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Standard Guide to Properties and Tests of Mastics and Coating Finishes for Thermal Insulation¹

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1. Scope

1.1 This guide identifies properties of mastics and coating finishes characterizing their performance as finishes for thermal insulation.

1.2 These properties relate to application and service. Each property is defined, and its significance and suggested test methods are described.

1.3 The properties appear in the following order in this guide.

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1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:²

- C168 Terminology Relating to Thermal Insulation
- C419 Practice for Making and Curing Test Specimens of Mastic Thermal Insulation Coatings
- C461 Test Methods for Mastics and Coatings Used With Thermal Insulation
- C488 Test Method for Conducting Exterior Exposure Tests of Finishes for Thermal Insulation
- C639 Test Method for Rheological (Flow) Properties of Elastomeric Sealants
- C681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds
- C733 Test Method for Volume Shrinkage of Latex Sealants (Withdrawn 2000)³
- C755 Practice for Selection of Water Vapor Retarders for Thermal Insulation
- C792 Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
- D36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- D56 Test Method for Flash Point by Tag Closed Cup Tester
- D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D529 Practice for Enclosed Carbon-Arc Exposures of Bituminous Materials
- D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

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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 The last approved version of this historical standard is referenced on www.astm.org.

D562 Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer

D638 Test Method for Tensile Properties of Plastics

D658 Test Method for Abrasion Resistance of Organic Coatings by Air Blast Abrasive (Withdrawn 1996)³

D747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D822 Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

D903 Test Method for Peel or Stripping Strength of Adhesive Bonds

D968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus

D1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature

D1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

D1823 Test Method for Apparent Viscosity of Plastisols and Organosols at High Shear Rates by Extrusion Viscometer

D1824 Test Method for Apparent Viscosity of Plastisols and Organosols at Low Shear Rates

D1849 Test Method for Package Stability of Paint

D2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer

D2243 Test Method for Freeze-Thaw Resistance of Water-Borne Coatings

D2354 Test Method for Minimum Film Formation Temperature (MFFT) of Emulsion Vehicles

D2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D2453 Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds

D2485 Test Methods for Evaluating Coatings For High Temperature Service

D2507 Terminology of Rheological Properties of Gelled Rocket Propellants (Withdrawn 2003)³

D2939 Test Methods for Emulsified Bitumens Used as Protective Coatings (Withdrawn 2012)³

D3134 Practice for Establishing Color and Gloss Tolerances

D3274 Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation

D3361 Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

D3828 Test Methods for Flash Point by Small Scale Closed Cup Tester

D4339 Test Method for Determination of the Odor of Adhesives

E84 Test Method for Surface Burning Characteristics of Building Materials

E96/E96M Test Methods for Water Vapor Transmission of Materials

E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

E659 Test Method for Autoignition Temperature of Liquid Chemicals

G21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000)³

3. Terminology

3.1 Terminology **C168** shall be considered as applying to the terms used in this specification.

3.2 General Definitions:

3.2.1 *application properties*—properties that influence or affect the effective installation of finishes.

3.2.2 *coating*—a liquid or semiliquid protective finish capable of application to thermal insulation or other surfaces, usually by brush or spray, in moderate thickness, 30 mils (0.76 mm).

3.2.3 *mastic*—a protective finish of relatively thick consistency capable of application to thermal insulation or other surfaces usually by spray or trowel, in thick coats greater than 30 mils (0.03 in.) (0.76 mm).

3.2.4 *service properties*—properties that govern performance of finishes after installation.

3.3 *Specific Definitions*—Terms specific to Sections 6 and 7 are defined as appropriate.

4. Significance and Use

4.1 Each of the properties listed should be considered in selecting materials for specific projects. A list of the selected properties with limiting values assigned will form a part of the product specification.

4.2 All of the properties may not be pertinent in any specific situation, and all of the tests outlined may not be required. A condition to any specification must be an evaluation of the proposed use to determine which properties may be required.

4.3 Membrane reinforcements are frequently specified and used with mastics and coatings. Service properties of such systems of finishes may be different from the unreinforced finishes; therefore, it is essential to test specimens of the reinforced system.

5. Classification of Mastics and Coatings

5.1 *Vapor-Retarder Type*—A finish intended for service on insulated units that are operated below ambient temperature at least part of the time.

NOTE 1—Practice **C755** may provide additional guidance.

5.1.1 Outdoor service.

5.1.2 Indoor service.

5.2 *Vapor-Permeable Type*—A finish intended for service on insulated units that are operated above ambient temperature. (See 7.6.2. Sometimes referred to as a “breather” finish.)

- 5.2.1 Outdoor service.
- 5.2.2 Indoor service.

6. Application Properties

6.1 Consistency:

6.1.1 *Definition*—the resistance of a non-Newtonian material to deformation or flow.

