
**Petroleum and liquid petroleum products —
Temperature measurements — Manual
methods**

*Pétrole et produits pétroliers liquides — Mesurages de la température —
Méthodes manuelles*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 4268:2000](https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000)

[https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-
897e443ea593/iso-4268-2000](https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000)



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 4268:2000

<https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000>

© ISO 2000

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Foreword.....	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Introduction to precautions	1
4 Precautions relating to procedures	2
5 Precautions relating to safety	3
5.1 Introduction	3
5.2 General safety precautions.....	3
5.3 Special safety precautions	4
6 Equipment	5
7 Portable electronic thermometers (PETs).....	5
7.1 Introduction	5
7.2 Accuracy requirements	5
7.3 Sensing elements	5
7.4 Electrical safety.....	6
7.5 Selection and operation of portable electronic thermometers	6
8 Liquid-in-glass thermometers	9
8.1 General.....	9
8.2 Accuracy and resolution	9
8.3 Specifications.....	9
8.4 General requirements for liquid-in-glass thermometers	10
8.5 Periodic checks of liquid-in-glass thermometers	10
8.6 Armoured cases for liquid-in-glass thermometers	11
9 Precautions to be taken when selecting and using liquid-in-glass thermometers	11
9.1 Selection of thermometers	11
9.2 Detection and prevention of errors in liquid-in-glass thermometers	13
9.3 Emergent-stem correction	13
10 Tank sampling methods.....	13
10.1 Cup-case thermometer.....	13
10.2 Flushing-case thermometer.....	14
10.3 Sampling-bottle methods.....	16
11 Vapour-lock samplers and associated thermometers.....	16
11.1 Vapour-locks on pressurized tanks	16
11.2 Outline description	16
12 Permanently installed spot thermometers	17
12.1 Angle-stem thermometers	17
12.2 Tank-bottom liquid-in-glass thermometers	19
12.3 Accuracy and resolution	19
13 Bimetal-actuated thermometer with dial	19
13.1 Introduction	19
13.2 Description	19
13.3 Accuracy and resolution	19
14 Procedures	19

15	Liquids in pressurized tanks	19
15.1	Introduction	19
15.2	General principles.....	20
15.3	Equipment.....	20
15.4	Procedures for pressurized tanks.....	20
16	Liquids in vapour-tight tanks.....	22
16.1	Introduction	22
16.2	General principles.....	23
16.3	Equipment.....	23
16.4	Procedure for vapour-tight tanks.....	23
17	Liquids in non-pressurized non-insulated tanks at or near ambient temperature, or in non-pressurized insulated tanks.....	24
17.1	Introduction	24
17.2	Equipment.....	24
17.3	Procedures	24
17.4	Vertical cylindrical fixed-roof tanks	26
17.5	Floating-roof tanks	27
17.6	Horizontal and inclined cylindrical tanks	27
17.7	Rail wagons and road vehicles carrying tanks.....	27
17.8	Ship and barge cargo tanks.....	28
18	Liquids in non-pressurized non-insulated tanks at temperatures differing by more than 15 °C from ambient	28
18.1	Introduction	28
18.2	General principle.....	28
18.3	Equipment.....	29
18.4	Measurement procedure	29
19	Procedures for the verification of permanently installed tank thermometers	30
19.1	Introduction	30
19.2	Specification of reference thermometer	30
19.3	Verification procedure for vertical cylindrical tanks	30
19.4	Verification procedure for other tanks with non-uniform vertical cross-sectional area	31
20	Procedures for using a permanently installed spot thermometer.....	31
20.1	Introduction	31
20.2	Location of single-point spot thermometers	31
20.3	Specification of thermometers	31
20.4	Verification of representivity of single-point spot thermometer measurements.....	31
20.5	Procedure for using single-point spot thermometers	32

iTeH STANDARD PREVIEW
(standards.iteh.ai)

ISO 4268:2000

<https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-4974d1ee593/iso-4268-2000>

1974d1ee593/iso-4268-2000

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 4268 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 3, *Static petroleum measurement*.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 4268:2000](#)

<https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000>

Introduction

In all calculations concerned with the measurement of bulk quantities of petroleum and petroleum products, whether in terms of volume at standard temperature or in terms of mass or apparent mass-in-air, a knowledge of the mean temperature of the oil is required. The following recommendations for the determination of the temperature of the contents of storage tanks, including tanks carried by road and rail vehicles and compartments of barges and ships, are designed to provide the most reliable measurement of the mean temperature under the given conditions.

