



Designation: D3451 – 06 (Reapproved 2017)

## Standard Guide for Testing Coating Powders and Powder Coatings<sup>1</sup>

This standard is issued under the fixed designation D3451; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This guide covers the selection and use of procedures for testing coating powders and powder coatings. The test methods included are listed in [Table 1](#). Where more than one test method is listed for the same characteristic, no attempt is made to indicate superiority of one method over another. Selection of the methods to be followed must be governed by experience and the requirements in each individual case, together with agreement between the purchaser and the seller.

1.2 This guide also refers to methods developed specifically for the coating powder industry by the Powder Coating Institute, PCI, and the International Organization for Standards, ISO.

1.3 This guide describes the testing of coating powders as applied by electrostatic spray, fluidized bed, or any other applicable method.

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

1.6 *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:<sup>2</sup>

[B117 Practice for Operating Salt Spray \(Fog\) Apparatus](#)

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.51 on Powder Coatings.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- [D522 Test Methods for Mandrel Bend Test of Attached Organic Coatings](#)
- [D523 Test Method for Specular Gloss](#)
- [D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products](#)
- [D610 Practice for Evaluating Degree of Rusting on Painted Steel Surfaces](#)
- [D658 Test Method for Abrasion Resistance of Organic Coatings by Air Blast Abrasive \(Withdrawn 1996\)<sup>3</sup>](#)
- [D660 Test Method for Evaluating Degree of Checking of Exterior Paints](#)
- [D661 Test Method for Evaluating Degree of Cracking of Exterior Paints](#)
- [D662 Test Method for Evaluating Degree of Erosion of Exterior Paints](#)
- [D714 Test Method for Evaluating Degree of Blistering of Paints](#)
- [D772 Test Method for Evaluating Degree of Flaking \(Scaling\) of Exterior Paints](#)
- [D822 Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings](#)
- [D870 Practice for Testing Water Resistance of Coatings Using Water Immersion](#)
- [D968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive](#)
- [D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers](#)
- [D1014 Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates](#)
- [D1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes](#)
- [D1474 Test Methods for Indentation Hardness of Organic Coatings](#)
- [D1535 Practice for Specifying Color by the Munsell System](#)
- [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](#)
- [D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting](#)

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**TABLE 1 List of Test Methods**

