Manual of Petroleum Measurement Standards Chapter 5—Metering

Section 6—Measurement of Liquid Hydrocarbons by Coriolis Meters

FIRST EDITION, OCTOBER 2002

REAFFIRMED, NOVEMBER 2013

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0 Introduction

0.1 This standard is intended to describe methods to achieve custody transfer levels of accuracy when a Coriolis meter is used to measure liquid hydrocarbons.

0.2 Coriolis meters measure mass flow rate and density. It is recognized that meters other than the types described in this document are used to meter liquid hydrocarbons. This publication does not endorse or advocate the preferential use of a Coriolis meter nor does it intend to restrict the development of other types of meters. Those who use other types of meters may find sections of this publication useful.

1 Scope

1.1 This standard is applicable to custody transfer applications for liquid hydrocarbons. Topics covered are:

a. Applicable API standards used in the operation of Coriolis meters.

b. Proving and verification using both mass- and volume-based methods.

c. Installation.

d. Operation.

e. Maintenance.

1.2 The mass- and volume-based calculation procedures for proving and quantity determination are included in Appendix E.

1.3 Although the Coriolis meter is capable of simultaneously determining density, this document does not address its use as a stand-alone densitometer. See API *MPMS* Chapter 14.6 for this type of application. The measured density from the Coriolis meter is used to convert mass to volume.

2 Field of Application

The field of application of this document is any division of the petroleum industry where dynamic flow measurement of applicable fluids is desired. The use of Coriolis meters for alternate applications or fluids may be addressed within other chapters of the API *MPMS* and are not precluded by this standard.

3 Definitions

3.1 accessory equipment: Any additional electronic or mechanical computing, display, or totalization equipment used as part of the metering system.

3.2 base conditions: Defined pressure and temperature conditions used in the custody transfer measurement of fluid volume and other calculations. Base conditions may be defined by regulation or contract. In some cases, base conditions are equal to standard conditions, which within the U.S. are usually 14.696 psia and 60°F, and in other regions 101.325 kPa (absolute) and 15°C.

3.3 base density: The density of the fluid at base conditions.

3.4 calibration: The process of utilizing a reference standard to determine a coefficient which adjusts the output of the Coriolis transmitter to bring it to a value which is within the specified accuracy tolerance of the meter over a specified flow range. This process is normally conducted by the manufacturer.

3.5 cavitation: Phenomenon related to and following flashing if the pressure recovers and the vapor bubbles collapse (implode). Cavitation will cause a measurement error and can damage the sensor.

3.6 Coriolis meter: Also referred to as Coriolis mass meter or Coriolis force flowmeter. A Coriolis meter is a device which by means of the interaction between a flowing fluid and the oscillation of a tube(s), measures mass flow rate and density. The Coriolis meter consists of a sensor and a transmitter.

3.7 Coriolis meter factor, mass or volume (*MF*, MF_m, MF_v): A dimensionless number obtained by dividing the actual quantity of fluid passed through the meter (as determined by proving), by the quantity registered by the meter. For subsequent metering operations, the actual quantity is determined by multiplying the indicated quantity by the meter factor.

3.8 Coriolis transmitter: The electronics associated with a Coriolis meter which interprets the phase shift signal from the sensor, converts it to a meaningful mass flow rate (represented in engineering units or a scaled value), and generates a digital or analog signal representing flow rate and/or quantity. Most manufacturers also use it to drive the sensor tubes, determine fluid density, and calculate a volumetric flow rate.

3.9 flashing: A phenomenon which occurs when the line pressure falls to or below the vapor pressure of the liquid, often due to local lowering of pressure because of an increase in the liquid velocity.