BRITISH STANDARD

BS 3195-1: 1989
ISO 3170:1988

Methods for

Sampling petroleum products —

Part 1: Manual sampling of liquid hydrocarbons

UDC 665.7.033.2 – 404:620.113.42

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Petroleum Standards Policy Committee (PTC/-) to Technical Committee PTC/12, upon which the following bodies were represented:

Department of Energy (Gas and Oil Measurement Branch)
Department of Trade and Industry (National Engineering Laboratory)
Department of Transport (Marine Directorate)
General Council of British Shipping
Institute of Petroleum
Royal Institution of Naval Architects
Salvage Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

GAMBICA (BEAMA Ltd.)
Institute of Measurement and Control
United Kingdom Offshore Operators' Association

This British Standard, having been prepared under the direction of the Petroleum Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1989

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First published December 1959
First revision September 1978
Second revision August 1989

The following BSI references relate to the work on this standard:
Committee reference PTC/12
Draft for comment 85/52105 DC

ISBN 0 580 17498 0

Amendments issued since publication

Amd. No.	Date of issue	Comments

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National foreword

This Part of BS 3195, which has been prepared under the direction of the Petroleum Standards Policy Committee, was first published in 1959 with the title "*Methods of sampling liquid petroleum products in bulk storage*". The method described was technically equivalent to the corresponding method published by the Institute of Petroleum as sections of IP 51. The first revision was identical with ISO 3170:1975, published by the International Organization for Standardization (ISO) and the present revision is identical with ISO 3170:1988 "*Petroleum liquids — Manual sampling*".

ISO 3170 was prepared by Subcommittee 3, Static petroleum measurement, of Technical Committee 28, Petroleum products and lubricants, of ISO.

This Part of BS 3195 supersedes BS 3195-1:1978, which is withdrawn.

The revision was entrusted to an international working group and extensive changes were introduced so as to provide greater detail based on the procedures described in the previous edition. Particular additions include the following:

a) package sampling including its statistical aspects;

b) sample handling so as to maintain the integrity of the sample and the procedure for its homogenization prior to subdivision or transfer between containers.

BS 3195-2 is identical with ISO 3171:1988, and a number of aspects including sample handling have been aligned with ISO 3170.

Cross-references

International standard	British Standard
ISO 2859:1974	BS 6001 Sampling procedures and tables for inspection by attributes Part 1:1972 Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection (Technically equivalent)
Addendum 1-1977	BS 6000:1972 Guide to the use of BS 6001. Sampling procedures and tables for inspection by attributes (Technically equivalent)
ISO 3171:1988	BS 3195 Methods for sampling petroleum products Part 2:1989 Automatic pipeline sampling of liquid hydrocarbons (Identical)
ISO 3733:1976	BS 4385:1980 Method for determination of water in petroleum products and bituminous materials (distillation method) (Identical)
ISO 3734:1976	BS 2882:1980 Method for determination of water and sediment in crude petroleum and fuel oils (centrifuge method) (Identical)
ISO 3735:1975	BS 4382: 1980 Method for determination of sediment in crude petroleum and fuel oils (extraction method) (Identical)

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The Technical Committee has reviewed the provisions of ISO 3007 and ISO 3165, which are referred to for information only, and has decided that they are acceptable for use in conjunction with this standard. A suitable alternative method to ISO 3007:1986 is described in BS 2000 "*Methods of test for petroleum and its products*" Part 69:1982 "*Reid vapour pressure of petroleum products*" which is a related standard. A related British Standard to ISO 3165:1976 is BS 5309 "*Methods for sampling chemical products*" — Part 1:1976 "*Introduction and general principles*".

Additional information. The definitions given in clause **3** apply for the purposes of this standard only. They do not apply for the purposes of other British Standards unless specific reference is made to them.

CAUTION. Attention is drawn to clause **6** and the need to observe the safety precautions and the requirements of the Health and Safety at Work etc. Act 1974. With respect to **6.1**, **6.2** and **7.2.5.2** the user should be familiar with the relevant UK regulations, which should be observed.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Introduction

This International Standard should be applied in combination with ISO 3171 *Petroleum liquids — Automatic pipeline sampling.*

The purpose of this International Standard is to standardize conditions for obtaining a sample of liquid/semi-liquid hydrocarbons from a tank, drum or pipeline. If the hydrocarbon materials to be sampled are of non-homogeneous character showing significant variations in composition or containing sediments and water, samples taker manually should not be expected to be representative, but enable the degree of non homogeneity to be assessed and estimates of quality and quantity to be made.

