graduated in units of volume or length, for measuring by ullage the quantity of liquid in small tanks which have been calibrated in terms of ullage.	
Ullage-rule	Graduated rule attached to a dip-tape to facilitate the measurement of ullage where it would not be practical to obtain a tape cut, for example when gauging viscous, waxy or heated oils.	
Uncertainty (U)	Estimate characterising the range of values within which the true value of a measurand lies. Note 1: The symbol e is sometimes used instead of U to designate uncertainty. Note 2: Uncertainty of measurement comprises, in general, many components. Some of these components may be estimated on the basis of the statistical distribution of the results of a series of measurements and can be characterised by experimental standard deviations. Estimates of other components can only be based on experience or other information.	*

Term	Definition	Reference
Uncertainty (<i>U</i>) (expanded) ($U = kuc$)	Quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand: the fraction may be viewed as the coverage probability or the level of confidence of the interval.	
Uncertainty (combined standard)	Standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or covariance of these other quantities weighted according to how the measurement result varies with changes in these quantities.	
Uncertainty (<i>U</i>) (standard)	Uncertainty of the result of a measurement expressed as a standard deviation.	
Uncertainty analysis	Process of determining the uncertainty in a measured or calculated parameter.	
Unheated oil	Oil not artificially heated above ambient conditions.	
Upper sample	See <i>sample – upper</i> .	
Validation (of data)	Process of verifying that measurement or calculated data are correct, either by comparing against an independent measurement or calculation, or by analysing past data for trends, changes etc.	
Vapour	Fluid in the gaseous state which may consist of: <ul style="list-style-type: none"> – hydrocarbons in the gaseous state; – air; – inert gases, or – any combination thereof. 	
Vapour control valve (VCV); Vapour lock valve (VLV)	Valve, usually with connector above it, fitted to the top of vapour tight or pressurised tanks to permit manual measurement and/or sampling operations to be carried out with little or no loss of vapour.	
Vapour pressure; saturated vapour pressure	Pressure exerted by the vapour above a liquid in equilibrium at a given temperature.	
Verification	Confirmation by examination and the provision of objective evidence that the specified requirements have been fulfilled.	
Vessel discharge ratio (VDR)	Total calculated quantity (TCV) by the vessel measurement on arrival, less remaining on board (ROB), divided by the TCV by shore measurement at discharge.	

Term	Definition	Reference
Vessel experience factor (VEF); VEFL; VEFD	Mean value of the vessel load ratios (VLR) or vessel discharge ratios (VDR) obtained using a set of qualifying voyages. Note 1: The number of such qualifying voyages is normally a minimum of five. Note 2: Depending on the determination, it is expressed as VEFL (VEF on loading) or VEFD (VEF on discharging).	*
Vessel experience factor (compartmental); compartmental VEF	VEF based on ratios of only a specific vessel cargo compartment (tank) and corresponding shore quantities based on the standards as described for generating a valid VEF.	
Vessel experience factor (partial)	VEF based on ratios of a specific set of compartments, or amount less than 75 % of a vessel capacity, with corresponding shore quantities based on the standards as described for generating a valid VEF.	
Vessel load ratio (VLR)	Ratio of the quantity (TCV) measured on board a vessel immediately after loading less the on-board quantity (OBQ) to the quantity (TCV) measured by the loading terminal, i.e. $VLR = (\text{vessel's TCV after loading} - \text{OBQ}) / \text{shore TCV loaded}$.	
Viscosity	Measurement of a fluid's resistance to flow at a prescribed temperature.	
Volatile crude oil	Crude oil, having a high concentration of components boiling below ambient temperature (gas to C4), which results in excessive gas evolution if used as a COW medium.	
Volatile organic compounds (VOCs)	Large family of carbon-containing compounds which are emitted or evaporate into the atmosphere and can take part in photochemical reactions in the air.	
Volume	Primary unit of volume is the cubic metre. Note: This is derived from the SI unit of length, the metre (m), which was originally defined by two marks on a metal bar at a specified temperature, but is now defined by a specified number of wavelengths of a specified type of radiation. The unit of volume known as the litre has had a number of different definitions in the past, but that now commonly used is the SI litre which is one-thousandth part of a cubic metre. The unit of volume still commonly used in the oil industry is the barrel, which was defined as 42 US gallons, but is now defined by the relationship that 1 cubic metre equals 6,28981 barrels.	

