



BSI Standards Publication

Hydrocarbon Liquids — Manual sampling

National foreword

This British Standard is the UK implementation of EN ISO 3170:2025. It is identical to ISO 3170:2025. It supersedes BS EN ISO 3170:2004, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PTI/13, Petroleum Testing and Terminology.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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European foreword

This document (EN ISO 3170:2025) has been prepared by Technical Committee ISO/TC 28 "Petroleum and related products, fuels and lubricants from natural or synthetic sources" in collaboration with Technical Committee CEN/TC 19 "Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin" the secretariat of which is held by NEN.

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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The text of ISO 3170:2025 has been approved by CEN as EN ISO 3170:2025 without any modification.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*, Subcommittee SC 2, *Measurement of petroleum and related products*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 19, *Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 3170:2004), which has been technically revised.

The main changes are as follows:

- document title amended to reflect the expanded scope of the document for non-petroleum liquids;
- inclusion of an equal representation of the closed and restricted sampling devices in addition to the traditional open sampling devices;
- expanded [Clause 3](#) and the Bibliography;
- added [Clause 4](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document can be used in conjunction with ISO 3171.

This document specifies standard conditions and methods for obtaining samples of liquid/semi-liquid hydrocarbons from a tank, drum or pipeline by manual means. If the hydrocarbon to be sampled is non-homogeneous, showing significant variations in composition or containing sediments and water, samples taken manually should not be expected to be representative, but can enable the degree of non-homogeneity to be assessed and estimates of quality and quantity to be made.

The procedures specified in this document are intended to minimize or eliminate losses of light ends from samples. Such losses can occur during the handling or transfer of samples, thereby making them non-representative of the bulk.

The procedures specified provide samples for:

- a) the determination of the liquid/hydrocarbon quality;
- b) the determination of the water content;
- c) the determination of other contaminants that are not considered to be part of the liquid hydrocarbon.

If the sampling conditions for purposes a), b) and c) are in conflict, separate samples are required.

The sampling procedures for tank contents that are not homogeneous specified in this document are intended to enable the degree of non-homogeneity to be assessed and estimates of quality and quantity to be made.

Procedures for the sampling of liquid hydrocarbons from tanks under inert gas pressure are included, together with techniques for sampling from tanks which are equipped with vapour emission control systems.

Hydrocarbon Liquids — Manual sampling

1 Scope

This document specifies the manual methods used for obtaining samples of liquid or semi-liquid hydrocarbons, tank residues and deposits from fixed tanks, railcars, road vehicles, ships and barges, drums and cans, or from liquids being pumped in pipelines.

It applies to the sampling of liquid products, including crude oils, intermediate products, synthetic hydrocarbons and bio fuels, which are stored at or near atmospheric pressure, or transferred by pipelines as liquids at elevated pressures and temperatures.

The sampling procedures specified are not intended for the sampling of special petroleum products which are the subject of other International Standards, such as electrical insulating oils (covered in IEC 60475), liquefied petroleum gases (covered in ISO 4257), liquefied natural gases (covered in ISO 8943) and gaseous natural gases (covered in ISO 10715).

This document refers to methods of sampling and sampling equipment in use at the time of writing. It does not exclude the use of new equipment, provided that such equipment enables samples to be obtained according to the requirements and procedures of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1998 (all parts), *Petroleum industry — Terminology*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

IP 476, *Petroleum liquids — Automatic pipeline sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1998 (all parts) and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 acceptable quality limit

AQL

maximum per cent that is defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average

3.2

all-level sample

sample obtained with an apparatus which accumulates the sample at a uniform rate while passing in one direction only through the total liquid height, excluding any free water

Note 1 to entry: Only bottom-up sampling is appropriate for aviation fuels. This is to ensure that the sample is satisfactorily taken. A bottom-up all-level sample shall have some ullage left in the sampling container to be valid. The disadvantage of bottom-up sampling is that the liquid column has been disturbed as the sampling apparatus is lowered.

3.3

automatic in-line sampler

automatic pipeline sampler

device used to extract a *representative sample* (3.18) from the liquid flowing in a pipe

Note 1 to entry: The automatic in-line sampler generally consists of a probe, a sample extractor, an associated controller, a flow measuring device, and a sample receiver.