It is realized that in many countries some or all of the items covered by this International Standard are the subject of mandatory regulations imposed by the laws of those countries; such regulations must be rigorously observed. In cases of conflict between such mandatory regulations and this International Standard, the former shall prevail.

1 Scope

1.1 This International Standard specifies the procedures to be used for obtaining, by manual methods, samples of 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 (see **4.3**).

1.2 It applies to the sampling of liquid petroleum products, crude oils and intermediate products, which are stored in tanks at or near atmospheric pressure, or transferred by pipelines, and are handled as liquids at temperatures from near ambient up to 100 °C.

The sampling procedures specified are not intended for the sampling of special petroleum products which may be the subject of other International Standards, such as aviation fuels, electrical insulating oils, liquefied petroleum gases, liquefied natural gases, bitumen and chemical products, nor to unstabilized crude oils having a Reid vapour pressure above 180 kPa (1,8 bar).

1.3 Two basic manual sampling methods are available:

— tank sampling;

— pipeline sampling.

When a batch is received or consigned, either tank or pipeline sampling, or both, may be possible. However, if both methods are used, the two sets of samples shall not be mixed.

1.4 Procedures are specified which minimize or eliminate losses of light ends from samples. Such losses can occur during handling or transfer of samples thereby making them non-representative of the bulk material.

1.5 If the procedures intended for obtaining representative samples of stocks or movements of homogeneous petroleum liquids are applied to non-homogeneous liquids having significant variations in composition or containing sediments and/or water, the samples may not be representative.

1.6 The sampling procedures specified are intended to provide samples for the following purposes:

a) the determination of the oil quality;

b) the determination of the water content of the oils;

c) the determination of other contaminants that are not considered to be part of the liquid transferred.

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

1.7 Sampling procedures for tank contents that are not homogeneous are specified that enable the degree of non-homogeneity to be assessed and estimates of quality and quantity to be made.

1.8 Procedures for the sampling of residues and deposits in tanks are included, together with techniques for liquid hydrocarbons under inert gas pressure.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3171:1988, *Petroleum liquids — Automatic pipeline sampling.*

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3 Definitions

3.1
competent person

a person who, by reason of his or her training, experience and theoretical and practical knowledge, is able to detect any defects or weaknesses in the plant or equipment and to make an authoritative judgement as to its suitability for further use

NOTE This person should have sufficient authority to ensure that the necessary action is taken following his or her recommendations.

3.2
integrity of the sample

the 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

3.3 mixer

A device which provides a homogeneous mixture of the liquid within a pipeline or container in order to obtain a representative sample.

3.3.1
static mixer

a mixing device having no moving parts and located within a pipe or tube. It depends on the kinetic energy of the moving liquid for the energy required to mix the liquid

3.4
pipeline

any section of pipe used for the transfer of liquid. An unobstructed pipe does not have any internal fittings such as a static mixer or orifice plate

3.5
residues and deposits

organic and inorganic material, together with any water dispersed within it, which has separated from the liquid and either

a) fallen to the bottom of the tank containing the liquid, or

b) been left in the tank after the liquid has been pumped out.

3.6 sample conditioning

homogenization necessary to stabilize the sample during sample handling in preparation for analysis

3.7 sample handling

the conditioning, transferring, dividing and transporting of the sample. It includes transferring the sample from the sampler (receiver) to a container and from the container to the laboratory apparatus in which it is to be analysed

3.8 sample types

3.8.1
all-levels sample

a sample obtained with an apparatus which is filled when passed through the total liquid height in one direction

3.8.2
bottom sample

a spot sample taken from the material at the bottom surface (floor) of a tank or container (see Figure 1)

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3.8.3
composite sample

a sample obtained by combining a number of spot samples in defined proportions so as to obtain a sample representative of the bulk of the material. The usual types of composite sample are obtained by combining samples in accordance with one of the following (see clause **4** and **7.3.1.1.2**):

a) upper, middle and lower samples in equal proportions;

b) upper, middle and suction-level samples in equal proportions;

c) a series of spot samples from a non-homogeneous oil taken at more than three levels and blended in proportion to the quantities of oil represented;

d) individual samples from several tanks or ship's compartments proportional to the total quantity each sample represents;

e) a series of spot samples of equal volume obtained from a flowing pipeline taken at specified intervals.

