

# Methods for calibration of vertical cylindrical tanks for petroleum and liquid petroleum products —

## Part 2: Optical-reference-line method

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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 Trade and Industry (Gas and Oil Measurement Branch)
- Department of Trade and Industry (National Engineering Laboratory)
- Institute of Petroleum
- Royal Institution of Naval Architects
- Salvage Association

The following body was also represented in the drafting of the standard, through subcommittees and panels:

GAMBICA (BEAMA Ltd.)

This British Standard, having been prepared under the direction of the Petroleum Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 January 1994

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# Contents

|                                                                                             | Page               |
|---------------------------------------------------------------------------------------------|--------------------|
| Committees responsible                                                                      | Inside front cover |
| National foreword                                                                           | ii                 |
| Introduction                                                                                | 1                  |
| 1 Scope                                                                                     | 1                  |
| 2 Normative references                                                                      | 1                  |
| 3 Definitions                                                                               | 1                  |
| 4 Precautions                                                                               | 1                  |
| 5 Equipment                                                                                 | 1                  |
| 6 Procedure                                                                                 | 2                  |
| 7 Tolerances                                                                                | 6                  |
| 8 Tank capacity calculation procedure                                                       | 6                  |
| Annex A (normative) Method for calibrating bottoms of tanks                                 | 7                  |
| Annex B (normative) Specification for equipment used in strapping                           | 7                  |
| Figure 1 — Optical measurement of offsets from tank wall (typical case)                     | 3                  |
| Figure 2 — Determination of internal radius from offsets to external optical reference line | 4                  |
| Figure 3 — Determination of internal radius from offsets to internal optical reference line | 4                  |
| Table 1 — Minimum number of stations                                                        | 5                  |
| List of references                                                                          | Inside back cover  |

# National foreword

This Part of BS 7723 has been prepared under the direction of the Petroleum Standards Policy Committee. It is identical with ISO 7507-2:1993 *Petroleum and liquid petroleum products — Calibration of vertical cylindrical tanks — Part 2: Optical-reference-line method*, published by the International Organization for Standardization (ISO). ISO 7507-2 was prepared by Subcommittee 3, Static petroleum measurement, of Technical Committee 28, Petroleum products and lubricants, in which the United Kingdom participated.

This British Standard forms part of a series, each Part of which is identical with the corresponding Part of ISO 7507 and it is envisaged that BS 7723 will consist of the following Parts:

- Part 1: *Strapping method*;
- Part 2: *Optical-reference-line method*;
- Part 3: *Optical-triangulation method*;
- Part 4: *Internal electro-optical distance-ranging methods*<sup>1)</sup>;
- Part 5: *External electro-optical distance-ranging methods*<sup>1)</sup>.

## Cross-references

| International Standard | Corresponding British Standard                                                                                                                                         |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 91-1:1992          | BS 6441:1993 <i>Schedule for petroleum measurement tables</i><br>(Identical)                                                                                           |
| ISO 7507-1:1993        | BS 7723 <i>Methods for calibration of vertical cylindrical tanks for petroleum and liquid petroleum products</i><br>Part 1:1993 <i>Strapping method</i><br>(Identical) |

CAUTION. Attention is drawn to the Health and Safety at Work etc. Act 1974, and the need for ensuring that the methods specified in this Part of BS 7723 are carried out with suitable precautions.

The methods described in this Part of BS 7723 are intended to be carried out by appropriately qualified and experienced persons or other suitable trained and/or supervised personnel. Normal safety precautions should be observed in the use of the methods.

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 and ii, pages 1 to 10, 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.

<sup>1)</sup> In preparation.

## Introduction

This method describes the calibration of vertical cylindrical tanks by measurement of one reference circumference by strapping and then determining the remaining circumferences at different levels from measurements of radial offsets from vertical optical reference lines. These circumferences are corrected to give the true internal circumferences.

This method is an alternative to other methods such as strapping (ISO 7507-1) and the optical-triangulation method (ISO 7507-3).

## 1 Scope

**1.1** This part of ISO 7507 specifies a method for the calibration of tanks above 8 m in diameter with cylindrical courses that are substantially vertical. It provides a method for determining the volumetric quantity contained within a tank at gauged liquid levels.

The optical (offset) measurements required to determine the circumferences may be taken internally or externally.

**1.2** Abnormally deformed, e.g. dented or non-circular, tanks are excluded from this part of ISO 7507.

**1.3** This method is suitable for tilted tanks up to 3 % deviation from the vertical provided that a correction is applied for the measurement tilt, as described in ISO 7507-1.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7507. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7507 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 91-1:1992, *Petroleum measurement tables — Part 1: Tables based on reference temperatures of 15 °C and 60 degrees F*.

ISO 7507-1:1993, *Petroleum and liquid petroleum products — Calibration of vertical cylindrical tanks — Part 1: Strapping method*.

## 3 Definitions

For the purposes of this part of ISO 7507, the definitions given in ISO 7507-1 apply.

## 4 Precautions

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

## 5 Equipment

**5.1 Equipment for tank strapping**, as listed in 5.1.1 to 5.1.5 below and specified in Annex B:

**5.1.1 Strapping tapes.**

**5.1.2 Spring balance.**

**5.1.3 Step-over.**

**5.1.4 Littlejohn grip.**

**5.1.5 Dip-tape and dip-weight.**

**5.2 Thermometer.**

**5.3 Tank bottom calibration equipment**, as specified in Annex A.

**5.4 Optical-reference-line device**, e.g. a precision optical plummet, a precision engineer's level with a pentaprism attachment, or a precision engineer's theodolite with a pentaprism attachment.

NOTE 1 These are optical instruments with a means of attachment to either a tripod, magnetic bracket or other stable means of support.

The instrument, when set on its support and levelled, either manually using bubble vials or automatically if an automatic levelling device is fitted, shall be capable of giving a vertical line of sight.

NOTE 2 The instrument should preferably be of short focal length so that, when set up at a practical working height, it can be focused on the scale at the reference strapping level.

The instrument shall have a resolution of at least 1 : 20 000 and be equipped with a telescope with a magnification of not less than 20. The pentaprism attachment for use with an engineer's level or engineer's theodolite shall not introduce any collimation errors.

NOTE 3 Optical plummets may be fitted with either a single optical train, i.e. a zenith plummet, or a double optical train or a single superimposed optical train giving both upward and downward lines of sight, i.e. a nadir/zenith plummet. It is preferable that the plummet does not have any movable elements in its optical train, such as mirrors or pentaprisms, to ensure stability of the line of sight.

**5.5 Magnetic trolley**, of robust construction. Its design shall include the following features:

- a) The magnet(s) shall be of sufficient power to ensure that the trolley does not lose contact with the tank shall in conditions of high wind or when ring joints have to be negotiated or when there are heavy layers of paint or scale.