Manual of Petroleum Measurement Standards Chapter 2—Tank Calibration

Section 2C—Calibration of Upright Cylindrical Tanks Using the Optical-triangulation Method

ANSI/API MPMS 2.2C
FIRST EDITION, JANUARY 2002

REAFFIRMED, APRIL 2013

ISO 7507-3:1993 (Modified), Petroleum and liquid petroleum products—Calibration of vertical cylindrical tanks—Part 3: Optical-triangulation method

AMERICAN PETROLEUM INSTITUTE

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FOREWORD

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Chapter 2—Tank Calibration

SECTION 2C—CALIBRATION OF UPRIGHT CYLINDRICAL TANKS USING THE OPTICAL-TRIANGULATION METHOD

0 Introduction

This method describes the calibration of vertical cylindrical tanks by means of optical triangulation using theodolites. The circumference of the tank is determined at different levels by reference to a base line, which may be either a reference circumference measured by strapping or a base line between two stations of a theodolite measured by means of a tape or by an optical method. External circumferences are corrected to give true internal circumferences. The method is an alternative to other methods such as strapping (Chapter 2, Section 2A) and the optical-reference-line method (Chapter 2, Section 2B).

1 Scope

1.1 This part specifies a calibration procedure for application to tanks above 26 ft 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 measurement required to determine the radius may be made internally (Clause 8) or externally (Clause 9). The external method is applicable only to tanks that are free of insulation.

1.2 Abnormally deformed tanks; e.g., dented or non-circular tanks are excluded from this section, API *MPMS* Chapter 2.

1.3 This method is suitable for tilted tanks up to 3% deviation from the vertical, provided that a correction is applied for the measured tilt as described in API *MPMS* Chapter 2.2A.

2 Normative Reference

The following standard contains provisions which through reference in this text, constitutes provisions of this part of Chapter 2. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this section of Chapter 2 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of API maintain registers of currently valid API Standards.

3 Definitions

For the purposes of this part of Chapter 2, the definitions given in Chapter 2.2A apply.

4 Precautions

The general precautions and safety precautions specified in Chapter 2.2A shall apply to this section of Chapter 2.

5 Equipment

5.1 EQUIPMENT FOR MEASUREMENT OF ANGLES

Equipment for measurement of angles as listed in 5.1.1 to 5.1.4 below.

5.1.1 Theodolites, with angular graduations and a resolution equal to or better than 5 seconds. Each theodolite shall be mounted on a tripod which is firm and stable. The legs of the tripod shall be steadied by means of magnetic bearers when being used for the internal method. Repeat readings shall agree to within 5 seconds.

5.1.2 Low-power laser-beam emitter, equipped with a device such as a fiber-optic light-transfer system and a theodolite-telescope eye-piece connection, by which the laser beam can be transmitted through a theodolite. The laser beam shall be coincident with the optical axis of the telescope.

5.1.3 Heavy weights, to set around the theodolite stations to prevent movement of the tank bottom plate.

5.1.4 Lighting, for use inside the tank to allow measurements to be read accurately.

5.2 STADIA

5.2.1 Stadia, 2 m long, such that the graduated length, between two marks, remains constant to within + 0.02 mm, at the temperature at which it is used.

Note: Conversion to USC units is not recommended for use of the stadia.

5.3 EQUIPMENT FOR BOTTOM CALIBRATION

Either:

a. A liquid method, equipment as specified in Appendix E, or
b. For a survey method, a theodolite, a dumpy level, a surveyor's level or water-filled tubes.