3.4

batch

identified quantity of product, the quality of which is covered by a single certificate of quality or certificate of analysis

3.5

bottom sample

spot sample (3.25) collected from the material at the bottom of the tank, container, or line at its lowest point

Note 1 to entry: 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.

3.6

dead bottom sample

sample taken of the liquid (fuel, water, mixture) in contact with the bottom surface of a tank or container

3.7

water sample

spot sample (3.25) of free water taken from beneath the hydrocarbon in a tank

3.8

closed sampling

process of taking samples within a tank under closed conditions, which does not permit the release of any tank contents or vapour to the atmosphere

3.9

composite sample

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

3.10

sample integrity

condition of being complete and unaltered, i.e. the sample being preserved with the same composition as when it was taken from the bulk of the liquid

3.11

skim sample

spot sample (3.25) taken from the surface of the liquid

3.12

lower sample

spot sample (3.25) taken at a level of five-sixths of the depth of liquid below the top surface

3.13

middle sample

spot sample (3.25) taken at a level of one-half of the depth of liquid below the top surface

3.14

meter interval level

spot sample (3.25) taken at meter intervals throughout the depth of the liquid

3.15

mixer

device that provides a homogeneous mixture of the liquid within a pipeline or container in order to obtain a *representative sample* (3.18)

3.16

open sampling

process of taking traditional samples from a tank via an open gauge hatch or gauging access point

Note 1 to entry: If the tank ullage space is pressurized, it will normally be necessary to use other (closed or restricted) procedures to avoid de-pressurizing the tank and the consequent loss of volatile organic compounds (VOCs).

3.17

portable sampling device

PSD

housing designed to connect to a vapour lock valve, which contains a restricted or closed system sampler and is fitted with a tape or cable winding mechanism for lowering and retrieving the sampler

3.18

representative sample

portion extracted from the total volume that is deemed to have the constituents in the same proportions that are present in that total volume

3.19

residue and deposit

organic and inorganic matter, together with any water dispersed within it, which has separated from the liquid and either fallen to the bottom of the tank containing the liquid, or been left in the tank after the liquid has been pumped out

3.20

restricted sampling

process of taking samples within a tank using equipment which is designed to substantially reduce or minimize the vapour losses that would occur during *open sampling* (3.16), but where the equipment is not completely gas-tight

3.21

running sample

sample obtained with an apparatus which accumulates the sample at a uniform rate while passing in both directions through the total liquid height, excluding any free water

3.22

sample conditioning

mixing necessary to homogenize the sample during *sample handling* (3.23) in preparation for subsampling or analysis

3.23

sample handling

conditioning, transferring, dividing, and transporting of the sample

Note 1 to entry: Sample handling includes transferring the sample from the primary sampling device to any secondary container, and the transferring of subsamples to the laboratory apparatus in which it is analysed.

3.24

sample size

number of samples to be drawn from a batch to determine its acceptability as given in sampling plans

3.25

spot sample

sample taken at a specific location in a tank or from a pipeline

3.26

static mixer

mixing device having no moving parts and located within a pipe or tube

Note 1 to entry: The effectiveness of the static mixer depends on the kinetic energy of the moving liquid for the energy required to mix the liquid.

3.27

still well

stand pipe

still pipe

sounding pipe

vertical cylindrical pipe built into a tank to permit gauging operations while reducing errors arising from turbulence or agitation of the liquid

Note 1 to entry: Samples taken from unperforated or unslotted still wells should not be used for custody transfer applications.

Note 2 to entry: Still wells can be found in static tanks and in ship and barge tanks.

3.28

suction level sample

outlet sample

sample taken at the lowest level from which liquid hydrocarbon is pumped from the tank

Note 1 to entry: On determining this level, appropriate allowance is made for any fittings within the tank such as swing-arms, suction baffles or internal bends.

3.29

sump sample

spot sample ([3.25](#)) taken from within a sump

3.30

suspended water

water contained within the liquid hydrocarbon that is finely dispersed as small droplets

Note 1 to entry: Over a period of time, this water can either collect as free water or, become dissolved water, depending on the conditions of temperature and pressure prevailing.

