



STANDARD

ANSI/ASHRAE Standard 41.8-2016
(Supersedes ASHRAE Standard 41.8-1989)

Standard Methods for Liquid Flow Measurement

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CONTENTS
ANSI/ASHRAE Standard 41.8-2016,
Standard Methods for Liquid Flow Measurement

SECTION	PAGE
Foreword	2
1 Purpose	2
2 Scope	2
3 Definitions	2
4 Classifications	2
5 Requirements	3
6 Instruments	3
7 Liquid Flow Measurement Methods	4
8 Uncertainty Requirements	12
9 Test Report	12
10 References	13
Informative Annex A: Bibliography	14
Informative Annex B: An Uncertainty Analysis Example for a Coriolis Flowmeter	15
Informative Annex C: An Uncertainty Analysis Example for a Differential Pressure Flowmeter	19
Informative Annex D: Information Regarding Liquid Flow Measurement Uncertainties for Installations That Do not Meet the Flowmeter Manufacturer's Requirements	24

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

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FOREWORD

The 1989 edition of Standard 41.8 was limited in scope to orifice flowmeters. For the 2016 edition, the scope has been expanded to cover the breadth of liquid flow measurement devices used for testing heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems and components, except for refrigerant liquid flow measurement devices, which are the focus of ASHRAE Standard 41.10. This standard now covers liquid flow measurements under both laboratory and field conditions and has been revised to meet ASHRAE's mandatory language requirements.

Selecting an appropriate liquid flow flowmeter can be a daunting task given the wide variety of operating principles, measurement precision, and costs of commercial products. Whether liquid flow measurements are to be taken in a laboratory or in the field, selecting the appropriate meter should be based on the required measurement accuracy. Once a liquid flowmeter has been selected, the user may need to consult with the meter manufacturer regarding installation specifics, operating range limits, calibration limits, and other similar specifics in order to obtain the expected measurement accuracy. For field test measurements, the manufacturer's installation specifics are often not achievable. Informative Annex D provides information regarding liquid flow measurement uncertainties for installations that do not meet the flowmeter manufacturer's requirements. Safety is an important consideration for all procedures involving liquids, particularly with regard to flammability, toxicity, and corrosiveness. As such, safety glasses and other personal protection equipment should be worn.

1. PURPOSE

This standard prescribes methods for liquid flow measurement.

2. SCOPE

This standard applies to laboratory and field liquid flow measurement for testing heating, ventilating, air-conditioning, and refrigerating systems and components. This standard is restricted to applications where the entire flow stream of liquid enters and exits the liquid flowmeter in a liquid-only state during data recording with the following exception:

- a. This standard does not apply to liquid-phase refrigerant mass flow measurements where the liquid flow includes circulating lubricant. Those measurements are within the scope of ASHRAE Standard 41.10.

3. DEFINITIONS

The following definitions apply to the terms used in this standard.

accuracy: the degree of conformity of an indicated value to the corresponding true value.

mean, \bar{X}_m : the arithmetic average of N readings.

measurement system: the instruments, signal conditioning systems, and data acquisition system.

sample size, N : the number of individual values in a sample.

test point: a specific set of test operating conditions and tolerances for recording data.

true value: the unknown, error-free value of a test result.

uncertainty: a measure of the potential error in a measurement or experimental result that reflects the lack of confidence in the result to a specified level.

unit under test: equipment that is subjected to liquid flow measurements.

4. CLASSIFICATIONS

4.1 Liquid Flow Operating State. As stated in Section 2, the entire flow stream of liquid entering and exiting the flowmeter shall be in a liquid-only state during liquid flow data recording. Verify that the total pressure is greater than the vapor pressure of the liquid at each test point, or use a sight glass upstream and a sight glass downstream of the flowmeter to verify that the entire flow stream is a liquid at both locations.

4.2 Liquid Flow Measurement Applications. Liquid flow measurement applications that are within the scope of this standard shall be classified as one of the types described in Sections 4.2.1 and 4.2.2.

4.2.1 Laboratory Applications. Liquid flow measurements under laboratory conditions are engineering development tests or tests to determine product ratings.

Informative Note: Laboratory liquid flow measurements tend to use more accurate instruments than field measurements, and the installation of those instruments normally meet the instrument manufacturer's installation requirements.

4.2.2 Field Applications. Liquid flow measurements under field conditions are tests to determine installed system liquid flow rates.

Informative Note: Field liquid flow measurements tend to use less accurate instruments than laboratory measurements, and the installation of those instruments often do not meet the instrument manufacturer's installation requirements.

4.3 Liquid Flowmeter Categories

4.3.1 Mass Flowmeters. Liquid flowmeters in this category perform direct measurement of liquid mass flow rates.

4.3.2 Volumetric Flowmeters. Liquid flowmeters in this category perform direct measurement of volumetric liquid flows. If liquid mass flow rates are required, each volumetric liquid flow measurement shall be multiplied by the liquid density at the flow measurement location to obtain the liquid mass flow rate measurement.

Informative Note: Ultrasonic flowmeters, vortex-shedding flowmeters, and drag-force flowmeters are examples of velocity measuring devices that can be used to determine volumetric flow rates.