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Standard Test Method for Airflow Calibration of Fan Pressurization Devices[1]

This standard is issued under the fixed designation E1258; 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 airflow measurement calibration techniques for fan pressurization systems used for measuring air leakage rates through building envelopes.

1.2 This test method is applicable to systems used for air leakage measurement as described in Test Methods E779, E1827, E3158, and ANSI/RESNET/ICC 380.

1.3 This test method involves the installation of the fan pressurization system in a calibration chamber. Use of the fan pressurization system in an actual building may introduce additional errors in the airflow measurement due to operator influence, interference of internal partitions and furnishings, weather effects, and other factors.

1.4 The proper use of this test method requires a knowledge of the principles of airflow and pressure measurement.

1.5 This standard includes two basic procedures, a preferred procedure, based on ASHRAE 51/AMCA 210, and an optional procedure based on a nonstandard airflow measurement technique, commonly used by manufacturers of fan pressurization devices, but which has not been compared with standard airflow measurement techniques.

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

1.7 *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.*

1.8 *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]

E631 Terminology of Building Constructions

E779 Test Method for Determining Air Leakage Rate by Fan Pressurization

E1827 Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door

E3158 Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building

2.2 *American Society of Heating, Refrigerating, and Air-Conditioning Engineers Standard:*[3]

ASHRAE 51/AMCA 210 Laboratory Methods for Testing Fans for Rating

2.3 *American Society of Mechanical Engineers Standard:*[4]

ASME MFC-3M Standard Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi

2.4 *Residential Energy Services Network (RESNET) Standard:*[5]

ANSI/RESNET/ICC 380 Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems

3. Terminology

3.1 *Definitions*—For definitions used in this test method, see Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *ambient conditions, n*—conditions in the space from which air is drawn into the calibration chamber and into which the chamber air is expelled.

[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

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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.

[3] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[5] Available from Residential Energy Services Network, Inc, P.O. Box 4561 Oceanside, CA 92052-4561, https://www.resnet.us/

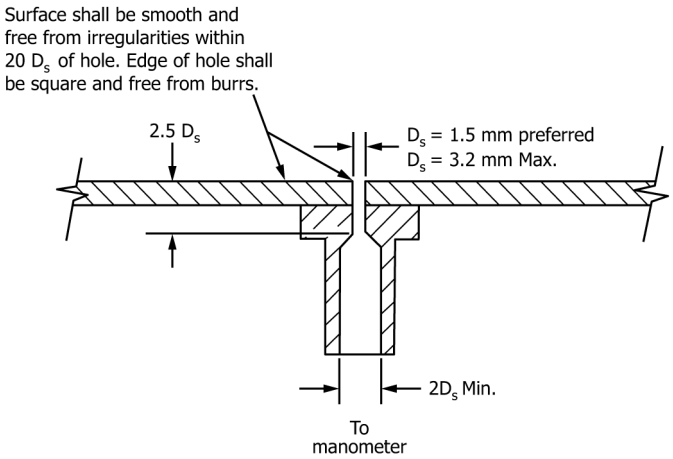

FIG. 1 Static Pressure Tap Specifications

3.2.2 *chamber, n*—an enclosure of rectangular or circular cross section to simulate the entrance and exit conditions that the fan is expected to encounter in service.

3.2.3 *fan air density, n*—density of air at the fan inlet expressed in kilograms per cubic metre.

3.2.4 *fan airflow rate, n*—volumetric airflow rate at the fan air density expressed in cubic metres per second.

3.2.5 *fan outlet area, n*—gross inside area measured in the plane of the fan outlet opening expressed in square metres.

3.2.6 *fan pressure difference, n*—the static pressure difference between two stations expressed in pascals, measured using the static pressure taps described in Fig. 1. One station is located within the chamber between the fan and the nearest flow conditioners. The other station is outside the chamber.

3.2.7 *fan pressurization system, n*—a device for measuring the air leakage rate of a building envelope under controlled pressurization or depressurization of the building interior. The system includes controllable air-moving equipment, an airflow rate measuring system, and a device for measuring the pressure difference across the building envelope. Such a system is often referred to as a blower door.

3.2.8 *fan signal, n*—an output from a fan pressurization system (other than fan speed) that is related to fan airflow rate by the system calibration, such as the static pressure difference across a constriction that is integral to the system.

3.2.9 *fan speed, n*—speed of rotation of the fan impeller expressed in inverse seconds.

3.2.10 *flow conditioners, n*—a combination of screens or perforated plates located within the calibration chamber to reduce pressure disturbances within the chamber.

3.2.11 *nozzle, n*—a gradually tapered constriction, of very precise elliptical shape, used in airflow rate measurement (see Fig. 2).

3.2.12 *nozzle chamber pressure difference, n*—static pressure difference measured across a nozzle or bank of nozzles when nozzles are installed in a chamber expressed in pascals.

3.2.13 *nozzle throat diameter, n*—diameter of nozzle discharge end expressed in square metres.

3.2.14 *nozzle throat pressure difference, n*—static pressure difference across the nozzle in a duct measured with throat taps expressed in pascals (see Fig. 2).

3.2.15 *orifice, n*—a sharp-edged circular constriction used in airflow measurement (see Fig. 3).

3.2.16 *orifice pressure difference, n*—static pressure difference measured across an orifice when the orifice is installed in a chamber expressed in pascals.

3.2.17 *revolution-per-minute (r/min) door, n*—a fan pressurization system with a calibration that relates the fan airflow rate to the fan speed.

3.2.18 *signal door, n*—a fan pressurization system with a calibration that relates the fan airflow rate to an output signal other than fan speed.

3.2.19 *transformation piece, n*—an element to connect a duct with a measuring station to a fan when the fan connection is a different size than the duct (see Fig. 4).

4. Summary of Test Method

4.1 This test method contains two procedures for calibrating fan pressurization devices, a preferred procedure based on ASHRAE 51/AMCA 210, and an optional procedure employing an orifice in a chamber.

4.2 Both procedures involve the installation of the fan pressurization system in a chamber.

4.3 The calibration consists of a comparison of the airflow rate through the fan pressurization system measured by the system itself, and the airflow rate measured in the calibration facility. In the preferred procedure, three modes of airflow measurement are acceptable: (*1*) a nozzle or bank of nozzles in the chamber, (*2*) a traverse in a duct using a pitot tube (see Fig. 5), and (*3*) a nozzle in a duct. Other airflow rate measurement techniques in a duct can be used such as orifice plates (ASME MFC-3M) or constant injection tracer gas methods.[6] In order for an alternative airflow rate measurement technique to be included as a preferred procedure, the errors introduced by the procedure must be demonstrated not to exceed those introduced by a nozzle or pitot traverse. In the optional procedure, the airflow is measured with a series of sharp-edged orifices installed in the wall of the chamber.

4.4 The calibration must include measurement points that cover a specific range in both fan pressure difference and fan airflow rate.

5. Significance and Use

5.1 The fan pressurization procedure provides a relatively fast evaluation of the airtightness of building envelopes. In order for the accuracy of the test results to be known, the airflow rate measurement technique of the fan pressurization system must be calibrated.

5.2 This test method is applicable to fan pressurization systems that are installed in an opening in the building

[6] Persily, A. K., "Air Flow Calibration of Building Pressurization Devices," NBSIR 84-2849, National Bureau of Standards, 1984.