Designation: E1554/E1554M – 13

Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization[1]

This standard is issued under the fixed designation E1554/E1554M; 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 The test methods included in this standard are applicable to the air distribution systems in low-rise residential and commercial buildings.

1.2 These test methods cover four techniques for measuring the air leakage of air distribution systems. The techniques use air flow and pressure measurements to determine the leakage characteristics.

1.3 The test methods for two of the techniques also specify the auxiliary measurements needed to characterize the magnitude of the distribution system air leakage during normal operation.

1.4 A test method for the total recirculating air flow induced by the system blower is included so that the air distribution system leakage can be normalized as is often required for energy calculations.

1.5 The proper use of these test methods requires knowledge of the principles of air flow and pressure measurements.

1.6 Three of these test methods are intended to produce a measure of the air leakage from the air distribution system to outside. The other test method measures total air leakage including air leaks to inside conditioned space.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.8 *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.* For specific hazard statements, see Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E631 Terminology of Building Constructions

E779 Test Method for Determining Air Leakage Rate by Fan Pressurization

E1258 Test Method for Airflow Calibration of Fan Pressurization Devices

2.2 *ASME Standard:*[3]

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

3. Terminology

3.1 *Definitions*—For definitions of general terms related to building construction used in these test methods, refer to Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *building envelope*—the boundary or barrier separating the interior volume of a building from the outside environment. Even when a garage is conditioned, for this standard it is considered to be outside the building envelope.

3.2.2 *blower*—the air moving device for a forced air space conditioning and/or ventilation system.

4. Summary of Test Methods

4.1 Four alternative measurement and analysis methods are specified and labeled A through D, Test Methods A and B give separate values for supply and return leakage to outside. Test Methods C and D do not separate supply and return leakage. Test Methods A, B, and C determine leakage to outside, but Test Method D measures total leakage, including leakage to inside. Test Method A is based upon changes in flow through distribution system leaks to outside due to blower operation over a range of envelope pressure differences. The envelope pressure differences are generated by a separate air moving fan and both pressurization and depressurization measurements are

[1] These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

Current edition approved April 15, 2013. Published April 2013. Originally approved in 1993. Last previous edition approved in 2007 as E1554 – 07. DOI: 10.1520/E1554_E1554M-13.

[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 Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

performed. Test Methods B and C are based upon pressurizing the distribution system at the same time as the building in order to isolate the leaks that are outside the building envelope. For Test Method B, measured system operating pressures are then used to estimate leakage under operating conditions. Test Method C determines the leakage to outside at a uniform reference pressure of 25 Pa [0.1 in. of water] instead of operating pressure, and does not separate supply and return leaks. Test Methods B and C are shown schematically in Fig. 1 and Fig. 2. Unlike Methods A, B, and C, Method D does not attempt to measure the leakage to outside under normal operating conditions, but measures the total system leakage at a uniform reference pressure of 25 Pa [0.1 in. of water]. The schematic in Fig. 3 applies to Method D.

4.2 These test methods also include specifications for the auxiliary measurements to interpret the air leakage measurements.

5. Significance and Use

5.1 Air leakage between an air distribution system and unconditioned spaces affects the energy losses from the distribution system, the ventilation rate of the building, and the entry rate of air pollutants.

5.2 The determination of infiltration energy loads and ventilation rates of residences and small commercial buildings are typically based on the assumption that the principal driving forces for infiltration and ventilation are the wind and indoor/

