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Standard Test Method for Durability Testing of Duct Sealants[1]

This standard is issued under the fixed designation ~~E2342;~~E2342/E2342M; 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.

ε[1] NOTE—Units statement was inserted in 1.4 and units information was corrected editorially in February 2015.

INTRODUCTION

Duct leakage has been identified as a major source of energy loss in residential buildings. Most duct leakage occurs at the connections to registers, plenums, or branches in the duct system. At each of these connections a method of sealing the duct system is required. Typical sealing methods include tapes or mastics applied around the joints in the system. Field examinations of duct systems have typically shown that these seals tend to fail over extended periods of time.

The proposed method evaluates the durability of duct sealants by blowing heated air into test sections, combined with a pressure difference between the test sections and their surroundings. The temperatures and pressures were chosen to expose the test sections to typical conditions that are found in residential duct systems. The duct leakage site geometry represents a leakage site commonly found in duct systems. The test sections are constructed from standard duct fittings.

1. Scope

1.1 This test method describes an accelerated aging test for evaluating the durability of duct sealants by exposure to temperatures and static pressures characteristic of residential duct systems.

1.2 This test method is intended to produce a relative measure of the durability of duct sealants. This standard does not measure durability under specific conditions of weather and building operation that might be experienced by an individual building and duct system. Instead it evaluates the sealant method under fixed conditions that do not include the manifold effects of installation practice.

1.3 This test method only addresses sealants not mechanical strength of the connections.

1.4 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.

1.5 *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

3. Terminology

3.1 Terminology E631 defines much of the terminology used in this test method.

3.2 *Definitions of Terms Specific to This Standard:*

[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.

3.2.1 *air-leakage rate*—the volume of air movement per unit time across the duct wall.

3.2.2 *duct sealant*—a method or material, or both, for sealing leaks in forced air thermal distribution duct systems.

3.2.3 *durability*—the capability of maintaining the serviceability of a product, component, or assembly over a specified time.

4. Summary of Test Method

4.1 To evaluate sealant durability this test method uses a standardized joint configuration with controlled temperature and pressure differences. These temperatures and pressures are chosen to represent conditions found in residential duct systems. The test apparatus applies temperature and pressure conditions and measures how well the sealant performs over time.

5. Significance and Use

5.1 Residential duct systems are often field designed and assembled. There are many joints, often of dissimilar materials that require both mechanical connection and air sealing. Without this sealing, duct systems would be extremely leaky and hence inefficient. While some duct sealants are rated on their properties at the time of manufacture or during storage, none of these ratings adequately addresses the in-service lifetime. This test method has been developed to address this durability issue.

5.2 This standard applies to products which list duct sealing as one of their uses. This includes duct tape (cloth, metal foil, or plastic backed), mastics, and sprayed/aerosol sealants. It does not apply to caulks or plaster patches that are not intended to be permanent duct sealing methods.

5.3 The standard duct leak site is a collar to plenum connection for round duct that is 10 to 20 cm ~~(4~~[4 to 8 ~~in.)~~in.] in diameter. This perpendicular connection was chosen because almost all residential duct systems have this type of connection and in field observations of duct systems, it is often this type of connection that has sealant failure.

6. Apparatus

6.1 The following is a general description of the required apparatus. Any arrangement of equipment using the same principles and capable of performing the test procedure within the allowable tolerances is permitted.

6.2 *Major Components*—There are two major components required to perform the testing: a test section leakage measurement device (Fig. 1) and a durability test apparatus (Fig. 2).

