
**Petroleum and liquid petroleum products —
Equipment for measurement of liquid levels
in storage tanks — Manual methods**

*Pétrole et produits pétroliers liquides — Appareils de mesure du niveau
des liquides dans les réservoirs — Méthodes manuelles*

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Printed in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

International Standard ISO 4512 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 3, *Static petroleum measurement*.

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Introduction

This International Standard describes the equipment required to measure the level of petroleum and petroleum products contained in a tank or container. Calculation of the quantity of petroleum and petroleum products contained in a tank or container also requires that the temperature of the liquid and its density are determined. The equipment required and the methods of determination of temperature and density are described in other International Standards to which reference should be made.

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Petroleum and liquid petroleum products — Equipment for measurement of liquid levels in storage tanks — Manual methods

1 Scope

This International Standard specifies the requirements for the equipment required to measure manually the liquid level or the corresponding volume of petroleum and petroleum products stored in tanks and containers.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

IEC 60079-11:1991, *Electrical apparatus for explosive gas atmospheres — Part 11: Intrinsic safety “I”*.

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3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 1998 and the following apply.

3.1

calibration table

tank table

tank capacity table

table showing the capacities of, or volumes in, a tank corresponding to various liquid levels measured from the specified dipping datum-plate and/or gauging reference point

3.2

dip

innage

depth of liquid in a tank above the dipping datum-plate

3.3

dip-rod

dip-stick

rigid length of wood or other material, graduated in units of volume or length, for measuring by dip the quantity of liquid in small tanks which have been calibrated in terms of dip

3.4

dip-tape

graduated steel tape used for measuring the level of oil or water in a tank, either directly by dipping or indirectly by ullaging

3.5

dip-weight

weight attached to a steel dipping-tape, of sufficient mass to keep the tape taut and of a shape to facilitate the penetration of any sludge that may be present on the datum-plate

3.6

dipping datum-point

point at the bottom of a tank which the dip-weight touches during dipping, and from which the measurements of the oil and water depths are taken

NOTE The dipping datum-point usually corresponds with the datum-plate but, when this is not so, the difference in level between the datum-plate and the datum-point should be allowed for in the calibration table.

3.7

free water

water, present in a tank, which is not in solution or suspension within the oil and which exists as a separate layer within the tank

3.8

gauge-hatch

opening at the top of a tank through which dipping, ullaging and/or sampling operations are carried out

NOTE When gauging operations are carried out under closed or restricted conditions (via a vapour lock valve), the term "gauging access point" may be used.

3.9

gauging

process of taking all the necessary measurements in a tank in order to determine the quantity of liquid which it contains

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NOTE For the purposes of this International Standard, gauging refers to level measurements only.

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3.10

gauging reference point

reference gauge point

upper datum

upper reference point

point clearly marked on the gauge-hatch, vapour lock valve or on a plate suitably located above or below the gauge-hatch, to indicate the position (and upper datum) from which the measurements of dip or ullage are made

3.11

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 this International Standard.

3.12

master dip-tape

dip-tape and weight combination of known accuracy, which is calibrated by an accredited laboratory and is traceable to national standards of length

3.13

portable electronic gauging device

PEGD

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.

3.14**pressure tank**

storage tank designed to operate at pressures above atmospheric

NOTE For convenience, this type of tank is divided into two general classes:

- low-pressure tanks, used for volatile products which are liquid at ambient temperatures;
- high-pressure tanks, used for liquids which are normally in the vapour phase at ambient temperature and pressure.

3.15**ullage paste****product-finding 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 do not give a clear cut on the gauging device

3.16**reference height****reference gauge height**

height of the gauging reference point above the dipping datum-point

3.17**ullage****outage**

working capacity of a tank not occupied by the liquid

3.18**ullage hatch****ullage port****ullage plug**

manual gauge-hatch usually fitted with a heavy-duty cover

3.19**ullage-rod****ullage-stick**

rigid length of wood or other material, usually graduated in units of volume, for measuring by ullage the quantity of liquid in small tanks which have been calibrated in terms of ullage

3.20**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

3.21**vapour lock valve**

device fitted to the top of vapour-tight or pressure tanks to permit manual measurement and/or sampling operations to be carried out without loss of pressure

3.22**vapour-tight tank**

tank intended primarily for the storage of volatile liquids, for example gasoline, and so constructed that it will withstand pressures slightly above atmospheric pressure

3.23**water bottom****water dip**

depth of any free water at the bottom of a tank

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3.24

water-finding paste

paste containing a chemical which changes colour on contact with water

NOTE The paste, when applied to a water-finding rule, indicates the level of any free water in a tank.

