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**Petroleum and liquid petroleum products —  
Calibration of horizontal cylindrical  
tanks —**

**Part 1:  
Manual methods**

iTeh STANDARD PREVIEW

*Pétrole et produits pétroliers liquides — Jaugeage des réservoirs  
cylindriques horizontaux*

*Partie 1: Méthodes manuelles*

ISO 12917-1:2002

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# Contents

	Page
Foreword .....	iv
Introduction.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions .....	1
4 Precautions .....	2
4.1 General .....	2
4.2 Internal method .....	2
4.3 External method .....	2
5 Equipment.....	2
5.1 Equipment as used in the ISO 7507 series .....	2
5.2 Telescopic rod .....	2
6 General requirements .....	2
7 Calibration procedures .....	3
8 External measurements .....	3
8.1 Introduction .....	3
8.2 General .....	3
8.3 Repetition of measurements .....	4
8.4 Tolerances .....	4
8.5 Other measurements on tank-shell plates.....	4
9 Internal measurements .....	5
9.1 General .....	5
9.2 Repetition of measurements .....	5
9.3 Tolerances .....	5
9.4 Other measurements on tank-shell plates.....	5
10 Additional measurements .....	6
10.1 Deadwood .....	6
10.2 Measurement of tilt .....	6
11 Other parameters .....	7
12 Recalibration.....	7
13 Descriptive data.....	7
14 Computation of tank capacity tables — General rules.....	7
15 Effects of tilt.....	8
16 Systematic calculations (summary) .....	8
16.1 General .....	8
16.2 Cylindrical volume .....	8
16.3 Volume of the knuckle-dish ends .....	9
16.4 Elliptical ends .....	11
16.5 Spherical head.....	11
16.6 Deadwood .....	12
Annex A (normative) Tilt .....	13
Annex B (informative) Corrections of volume of tank table .....	15
Bibliography.....	18

## 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.

The main task of technical committees is to prepare International Standards. 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 part of ISO 12917 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12917-1 was prepared by Technical Committee ISO/TC 28, Petroleum products and lubricants, Subcommittee SC 3, Static petroleum measurement.

ISO 12917 consists of the following parts, under the general title Petroleum and liquid petroleum products — Calibration of horizontal cylindrical tanks: **(standards.iteh.ai)**

— *Part 1: Manual methods*

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— *Part 2: Internal electro-optical distance-ranging method*

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Annex A forms a normative part of this part of ISO 12917. Annex B is for information only.

This corrected version of ISO 12917-1:2002 incorporates the following corrections.

On the cover page, “Première édition” has been replaced by “First edition”.

The missing Greek symbols have been added in the following equations:

- page 9, subclause 16.3, four equations;
- page 10, subclause 16.3, equation immediately above Figure 4;
- pages 15 and 16, clause B.2, six equations.

## Introduction

This International Standard forms part of a series on tank calibration methods. In countries where some or all of the items covered by this part of ISO 12917 are subject to mandatory regulations, the regulations have to be observed. In cases where differences exist between this part of ISO 12917 and regulations, precedence is given to the latter.

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# Petroleum and liquid petroleum products — Calibration of horizontal cylindrical tanks —

## Part 1: Manual methods

### 1 Scope

This part of ISO 12917 specifies manual methods for the calibration of nominally horizontal cylindrical tanks, installed at a fixed location. It is applicable to horizontal tanks up to 4 m in diameter and 30 m in length.

The methods are applicable to insulated and non-insulated tanks, either when they are above-ground or underground. The methods are applicable to pressurized tanks, and to both knuckle-dish-end and flat-end cylindrical tanks as well as elliptical and spherical head tanks.

This part of ISO 12917 is applicable to tanks inclined by up to 10 % from the horizontal provided a correction is applied for the measured tilt.

For tanks over and above these dimensions and angle of tilt, appropriate corrections for tilt and appropriate volume computations should be based on the “Coats” equation [1].

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### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12917. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12917 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*

ISO 7507 (all parts), *Petroleum and liquid petroleum products — Calibration of vertical cylindrical tanks*

### 3 Terms and definitions

For the purposes of this part of ISO 12917, the terms and definitions given in ISO 1998, ISO 7507-1 and the following apply.

#### 3.1

##### **telescopic rod**

extendable tubular measuring device to measure a distance between two points

NOTE For example, to measure the internal diameter of a cylindrical tank.

## 4 Precautions

### 4.1 General

The general and safety precautions given in ISO 7507-1 shall apply to this part of ISO 12917.

### 4.2 Internal method

Before a tank which has been used is entered, a safe-entry certificate, issued in accordance with local or national regulations, shall be obtained. All lines entering the tank shall be disconnected and blanked. The national or local regulations regarding entry into tanks which have contained leaded fuels shall be meticulously observed.

### 4.3 External method

National or local regulations regarding entry to the tank area shall be observed.

## 5 Equipment

### 5.1 Equipment as used in the ISO 7507 series

The equipment required to carry out the calibration is dependent on the method to be employed. This part of ISO 12917 uses techniques and equipment described in ISO 7507-1. Equipment used in the calibration of horizontal tanks shall conform with the specifications laid down in the relevant parts of ISO 7507. All equipment shall be traceable to a reference standard.

