



Designation: D6011 – 96 (Reapproved 2022)

Standard Test Method for Determining the Performance of a Sonic Anemometer/ Thermometer¹

This standard is issued under the fixed designation D6011; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the dynamic performance of a sonic anemometer/thermometer which employs the inverse time measurement technique for velocity or speed of sound, or both. Performance criteria include: (a) acceptance angle, (b) acoustic pathlength, (c) system delay, (d) system delay mismatch, (e) thermal stability range, (f) shadow correction, (g) velocity calibration range, and (h) velocity resolution.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C384 Test Method for Impedance and Absorption of Acoustical Materials by Impedance Tube Method

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D5527 Practices for Measuring Surface Wind and Temperature by Acoustic Means

¹ This test method is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.11 on Meteorology.

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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.

IEEE/ASTM SI 10 American National Standard for Metric Practice

3. Terminology

3.1 *Definitions*—For definitions of terms related to this test method, refer to Terminology **D1356**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *axial attenuation coefficient*—a ratio of the free stream wind velocity (as defined in a wind tunnel) to velocity along an acoustic propagation path (v_t/v_d) (**1**).³

3.2.2 *critical Reynolds number (R_c)*—the Reynolds number at which an abrupt decrease in an object's drag coefficient occurs (**2**).

3.2.2.1 *Discussion*—The transducer shadow corrections are no longer valid above the critical Reynolds number due to a discontinuity in the axial attenuation coefficient.

3.2.3 *Reynolds number (R_e)*—the ratio of inertial to viscous forces on an object immersed in a flowing fluid based on the object's characteristic dimension, the fluid velocity, and viscosity.

3.2.4 *shadow correction (v_{dm}/v_d)*—the ratio of the true along-axis velocity v_{dm} , as measured in a wind tunnel or by another accepted method, to the instrument along-axis wind measurement v_d .

3.2.4.1 *Discussion*—This correction compensates for flow shadowing effects of transducers and their supporting structures. The correction can take the form of an equation (**3**) or a lookup table (**4**).

3.2.5 *speed of sound (c , (m/s))*—the propagation rate of an adiabatic compression wave:

$$c = (\gamma \partial P / \partial \rho)^{0.5}_s \quad (1)$$

where:

P = pressure

ρ = density,

γ = specific heat ratio, and

s = isentropic (adiabatic) process (**5**).

3.2.5.1 *Discussion*—The velocity of the compression wave

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