3.25

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

4 General

4.1 If a certificate of calibration is required for any of the equipment, such as dip-tapes, dip-weights or ullage-rules, this shall be obtained from a competent authority and shall be traceable to national or international standards with a 95 % confidence limits uncertainty, which is within the maximum permissible error requirements specified in this International Standard (5.9).

4.2 Equipment which has been subjected to repair shall not be used for reference purposes, but may be used for other purposes if it has been verified by a competent authority and found to comply with the requirements of this International Standard.

5 Dip-tapes

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5.1 General

5.1.1 Dip-tapes shall be used in conjunction with a standard dip-weight or ullage-rule or water-finding rule described in clauses 7, 8 and 9 (see Figure 1). They shall be wound onto a drum contained within a frame equipped with a handle (see Figure 2).

It is strongly recommended that dip-weights, ullage-rules and water-finding rules are detached from the dip-tape when either carried or stored to avoid constant flexing of the dip-tape at the point of attachment, leading to breakage of the dip-tape.

5.1.2 The dip-tape, hanging device (see 5.5) and dip-weight shall be so constructed that the zero of the system is at the lower face of the dip-weight; i.e. the dip-tape, hanging device and dip-weight form one continuous system. Graduations shall be continuous throughout the length of the tape.

NOTE In some countries, local metrological regulations may require that the graduations are also continuous throughout the tape/weight combination.

5.2 Construction

Dip-tapes shall be constructed from one continuous length of steel.

5.3 Material

The steel from which the tape is manufactured shall have the following specification (or shall be a steel of similar specification):

- a) high carbon content (mass fraction of carbon of approximately 0,8 %);
- b) tensile strength of between 1 600 N/mm² and 1 850 N/mm²;
- c) coefficient of linear expansion of $(11 \pm 1) \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$.

For gauging certain petrochemical products, alternative material such as stainless steel may be specified. In this case, a length-correction table according to temperature may be required.