### 5.2 Telescopic rod

**5.2.1** In addition to the equipment mentioned in 5.1 a telescopic rod shall be used. This telescopic rod shall have a scale capable of being read to 1 mm, and shall be calibrated to within  $\pm 0,5$  mm.

**5.2.2** The telescopic rod shall give a repeatability of maximum 1 mm.

## 6 General requirements

**6.1** The tank shall be filled to its normal working capacity and working pressure at least once and allowed to stand while full for at least 24 h prior to emptying and preparing the tank for calibration.

NOTE The hydrostatic test applied to new or repaired tanks will satisfy this requirement when additional pressure tests are carried out.

**6.2** The following variables shall be considered for the development of the capacity tables:

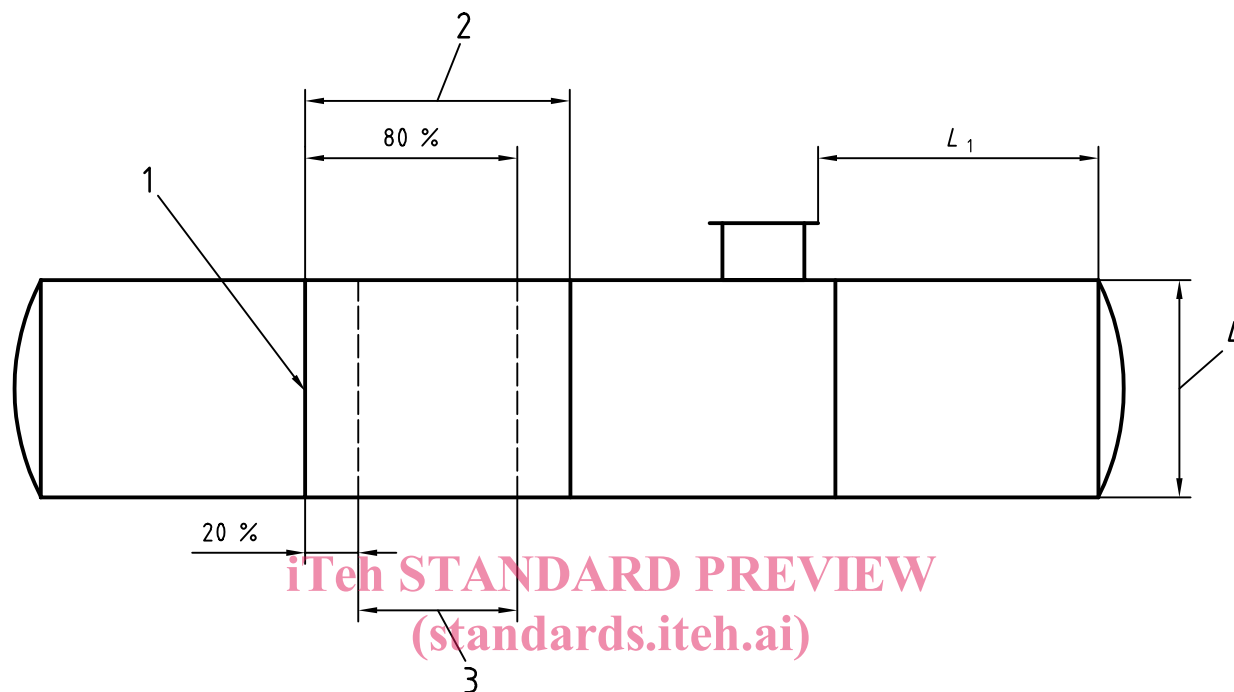
- slope/tilt;
- deadwood;
- temperature;
- pressure;
- liquid head;
- position of gauge point.



## 7 Calibration procedures

The calibration procedures for calibration of horizontal cylindrical tanks are described in clause 8 (external measurements) and clause 9 (internal measurements).

For both methods, measurements will be taken at around 20 % and 80 % of the width of each ring (see Figure 1).



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### Key

- 1 Weld line
- 2 Course length
- 3 Circumference measurement
- 4 Reference height

Figure 1 — Measurements of the diameters/circumferences

## 8 External measurements

### 8.1 Introduction

External measurements may be executed with any depth of liquid and liquid pressure in the tank. The depth, temperature, density and pressure of the liquid at the time of calibration shall be recorded. However, if the temperature of the tank wall could differ by more than 10 °C between the empty part and full part of the tank whilst the measurements are being taken, the tank shall be either completely full or empty during the procedure.

### 8.2 General

For the measurement procedures, a circumferential tape of sufficient length to completely encircle the tank should be used and measurements of the total circumference shall be taken.

- a) In all cases, the tape to be used should be applied to the tank surface at the prescribed locations by the wraparound procedure; i.e. the required length of tape should be applied in a slack condition, positioned, and tightened by the application of the proper tension.

As indicated in Figure 1, strapping should be undertaken around 20 % and 80 % of the course length

- b) In the case in which the circumferential measuring tape is in contact with the tank surface at all points along its path, circumferential measurements should be made and checked in accordance with the relevant procedure given in ISO 7507-1. The checked measurements should be recorded as final measurements.

