



STANDARD

ANSI/ASHRAE Standard 41.7-2015
(Supersedes ANSI/ASHRAE Standard 41.7-1984)

Standard Methods for Gas Flow Measurement

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NOTE

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

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FOREWORD

The 1984 edition of Standard 41.7 was limited to square-edged orifice meters. In the 2015 edition, the scope has been expanded to cover the breadth of gas flow measurement devices used for testing heating, ventilating, air-conditioning, and refrigerating systems and components, and to include field gas flow measurements in addition to laboratory gas flow measurements. This standard meets ASHRAE's mandatory language requirements.

Selecting an appropriate gas flow flowmeter can be a daunting task given the wide variety of operating principles, measurement precision, and costs of commercial products. Whether gas 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 gas 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. Safety is an important consideration for all procedures involving gases, particularly regarding flammability, toxicity, and corrosiveness. Safety glasses and other personal protection equipment should be worn.

1. PURPOSE

This standard prescribes methods for gas flow measurement.

2. SCOPE

This standard applies to laboratory and field gas 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 gas enters and exits the gas flowmeter in a gas-only state during data recording with the following exceptions:

- a. This standard does not apply to airflow measurements at pressures within this range: -25 kPa to $+25$ kPa (-100 in. H_2O to $+100$ in. H_2O) referenced to ambient pressure. Those measurements are within the scope of ASHRAE Standard 41.2.
- b. This standard does not apply to fan performance rating airflow measurements. Those measurements are within the scope of ASHRAE Standard 51.
- c. This standard does not apply to gaseous-phase refrigerant mass flow measurements where the gas 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.

equivalent diameter: the diameter of a circle having the same area as a rectangular area.

error: the difference between the test result and its corresponding true value.

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

measurement system: the instruments, signal conditioning systems (if any), and data acquisition system (if any).

precision: the closeness of agreement among repeated measurements of the same characteristic by the same method under the same conditions.

random error, ϵ : the portion of total error that varies randomly in repeated measurements throughout a test process.

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

systematic error, β : the portion of total error that remains constant in repeated measurements throughout a test process.

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 the subject of the gas flow rates measurements using this standard.

4. CLASSIFICATIONS

4.1 Gas Flow Operating State. Gas flow measurement methods shall be restricted to applications where the entire gas flow stream enters and exits the flowmeter in the vapor-only state during data recording. Trace amounts of liquids shall be less than 1% by mass unless otherwise specified by the flowmeter manufacturer or by the test plan in Section 5.1.

4.2 Gas Flow Measurement Applications. Gas flow measurement applications that are within the scope of this standard shall be classified as one of the following types.

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

Informative Note: Laboratory gas flow measurements tend to use more accurate instruments than field measurements do and tend to meet the instrument manufacturer's installation requirements.

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

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

4.3 Gas Flowmeters

4.3.1 Mass Flowmeters. Gas flowmeters in this category perform direct measurement of gas mass flow rates.