	Section	ASTM Method	PCI Procedure	ISO
<b>Coating Powder Properties:</b>				
Sampling	6	D1898		8130-9
Compatibility	9		#2	8130-12
Lower explosion limit	10			8130-4
Particle size and distribution	11.2	D5861		
Multiple sieve and analysis	11.4.1	D1921, E11		8130-13
Accelerated storage stability	12			
Glass vial method	12.2		#1	8130-8
Pourability	13	D1895		8130-5
Fluidity	14			
Cured weight loss for thermosetting coating powders	15		#9	8130-7
Gel time (stroke cure)	16	D4217	#6	8130-6
Flow test (incline method)	17	D4242	#7	8130-11
Specific gravity	18	D5965	#4	8130-2; 8130-3
Melting point determination	19			
<b>Application Properties:</b>				
Deposition/transfer efficiency of powder coating process	20			8130-10
<b>Powder Coating Properties:</b>				
Abrasion resistance	22			
Air blast abrasion tester	22.2	D658		
Falling sand method	22.2	D968		
Taber abraser	22.2	D4060		
Adhesion	23			
Tape adhesion	23.2	D3359		
Chemical resistance	24			
Household chemical resistance	24.2	D1308		
Detergent resistance	24.3	D2248		
Acid resistance	24.4	D3260		
Stains or reagents on wood substrates	24.5	D3023		
Chip resistance	25			
Gravelmeter	25.2	D3170		
Corner coverage	26.2	D2967		
Elongation (flexibility)	27			
Conical/cylindrical mandrel	27.2	D522		
T-Bend	27.2	D4145		
Film thickness	21.5			
Nonmagnetic coatings on ferrous metals		D7091		
Nonmagnetic, nonconductive coatings on non-ferrous metals		D7091		
On nonmetal base		D6132		
Destructive method		D1005		
Hardness	28			
Pencil	28.2	D3363		
Knoop Indention	28.3	D1474		
Impact resistance	29	D2794		
Molting/blocking resistance	30	D3003		
On Metal substrates	30.2	D3003		
In Wood substrates	30.3	D2793		
Print resistance	31	D2091		
Optical properties	32			
Guide To:	32.1	D5382		
Color pigmented coatings	32.2			
Visual	32.2.2	D1535		
Instrumental	32.3.3	D2244, E308, E1164, E1331, E1345, E1347, E1349		
Color difference	32.3			
Visual	32.3.2	D1535, D1729, D2244 D2244, E308, E1164, E1331, E1345, E1347, E1349		
Instrumental	32.3.3	D2244, E308, E1164, E1331, E1345, E1347, E1349		
Metamerism (visual)	32.4.1	D4086		
Distinction of image (DOI)	32.5.1	D5767, E430		
Hiding power/opacity	32.6.2	D6441	#3	
Gloss	32.7.2	D523		
Surface profile (orange peel)	32.8.2			
Color/Gloss/Texture Standards	32.9			
Preparation, Maintenance, and Distribution	32.9.1			
Tolerances	32.9.2	D5531		
Outdoor exposure (natural)	32.9.3	D3134		
Adhesion	33	D1014, D4141		
Adhesion	33.2.1	D3359		
Blistering	33.2.2	D714		
Chalking	33.2.3	D4214		
Checking	33.2.4	D660		
Cracking	33.2.5	D661		

**TABLE 1** *Continued*

	Section	ASTM Method	PCI Procedure	ISO
Rusting	33.2.6	D610		
Erosion	33.2.7	D662		
Flaking	33.2.8	D772		
Gloss	33.2.9	D523		
Color	33.2.10	D1729, D2244, D4086		
Accelerated artificial weathering	34.3	D822, D4587, D5031, D6695, G141, G147, G151, G152, G153, G154, G155		
Accelerated environmental exposures	35			
Filiform corrosion	35.2.1	D2803		
Salt spray	35.2.2	B117		
SCAB corrosion	35.2.3			
Water resistance	35.2.4			
High humidity/100 % humidity	35.2.4.1	D1735, D2247		
Condensation	35.2.4.2	D4585		
Water immersion	35.2.4.3	D870		