3.31

tap sample

spot sample ([3.25](#)) taken via a tap, typically located on the side of a shore tank

3.32

top sample

spot sample ([3.25](#)) obtained 150 mm below the surface of the liquid

3.33

total water

sum of all the dissolved, suspended, and free water in a cargo or parcel of liquid hydrocarbon

3.34

ullage

empty capacity left in a fixed volume sample receiver or container above the liquid surface

3.35

upper sample

spot sample (3.25) taken at a level of one-sixth of the depth of the liquid below the top surface

3.36

upper, middle, lower sample

UML sample

individual spot samples taken from *upper* (3.35), *middle* (3.13) and *lower* (3.12) levels in a tank

3.37

vapour lock valve

vapour control valve

valve, usually with connector above it, fitted to the top of vapour tight or pressurised tanks to permit manual measurement or sampling operations to be carried out with little or no loss of vapour

3.38

zone sample

core sample

flow-through sample

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

3.39

stop work authority

SWA

authority given to all personnel to stop work activities if the situation is deemed to be unsafe and until the risk is either removed or reduced to as low as reasonably practical

4 Safety

4.1 General

The safety precautions given in this clause apply generally and constitute good practice but are not comprehensive.

NOTE Appropriate international and national safety regulations or recognized codes of practice in the hydrocarbon industry can apply.

Personnel involved in sampling shall be familiar with the associated hazards and the precautions which must be taken to reduce health and environmental risks to an acceptable level. If any aspect of the operation is considered unsafe, a stop work authority (SWA) shall be implemented.

Any unsafe actions, equipment or conditions should be identified and reported immediately to the appropriate parties.

Safety and environmental regulations can restrict or prevent sampling operations which result in the release of hydrocarbons or other volatile organic compounds (VOCs) into the atmosphere. In most circumstances, it will not be feasible to use traditional open sampling procedures via an open gauge hatch or gauging access point. If the tank ullage space is pressurized, or the tank forms part of a vapour balancing/recovery system, it is necessary to use closed sampling procedures to avoid de-pressurizing the tank and minimize the consequent loss of VOCs. Similar procedures apply if the vapour from the tank contents is hazardous.

Personnel should be aware of the hazards associated with the product as detailed in safety data sheets (SDS) and the safety precautions which must be observed.

All regulations covering entry into hazardous areas should be observed.

When sampling hydrocarbon liquids, vapour level can increase and pose a potential hazard, care should be taken to avoid breathing hydrocarbon vapour during the sampling operations.

The wearing of personal protective equipment (PPE) is required and shall include:

- goggles or safety spectacles;
- fire retardant coverall incorporating high visibility panels (or high vis vest);
- safety boots with toe protection;
- heavy duty impervious gloves;
- hard hat;
- personal hydrogen sulphide (H₂S) monitors when working in hydrocarbon environments.

Where defined by risk assessment or client requirements, additional PPE can be required.

4.2 Safety aspects of equipment

It is expected that pressure tests and other inspection work are performed according to the local regulations. The results of such tests should be recorded. Cleaning and leak testing operations should be performed at regular intervals.

Cords used for lowering sampling equipment should be electrically conductive or made from natural material such as cotton. They shall not be made from synthetic fibres. Chains are not recommended for lowering sampling equipment as electrical continuity cannot be guaranteed.

Portable metallic equipment used in flammable atmospheres should be of non-sparking material.

Caution should be exercised when using equipment made of aluminium, magnesium or titanium which can generate incendive sparks when struck against rusted steel. Some countries restrict the use of sampling equipment made from such materials, or from alloys containing more than a mass fraction of 15 % in total of these metals or a mass fraction of 6 % of magnesium.

Sampling personnel should use carriers for their equipment so that at least one hand is free. Sample containers should be carefully handled to prevent accidental leakage and protected during transit by using boxes or carrying frames.

Care should be taken to avoid heating of volatile samples in containers with gas-tight closures.

4.3 Safety at sampling points

Safe access to sampling points with adequate lighting shall be provided. Access ladders, stairways, platforms and handrails shall be maintained in a safe condition and regularly inspected. Sampling points shall be adequately ventilated and free of hydrocarbon residues which can cause slipping.