It cannot be too strongly emphasized that errors in temperature measurement can account for the larger part of the total error in quantitative measurement of petroleum and liquid petroleum products, and great care is therefore needed in the selection and use of temperature-measuring equipment. The methods specified should be followed in scrupulous detail if the final measurement is to have the smallest possible uncertainty.

Gaugers employed in temperature measurement should be fully trained and instructed in the application of the procedures of this International Standard. They should be instructed to report any deviations that are unavoidable.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 4268:2000](https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000)

<https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000>

Petroleum and liquid petroleum products — Temperature measurements — Manual methods

1 Scope

This International Standard specifies methods, procedures and equipment for the manual measurement of the temperature of bulk quantities of petroleum and petroleum products in storage tanks.

The preferred method is to use a portable electronic thermometer as described in clause 7. Other methods included use permanently installed indicating thermometers of the spot-measurement type and temperature determination by sampling methods using cup-case thermometers, flushing-case thermometers, and thermometers within conventional tank samples taken in accordance with ISO 3170.

This International Standard excludes averaging thermometers forming part of an automatic gauging system. These are described in ISO 4266.

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 prevails.

2 Normative references

[ISO 4268:2000](https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000)

<https://standards.iteh.ai/catalog/standards/sist/12997bfe-8c63-40b6-8e64-897e443ea593/iso-4268-2000>

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 386:1977, *Liquid in-glass laboratory thermometers — Principles of design construction and use.*

ISO 3170:1988, *Petroleum liquids — Manual sampling.*

ISO 4266:1994, *Petroleum and liquid petroleum products — Direct measurement of temperature and level in storage tanks — Automatic methods.*

ISO 4512:—¹⁾, *Petroleum and liquid petroleum products — Equipment for measurement of liquid levels in storage tanks — Manual methods.*

3 Introduction to precautions

Clauses 4 and 5 outline the precautions which are applicable whenever the temperature of a bulk quantity of oil is to be determined. For emphasis, the precautions necessary to ensure the safety of the operator or the safe working of the plant (clause 5) are dealt with separately from those precautions that shall be taken during the procedure used, to ensure the most reliable measurement of temperature (clause 4).

1) To be published.

Certain special precautions that are necessary when applying some of the equipment specified are dealt with subsequently in the clauses relating to that equipment.

4 Precautions relating to procedures

Whatever apparatus is used for taking temperature measurements, the following precautions shall be taken.

- a) Whenever determination of the temperature of the contents of a tank is made before and after a movement of a bulk quantity of oil, the same general procedure shall be followed in each case.

NOTE 1 To minimize measurement uncertainties, it is recommended that the same equipment should be used for both the opening and closing measurements.

If liquid-in-glass thermometers are used, care shall be taken to avoid parallax errors.

- b) Temperature determination for referee purposes shall be made under the immediate supervision of a skilled person with previous experience in oil measurement. Readings shall be recorded immediately and agreed upon by all interested parties before the gauger and apparatus leave the tank or container.

- c) The thermometer reading obtained on each spot measurement made at each level in a tank, the date and the time shall be recorded immediately the reading is taken. The number of the tank, the position of the access point (gauge-hatch or vapour-lock valve), and the level at which each measurement was made (or from which each sample was drawn) shall be clearly indicated in the gauger's notes. In general, the calculation of the mean temperature of the contents of the tank from the observed temperatures shall not be part of the gauger's duties.

iTeh STANDARD PREVIEW

- d) Temperature determination shall be made through openings giving direct access to the bulk of oil in the tank. Still-wells or thermo-wells shall not be used, except as described in this International Standard.

NOTE 2 If temperature measurements are made through a still-well (guide pole), it is essential that the still-well be perforated throughout its working length to ensure that the temperature measurements are representative of the bulk tank contents.

<https://standards.iteh.ai/catalog/standards/sist/12997b1e-8c63-40b6-8c64-897e443ea593/iso-4268-2000>

- e) Temperature measurements shall be made immediately after the level of the contents within the tank has been determined (see ISO 4512).

The depth of any free water in a tank shall be ascertained before temperature determinations are made, so that the correct levels for the measurement of temperature can be properly determined (see Table 2).

- f) If protective metal cases are used for liquid-in-glass thermometers [8.6 and Figures 1a) and 1b)], they shall permit free access of the oil to the thermometer bulb, and ample provision shall be made for viewing the scale. Sufficient time shall always be allowed for the case to take up the temperature of the oil before the reading is taken.