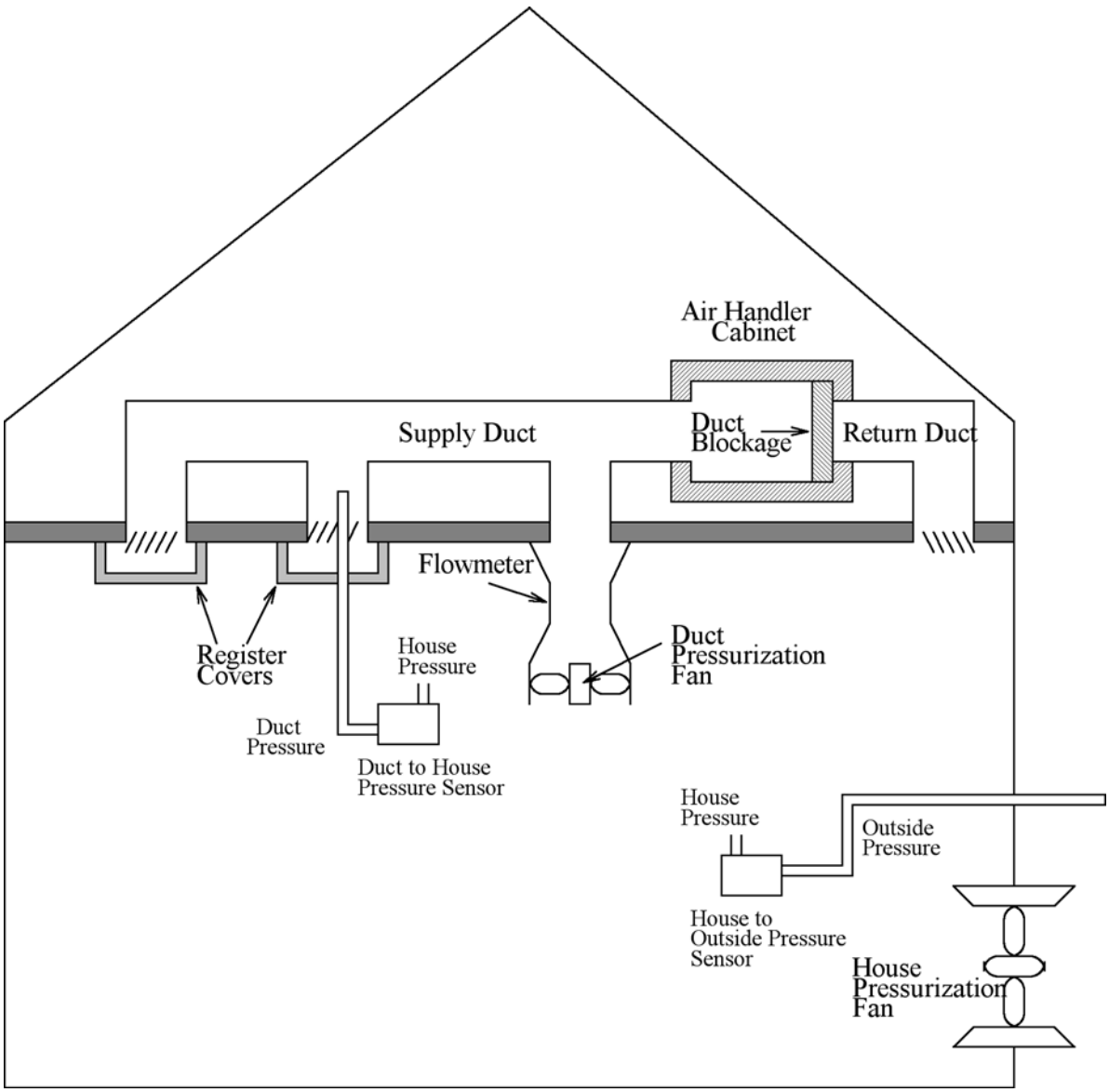

FIG. 1 Schematic of Method B—Distribution System and Building Pressurization Test (for Supply Leakage)