Sampling points should enable samples to be taken in a safe manner. Any potential hazards associated with sampling should be clearly marked. It is recommended that a pressure gauge be provided at pipeline sampling points.

The sampling point and equipment should be adequately maintained and regularly inspected. The results of the inspection should be recorded.

Still wells should be slotted in order to prevent any pressure differential between the inside of the still well and the tank head space which can cause liquid to be driven up into the sampling apparatus.

Adequate and safe disposal facilities for draining and flushing should be available.

All equipment and material brought by and used by personnel engaged in sampling operations should be removed on completion of the operation. Rags and other waste material should be disposed of appropriately.

4.4 Entry into enclosed (confined) spaces

It is the responsibility of vessel(s) and terminal personnel to identify enclosed spaces and to establish procedures for safe entry. Pump rooms, deck tunnels, cargo tanks, cofferdams, double bottom tanks, shore tanks, floating roofs or any enclosed space can be subject to oxygen deficiency as well as the presence of hydrocarbon or toxic gas.

Personnel shall consult the responsible vessel officer or terminal operator to determine whether entry into such enclosed spaces is permitted. Personnel shall be supervised and accompanied by a representative of either the vessel or the terminal, or both, at all times.

Suitable notices should be prominently displayed to inform personnel of the precautions to be taken when entering tanks or other enclosed spaces and of any restrictions placed upon the work permitted there.

Extra care should be taken when moving around inside tanks, as surfaces can be slippery and lighting can be poor.

Entry into enclosed spaces and tanks shall only be permitted upon the production of a valid permit issued by responsible personnel from the terminal or vessel. The entry permit should confirm that the atmosphere has been tested to be safe on all occasions immediately prior to entry. In addition to the entry permit, the responsible person should ensure that:

- the appropriate atmosphere checks have been carried out;
- effective ventilation shall be maintained continuously while personnel are in the enclosed space;
- lifelines and harnesses are ready for immediate use. Where possible, pump room lifelines should be already rigged, and an unobstructed direct lift provided;
- approved breathing apparatus and resuscitation equipment are ready for use at the entry to the enclosed space;
- proper clothing and particularly safety helmets are being worn;
- where possible, a separate means of access is available for use as an alternative means of escape in an emergency;
- a responsible person from the terminal or vessel is in constant attendance outside the enclosed space in the immediate vicinity of the entrance and in immediate contact with a responsible officer;
- a means of communication between persons inside enclosed spaces and those outside is established and frequently tested. Where possible, the responsible person outside the enclosed space should be in permanent visual contact with the personnel inside the closed space.

In the event of an emergency, under no circumstances should the attending personnel from the terminal or vessel enter the enclosed space before help has arrived. The lines of communication for dealing with emergencies should be clearly established and understood by all concerned.

Pump rooms and deck tunnels, by virtue of their location, design and operation, constitute a particular hazard and therefore necessitate special precautions. No-one should enter a pump room or deck tunnel at any time without first obtaining the permission of a responsible officer.

It is the duty of the responsible vessel's officer in charge of cargo operations to ensure that there is adequate ventilation of the pump room or deck tunnel and that the atmosphere is suitable for entry. Approved breathing apparatus and resuscitation apparatus should be available in an accessible location. At no time should personnel enter a pump room or deck tunnel unless supervised and accompanied by a responsible member of the vessel's staff.

4.5 Electrical safety

4.5.1 Static electricity

The following precautions should be taken to avoid danger from static electricity when sampling tanks containing flammable hydrocarbons stored at temperatures above their flash points, or in which a flammable atmosphere of hydrocarbon vapour or mist has been produced.

The contents of storage tanks, road vehicles, railcars, ships or barges should not be open sampled during filling, especially when being filled with clean, refined, volatile products capable of giving rise to flammable vapour/air mixtures in the ullage space.

When sampling a tank, the sampling device should be kept firmly earthed/grounded at all times, either by direct connection to the tank structure, or by firm contact of the suspending cable, cord or tape with the gauge hatch or vapour lock valve. When sampling a pipeline, electrical continuity should be maintained between the pipeline and the sample receiver via the connecting pipework.