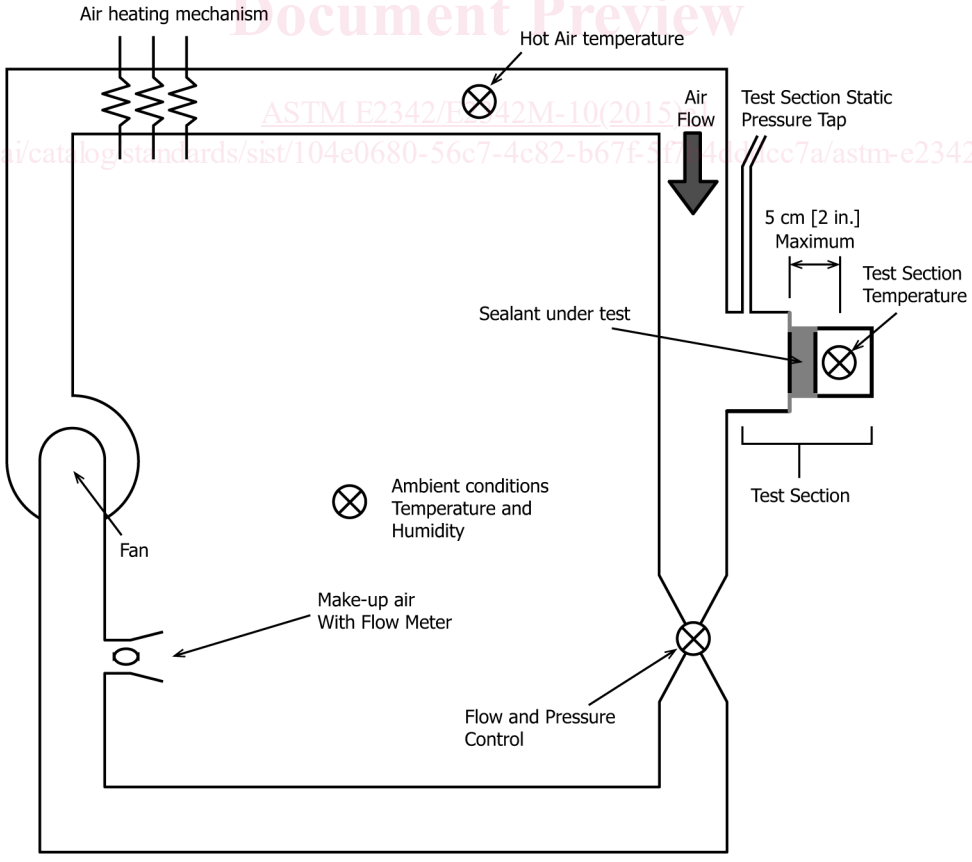

FIG. 1 Schematic of Durability Apparatus

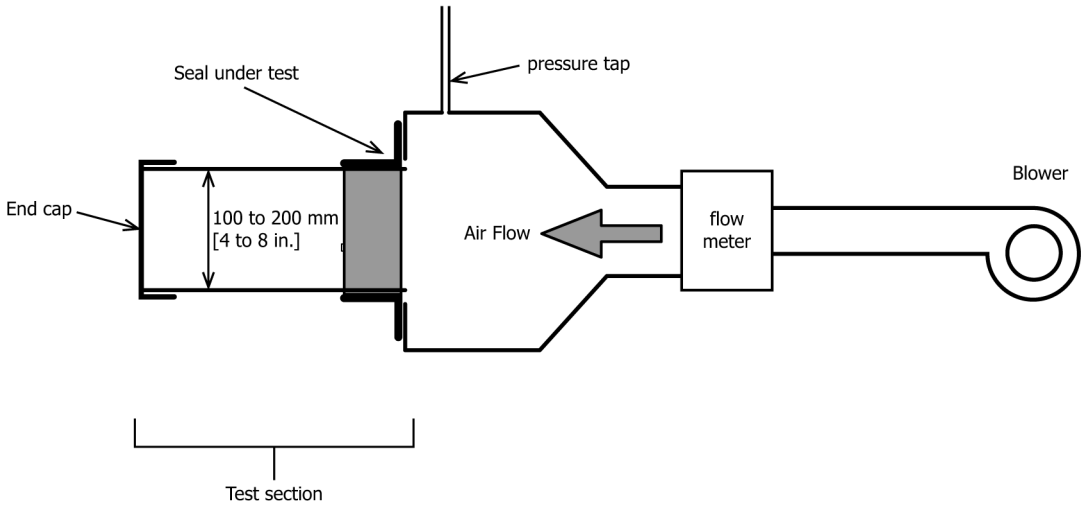

FIG. 2 Schematic of Apparatus for Measuring Leakage of Test Sections

6.2.1 *Test Section Leakage Measuring Device*—A device for measuring the leakage of individual test sections. This device shall consist of a fan to blow air into the test section, a flow measurement device for measuring the flow rate in the test section, a pressure measuring device for measuring the pressure difference between the inside and outside of the test section, and a cap to seal the end of the test section. See Fig. 2. For these test section leakage measurements, the air flow measuring device shall have an accuracy of ±0.085 m^3/h ~~(0.05 cfm)~~[0.05 cfm] or ±1 % of the measured flow, whichever is greater.

6.2.2 *Durability Test Apparatus*—A device for blowing hot air through one or more test sections. This device is comprised of the following components.

6.2.2.1 *Air-Moving Equipment*—A fan that is capable of moving air through the test sections. The fan must be selected to provide the required flow rates and pressure differences. In addition, the fan must be selected to be capable of operating at the hot conditions existing in the test apparatus.

6.2.2.2 *Pressure-Measuring Devices*—Manometers or pressure indicators to measure pressure difference with an accuracy of ±0.2 Pa ~~(0.0008~~[0.0008 in. of ~~water)~~water] or ±1 % of the measured pressure, whichever is greater.

6.2.2.3 *Temperature-Measuring Devices*—Instruments to measure temperature with an accuracy of ±1°C ~~(2°F).~~[2°F]. The test section surface temperatures shall be measured using surface mount temperature sensors with heat transfer paste between the sensor and the test section.

6.3 *Test Section*—Sheet metal duct system components combined to create a plenum to collar connection. The test section consists of a flange and a collar with fingers to fold in and out of the hole in the flange. The gap between the flange and the collar shall be 6 mm ~~([¼ in.)~~[in.] all the way around. The collar shall be centered in the flange. Sheet metal screws shall be used to mechanically connect the collar to the flange. See Fig. 3.

7. Hazards

7.1 *Eye Protection*—Ducts should not break at the pressure differences normally applied to the test structure. However, for added safety, adequate precautions such as the use of eye protection should be taken to protect the personnel.

7.2 *Safety Clothing*—Use safety equipment required for general laboratory work, including safety shoes, and work gloves.

7.3 *Equipment Guards*—The air-moving equipment shall have a proper guard or cage to house the fan, motor, and pulleys and to prevent accidental access to any moving parts of the equipment.

7.4 *Noise Protection*—Make hearing protection available for personnel who must be close to the noise that may be generated by the fan.

7.5 *Debris and Fumes*—Duct materials may decompose during the test releasing particles and fumes into the air. Adequate protection must be provided in the form of ventilation of the test space or other appropriate means.

8. Procedure

8.1 Construct test sections of the plenum to collar joint type shown in Fig. 3. The test sections shall use ducts of 100 to 200 mm ~~(4~~[4 to 8 ~~in.)~~in.] diameter round sheet metal. The sheet metal sections shall be mechanically connected using sheet metal screws.

8.2 The test sections shall be tested for their air leakage before and after they are sealed. The temperature of air flowing through the test section and flowmeter shall be measured and the leakage tests for the test sections shall be performed with the temperature