



Standard Practice for Calibration of Type S Pitot Tubes¹

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1. Scope

1.1 This practice covers the determination of Type S pitot tube coefficients in the gas velocity range from 305 to 1524 m/min or 5.08 to 25.4 m/s (1000 to 5000 ft/min). The method applies both to the calibration of isolated Type S pitot tubes (see 5.1), and pitobe assemblies (see 5.2).

1.2 This practice outlines procedures for obtaining Type S pitot tube coefficients by calibration at a single-velocity setting near the midpoint of the normal working range (see 5.3). Type S pitot coefficients obtained by this method will generally be valid to within $\pm 3\%$ over the normal working range. If a more precise correlation between Type S pitot tube coefficient and velocity is desired, multivelocity calibration technique (Annex A1) should be used.

1.3 This practice may be used for the calibration of thermal anemometers for gas velocities in excess of 3 m/s (10 ft/s).

1.4 *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.*

2. Referenced Document

2.1 ASTM Standards:

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres²

3. Terminology

3.1 For definitions of terms used in this test method, refer to Terminology D 1356.

3.2 Definitions:

3.2.1 *isolated Type S pitot tube*—any Type S pitot tube that is calibrated or used alone (Fig. 1).

3.2.2 *normal working velocity range*—the range of gas velocities ordinarily encountered in industrial smokestacks and ducts: approximately 305 to 1524 m/min or 5.08 to 25.4 m/s (1000 to 5000 ft/min).

3.2.3 *pitobe assembly*—any Type S pitot tube that is calibrated or used while attached to a conventional isokinetic source-sampling probe (designed according to Martin **(1)**³ or allowable modifications thereof; see also Fig. 7).

4. Summary of Practice

4.1 The coefficients of a given Type S pitot tube are determined from alternate differential pressure measurements, made first with a standard pitot tube, and then with the Type S pitot tube, at a predetermined point in a confined, flowing gas stream. The Type S pitot coefficient is equal to the product of the standard pitot tube coefficient, C_p (std), and the square root of the ratio of the differential pressures indicated by the standard and Type S pitot tubes.

5. Significance and Use

5.1 The Type S pitot tube (Fig. 1) is often used to measure the velocity of flowing gas streams in industrial smokestacks and ducts. Before a Type S pitot tube is used for this purpose, its coefficients must be determined by calibration against a standard pitot tube **(2)**.

6. Apparatus

6.1 *Flow System*—Calibration shall be done in a flow system designed in accordance with the criteria illustrated in Fig. 2 and described in 6.1.1 through 6.1.5.

6.1.1 The flowing gas stream shall be confined within a definite cross-sectional area; the cross section shall be preferably circular or rectangular **(3)**. For circular cross sections, the minimum duct diameter shall be 305 mm (12 in.). For rectangular cross sections, the width shall be at least 254 mm (10 in.). Other regular cross-section geometries (for example, hexagonal or octagonal) are permissible, provided that they have cross-sectional areas of at least 645 cm² (100 in.²).

6.1.2 It is recommended that the cross-sectional area of the flow-system duct be constant over a distance of 10 or more duct diameters. For rectangular cross sections, use an equivalent diameter, calculated as follows, to determine the number of duct diameters:

$$D_e = 2LW/(L + W) \quad (1)$$

¹ This practice is under the jurisdiction of ASTM Committee D22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.01 on Quality Control.

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² *Annual Book of ASTM Standards*, Vol 11.03.

³ The boldface numbers in parentheses refer to the list of references at the end of this practice.