3.8.4
representative sample

a sample having its physical or chemical characteristics identical to the volumetric average characteristics of the total volume being sampled

3.8.5
running sample

a sample obtained by lowering a container from the top of the oil to the bottom and returning it to the top of the oil at a speed such that the container is about three-quarters full when withdrawn from the oil

3.8.6
spot sample

a sample taken at a specific location in a tank or from a pipe at a specific time during a pumping operation

3.8.7
suction-level sample

a sample taken at the lowest level from which liquid hydrocarbon is pumped from the tank. In determining this level, appropriate allowance is made for any fittings within the tank such as swing-arm, suction baffle or internal bend (see Figure 1)

3.8.8
upper sample

a sample taken at a level of one-sixth of the depth of liquid below the top surface (see Figure 1)

3.8.9
middle sample

a sample taken at a level of one-half of the depth of liquid below the top surface (see Figure 1)

3.8.10
lower sample

a sample taken at a level of five-sixths of the depth of liquid below the top surface (see Figure 1)

3.8.11
top sample

a spot sample obtained 150 mm below the top surface of the liquid (see Figure 1)

3.8.12
skim sample (surface sample)

a sample taken from the surface of the liquid (see Figure 1)

3.9 Statistical terms

3.9.1
AQL (acceptable quality level)

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

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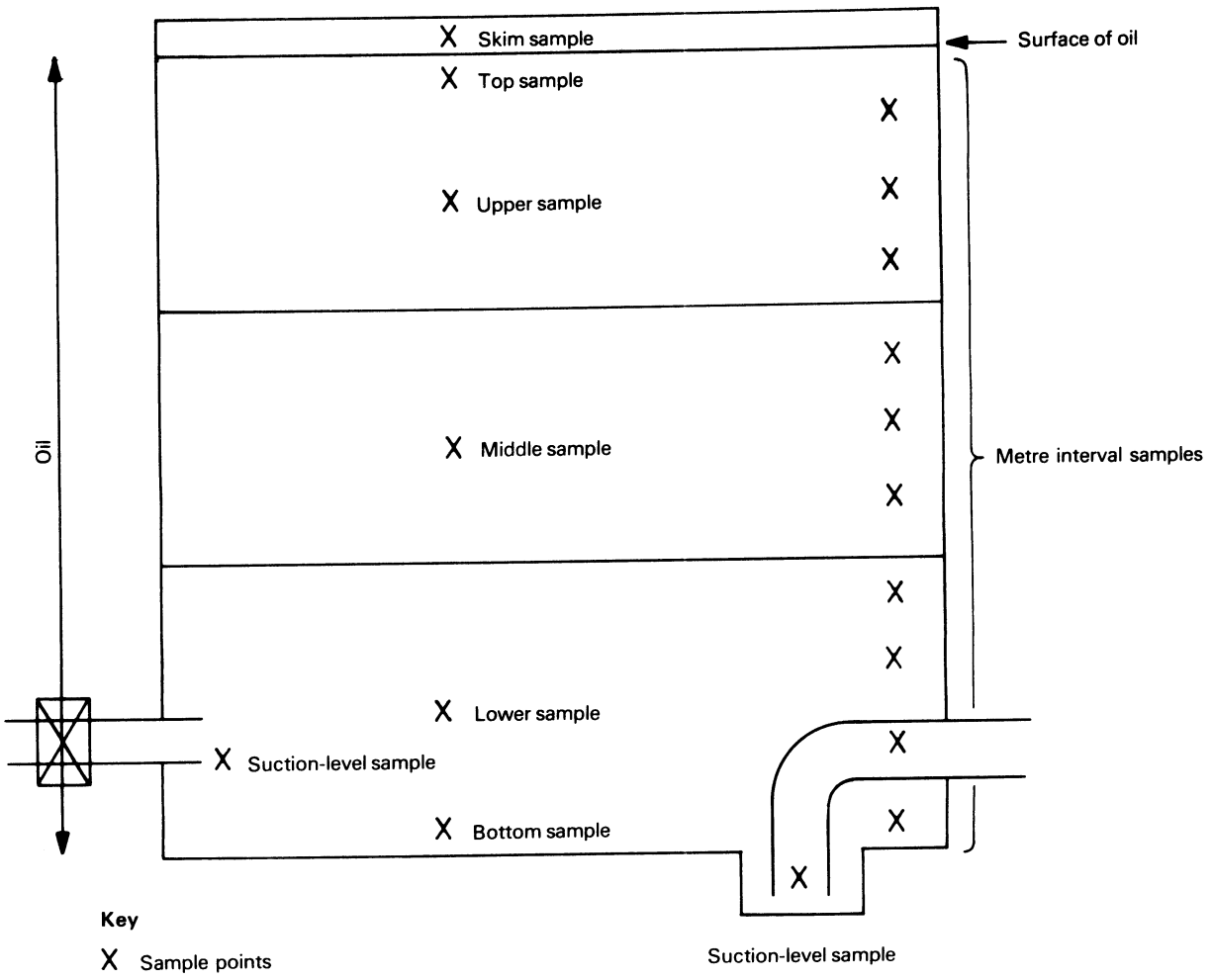


