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Hydrocarbon Liquids – Manual Sampling

Hydrocarbures liquides – Échantillonnage manuel

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Foreword

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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 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 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 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 taken from the surface of the liquid

3.12
lower sample
spot sample taken at a level of five-sixths of the depth of liquid below the top surface

3.13
middle sample
spot sample taken at a level of one-half of the depth of liquid below the top surface

3.14
meter interval level
spot sample 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

3.16
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).

3.18
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

3.19
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

3.20
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

3.21
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

3.22
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

3.23
sample conditioning
mixing necessary to homogenize the sample during *sample handling* (3.24) in preparation for subsampling or analysis

3.24
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.

3.25
sample size
number of samples to be drawn from a batch to determine its acceptability as given in sampling plans

3.26
spot sample
sample taken at a specific location in a tank or from a pipeline

3.27
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.

3.28
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.

3.29
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.

3.30
sump sample
spot sample taken from within a sump

3.31
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.

3.32
tap sample
spot sample taken via a tap, typically located on the side of a shore tank

3.34
top sample
spot sample obtained 150 mm below the surface of the liquid

3.35
total water
sum of all the dissolved, suspended, and free water in a cargo or parcel of liquid hydrocarbon

3.36
ullage
empty capacity left in a fixed volume sample receiver or container above the liquid surface

3.37
upper sample
spot sample taken at a level of one-sixth of the depth of the liquid below the top surface

3.38
upper, middle, lower sample
UML sample
individual spot samples taken from *upper* (3.37), *middle* (3.13) and *lower* (3.12) levels in a tank

3.39
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

3.40
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

3.41
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 (H_2S) 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.