



Designation: D5366 – 23

Standard Test Method for Determining the Dynamic Performance of a Wind Vane¹

This standard is issued under the fixed designation D5366; 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 starting threshold, delay distance, and overshoot ratio of a wind vane from direct measurements in a wind tunnel. This test method is applicable only to wind vanes having measurable overshoot.

1.2 This test method provides for determination of the performance of a system consisting of a wind vane and its associated position-to-output transducer in wind tunnel flow. Use of values determined by this test method to describe performance in atmospheric flow of a wind direction measuring system incorporating the vane must be done with an understanding of the differences between the two systems and the two environments.

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

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

1.5 *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

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

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. Current edition approved Sept. 1, 2023. Published September 2023. Originally approved in 1993. Last previous edition approved in 2017 as D5366 – 96 (2017). DOI: 10.1520/D5366-23.

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. Terminology

3.1 Refer to Terminology **D1356** for general terms and their definitions.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *delay distance (D)*, *n*—the distance air flows past a wind vane during the time it takes the vane to return to 50 % of the initial displacement.

3.2.2 *overshoot (θ_n)*, *n*—the amplitude of a deflection of a wind vane as it oscillates about θ_B after release from an initial displacement.

3.2.3 *overshoot ratio (Ω)*, *n*—the ratio of two successive overshoots, as expressed by the equation:

$$\Omega = \theta_{(n+1)} / \theta_n \quad (1)$$

where θ_n and θ_(n+1) are the *n* and *n* + 1 overshoots, respectively. In practice, since deflections after the first to the side opposite the release point are normally small, the initial release point (that is, the *n* = 0 deflection) and the first deflection after release (*n* = 1) are used in determining the overshoot ratio.

3.2.4 *starting threshold (U_o)*, *n*—the lowest speed at which the vane can be observed or measured moving from a 10° offset in a wind tunnel.

3.3 *Symbols:*

<i>D</i>	(m)	delay distance
<i>U_o</i>	(m/s)	starting threshold
<i>Ω</i>	(none)	overshoot ratio
<i>η</i>	(none)	damping ratio
<i>λ_d</i>	(m)	damped natural wavelength
<i>θ_n</i>	(degrees)	overshoot; maximum angular excursion
<i>θ_o</i>	(degrees)	reference direction
<i>θ_B</i>	(degrees)	vane equilibrium position
<i>θ_B – θ_o</i>	(degrees)	dynamic vane bias

3.4 *Calculated or Estimated Values:*

3.4.1 *damping ratio (η)*, *n*—calculated from the overshoot ratio (**1**, **2**).³

$$\eta = \frac{\ln(1/\Omega)}{(\pi^2 + [\ln(1/\Omega)]^2)^{0.5}} \quad (2)$$

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