Some liquids can accumulate a static charge during the loading or discharge process and can require some relaxation time for the charge to dissipate before measurement equipment can be safely introduced into the tank. In addition, static inhibitors can be added to some liquids to reduce the risk of static charge. To determine which liquids are accumulators and to ensure that special considerations are taken during their measurement, the International Safety Guide for Oil Tankers and Terminals (ISGOTT)^[18] and the safety data sheet (SDS) should be consulted.

If the tank is in a non-inert condition, specific precautions are required with regard to safe measurement procedures when handling static accumulator liquids. Metallic equipment for sampling or measurement shall not be introduced into or remain in the tank during the transfer or shore tank mixing, and for 30 min afterwards. The 30-min relaxation time is not required if the gauging takes place via a grounded still well.

Sampling activities shall not be carried out during lightning or hailstorms.

4.5.2 Electronic and electrical equipment

Personnel are expected to use equipment which complies with all applicable safety codes. Portable electronic equipment, such as mobile phones, tablets and computers, shall not be operated except in designated areas.

All portable test apparatus, lamps, flashlights, and other equipment such as portable electronic temperature devices (PET) or portable electronic gauging devices (PEGD) shall be intrinsically safe and of an approved type suitable for the electrical classification of the area and, where required by the legislator, are expected to have a valid safety certificate. The changing of batteries shall only be done in a non-hazardous area.

5 Sampling

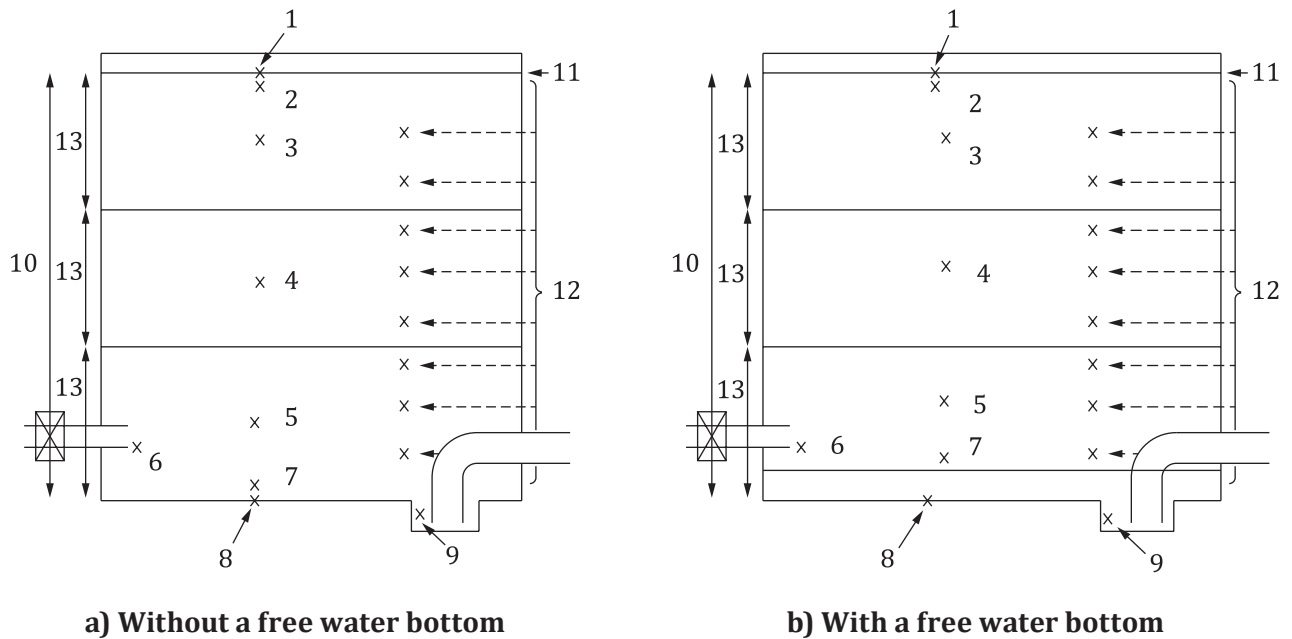
5.1 General

Representative samples of liquid hydrocarbons are required for the determination of chemical and physical properties, which are used to establish standard volumes, and compliance with commercial and regulatory specifications. The treatment of samples from the time of collection until they are analysed requires care and effort to maintain their compositional integrity.

