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Standard Guide to Properties and Tests of Mastics and Coating Finishes for Thermal Insulation[1]

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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:*

C 419 Practice for Making and Curing Test Specimens of Mastic Thermal Insulation Coatings[2]

C 461 Test Methods for Mastics and Coatings Used with Thermal Insulation[2]

C 488 Test Method for Conducting Exterior Exposure Tests of Finishes for Thermal Insulation[2]

C 639 Test Method for Rheological (Flow) Properties of Elastomeric Sealants[3]

C 681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds[3]

C 733 Test Method for Volume Shrinkage of Latex Sealants[3]

C 755 Practice for Selection of Vapor Retarders for Thermal Insulation[2]

C 792 Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants[3]

D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)[4]

D 56 Test Method for Flash Point by Tag Closed Tester[5]

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup[5]

D 93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester[5]

D 529 Practice for Enclosed Carbon-Arc Exposures of Bituminous Materials[4]

D 543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents[6]

D 562 Test Method for Consistency of Paints Using the Stormer Viscometer[7]

D 638 Test Method for Tensile Properties of Plastics[6]

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[2] *Annual Book of ASTM Standards*, Vol 04.06.
[3] *Annual Book of ASTM Standards*, Vol 04.07.
[4] *Annual Book of ASTM Standards*, Vol 04.04.
[5] *Annual Book of ASTM Standards*, Vol 05.01.
[6] *Annual Book of ASTM Standards*, Vol 08.01.
[7] *Annual Book of ASTM Standards*, Vol 06.01.

D 658 Test Method for Abrasion Resistance of Organic Coatings By Air Blast Abrasive[7]
D 747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam[6]
D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[6]
D 822 Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus[7]
D 903 Test Method for Peel or Stripping Strength of Adhesive Bonds[8]
D 968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive[7]
D 1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus[7]
D 1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature[7]
D 1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments[7]
D 1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials[7]
D 1823 Test Method for Apparent Viscosity of Plastisols and Organosols at High Shear Rates by Extrusion Viscometer[6]
D 1824 Test Method for Apparent Viscosity of Plastisols and Organosols at Low Shear Rates by Brookfield Viscometer[6]
D 1849 Test Method for Package Stability of Paint[9]
D 2196 Test Methods for Rheological Properties of Non-Newtonian Materials By Rotational (Brookfield type) Viscometer[7]
D 2243 Test Method for Freeze-Thaw Resistance of Water-Borne Coatings[9]
D 2354 Test Method for Minimum Film Formation Temperature (MFT) of Emulsion Vehicles[10]
D 2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)[11]
D 2453 Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds[3]
D 2485 Test Method for Evaluating Coatings for High Temperature Service[7]
D 2507 Terminology of Rheological Properties of Gelled Rocket Propellants[12]
D 2939 Test Methods for Emulsified Bitumens Used as Protective Coatings[4]
D 3134 Practice for Establishing Color and Gloss Tolerances[7]
D 3274 Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation[7]
D 3361 Practice for Operating Light- and Water-Exposure Apparatus (Unfiltered Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products Using the Dew Cycle[7]
D 3828 Test Methods for Flash Point by Small Scale Closed Tester[13]
D 4339 Test Method for Determination of the Odor of Adhesives[8]
E 84 Test Method for Surface Burning Characteristics of Building Materials[3]
E 96 Test Methods for Water Vapor Transmission of Materials[2]
E 162 Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source[3]
E 659 Test Method for Autoignition Temperature of Liquid Chemicals[14]
G 21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi[15]
G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials[15]

3. Terminology

3.1 *General Definitions:*

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

3.1.2 *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).

3.1.3 *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).

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

3.2 *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.

[8] *Annual Book of ASTM Standards*, Vol 15.06.
[9] *Annual Book of ASTM Standards,* Vol 06.02.
[10] *Annual Book of ASTM Standards,* Vol 06.03.
[11] *Annual Book of ASTM Standards,* Vol 08.04.
[12] *Annual Book of ASTM Standards,* Vol 15.03.
[13] *Annual Book of ASTM Standards,* Vol 05.02.
[14] *Annual Book of ASTM Standards,* Vol 14.02.
[15] *Annual Book of ASTM Standards,* Vol 14.04.

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 C 755 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 D 2507). 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 C 461, C 639, D 562, D 1823, D 1824, and D 2196.

6.2 *Coverage*:

6.2.1 *Definition*—the measure of surface area in square feet per gallon (m^2/litre) (coatings) or gallons per 100 ft^2(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 C 461.

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 C 461.

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 D 56, D 92, D 93, D 1310, and D 3828.

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.[16]

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 D 2354, 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.

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