

Manual of Petroleum Measurement Standards Chapter 2—Tank Calibration

Section 7—Calibration of Barge Tanks

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Foreword

This standard has been prepared as a guide for the calibration of barge tanks for coastal and inland waterway service by linear measurement, liquid calibration, or barge drawings. This document and Chapter 2.8A, *Calibration of Tanks on Ships and Oceangoing Barges*, supersede the previous API Standard 2553, *Standard Method for Measurement and Calibration of Barges* (ASTM D 1407).

Other sections of Chapter 2 contain an overview of tank calibration, detailed procedures for calibrating various types of tanks, and a detailed discussion of liquid calibration.

Chapter 2 consists of the following sections:

2.2A, *Measurement and Calibration of Upright Cylindrical Tanks by the Manual Strapping Method*

2.2B, *Calibration of Upright Cylindrical Tanks using the Optical Reference Line Method*

2.2C, *Tank Calibration by Optical Triangulation Method*

2.2D, *Tank Calibration by Internal Electro-Optical Distance-Ranging Method*

2.2E, *Petroleum and Liquid Petroleum Products—Calibration of Horizontal Cylindrical Tanks—Part 1: Manual Methods/ISO 12917-1*

2.2F, *Petroleum and Liquid Petroleum Products—Calibration of Horizontal Cylindrical Tanks—Part 2: Internal Electro-Optical Distance-Ranging Method/ISO 12917-2*

2.2G, *Calibration of Upright Cylindrical Tanks using the Total Station Reference Line Method*

2.3/Standard 2552, *Calibration of Spheres and Spheroids*

2.4/Standard 2554, *Measurement and Calibration of Tank Cars*

2.7, *Calibration of Barge Tanks*

2.8A, *Calibration of Tanks on Ships and Oceangoing Barges*

2.8B, *Establishment of the Location of the Reference Gauge Point and the Gauge Height of Tanks on Marine Tank Vessels*

NOTE Users of this chapter and any of its sections should be aware of and comply with any federal, state, or municipal regulations that have a bearing on the procedures, including, in particular, those regulations dealing with the safe handling of volatile materials, worker safety, and environmental protection.

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**API/ASTM JOINT COMMITTEE ON STATIC
PETROLEUM MEASUREMENT WORKING GROUP
ON TANK CALIBRATION**

S. Sivaraman, Chairman
Exxon Research & Engineering Company
Florham Park, New Jersey

S.O. Aboulmagd
Arab Petroleum Pipelines Company
(SUMED)
Alexandria, Egypt

F.R. Conway
Inspectorate America
Pasadena, Texas

J.M. Johnson, Secretary
American Petroleum Institute
Washington, D.C.

H.S. Moore III
E.W. Saybolt & Company, Inc.
Pasadena, Texas

R.C. Morrel
Marine Consultant
Bartlesville, Oklahoma

D. Sauer
Inspectorate America
Pasadena, Texas

W.K. Tkachuk
Shell Oil Company
Houston, Texas

B.J. Hampton, Technical Advisor
Citgo Petroleum Company
Lake Charles, Louisiana

R.I. Wallace
Institute of Petroleum Liaison
Wirral, United Kingdom



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Tank Calibration—Calibration of Barge Tanks

2.7.1 Scope

This standard describes three methods for determining the total and incremental volumes of liquids in barge tanks for coastal and inland waterway service that have integral hull tanks. The three methods are:

- a) Liquid calibration.
- b) Calibration by linear measurement.
- c) Calibration from barge drawings.

Sections 2.7.7 through 2.7.9 describe procedures and equipment for obtaining the requisite field measurement data and suggestions for the orderly and complete recording of field data. Sections 2.7.10 through 2.7.12 include procedures for calculating the total and incremental tank capacities from field data and suggestions for the presentation of capacity tables. Examples of typical calculations are presented in Annex A. Terms specific to the maritime industry are defined in Annex B.