- [D1731](#) Practices for Preparation of Hot-Dip Aluminum Surfaces for Painting
- [D1732](#) Practices for Preparation of Magnesium Alloy Surfaces for Painting
- [D1735](#) Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
- [D1895](#) Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials
- [D1898](#) Practice for Sampling of Plastics (Withdrawn 1998)<sup>3</sup>
- [D1921](#) Test Methods for Particle Size (Sieve Analysis) of Plastic Materials
- [D2091](#) Test Method for Print Resistance of Lacquers
- [D2092](#) Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting (Withdrawn 2008)<sup>3</sup>
- [D2201](#) Practice for Preparation of Zinc-Coated and Zinc-Alloy-Coated Steel Panels for Testing Paint and Related Coating Products
- [D2244](#) Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- [D2247](#) Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
- [D2248](#) Practice for Detergent Resistance of Organic Finishes
- [D2369](#) Test Method for Volatile Content of Coatings
- [D2454](#) Practice for Determining the Effect of Overbaking on Organic Coatings
- [D2616](#) Test Method for Evaluation of Visual Color Difference With a Gray Scale
- [D2793](#) Test Method for Block Resistance of Organic Coatings on Wood Panel Substrates
- [D2794](#) Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- [D2803](#) Guide for Testing Filiform Corrosion Resistance of Organic Coatings on Metal
- [D2967](#) Test Method for Corner Coverage of Powder Coatings
- [D3003](#) Test Method for Pressure Mottling and Blocking Resistance of Organic Coatings on Metal Substrates
- [D3023](#) Practice for Determination of Resistance of Factory-Applied Coatings on Wood Products to Stains and Reagents
- [D3134](#) Practice for Establishing Color and Gloss Tolerances
- [D3170](#) Test Method for Chipping Resistance of Coatings
- [D3260](#) Test Method for Acid and Mortar Resistance of Factory-Applied Clear Coatings on Extruded Aluminum Products
- [D3359](#) Test Methods for Rating Adhesion by Tape Test
- [D3363](#) Test Method for Film Hardness by Pencil Test
- [D3960](#) Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- [D4017](#) Test Method for Water in Paints and Paint Materials by Karl Fischer Method
- [D4060](#) Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- [D4086](#) Practice for Visual Evaluation of Metamerism
- [D4141](#) Practice for Conducting Black Box and Solar Concentrating Exposures of Coatings
- [D4145](#) Test Method for Coating Flexibility of Prepainted Sheet
- [D4214](#) Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
- [D4217](#) Test Method for Gel Time of Thermosetting Coating Powder
- [D4242](#) Test Method for Inclined Plate Flow for Thermosetting Coating Powders
- [D4585](#) Practice for Testing Water Resistance of Coatings Using Controlled Condensation
- [D4587](#) Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
- [D5031](#) Practice for Enclosed Carbon-Arc Exposure Tests of Paint and Related Coatings
- [D5382](#) Guide to Evaluation of Optical Properties of Powder Coatings
- [D5531](#) Guide for Preparation, Maintenance, and Distribution of Physical Product Standards for Color and Geometric Appearance of Coatings
- [D5767](#) Test Methods for Instrumental Measurement of Distinctness-of-Image Gloss of Coating Surfaces
- [D5861](#) Guide for Significance of Particle Size Measurements of Coating Powders
- [D5965](#) Test Methods for Specific Gravity of Coating Powders
- [D6132](#) Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an

Ultrasonic Coating Thickness Gage  
**D6441** Test Methods for Measuring the Hiding Power of Powder Coatings  
**D6695** Practice for Xenon-Arc Exposures of Paint and Related Coatings  
**D7091** Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals  
**E11** Specification for Woven Wire Test Sieve Cloth and Test Sieves  
**E284** Terminology of Appearance  
**E308** Practice for Computing the Colors of Objects by Using the CIE System  
**E430** Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry  
**E1164** Practice for Obtaining Spectrometric Data for Object-Color Evaluation  
**E1331** Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry  
**E1345** Practice for Reducing the Effect of Variability of Color Measurement by Use of Multiple Measurements  
**E1347** Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry  
**E1349** Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry  
**G141** Guide for Addressing Variability in Exposure Testing of Nonmetallic Materials  
**G147** Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests  
**G151** Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources  
**G152** Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials  
**G153** Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials  
**G154** Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials  
**G155** Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials  
**2.2 ISO Standards:**<sup>4</sup>  
**ISO 8130-1** Determination of particle size distribution by sieving  
**ISO 8130-2** Determination of density by gas comparison pykometer (referee method)  
**ISO 8130-3** Determination of density by liquid displacement pykometer  
**ISO 8130-4** Calculation of lower explosion limit  
**ISO 8130-5** Determination of flow properties of a powder/air mixture  
**ISO 8130-6** Determination of gel time of thermosetting coating powders at a given temperature  
**ISO 8130-7** Determination of loss of mass on stoving  
**ISO 8130-8** Assessment of the storage stability of thermosetting powders