- g) If a tank is provided with more than one access point (gauge-hatch or vapour-lock valve), each one shall have a number, or other means of identification, clearly marked on or near it. The recorded results of all temperature measurements shall clearly indicate the access point from which they were obtained.

NOTE 3 Temperatures should not be taken within 500 mm of the walls (shell) of a vertical cylindrical tank in order to avoid extraneous thermal effects. In older vertical cylindrical tanks, gauge-hatches and roof manholes may be situated nearer the tank shell. In such cases, it is recommended that consideration be given to the provision of a new access point in the preferred position. In new tanks, it is recommended that access points (gauge-hatches or vapour-lock valves) should be positioned with their centres not less than 500 mm from the tank shell and sited so as to be clear of bottom fittings.

NOTE 4 While it may be possible to obtain temperature measurements from more than one access point, the associated measurement of stock level within the tank should only be obtained from that access point to which the tank capacity table relates.

5 Precautions relating to safety

5.1 Introduction

The safety precautions given in 5.2 and 5.3 constitute good practice, but the list is not comprehensive. It is essential that the list be read in conjunction with any relevant sections of national/ international codes of safe practice in the petroleum industry.

In cases of conflict between this International Standard and legal regulations or national safety codes, the latter shall be followed; otherwise, the provisions of this International Standard shall be observed.

5.2 General safety precautions

The following safety precautions apply in all cases.

- a) All regulations covering entry into hazardous areas shall be rigorously observed.
- b) Access ladders, stairways, platforms and handrails shall be maintained in a structurally safe condition.
- c) The plant and equipment shall be adequately maintained, and it is strongly recommended that a regular inspection be made by a competent person.
- d) Gaugers shall be provided with carriers for their equipment in order that at least one hand is free for climbing ladders, etc.
- e) Hand lamps and electric torches (flashlights) shall be of an approved type.
- f) Footwear and clothing (for example nylon overalls) capable of causing sparks shall not be worn in areas where flammable vapours are likely to be present.

NOTE 1 Footwear and gloves should be sufficiently conductive to dissipate any electrostatic charge safely.

- g) Care shall be taken when opening tank access points (gauge-hatches or vapour-lock valves), particularly on vapour-tight tanks, which may be under pressure. If temperature measurements are obtained using closed or restricted Portable Electronic Thermometers (PETs) or sampling methods, the equipment shall be connected to the vapour-lock valve before the valve is opened. If gauge hatches or covers are used for open gauging measurements, the retaining clips on the hatch (or cover) shall be loosened but kept in position until any pressure has been released. **Persons on the tank top shall stand well clear of any vapours that are expelled.**
- h) Care shall be taken to ensure that any metallic component of the equipment that could act as an insulated electrical conductor is effectively earthed and bonded before opening the access point (gauge-hatch or vapour-lock valve), during measurement, and until after closure of the access point. If a cord is used for lowering equipment into tanks, it shall be made of natural fibre and not of synthetic material, in order to minimize the hazard of static electricity.
- i) In order to earth (ground) any static charges on his person, a gauger shall touch some earthed (grounded) part of the tank structure immediately before carrying out any gauging operation.
- j) When carrying out any gauging, sampling or temperature-measuring operation, only one access point shall be open at any one time. Such operations shall not be carried out during electrical storms, when all access points shall be closed. Special attention is drawn to the fact that electrical discharges capable of igniting petroleum vapours, such as might be issuing from an open gauge-hatch, may take place under a variety of weather conditions other than thunderstorms.

NOTE 2 In the case of static accumulator oils in non-inerted tanks at temperatures above their flash point, it is strongly recommended that tanks should not be gauged whilst the product is being transferred into it and until at least 30 min have elapsed after transfer has ceased. This allows time for any electrostatic charge that may be present on the surface of the

liquid to dissipate and for the oil surface to become quiescent. This restriction does NOT apply if measurement is made via a permanently installed stilling well that is electrically bonded to the tank shell.

NOTE 3 It is strongly recommended that gaugers should be thoroughly trained in gas safety, including the uses and limitations of rescue equipment.

NOTE 4 It is recommended that trays or other receptacles should be provided near gauge-hatches on the roofs of tanks containing non-volatile products to hold equipment after it has been used, in order to prevent unnecessary spillage on the roof.

- k) Temperature-measurement apparatus that may be used in a flammable atmosphere shall not be made of aluminium or its alloys (to prevent any possible risk of a Thermite reaction resulting in the ignition of flammable vapours).