NOTE 2—Consistency is not a fundamental property but is made up of viscosity, plasticity, and other rheological phenomena (see Terminology D2507). In non-Newtonian behavior, usual for mastics and coatings for thermal insulation, the ratio of shearing stress to the rate of shearing strain varies with the shearing stress.

6.1.2 *Significance and Use*—Consistency determines whether a mastic or coating can be troweled, applied by gloved hand, brushed, or sprayed. It has a direct effect on application costs.

6.1.3 *Technical Evaluation*—Test Methods C461, C639, D562, D1823, D1824, and D2196.

6.2 Coverage:

6.2.1 *Definition*—the measure of surface area in square feet per gallon (m²/litre) (coatings) or gallons per 100 ft² (mastics) at which finish must be applied to obtain specified dry thickness and desired performance.

6.2.2 *Significance and Use*—The performance of finishes is related directly to the optimum dry thickness. Therefore, performance properties must be defined in terms of optimum dry thickness, and this value must be established for application purposes in terms of coverage. Coverage data are essential for estimating material quantities and costs.

6.2.3 *Technical Evaluation*—Test Methods C461.

6.3 Build:

6.3.1 *Definition*—the thickness to which a coating or mastic finish can be applied without sagging, running, sliding, or dripping.

6.3.2 *Significance and Use*—Finishes for thermal insulation must be capable of application on vertical or overhead surfaces at specified coverage without subsequent reduction in thickness, caused by excessive flow or slump. Build also determines the number of coats required for optimum dry thickness.

6.3.3 *Technical Evaluation*—Test Methods C461.

6.4 Wet Flammability (during application):

6.4.1 *Definition*—the relative ease of ignition and consequent fire hazard of a finish during application, as indicated by its flash point, fire point, and fuel contribution.

6.4.2 *Significance and Use*—Finishes that contain volatile flammable solvent may ignite readily from a source such as welding sparks and spatter, electrical short circuits, open flames, or personnel smoking. Such a fire could spread very rapidly over freshly finished surfaces.

6.4.3 *Technical Evaluation*—Test Methods D56, D92, D93, D1310, and D3828.

6.5 Toxicity:

6.5.1 *Definition*—harmful physiological response to vapor inhalation or skin contact with finishes during application.

6.5.2 *Significance and Use*—Finishes should not adversely affect health of personnel making applications. Container labels must describe legally and adequately any health hazard involved in using the product.

6.5.3 *Technical Evaluation*—Test as recommended by American Conference of Governmental Industrial Hygienists.⁴

6.6 Temperature and Humidity Range (during application):

6.6.1 *Definition*—the limiting temperatures and relative humidities between which practical application of finish can be made without adverse effect on service properties.

6.6.2 *Significance and Use*—Application of finishes under extremes of atmospheric temperature or humidity, or both, can hinder or prevent attainment of necessary coverage and proper cure, thus changing performance properties significantly. The temperature of the surface to which the finish is applied also must be considered.

6.6.3 *Technical Evaluation*—Test Method D2354, and product application tests made at maximum and minimum values of temperature and humidity in stated design conditions.

6.7 Surface Wetting and Adhesion:

6.7.1 *Definition*—the mutual affinity of the bonding between finish and the surface to which it is applied.

6.7.2 *Significance and Use*—Coatings and mastics must wet and bond readily to insulation surfaces without special treatments or application techniques, or both. Ease and cost of application require good surface wetting and adhesion.

6.7.3 *Technical Evaluation*—Closely observe during finish application under real or simulated field conditions.

6.8 Gap Filling and Bridging:

6.8.1 *Definition*—the ability to bridge, fill, and level joints and gaps in installed thermal insulation.

6.8.2 *Significance and Use*—Joints and gaps exist in installed block and blanket insulation. If these are not filled or bridged adequately, the protective value of the finish will be impaired seriously.

6.8.3 *Technical Evaluation*—Apply finish over insulation in real or simulated field conditions over typical joints and gaps. Follow with destructive examination to determine effectiveness.

6.9 Sizing and Sealing:

6.9.1 *Definition*—the ability of a finish to resist excessive absorption into porous insulation.

6.9.2 *Significance and Use*—Excessive penetration of finishes into insulation will affect adversely the performance of the finish and the thermal conductivity of the insulation.

6.9.3 *Technical Evaluation*—Apply finish by film applicator simultaneously on insulation and on a nonporous surface. After curing, measure the dry film thickness on the surfaces to establish the difference due to absorption.

6.10 Corrosion or Solvent Attack:

⁴ Available from American Conference of Governmental Industrial Hygienists, Inc. (ACGIH), 1330 Kemper Meadow Dr., Cincinnati, OH 45240, <http://www.acgih.org>.