**ISO 8130-9** Sampling  
**ISO 8130-10** Deposition efficiency of coating powders  
**ISO 8130-11** Inclined-plane flow test  
**ISO 8130-12** Determination of compatibility  
**ISO 8130-13** Coating Powder – Part B; Particle size analysis by laser diffraction  
**ISO 8130-14** Powder Coating Terminology  
**2.3 PCI Recommended Procedures:**<sup>5</sup>  
**PCI #1** Accelerated Stability Test – Powder Coatings  
**PCI #2** Compatibility of Powder Coatings  
**PCI #3** Contrast Ratio – Powder Coatings  
**PCI #4** Density of Powder Coating Materials  
**PCI #6** Gel Time Reactivity  
**PCI #7** Inclined Plate Flow  
**PCI #9** Cured Weight Loss for Thermosetting Coating Powders

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *contrast ratio, n*—a value related to the hiding powder of a coating.

3.1.1.1 *Discussion*—The ratio of the reflectance of the coating over black and white backgrounds at equal film thickness. In the coatings industry 98 % contrast ratio is by convention characterized as being visually opaque, for hiding power measurement purposes, although it is recognized that visually (just as photometrically) the opacity is actually somewhat less than complete. For the reported hiding power to be significant, the contrast ratio value must be reported at a specific film thickness.

3.1.2 *hiding power, n*—the spreading rate of a coating at a specified level of hiding, which is conventionally 0.98 contrast ratio representing photometric “complete hiding.”

3.1.2.1 *Discussion*—Practically speaking, hiding power is the extent to which a powder coating masks the color and pattern of the substrate at a given film thickness.

3.1.3 *minimum explosive concentration (MEC), n*—the lower point for a range of concentrations of organic particles suspended in air that can be ignited by a sufficient energy source.

3.1.3.1 *Discussion*—Also referred to as *LEL or Lower Explosive Level*.

3.1.4 *orange peel, n*—the appearance of irregularity of a surface resembling the skin of an orange.

3.1.5 *pourability, n*—the ability of a dry coating to flow uniformly or to be continuously poured from a container at a steady rate.

3.1.6 *specific gravity, n*—an expression of ratio of the density of a material to that of water at a given temperature and pressure.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 Many of the following definitions specific to this guide were taken from the Powder Coating Institute’s

<sup>4</sup> ISO standards are available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>5</sup> The PCI Recommended Procedures are available from the Powder Coating Institute (PCI), 2121 Eisenhower Avenue, Suite 401, Alexandria, VA 22314, <http://powdercoating.org>.



Publication, “Powder Coating Terms & Definitions,” and are indicated as such by the initials, PCI.<sup>6</sup> Another useful source of terminology for coating powders and powder coatings is ISO 8130-14.

3.2.2 *bulk density, n*—mass per unit volume in powder form including the air trapped between particles. (PCI)

3.2.3 *coating powder, n*—finely divided particles of organic polymer, either thermoplastic or thermosetting, which generally contain pigments, fillers, and additives and which remain finely divided during storage under suitable conditions. (PCI)

3.2.4 *coverage rate, n*—the area covered per unit quantity of coating at a specified film thickness, typically expressed in ft<sup>2</sup>/lb./mil.

3.2.4.1 *Discussion*—The term coverage rate is similar to “spreading rate” as often used in liquid technologies.

3.2.5 *electrostatic deposition, n*—technique of moving and charging coating powder so that it is deposited onto a grounded substrate by one of the following methods: (PCI)

3.2.5.1 *cloud chamber technique, n*—method of moving a charged or uncharged object through a charged or uncharged cloud of coating powder in an enclosed chamber.

3.2.5.2 *fluidized bed technique, n*—method of moving a ground objective over or through a charged fluidized coating powder.

3.2.5.3 *spray technique, n*—method of spraying and charging coating powder so that it is deposited onto a grounded charged substrate.