5.3 Special safety precautions

5.3.1 Leaded fuels

Regulations on the handling of leaded fuels shall be rigorously observed.

5.3.2 Liquefied petroleum gases

Liquefied petroleum gases can cause serious cold burns. Care shall be taken, therefore, to prevent the liquid from coming into contact with the skin.

5.3.3 Pressure-type and vapour-tight tanks

The following precautions shall be observed.

- a) All gauging equipment used on pressure-type tanks shall be designed to withstand a pressure equal to the working pressure plus an adequate safety margin (typically 1,5 times the designed maximum working pressure).
- b) Measurements shall only be made through a vapour-lock valve or vapour-lock. Such systems are available for various ranges of operating pressures. In no circumstances shall measurement apparatus be used on tanks at a higher pressure than that for which it was designed.

5.3.4 Floating-roof tanks

Floating-roof tanks are usually gauged from the platform, but in exceptional circumstances it may be necessary to descend onto the roof. Toxic and flammable vapours may accumulate above the roof, and if it is necessary for a gauger to descend on the roof, he shall at all times be kept under observation by another operator from the top platform. It is essential, before the gauger descends on the roof, that he shall be equipped with a safety-line and harness. Both the gauger and observer shall have breathing apparatus in the following circumstances:

- a) whenever the product contained in the tank may contain volatile mercaptans or hydrogen sulfide;
- b) when the roof is at rest on its supports, or is within the tank roof's critical flotation zone;
- c) when the roof is out of round or when the roof-seal is known to be faulty;
- d) in any other circumstances, when there may be vapours present in dangerous concentrations.

5.3.5 Benzene

Benzene is a known carcinogen. Personal protective equipment shall therefore be used to minimize the risk of vapour inhalation and/or skin contact when gauging or sampling tanks containing benzene.

6 Equipment

Clauses 7 to 13 describe and give detailed specifications for equipment used for temperature measurement. Precautions that are necessary when using or installing certain items of equipment are listed, and procedures for calibration or verification are given.

7 Portable electronic thermometers (PETs)

7.1 Introduction

A wide range of portable electronic tank thermometers are available which are designed to take spot temperatures at any location within a tank which is accessible from the available gauging access point(s). Suitable sensing elements include resistance thermometers and thermistors, but other sensors capable of meeting the required accuracy may also be used.

7.2 Accuracy requirements

The minimum resolution of measurement of a PET shall be 0,1 °C.

The electronic thermometer shall be calibrated against a reference thermometer certified by an approved laboratory (see 7.5.3), to ensure that the overall accuracy shall be within $\pm 0,2$ °C for a range of -10 °C to $+35$ °C, and within $\pm 0,3$ °C for ranges of -25 °C to -10 °C and $+35$ °C to $+100$ °C (with the calibration correction(s) applied).

7.3 Sensing elements

iTeh STANDARD PREVIEW
(standards.iteh.ai)

7.3.1 Resistance thermometers

Nickel-wound resistance thermometers have a useful range from -200 °C to $+350$ °C, and platinum-wound resistance thermometer elements have a useful range of -200 °C to $+600$ °C. Copper-wound resistance elements are also employed, but over a more restricted range of -40 °C to $+175$ °C.

A suitable protective sheath shall be provided to protect the sensing element, and the connecting leads shall be carefully sealed to prevent the ingress of moisture.

It is essential to ensure that the effective change in electrical resistance only occurs in the temperature-sensitive element. This will usually be accommodated by the circuit employed, which accurately balances out, and automatically compensates for, changes in the electrical resistance of all other parts of the resistance-thermometer circuit. The measuring instrument may be located a relatively long distance from the sensing element without introducing errors in the reading.

NOTE The abbreviation RTD (resistance temperature detector), is commonly used, and is synonymous with the term "resistance thermometer". Platinum RTDs are also commonly referred to as Pt100s, indicating that they are platinum RTDs with 100 Ω ice-point.

7.3.2 Thermistors

These are used as an alternative to the resistance thermometers for portable electronic thermometers. Given the small size of the semiconductor used in the sensitive element of a thermistor, the thermometer will usually have a very quick response. By a suitable choice of the semiconductor, linearity of response can be obtained over a wide range of temperatures. Some zero-drift may be experienced with thermistors, and errors can arise from auto-heating of the semiconductor. Zero-adjusting facilities are therefore usually incorporated in thermistor-based portable electronic thermometers.

7.4 Electrical safety

All portable electronic thermometers shall be suitable for the hazardous areas where they will be used. They shall be either intrinsically safe or explosion proof, and grounded via the gauge-hatch or vapour-lock valve.