There are inherent limitations when performing any type of sampling that can affect the representative nature of the sample. The sampling process should address the factors to be controlled to ensure the validity of test results. Those responsible for sampling shall follow the procedures for sampling in [Clause 8](#).

5.2 Typical locations from where samples are drawn

5.2.1 Tank sampling



Key

1 skim sample	8 dead bottom sample
2 top sample	9 sump sample
3 upper sample	10 product level
4 middle sample	11 surface of product
5 lower sample	12 meter interval levels
6 suction level sample	13 one third of the product level (split into upper, middle and lower)
7 bottom sample	X sample points

Figure 1 — Examples of spot sample positions in tank

A tank sample shall be a small portion of the contents of a tank that represents either:

- a limited area in a tank (e.g. a spot sample or a free water sample), or
- the total product content of the tank (a running sample, all-levels sample or composite of spot samples).

A series of spot samples from one tank can be mixed in equal portions to create a sample that represents the total product content of a tank (a tank composite sample). Typically, this is made from upper, middle and lower (UML) samples. For examples of spot sampling locations, see [Figure 1](#).

UML samples can sometimes be replaced by all-levels or running samples.

All levels or running samples can be important as a means of obtaining representative samples in certain conditions but are not capable of verifying homogeneity.

Spot, all levels, running or composite samples from two or more tanks can be mixed proportionally to represent a cargo that is drawn from those tanks (a multiple-tank composite sample).

5.2.2 Line sampling

For continuous line sampling, either an isokinetic line sampling point is required, or an automatic in-line sampler should be used. These can be flow proportional or designed to take a certain volume in relation to time, where constant flow is expected.

NOTE Automatic in-line samplers are excluded from the scope of this document. See IP 476 or ISO 3171, for further details.

5.3 Restricted opening/vapour trap sampling

Safety and environmental regulations have been imposed worldwide to prohibit tank vessel operations from releasing hydrocarbons into the atmosphere. This has resulted in the restriction and, in some cases, the prohibition of traditional methods of obtaining cargo samples. Consequently, at the time of writing, methods and technologies are being used that allow cargo samples to be taken with no vapour release (closed sampling) or with very little vapour release (restricted sampling). These methods and technologies can apply as specified below.

- Shipboard sampling at the load or discharge port is frequently required to test the quality of the cargo against contract and to determine if any cargo quality degradation has occurred during the shipping process. Further guidance for shipboard sampling is given in EI HM 52/API MPMS Chapter 17.11.^[15]
- Shipboard sampling can also be required particularly where shipboard blending has taken place. HM 66^[16] includes guidance on sampling for shipboard blending operations.

5.4 Representative samples

UML sampling is often adopted to obtain representative samples. However, this presents significant challenges for non-homogenous products or non-uniform storage facilities such as rock caverns and geometrically complex tanks with baffles, pillars, and other internal structures.

In very large tanks, the challenge increases with the sample size relative to the bulk content and possibility of non-homogeneity. Ship sampling of multi-compartment vessels is also an area where great care is needed to obtain representative samples.

Depending on the extent of stratification, it can be difficult to obtain a representative sample.

UML samples are the minimum samples recommended to assess stratification.

Running or all-levels samples contain all product layers in the vertical column from the sample point but cannot be used to determine stratification.

Even with care, it is possible that a representative sample from a nonhomogeneous or stratified tank cannot be exactly reproduced.

5.5 Homogeneity

By agreement of all parties, spot or zone samples can be drawn to check for tank homogeneity (see [10.6](#)).

Spot samples shall be taken to assess the level of stratification of the commodity within a shore tank or marine vessel compartment. The determination as to what constitutes stratification should be based on the agreement of the interested parties.

To determine whether a tank is homogeneous, samples are drawn from various levels in the tank and tested for the desired quality parameter. If the tested parameter for each sample is similar within defined limits, the tank can be considered uniform. The number of samples taken and properties tested shall be considered in relation to the circumstances or specification requirement.