For barges having independent tanks, refer to other sections of Chapter 2 for a similar discussion of horizontal spherical, upright, and other mobile tanks. For the large; oceangoing barges and integrated tug barge units, refer to Chapter 2.8A.

This standard addresses liquid calibration procedures pertaining to barges. For details relating to metering systems, installation, meter proving requirements, and other guidelines relating to liquid calibration, refer to API Standard 2555.

The capacity tables should be computed so that volume is given at standard conditions, that is, at 60 °F (15 °C). Appropriate liquid and tape temperature corrections to 60 °F (15 °C) should be applied. API MPMS Chapter 7 shall be consulted for temperature determination in the marine environment.

2.7.2 Field of Application

The procedures described here are intended primarily for the calibration of integral hull tanks for carrying cargo and ballast on barges for coastal and inland waterway service.

2.7.3 Safety

Before entering any compartment, permission must be obtained from the vessel's master, senior deck officer, authorized shipyard official, or other responsible person in charge. This responsible person should supply information regarding particular materials and conditions or the applicable Material Safety Data Sheet (MSDS).

Due consideration should be given to applicable safety procedures. Safety considerations include, but are not limited to, potential electrostatic hazards, potential personnel exposure (and associated protective clothing and equipment requirements), and potential explosive and toxic hazards as associated with a cargo tank's atmosphere. The physical characteristics of the cargo and existing operational conditions should be evaluated, and applicable international, federal, state, and local regulations should be observed.

In addition, before entering a compartment, a valid marine chemist's certificate must be obtained and indicate that the compartment is "Safe for Workers" and/or "Safe for Hot Work," as prescribed in NFPA

306, U.S. Coast Guard, OSHA, or other international, federal, state, or local regulations that may apply. Such testing must be made at least every 24 hours or more frequently when changing conditions warrant.

In addition, safety procedures designated by the employer, the vessel operator, and other concerned parties should also be observed. Internationally, the International Safety Guide for Oil Tankers and Terminals (ISGOTT), and publications of the Oil Companies International Marine Forum and API provide additional safety information and should be consulted. See Annex C.

Furthermore, another person should stand watch at the compartment entrance for the duration of an entry and sound an alarm if an emergency occurs. Appropriate protective clothing and equipment should be used. Normal safety precautions with respect to staging and ladders must also be observed.

2.7.4 Referenced Publications

The most recent editions of the following standards, codes, and specifications are cited in this chapter.

API *Manual of Petroleum Measurement Standards*, Chapter 1, *Vocabulary*; Chapter 2, *Tank Calibration*, Section 8A, *Calibration of Tanks on Ships and Ocean-going Barges*; Chapter 17, *Marine Measurement*

API Recommended Practice 2026, *Safe Access/Egress Involving Floating Roofs of Storage Tanks in Petroleum Service*

API Recommended Practice 2217A, *Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries*

API MPMS Chapter 7 (all sections), *Temperature Determination*

API MPMS Chapter 2.2A, *Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method*

API Standard 2555, *Liquid Calibration of Tanks*

ISO 7507-1, *Petroleum and liquid petroleum products calibration of vertical cylindrical tanks – Part 1: Strapping method*

NFPA 306, *Control of Gas Hazards on Vessels*

OSHA, *Occupational Safety and Health Standards* (29 Code of Federal Regulations, Sections 1910.1000 and following)

2.7.5 Significance and Use

An accurate calibration of barge tanks is essential for accurate determination of volume of cargoes loaded or discharged from the barge tanks, whether full or partial cargoes. This standard provides three methods for developing such calibrations of barge tanks.

2.7.6 Nomenclature

C	Camber
D	Molded depth of barge
d	Depth of double bottom
G	Reference gauge height
H	Deadrise
IM	Innage as measured at reference gauge point

IT	Innage at desired transverse frames a, b, c (Ia, Ib, Ie...)
K	Distance of reference gauge point from aft bulkhead
L	Length between draft marks
LT	Tank length
Rb	Bilge radius
T	Barge trim
UM	Measured ullage
UT	Ullage corrected for trim
W	Tank width
Y	Distance from the reference gauge point to the transverse frame (Ya, Yb, Ye ...)