Figure 1 — Examples of sample positions

3.9.2
batch

a collection of packages containing a product of a single type and composition and of a single manufactured lot, or of a single delivery

3.9.3
package

any type of container, such as a drum, barrel, peg, can or bottle

3.9.4
per cent defective

one hundred times the number of defective units of product contained in any given quantity of units of product divided by the total number of units of product, i.e.:

$$\text{per cent defective} = \frac{\text{number of defectives}}{\text{number of units inspected}} \times 100$$

3.9.5
sample size

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

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3.10
ullage

for the purpose of this International Standard, the empty capacity left in a sample receiver/container above the liquid surface, expressed as volume

3.11 Water

3.11.1
dissolved water

the water contained within the oil forming a solution at the prevailing temperature

3.11.2
suspended water

the water 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.

3.11.3
free water

the water that exists as a separate layer from the oil, and typically lies beneath the oil

3.11.4
total water

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

4 Principles

4.1 To ensure that samples submitted for examination are as representative as possible of the oil being sampled, the necessary precautions are given. These depend on the characteristics of the liquid, the tank, container or pipeline from which the sample is being obtained and the nature of the tests to be carried out on the sample.

4.2 Tank sampling is commenced when the contents of the tank are at rest. The following samples are normally taken for analysis:

either

a) upper, middle and lower samples,

or

b) upper, middle and suction-level samples.

If tests on these samples show that the contents of the tank are homogeneous, they may be combined in equal proportions for further tests.

If the tests on these samples show that the contents of the tank are non-homogeneous, it is necessary to draw samples from more than three levels and either a composite sample is prepared for analysis or, if blending would impair the integrity of the sample, each sample is analysed separately and the composition corresponding to the composite sample is calculated. In this calculation, allowance is made for the proportion of the oil represented by each sample.

Other methods are

c) a running sample, or

d) an all-levels sample.

4.3 To obtain a representative sample from a batch of non-homogeneous material being pumped in a pipeline, the sample shall be drawn using an automatic sampling device as stated in ISO 3171. On occasions it may be necessary to take samples manually. These are spot samples and may not be representative of the bulk.

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5 Apparatus

5.1 *General*

All sampling devices shall be designed and constructed so as to assure the function for which they are intended in order to maintain the initial characteristics of the oil. They shall be of sufficient strength and externally protected to withstand normal internal pressures likely to be generated, or provided with a relief valve, and sufficiently robust to withstand any handling that may be encountered. Their cleanliness shall be confirmed before use.

NOTE Various sampling devices are described in general terms in **5.2** to **5.7** and any essential aspects are specified. Detailed specifications have not been given for these items because any suitable device of the type described may be used.

5.2 *Tank samplers*

5.2.1 *General*

The tank samplers are classified according to the type of sample to be drawn:

— spot sample;

— bottom sample;

— tank deposits/residues sample;

— running sample;

— all-levels sample.

The devices shall have a cord or cable or chain of conductive, sparkproof material attached to them for the purpose of lowering or raising them in the tank.

NOTE The cord should be sufficiently conductive not to be capable of producing static electricity.

5.2.2 *Spot samplers*

This apparatus shall be constructed so that a sample can be taken at any specific level in a tank. The following kinds of apparatus are suitable.

5.2.2.1 *Sampling cage*

This shall be a metal or plastics holder or cage, suitably constructed to hold the appropriate container. The combined apparatus shall be weighted so as to sink readily in the material to be sampled, and provision shall be made to fill the container at any desired level (see Figure 2).

Bottles of the appropriate dimensions are required to fit a sampling cage. The use of a sampling cage is generally preferred to that of a weighted sampling can for volatile products, since loss of light ends is likely to occur when transferring the sample from a weighted sampling can to another container.

NOTE The sampling cage may be omitted if the sample bottle is securely attached to a weighted cord. The cork is also tied to the line about 150 mm from the neck of the bottle.

5.2.2.2 *Weighted sampling can (see Figure 3)*

This shall be weighted so as to sink readily in the oil to be sampled. If used for obtaining upper, middle, lower or suction-level samples, 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. If used as a running sampler, the special stopper shown in Figure 4 shall be used. In order to avoid problems in cleaning the can, any weighting material shall be fixed to the can in such a way that it does not come into contact with the sample.

Some sampling cans have special opening facilities, for example devices having valves opened or closed at the desired level by a weight falling down alongside and guided by the suspending cable, or having wing or flap valves which are closed upon initiation of upward movement.

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