Dimension in millimetres

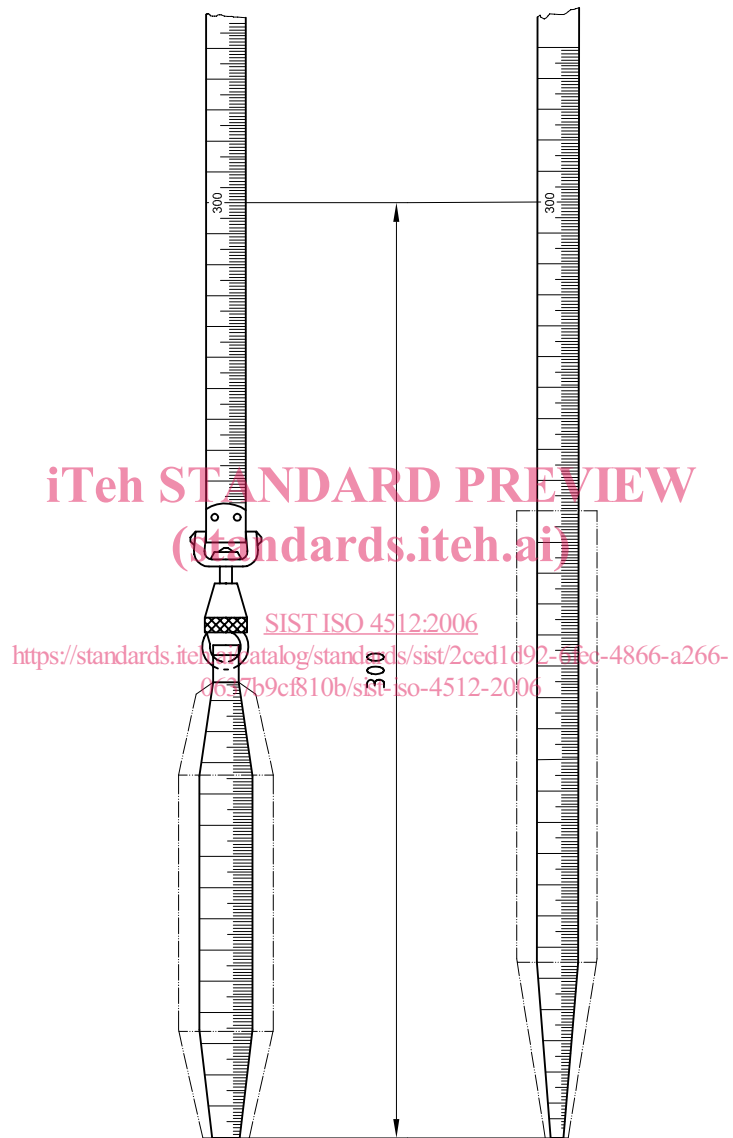
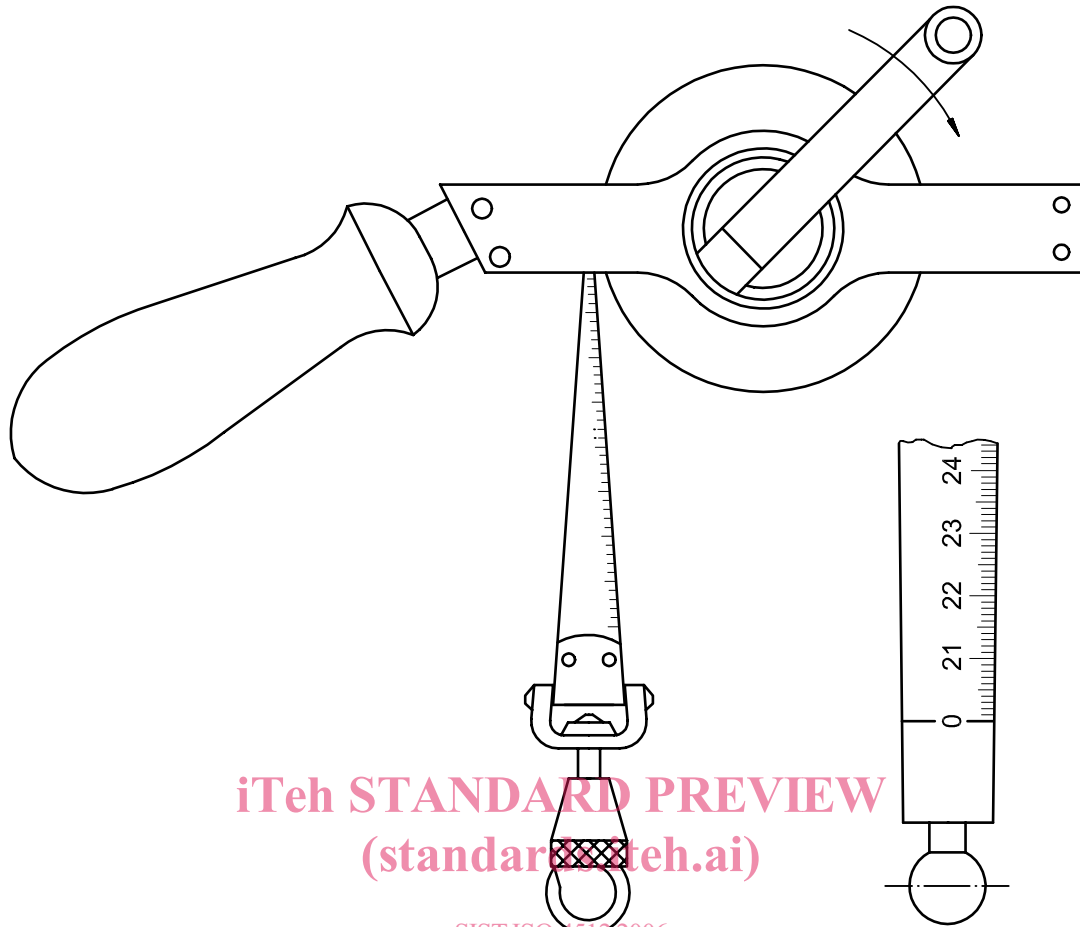


Figure 1 — Examples of dip-tapes with different dip-weights



NOTE This figure is an example, other types of winding frames are acceptable.

Figure 2 — Typical winding-frame

5.4 Coating

Dip-tapes shall be supplied coated with a suitable anticorrosion material for protection in storage. Such coatings shall not electrically insulate the dip-tape.

5.5 Attachment

A hanging device such as a rotule or swivel hook shall be permanently secured (e.g. rivetted) to the leading end of the tape for the attachment of a dip-weight, ullage-rule or water-finding rule. The hanging device shall have a means of preventing the accidental detachment of the dip-weight, ullage-rule or water-finding rule.

5.6 Dimensions

The dimensions of the dip-tape shall be:

- width, $(13 \pm 0,5)$ mm;
- thickness (before etching), $(0,25 \pm 0,05)$ mm.

Recommended lengths for dip-tapes are 5 m, 10 m, 15 m, 20 m, 25 m, 30 m, 40 m and 50 m.