3.2.6 *film formation of a coating powder, n*—the forming of a continuous film by melting coating powder particles and coalescing them by the application of energy. (PCI)

3.2.6.1 *Discussion*—For thermosetting materials, a chemical reaction, either condensation or addition, also takes place. For thermoplastic materials, no chemical reaction takes place. Thermoplastic materials flow when heat is applied and develop performance properties when cooled. Flow will re-occur if re-heated. Both thermoset and thermoplastic films have uniformity of color, toughness, and other properties associated with protective and decorative coatings.

3.2.7 *fluidity, n*—the ability of a powder to move freely, uniformly, and continuously (somewhat like a liquid) when subjected to certain conditions of pressure, temperature, and velocity of a carrier gas.

3.2.8 *gel time, n*—the time interval (measured in seconds) required for a coating powder to be transformed from a dry solid to a gel-like state at a given temperature. (PCI)

3.2.9 *glass plate flow, (GPF), n*—the measurement (in millimetres) of flow-out on an inclined smooth glass surface when powder is in a molten state at a given temperature. (PCI)

3.2.10 *impact fusion, n*—the tendency of finely divided powders to fuse with other particles in the application equipment during the application process. (PCI)

3.2.11 *nonelectrostatic deposition, n*—technique of moving coating powder onto a substrate, which may be heated above the melt point of the coating powder material. (PCI)

3.2.11.1 *Discussion*—The actual application could be the spray or fluidized bed technique as with electrostatic deposition.

3.2.12 *particle size, n*—average diameter of particles having irregular boundaries that can be determined by various test methods. (PCI)

3.2.13 *particle-size distribution, n*—arrangement of particle size measurements on a coating powder in groups of specified diameters. (PCI)

3.2.14 *powder coatings, n*—coatings that are protective, decorative, or both, formed by the application of a coating powder (3.1.1) to a substrate and fused into a film by the application of heat or radiant energy. (PCI)

3.2.15 *storage stability, n*—the ability of coating powders to maintain physical and chemical properties during specific storage conditions. (PCI)

3.2.16 *tribocharging, n*—the process of creating a static electric charge on powder particles by friction against a nonconductive material. (PCI)

3.2.17 *volatile content, n*—the weight percent of the coating powder which is lost under specified conditions of temperature and time. (PCI)

## 4. Significance and Use

4.1 This guide provides a useful summary to the selection and use of procedures for testing coating powders and powder coatings. It is applicable to both thermoplastic and thermoset coatings, unless indicated otherwise. By design this guide does not purport to address test methods or procedures developed specifically for the functional powder coating market, those coating powders for application to pipe or reinforced steel bars (rebar). Information on current test procedures for pipe and reinforced steel bar coating powders and powder coatings can be obtained through their respective ASTM Subcommittees, A01.05 and D01.48.

4.2 Selection of the methods to be followed and the interpretation of results must be governed by experience and the requirements in each individual case, together with agreement between the purchaser and seller. It should be noted that many of the methods used for characterizing a coating powder, such as gel time (Section 16) and inclined flow (Section 17), are primarily meant for the relative comparison of two coating powders, rather than to give a test value that can be interpreted as good or bad. Interpretation of the test results will depend on the specific application in question and will also often depend on the chemistry of the coating powder used.

## 5. General Requirements

5.1 Ideally, all tests shall be conducted under the same conditions as to light source, sample age, temperature, and humidity. These conditions may be indicated by the individual test procedure used or agreed upon between the purchaser and seller. In the absence of other guidance, test conditions of 23 ±

<sup>6</sup> The PCI publication, “Powder Coating Terms & Definitions” is available from the Powder Coating Institute (PCI).

2°C, 50 ± 5 % relative humidity, and a relatively consistent sample (panel) conditioning time, (sample to sample), are recommended.

## 6. Sampling

6.1 Sample the coating powder in accordance with Practice **D1898** or ISO 8130-9.

6.2 Prepare specimens as required for the specific tests on the coating.

## 7. Equipment

7.1 Use the equipment as specified in each test method.

## 8. Conditions Affecting Coating Powder or Powder Coatings, or Both

8.1 The performance of a coating powder can be affected by damage to container, size of container, storage time, excessive temperature, excessive humidity and temperature fluctuations, which may cause settling, caking, or chemical change.