Term	Definition	Reference
Volume – base	Calibrated volume of a pipe prover at standard conditions of temperature and pressure.	
Volume – calibrated	Volume at a stated temperature and pressure between the detectors in a pipe prover, or the volume of a proving tank between empty and full levels. Note: The calibrated volume of a bi-directional prover is the sum of the two swept volumes between detectors during a round trip.	
Volume correction factor (VCF) (also termed Ctl in dynamic calculations)	Factor for correcting oil volumes to a standard reference temperature.	*
Volumetric standard measure	Primary or secondary measure used in the calibration of other volumetric devices, e.g. meters, provers, vessels.	
Wall wash test	Procedure for washing selected areas such as the interior bulkheads, tank bottoms and sumps of cargo tanks with an appropriate wash liquid and testing the wash liquid for the presence of material which might contaminate cargo to be loaded.	
Water – dissolved	Water contained within the oil forming a solution at the prevailing temperature.	
Water – free	Water that exists in a separate layer and typically lies beneath the oil.	
Water – suspended	Water which is finely dispersed as small droplets within the oil. It may over a period of time either collect as free water or become dissolved water, depending on the conditions of temperature and pressure prevailing.	
Water – total	Sum of all the dissolved, suspended and free water in a cargo or parcel of oil.	
Water cut or dip (static measurement)	Level or volume of free water in a tank.	*
Water cut (dynamic measurement)	Volume of free water passing through a pipeline.	*
Water draw	Technique for calibrating a proving tank or pipe prover by displacing water from the prover into a primary or secondary measure.	*
Water-finding paste	Paste containing a chemical which changes colour on contact with water. The paste, when applied to a water-finding rule, indicates the level of any free water in a tank.	

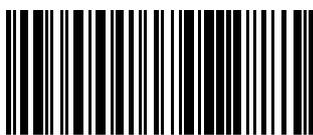
Term	Definition	Reference
Water-finding rule	Graduated rule attached to a dipping tape which is used in conjunction with water-finding paste to measure the depth of any free water in a tank.	
Wax	Mixture of long chain hydrocarbons that crystallise at different temperatures as the overall fluid temperature falls.	
Waxy paraffinic crude oil	Crude oil which, by function of its total wax content, requires heating to prevent sludge deposition during transportation and discharge.	
Wedge formula	Mathematical means to assess small quantities of measurable liquid and/or non-liquid material which is in a wedge configuration and does not touch all bulkheads of the vessel's tank. Note: The formula is based on the characteristics of cargo compartments, vessel trim and the depth of the material.	*
Weight (wt)	The force exerted by an object's mass as a result of gravity; measured by comparison to a reference standard.	
Weight (mass) conversion factor (WCF)	Factor for converting mass to apparent mass-in-air. Note: The acronym WCF is generally used rather than the full term.	*****
Weighted average	Average determined by giving a value to each component according to the proportion it represents of the total quantity.	
Wetted area	Portion of the internal surface of a volumetric tank which has been in contact with the liquid during the proving operation.	*
White oils	Clean, refined products which are not dark in colour such as motor spirit, kerosene, gas oil, diesel fuel and blending components.	
Wipe test	Procedure of physically wiping any interior surface (bulkheads, steam coils, etc.) with absorbent white rags. This procedure is used to test the wiped surfaces for possible colour contamination.	
Worst case conditions	Operating conditions for the sampler that present the most uneven and unstable concentration profile at the sampling location. This will usually be at minimum flowrate, minimum oil density and minimum oil viscosity but may also be influenced by other factors such as emulsifiers, surfactants, etc.	
Zone sample (core sample, flow through sample)	See <i>sample – zone (core, flow through)</i> .	



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