The test method precision and laboratory site precision can be used to assess if the analytical results differ significantly enough to indicate stratification.

As agreed between interested parties, individual spot sample test results can be averaged, a volumetric composite sample can be prepared and tested, or an alternative sample or sample location can be agreed upon.

When a tank is found to be stratified, the following can be considered:

- Samples can be taken at additional levels (e.g. top and bottom samples or each 1 m level) and checked for conformity.
- The bulk product can be mixed to improve homogeneity (by pumping, blowing air or nitrogen in the tank, mixing with mechanical mixers or transferring from tank to tank).

6 Equipment

6.1 General

All sampling equipment shall be designed and constructed specifically for the function for which it is intended. Containers shall be leak tight and designed to maintain the initial characteristics of the sample. They shall be of sufficient strength to withstand internal pressures likely to be generated, and sufficiently robust to withstand repeated use and handling.

Sampling equipment shall be kept in a clean condition; equipment dedicated for specific products is preferred.

Whenever possible, the sample should be drawn in the container in which it will be transported to the laboratory. Decanting of samples from one container to another can affect the quality parameters to be tested, particularly density, vapour pressure, light end composition and water content. This is particularly true when sampling volatile products.

6.2 Types of tank samplers

6.2.1 General

The types of samplers described in [6.2.2](#) to [6.2.7](#) can be applicable to both open and restricted sampling methods.

6.2.2 Spot samplers

Spot samples are used to take samples at specific levels within the liquid and allowed to fill before retrieving the sampler [e.g. at upper, middle and lower (UML) or at the tank bottom].

6.2.3 Zone samplers/flow-through samplers

Zone samplers operate based on an open-ended tube with a valve at the bottom. The sampler is lowered to the required level during which the liquid flows through the sampler while it descends. The valve closes and the sampler retains the sample from that level in the tank while it is retrieved.

6.2.4 Running samplers

A running sampler is a container equipped with a restricted filling device that obtains a sample while being lowered and raised through the liquid.

NOTE 1 It has not been established that running samplers fill at a uniform rate, because:

- a) it is possible that the tank volume is not proportional to the depth, or
- b) it is possible that the operator is not able to raise (or lower) the sampler at the variable rate required for proportionate filling, which is approximately proportional to the square root of the depth of immersion.

NOTE 2 A fixed volume running sampler can be based on a sampling-bottle cage or a weighted sampling can. Proprietary fixed volume running sampler devices are also available, which can be provided with a series of selectable orifices to suit different oil depths and viscosities.

NOTE 3 Alternatively, it is possible that variable volume running samplers are available, where the capacity of the primary sample receiver increases with the distance travelled through the tank contents. Such devices are acceptable provided that they can be shown to fill at a consistent rate during travel through the liquid.

6.2.5 All-level samplers

An all-level sampler is a container equipped with a restricted filling device that obtains a sample when moved through the liquid in one direction only.

NOTE 1 It has not been established that all-level samplers fill at a uniform rate, because:

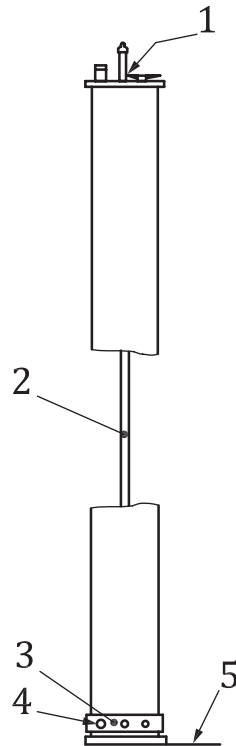
- a) it is possible that the tank volume is not proportional to the depth, or
- b) it is possible that the operator is not able to raise (or lower) the sampler at the variable rate required for proportionate filling, which is approximately proportional to the square root of the depth of immersion.

NOTE 2 These devices can be similar to those devices used to take running samples or can be proprietary devices specifically designed to obtain this type of sample.

NOTE 3 A “bottom-up” fixed volume all-level sampler can be based on a sampling bottle or cage (or a weighted sampling can), which is lowered in the closed position to the bottom of the tank, opened, and the sample is collected as it is raised through the liquid.

