Manual of Petroleum Measurement Standards Chapter 4—Proving Systems

Section 9—Methods of Calibration for Displacement and Volumetric Tank Provers

Part 4—Determination of the Volume of Displacement and Tank Provers by the Gravimetric Method of Calibration

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Foreword

This multi-part publication consolidates and standardizes calibration procedures for displacement and volumetric tank provers used in the metering of petroleum liquids. It provides essential information on the operations involved in obtaining a valid, accurate and acceptable prover volume by different calibration methods. Units of measure in this publication are in the International System (SI) and United States Customary (USC) units consistent with North American industry practices. The parts consist of the following:

— Part 1—*Introduction to the Determination of the Volume of Displacement and Tank Provers*;

— Part 2—*Determination of the Volume of Displacement and Tank Provers by the Waterdraw Method of Calibration*;

— Part 3—*Determination of the Volume of Displacement Provers by the Master Meter Method of Calibration*;

— Part 4—*Determination of the Volume of Displacement and Tank Provers by the Gravimetric Method of Calibration*.

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Introduction

This standard describes the gravimetric method of calibration (GM), which is used to determine the calibrated volume of both displacement and tank provers. All prover volumes shall be determined by calibration and not by calculation.

The GM differs from the waterdraw (volumetric) method found in API *MPMS* Ch. 4.9.2. The main difference between the methods is that a field standard test measure is replaced with a weighing system (weigh scale and container).

A majority of the activities necessary to prepare the prover, conduct calibration runs, and record all the required data necessary to calculate the base volumes of displacement and tank provers are identical for the waterdraw and GMs. This standard will describe activities that are different from the waterdraw method. Therefore, it will be necessary for the user to reference API *MPMS* Ch. 4.9.1 and API *MPMS* Ch. 4.9.2 to perform all activities necessary for a calibration. Detailed volume calculation procedures for this method are included in Annex A.

Chapter 4—Proving Systems
Section 9—Methods of Calibration for Displacement and Volumetric Tank Provers
Part 4—Determination of the Volume of Displacement and Tank Provers by the Gravimetric Method of Calibration

1 Scope

1.1 General

This standard covers the specific procedures, equipment, and calculations required to determine the Base Prover Volume (BPV), of both tank and displacement provers by the gravimetric method of calibration (GM).

1.2 U.S. Customary (USC) and International System (SI) Units

This standard presents both International Systems (SI) and U.S. Customery (USC) units, and may be implemented in either system of units. The presentation of both units is for the convenience of the user, and is not necessarily the exact conversions. The system of units to be used is typically determined by contract, regulatory requirement, the manufacturer, or the user's calibration program.

1.3 National Metrology Institute

Throughout this document issues of traceability are addressed by references to National Institute of Standards and Technology (NIST). However, other appropriate national metrology institutes can be referenced.

1.4 Safety Considerations

There is no intent to cover safety aspects of conducting the work described in this standard, and it is the duty of the user to be familiar with all applicable safe work practices. It is also the duty of the user to comply with all existing federal, state, or local regulations [e.g. the Occupational Safety and Health Administration (OSHA)] that govern the types of activities described in this standard, and to be familiar with all such safety and health regulations.

2 Normative References

The following referenced documents are indispensable for the application of this document. For date references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API *Manual of Petroleum Measurement Standards* (*MPMS*) Chapter 1, *Vocabulary*

API *MPMS* Chapter 4 (All Sections), *Proving Systems*

API *MPMS* Chapter 5 (All Sections), *Metering*

API *MPMS* Chapter 7 (All Sections), *Temperature Determination*

API *MPMS* Chapter 9 (All Sections), *Density Determination*

API *MPMS* Chapter 11 (All Sections), *Physical Properties Data*

API *MPMS* Chapter 12 (All Sections), *Calculation of Petroleum Quantities*

API *MPMS* Chapter 13 (All Sections), *Statistical Aspects of Measuring and Sampling*