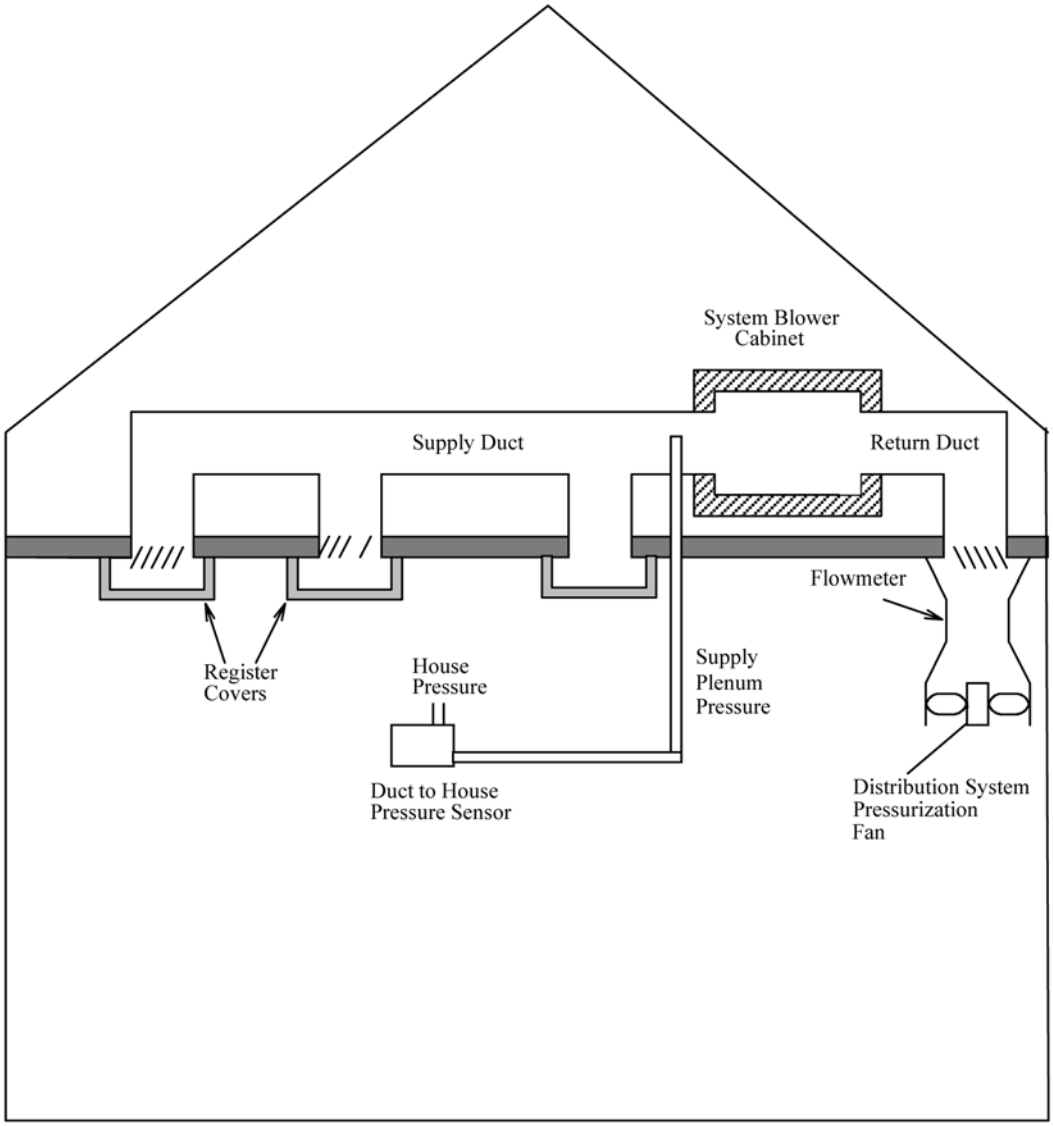

FIG. 2 Schematic of Method C—Distribution System Pressurization Test

outdoor temperature differences. This can be an inappropriate assumption for buildings that have distribution systems that pass through unconditioned spaces, because the existence of relatively modest leakage from that system has a relatively large impact on overall ventilation rates. The air leakage characteristics of these exterior distribution systems are needed to determine their ventilation, energy, and pollutant-entry implications.

5.3 Air leakage through the exterior air distribution envelope may be treated in the same manner as air leakage in the building envelope as long as the system is not operating (see Test Method E779). However, when the system blower is on, the pressures across the air distribution system leaks are usually significantly larger than those driving natural infiltration. Depending on the size of the leaks, these pressures can induce much larger flows than natural infiltration. Thus, it is important to be able to isolate these leaks from building envelope leaks. The leakage of air distribution systems must be measured in the field, because it has been shown that workmanship and installation details are more important than design in determining the leakage of these systems.

5.4 For codes, standards, and other compliance or quality control applications, the precision and repeatability at meeting a specified target (for example, air flow at reference pressure) is more important than air leakage flows at operating conditions. Some existing codes, standards, and voluntary programs require the use of a simpler test method (Test Method D) that does not separate supply from return leakage, leakage to inside from leakage to outside, or estimate leakage pressures at operating conditions.