8.2 The performance of powder coatings may be affected by:

8.2.1 Substrate type, substrate age, substrate condition, and the type, quality, and suitability of the metal treatment or primer used under the powder coating.

8.2.2 Application conditions such as temperature, humidity, voltage, part grounding, and gun to part distance.

## COATING POWDER PROPERTIES

## 9. Compatibility

9.1 The need for compatibility arises when working with coating powders of varying color or chemical composition. Problems such as changes in gloss, surface appearance, physical properties, and color contamination may occur if incompatible powders are mixed. Rather than discover these problems on the production coating line, it is recommended that the compatibility of powders be checked prior to their use.

9.2 Test compatibility of coating powders in accordance with PCI Procedure #2 or ISO 8130-12.

## 10. Minimum Explosive Concentration (Lower Explosive Level (LEL))

10.1 The minimum explosive concentration (MEC) as defined in 3.1.3 is a value that is critical in the proper design of coating powder application and collection systems. To obtain precise and reliable LEL results, it is best to employ the service of an independent laboratory, which has the special apparatus needed. However, a quick calculation method, as listed below, has been proved in practice to be satisfactory when applied to coating application plants.

10.2 Calculate the MEL (or LEL) of a coating powder in accordance with ISO 8130-4.

## 11. Particle Size and Distribution

11.1 A coating powder's particle size distribution (P.S.D.) and the resulting median particle size can have a significant affect on the coating powder's application properties and the

appearance of the cured powder coating. There is unfortunately, no one optimum P.S.D. or median particle size. The optimum P.S.D. and median particle size for each application will be influenced by the part configuration being coated, the desired film thickness range, the desired film appearance, the powder chemistry, and the application equipment.

11.2 Guide **D5861** references a number of commonly used methods for the measurement of particle size.

11.3 Particle Size by Laser Defraction.

11.3.1 Run particle size analysis by laser diffraction using ISO 8130-13.

11.4 *Multiple Sieve Analysis:*

11.4.1 Run multiple sieve analysis in accordance with Test Method **D1921** or ISO 8130-1.

11.4.2 Specification **E11** can be used in specifying the required sieves.

## 12. Accelerated Storage Stability

12.1 For the recommended useful life of a coating powder, the coating powder must be easily fluidized and free-flowing in order to be properly applied. In addition, the coating powder has to melt, flow out, and cure (thermoset coating powders), to form a powder coating possessing the aesthetic and protective properties desired. In the case of a thermoset coating powder, an accelerated storage stability test can allow a powder user to predict the physical and chemical stability of a coating powder in order to determine its long term usability as a function of time and temperature. The physical stability of a thermoplastic coating powder can also be predicted.

12.2 Run accelerated storage stability in accordance with PCI Procedure #1 or ISO 8130-8.

## 13. Pourability

13.1 Test for pourability in accordance with Test Method **D1895**.

## 14. Fluidity

14.1 A coating powder's transport and spraying characteristics are, among other things, highly dependent on it's fluidity, defined as the ability to move freely, uniformly, and continuously (somewhat like a liquid), when subjected to certain conditions of pressure, temperature, and velocity of a carrier gas (air).

14.2 Test fluidity in accordance with ISO 8130-5.

## 15. Cured Weight Loss for Thermosetting Coating Powders

15.1 In comparison to liquid coatings, coating powders will have a relatively small cured weight loss as a result of the cure cycle. Typically, the cured weight loss from a coating powder will consist of water and low molecular weight organic compounds or blocking agents, or both. The cured weight loss may be requested in order to properly determine the exhaust requirements of a bake oven or to comply with state or federal reporting guidelines. At this time, there is not a recognized