

Manual of Petroleum Measurement Standards Chapter 3—Tank Gauging

Section 6—Measurement of Liquid Hydrocarbons by Hybrid Tank Measurement Systems

FIRST EDITION, FEBRUARY 2001

ERRATA, SEPTEMBER 2005

REAFFIRMED, DECEMBER 2022



American
Petroleum
Institute

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Manual of Petroleum Measurement Standards

Chapter 3—Tank Gauging

Section 6—Measurement of Liquid Hydrocarbons by Hybrid Tank Measurement

Measurement of liquid hydrocarbons by hybrid tank measurement systems

1 Introduction

A Hybrid Tank Measurement System (HTMS) is a method of combining direct product level measured by an automatic tank gauge (ATG), temperature measured by an automatic tank thermometer (ATT), and pressures from one or more pressure sensors. These measurements are used, together with the tank capacity table and applicable volume and density correction tables, to provide level, temperature, mass, observed and standard volume, and observed and reference density.

The product level is directly measured by the ATG. The product temperature is directly measured by the ATT. The true (observed) density is determined from hydrostatic pressure measured by the pressure sensor(s) and the product height above the bottom pressure sensor, as measured by the ATG. Total static mass is computed by a hybrid processor from the true density and the tank capacity table. Gross observed volume, standard volume, and reference density are computed using industry practice for static calculations (See MPMS Chapter 12.1).

2 Scope

This standard covers selection, installation, commissioning, calibration and verification of Hybrid Tank Measurement Systems (HTMSs) for the measurement of level, static mass, observed and standard volume, and observed and reference density in tanks storing petroleum and petroleum products. It is up to the user to define which measurements are required for custody transfer or inventory control purposes (standard volume, mass, or both). Therefore, this standard also provides a method of uncertainty analysis, with examples, to enable users to select the correct components and configure an HTMS to more closely address the intended application. (See Appendix B.)

This standard covers HTMSs for stationary storage tanks storing liquid hydrocarbons with a Reid Vapor Pressure below 5 psia (10.42 kPa). This standard applies to vertical cylindrical tanks, and can also be applied to tanks with other geometries (e.g., spherical and horizontal cylindrical) which have been calibrated by a recognized oil industry method. Examples of uncertainty analysis for spherical and horizontal cylindrical tanks are also given in Appendix B. This standard does not apply to pressurized tanks or marine applications.

This standard covers the installation and calibration of HTMSs for custody transfer and inventory control.

Note: The term “mass” is used to indicate mass in vacuum (true mass). In the petroleum industry, it is not uncommon to use apparent mass (in air) for commercial transactions. Guidance is provided on the calculation of both mass and apparent mass in Appendix A).

3 Referenced Publication

API *Manual of Petroleum Measurement Standards*

- Chapter 1 “Vocabulary”
- Chapter 2.2A “Measurement and Calibration of Upright Cylindrical Tanks by the Manual Strapping Method”
- Chapter 2.2B “Calibration of Upright Cylindrical Tanks Using the Optical Reference Line Method”
- Chapter 3 “Tank Gauging”
- Chapter 3.1 “Manual Gauging of Petroleum and Petroleum Products”
- Chapter 3.3 “Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging”
- Chapter 7 “Temperature Determination”
- Chapter 7.1 “Static Temperature Determination Using Mercury-in-Glass Tank Thermometers”
- Chapter 7.3 “Static Temperature Determination Using Portable Electronic Thermometers”
- Chapter 7.4 “Static Temperature Determination Using Fixed Automatic Tank Thermometers”
- Chapter 8.1 “Manual Sampling of Petroleum and Petroleum Products”
- Chapter 8.3 “Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products”
- Chapter 9.1 “Hydrometer Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products”
- Chapter 9.2 “Pressure Hydrometer Test Method for Density or Relative Density”
- Chapter 11.1 “Volume Correction Factors”
- Chapter 12.1 “Calculation of Static Petroleum Quantities in Upright Cylindrical Tanks and Marine Tank Vessels”
- Chapter 15 “Guidelines for Use of the International System of Units (SI) in the Petroleum and Allied Industries”
- Chapter 16.2 “Mass Measurement of Liquid Hydrocarbons in Vertical Cylindrical Storage Tanks by Hydrostatic Tank Gauging”