### 8.3 Repetition of measurements

After the circumference has been measured, the tension shall be released and the tape brought again to the required level and tension. The readings shall then be repeated and recorded.

### 8.4 Tolerances

Measurements shall be read to the nearest 1 mm and shall be considered satisfactory if two consecutive readings are within  $\pm 0,03$  % of the circumference or 3 mm, whichever is greater.

If agreement is not obtained, further measurements shall be taken and recorded until two consecutive readings agree. The average of these two readings shall be taken as the circumference. If consecutive measurements do not agree, the reason for the disagreement shall be determined and the calibration procedure shall be repeated.

### 8.5 Other measurements on tank-shell plates

#### 8.5.1 Plate and paint thickness

Plate, paint and any coating thickness shall either be measured for each course, whenever possible, by an ultrasonic device/primary method, or will be taken from the drawings. The plate and paint thickness for each course shall be recorded to the nearest 0,5 mm. Physical measurements are preferred to readings from drawings.

#### 8.5.2 Length of the horizontal cylinder

ISO 12917-1:2002

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The length of the horizontal tank (cylindrical part) shall be measured at the welding of the first knuckle at four measuring points representative of the length of the tank (see Figure 2).

For each measuring point, a reference point shall be marked on the tank. The measurement of the length should be repeated at least twice. Measurements shall be read to the nearest 1 mm and shall be considered satisfactory if two consecutive readings are within 0,03 % of the length or  $\pm 3$  mm, whichever is greater. Determine the overall length by taking the average of the two consecutive readings.

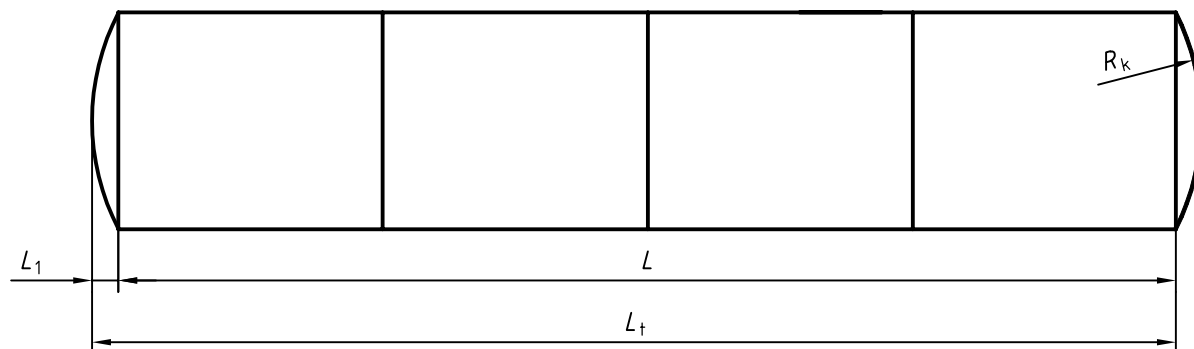
#### 8.5.3 Head radii measurements

The radius of the knuckle shall be measured using templates or depth gauges whenever possible (see Figure 2), taking up to eight measurements around the circumference, if practical, or taken from the drawings. An average of eight measurements shall then be computed.

NOTE Physical measurements are preferred to readings from drawings.

#### 8.5.4 Head length measurements

The length of the head shall be measured between the weldings mentioned in 8.5.2 at least two points (see Figure 2).



- $L$  Length of cylindrical part of tank (see 8.5.2 and 9.4.2);
- $L_t$  Total length of tank (see 9.4.5);
- $L_1$  Length of head (see 8.5.4 and 9.4.4);
- $R_k$  Radius of knuckle (see 8.5.3 and 9.4.3).

**Figure 2 — Measurements of lengths and radii**

## 9 Internal measurements

### 9.1 General

For the measurement procedures, a telescopic rod (5.2) of sufficient length to completely measure the internal diameter of the tank shall be used. The internal method is applicable to tanks less than 4 m in diameter.

In all cases, the telescopic rod shall be applied to the tank at the prescribed locations, at four positions, equally divided around the circumference. The average of these four measurements shall be recorded.

### 9.2 Repetition of measurements

After an internal diameter has been measured, the telescopic rod shall be released and brought back again to the tank shell. The readings shall be repeated and recorded.

### 9.3 Tolerances

Measurements shall be read to the nearest 1 mm and shall be considered satisfactory if they are within  $\pm 0,05$  % of the diameter or  $\pm 1$  mm, whichever is greater.

If agreement is not obtained, further measurements shall be taken and recorded until two consecutive averages agree. The overall average of these two averages shall be taken as the diameter. If consecutive measurements do not agree, the reason for the disagreement shall be determined and the calibration procedure shall be repeated.

### 9.4 Other measurements on tank-shell plates

#### 9.4.1 Plate thickness

The plate thickness shall either be measured for each course, whenever possible, or will be taken from the drawings. The plate thickness for each course shall be recorded to the nearest 0,5 mm. Physical measurements are preferred to readings from drawings.

NOTE The thickness is required for pressure correction.