NOTE 4 Proprietary “top-down” and “bottom-up” fixed volume all-level sampler devices are also available, which are provided with different opening or closing mechanisms. Additional means can be provided to restrict the inlet flow rate to suit different oil depths and viscosities. A typical example of a “top-down” fixed volume all-level sampler is illustrated in [Figure 2](#).

NOTE 5 Alternatively, it is possible that variable volume all-level samplers are available. Such devices are acceptable provided that they can be shown to fill at a consistent rate during travel through the liquid.

**Key**

- 1 air exhaust
- 2 suspension rod
- 3 knurled ring with 1 orifice, used to select required inlet orifice in main sampling body, to vary speed of filling
- 4 range of different size inlet orifices in bottom section of main sampler body
- 5 contact line

NOTE The filling holes are closed by the bottom internal section rising when it makes contact with the tank bottom.

Figure 2 — Example of a “top down” all-level sampler

6.2.6 Bottom samplers

Bottom samplers with an adjustable foot are a type of spot sampler specifically designed to collect samples from a specified height from the tank floor or water interface.

6.2.7 Dead bottom samplers

Dead bottom samplers are a type of spot sampler specifically designed to collect samples from either the tank floor or the product/water interface. This sampler fills on contact with tank bottom and fills from the base of the sampler.

NOTE The samplers mentioned in [6.2.6](#) and [6.2.7](#) can be the same equipment.

6.2.8 Residue samplers (sediment samplers)

Sediment samplers are designed to draw in a sample of the sludge at the floor of a tank.

6.3 Samplers used for open sampling methods in tanks

6.3.1 General

This equipment is designed to be used in conjunction with a cord or cable during open sampling.

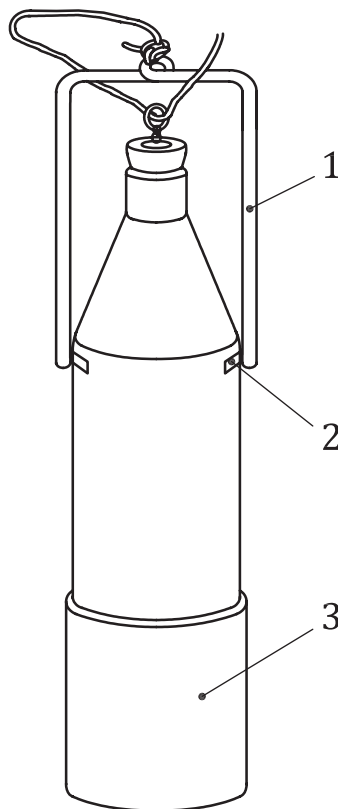
Open sampling equipment can be used to perform several different types of sampling operations e.g. spot, running, all levels, bottom and dead bottom samples. This is achieved by using different designs of sampler.

6.3.2 Sampling can/thief

The sampling can or beaker (see [Figure 3](#)) shall be weighted so as to sink readily in the liquid to be sampled. The lowering device shall be attached to the can in such a manner that the stopper can be opened by means of a sharp jerk. In order to avoid problems in cleaning the can and/or possible contamination of sensitive samples, any weighting material shall be fixed to the can in such a way that it does not come into contact with the sample.

This equipment can be used to take running samples by modifying the cork or stopper to regulate the filling rate. However, using this method will result in changes in the filling rate which are inversely proportional to the depth of the sampler. So, unless the operator changes the rate of lowering and raising, it is possible that the sample will not be representative. Mechanical devices are available that attach to a sample bottle and give constant filling rates (See [6.2.5](#)).

Some sampling cans consist of the flow-through design and can be referred to as zone samplers.



Key

- 1 wire handle
- 2 wire lugs
- 3 weighting material

Figure 3 — Example of a weighted can or beaker

6.3.3 Sampling cage and bottle

A sampling cage shall be a metal or plastic holder, suitably constructed to hold the appropriate container, typically a bottle or can. The combined apparatus shall be weighted so as to sink readily in the product to be sampled. Provision shall be made to fill the container at any desired level (see [Figure 4](#) and [5](#)).