NOTE All dimensions must be in consistent units.

2.7.7 Tank Measuring Equipment

The equipment used in dimensional tank calibration is described in 2.7.7.1 through 2.7.7.8. All measuring tapes shall be in one piece and free of kinks.

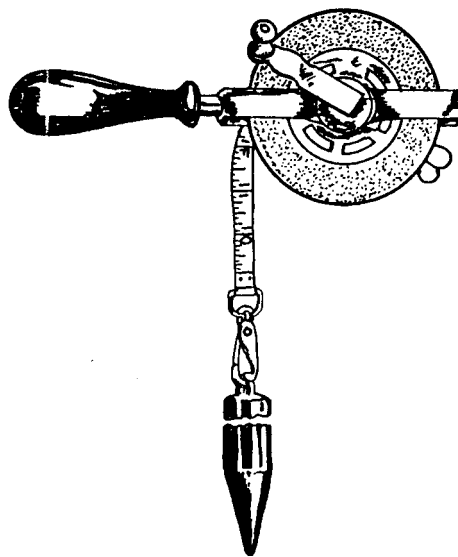


Figure 1—Height-measuring Tape and Bob

2.7.7.1 For Height Measurement

For height measurements, a steel tape of convenient length is recommended and should be 0.375 or 0.500 inch wide and 0.008 to 0.012 inch thick, graduated in feet and inches to eighths of an inch, or in feet, tenths and hundredths of a foot. Tapes graduated in metric units must meet similar specifications (for metric tapes, refer to ISO 7507-1). The working tape shall be calibrated against a master tape in accordance with procedures outlined in API MPMS Ch. 2.2A. An example of a commonly used measuring tape is shown in Figure 1.

2.7.7.2 Tapes for Length and Width Measurements

For length and width measurements, a steel tape of convenient length relative to the length or width of the tanks involved, usually 100 to 200 feet, is recommended, as shown in Figure 2.

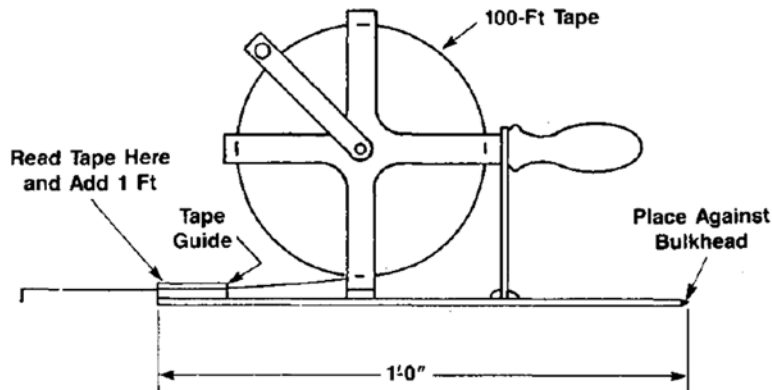


Figure 2—Length and Width-measuring Tape

The working tape should not be more than 0.25 inch wide, and approximately 0.01 inch thick. Graduations should be in feet and inches to eighths of an inch, or in feet, to tenths and hundredths of a foot (for metric tapes, refer to ISO 7507-1). The tapes shall be checked and conform with specified limits of accuracy when compared with the master tape as described in 2.7.7.3.

2.7.7.3 Master Tapes

The master tape that is used for calibrating working tapes for tank measurement should be identified with a Report of Calibration at 68 °F by the National Institute of Standards and Technology. The Report of Calibration attests to the tape accuracy within 0.001 foot (approximately $\frac{1}{64}$ inch) per 100 feet of length. The Report of Calibration also includes the factors and formulas necessary to correct tape length for use at either 60 °F (or 15 °C) under tension differing from that used during calibration and under conditions of sag in an unsupported tape.