7.5 Selection and operation of portable electronic thermometers

7.5.1 General

The portable electronic thermometer may be used as a precise measuring device for measuring the temperature of oil at one or several points within a tank. It may also be used as a reference thermometer for verifying the calibration of other (permanently installed) temperature-measuring devices.

7.5.2 Specification for portable electronic thermometers (PETs)

7.5.2.1 Range

The thermometer shall have any convenient range to cover the minimum and maximum operating temperatures expected. Thermometers may be provided with a dual scale and a range-change switch to enable them to cover the maximum anticipated range.

7.5.2.2 Accuracy

The accuracy of a PET shall comply with the specification in 7.2.

7.5.2.3 Resolution

If the display is digital, the last digit shall correspond to 0,1 °C or better. The readout numerals shall be clear and bold, with no possibility of misinterpretation, even with partial failure of light emission, or for any other reason.

Analogue PETs are acceptable, provided that they can ensure the same resolution of measurement.

7.5.2.4 Housing

The instrument shall have a protective case or enclosure and be self-contained. It shall be robust and shock proof, but shall be sufficiently light to be carried by an operator without undue fatigue.

7.5.2.5 Cables/tapes

The cable or tape connecting the sensing element to the measuring instrument shall be resistant to immersion in petroleum products. It shall be long enough to cover the full depths of the tanks for which the thermometer is likely to be used. It may be marked at metre intervals or graduated in millimetres in order to assist in lowering to the required level.

NOTE For convenience, the cable or tape should be wound on a reel.

7.5.2.6 Calibration check facilities

Calibration resistances may be used for verifying the electronic circuitry of resistance-thermometer based PETs. They may either be integrated into the equipment or connected into the circuit by a test plug. Alternative means may be provided for checking the calibration of other types of PET.

7.5.2.7 Battery charger

If the equipment has a rechargeable battery, a battery charger suitable for the voltages used shall be provided. Battery charging shall only take place in a safe area.

7.5.3 Initial calibration

Before a portable electronic thermometer is used it shall be calibrated by a calibration laboratory, which shall issue a calibration certificate. The certificate shall detail the uncertainty of measurement and the traceability of the calibration to a national standard. The certificate shall be dated, and shall refer to the unique serial number of the PET.

The laboratory shall calibrate the complete PET (i.e. the sensor, cable/tape, electronic circuitry, and display/readout) at several different temperatures over the desired measurement range. This shall be achieved by direct comparison with a standardized reference thermometer when both sensors are immersed at the same location within a series of temperature controlled baths. To obtain an uncertainty of $\pm 0,2$ °C for the PET, the reference thermometer that it is compared with shall be accurate to $\pm 0,05$ °C (or better), have a resolution of 0,02 °C (or better), and be traceable to a national standard.

NOTE If the PET uses a resistance-thermometer sensor, the laboratory may also check the operation of the electronic circuitry and readout by substitution of a resistance box containing precision resistances for the sensing element. The uncertainty of the standard resistances should be at least five times better than that required for the PET.

7.5.4 Pre-commissioning checks

Before a new PET is commissioned, the following checks shall be carried out.

- a) Check that the PET conforms to the specification itemized in this International Standard and has no visual damage.
- b) Check the state of the battery. Replace or recharge as necessary.
- c) Check the PET against a certified reference thermometer. If the PET is fitted with a checking facility, press the test button or insert the calibration resistance.
- d) Check the thermometer's response time. Equilibrium should be established when the indicated temperature is stable to 0,1 % for 30 s. Check the practical response time of the thermometer, i.e. the time in seconds that it takes for the thermometer to respond to a known step change in temperature.

NOTE To be considered fit for the purpose of tank measurement applications, the response time should typically be less than 15 s.

7.5.5 Storage precautions

The cable/tape shall be kept wound in order to avoid kinks and bends.

NOTE When not in use, a rechargeable instrument should be placed on charge. On non-rechargeable units, the battery should be removed prior to a period of extended storage.

7.5.6 Operating procedures

When using a PET, the following operating procedures shall be carried out.

- a) Earth the case or housing of the PET to the tank structure before opening the gauge-hatch or vapour-lock valve.
- b) Before and after each use for custody transfer measurements, check the state of the charge of the battery.
- c) If applicable, check the electronic circuitry and readout using the test facilities provided with the equipment.
- d) Lower the sensing probe to the first predetermined level, see 15.4.1 and Table 2.