



Standard Practice for Calibrating Gaseous Reference Leaks¹

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1. Scope

1.1 This practice covers procedures for calibrating leak artifacts of a specified gas, that may be used for determining the response of leak detectors, or in other situations where a known small flow of gas is required. The purpose of this practice is to establish calibration without reference to other calibrated leaks in as straightforward a manner as possible using the likeliest available equipment. While the uncertainties associated with these procedures will most likely be greater than those obtained via traceable calibration chains (on the order of 10 %), these procedures allow independent means of establishing or verifying the leakage rate from leak artifacts of questionable history, or when traceable leak artifacts are not available.

1.2 Two types of leaks are considered:

1.2.1 *Type I*—Pressure to vacuum.

1.2.2 *Type II*—Pressure to atmosphere.

1.3 Three calibration methods are described under each type of reference leak:

1.3.1 *Method A*—Accumulation comparison, using a known volume of gas at specified conditions of temperature and pressure as a reference.

1.3.2 *Method B*—Accumulation comparison, using a leak artifact calibrated using Method A.

1.3.3 *Method C*—Displacement of a liquid slug, by the leak, in capillary tube of known dimensions.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.08 on Leak Testing Method.

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2. Referenced Documents

2.1 *ASTM Standards:*²

E425 [Definitions of Terms Relating to Leak Testing](#) (Withdrawn 1991)³

E427 [Practice for Testing for Leaks Using the Halogen Leak Detector Alkali-Ion Diode](#) (Withdrawn 2013)³

E479 [Guide for Preparation of a Leak Testing Specification](#) (Withdrawn 2014)³

F134 [Test Methods for Determining Hermeticity of Electron Devices with a Helium Mass Spectrometer Leak Detector](#) (Withdrawn 1996)³

2.2 *Other Documents:*

[AVS 2.2-1968 Method for Vacuum Leak Calibration](#)⁴

[Recommended Practices for the Calibration and Use of Leaks](#)⁵

3. Summary of Practice

3.1 *Method A*—Accumulation comparison, using a known volume of tracer gas:

3.1.1 This method uses a closed chamber of nonreactive material having a means of removing all tracer gas and a connection to the tracer sensor.

3.1.2 A small, known quantity of tracer gas is discharged into the chamber and the response recorded for a period of time in which it is anticipated the unknown leak will require to reach the same concentration.

3.1.3 The tracer gas is removed from the chamber, and the unknown leak is allowed to discharge into it until the sensor response equals that of 3.1.2.

3.1.4 The leakage rate in mol/s can be calculated as:

$$Q_m = PV(t \cdot R \cdot T) \quad (1)$$

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from AVS, American Vacuum Society, 335 E. 45th Street, New York, N.Y., 10017.

⁵ C.D. Ehrlich and J.A. Basford, *Journal of Vac. Sci. Technology*, A(10), 1992, pp. 1–17.