2.7.7.4 Reels and Brackets

Tapes shall be equipped with adequate reels and handles or 1-foot tape brackets with guides, whichever is appropriate for the tape to be used.

2.7.7.5 Tape Clamps

To ensure a positive grip on the tape, clamps shall be used, as shown in Figure 3.

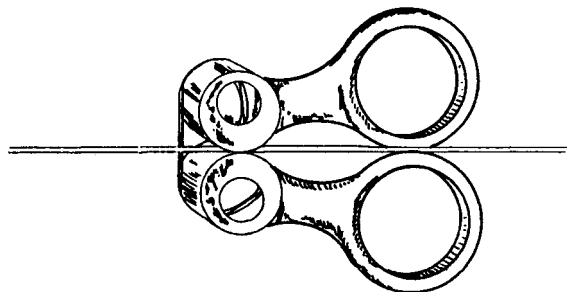


Figure 3—Tape Clamp

2.7.7.6 Measuring Devices (Telescoping Barge and Strapping Pole)

The measuring devices shall be constructed of straight grained hardwood, fiberglass, aluminum, or other suitable material. The scales along the faces of the measuring device shall be graduated in eighths of an inch or in tenths or hundredths of a foot. The measuring device shall be fabricated in two or more sections so that it may be readily adjusted to the required height. Two measuring devices are illustrated in Figure 4.

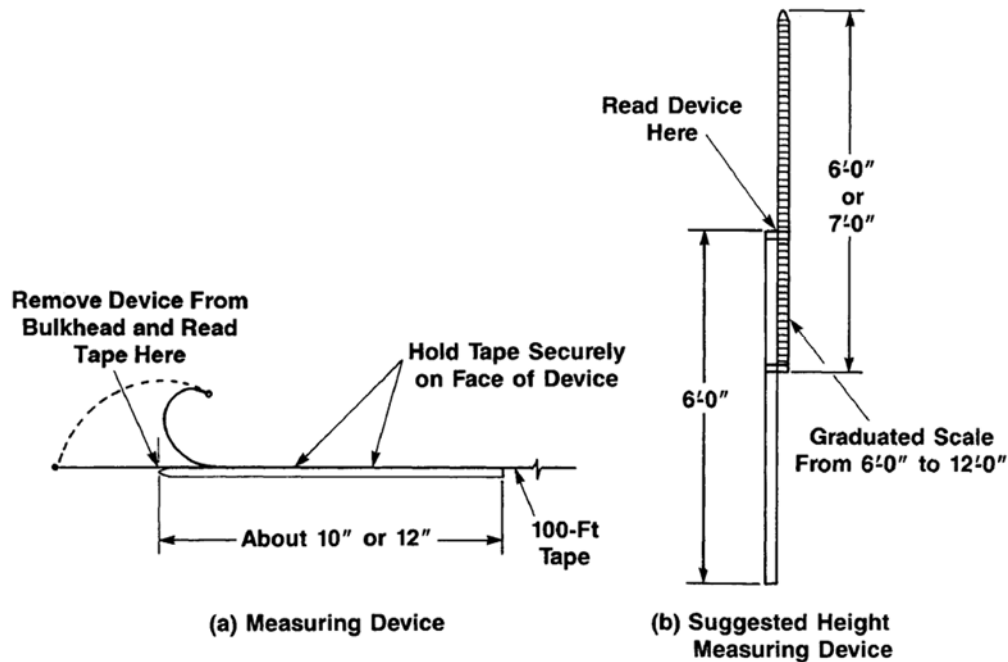


Figure 4—Measuring Devices

2.7.7.7 Other Required Equipment

A flexible steel ruler of suitable length, a line level or leveling device, and a depth gauge for determining strike plate thickness are also required.

2.7.7.8 Accessory Equipment

The following supplementary equipment may also be needed:

- Straightedge.
- Crayon, awl, and scribe.
- Cleaning instruments (for example, a putty knife).
- Ladders.
- Coil of wire or fishing line.