NOT MEASUREMENT SENSITIVE

FED. TEST METHOD STD. 141D
March 22, 2001
SUPERSEDING
FED. TEST METHOD STD. 141C
January 24, 1986

FEDERAL TEST METHOD STANDARD

PAINT, VARNISH, LACQUER AND RELATED MATERIALS: METHODS OF INSPECTION, SAMPLING AND TESTING

The General Services Administration has authorized the use of this federal standard, by all federal agencies.

FSC 8010

FEDERAL TEST METHOD STANDARD

PAINT, VARNISH, LACQUER AND RELATED MATERIALS: METHODS OF INSPECTION, SAMPLING AND TESTING

AUTHORITY: This standard is issued pursuant to the Federal Property and Administration Service Act of 1949, as amended, and its application to the purchase of commodities referred to herein is mandatory on all Federal agencies.

SECTION 1

SCOPE AND CONTENTS

1. SCOPE

1.1 Scope. This standard elaborates the methods used to determine the physical and chemical properties of paint, varnish, lacquer, and related materials. The purpose of this standard is to establish standardized testing methodologies and to eliminate unnecessary or undesirable variations in test results when evaluating a product's adherence to specification requirements. If any variation or modification of the methods established in this standard is required by any specification, the procedures listed in the specification will take precedence. Any conflict between this standard and any particular specification will be resolved in favor of the specification.

2. CONTENTS

2.1 Contents. The contents of this standard are arranged in sections as follows:

Section
1. Scope and Contents.
2. Form and Numbering System.
3. Alphabetical Index of Test Methods.
4. Numerical Index of Test Methods.
5. Numerical Index of Canceled Test Methods.
6. Numerical Index of ASTM methods to be used in place of canceled FTMS 141 Test Methods.
7. Notes on the Use of this Standard.
8. Reagents, Water, and Ethyl Alcohol.
9. Routine and Referee Testing Conditions.
1000. Sampling for Inspection and Testing.
2000. Preparation of Panels and Application of Test Films.
3000. Package Stability Tests.
4000. Physical Tests of Coating Materials and Coating Ingredients.
6000. Physical and Chemical Tests of Dried Films.

SECTION 2

FORM AND NUMBERING SYSTEM

1. SCOPE

1.1 Scope. This section contains a brief description of the form and the system of numbering within the individual methods, and also the manner in which new methods are added and old methods revised.

2. FORM

2.1 Revision of existing methods. The binding of this standard permits separation for convenience in adding new methods and revising existing methods.

2.1.1 Numbering system used. When a technical change or modification is issued, one will identify it by adding a decimal point to the basic method number or by incrementing the decimal.

2.1.2 Revision precedence. When a revision is issued on a Standard 141 method, it automatically supersedes the previous method. Use the method of the particular revision in force at the time of invitation to bid for testing.

2.2 New methods. A placement of new methods in this standard is based on the following criteria:

a. The character or purpose of the test method indicates the specific section to which it belongs.

b. A method number is assigned so that the new method is located close to methods of similar or related type.

2.3 Use of ASTM test methods. American Society for Testing and Materials (ASTM) methods listed in section 6 of this standard have been accepted as substitutes for the applicable canceled Federal test methods and should be used whenever the Fed. Test Method Std. 141 method number is referenced. When superseded 141 methods are to be cited in the future, the accepted ASTM method should be cited directly.

3. INDEXES AND METHOD FORMAT

3.1 The indexes.

3.1.1 Alphabetical index (section 3). In the alphabetical index, each current method is listed alphabetically by its primary purpose as indicated in its title.

3.1.2 Numerical index (section 4). The numerical index lists all current methods in numerical order.

3.1.3 Numerical index of canceled test methods (section 5). An index of canceled, deleted, or superseded test methods is listed with cross-reference to the superseding Fed. Test Method Std. 141 or accepted ASTM test methods where applicable.

3.1.4 Numerical index of accepted ASTM test methods (section 6). The ASTM test methods accepted are listed with cross-reference to canceled Fed. Test Method Std. 141 test methods.

3.2 Test method format. Whenever possible, the test methods contain the first five of the following six paragraphs. Data on precision are included whenever available.

3.2.1 Scope. The scope of each test method is given in paragraph 1. It describes the purpose of the test method.

3.2.2 Apparatus. The apparatus for each test method is listed in paragraph 2. Unusual apparatus is listed, along with standardization techniques and construction requirements, if applicable.

3.2.3 Reagents. All reagents required in a test method are listed in paragraph 3. Details are given for the preparation of reagents that must be manufactured specifically for a particular test method.

3.2.4 Procedure. The procedure to be followed in each test method is detailed in paragraph 4. The procedure generally includes three major sections, preparation of the test specimen, performance of the test involved, and calculation of results.

3.2.5 Precision. Data on precision for each test method, both within one laboratory and between different laboratories, are listed in paragraph 5.

3.2.6 Notes. Any pertinent notes for each test method are listed in paragraph 6. These notes will include caution warnings, comments on variations in results, and similar comments.

SECTION 3

ALPHABETICAL INDEX OF TEST METHODS

Title	Method No.
Adhesion (Wet) Tape Test	6301.3
Application of Sprayed Films	2131.2
Brushing Properties	4321.3
Color Specification from Photometric Tristimulus Data	4252.1
Condition in Container	3011.3
Contractor Inspection Responsibility	1031.1
Drying Time	4061.3
Infrared Reflectance from Reflectometer	6242.2
Infrared Reflectance from Spectrophotometric Data	6241.2
Knife Test	6304.2
Nonvolatile Vehicle Content	4053.2
Reducibility and Dilution Stability	4203.2
Spraying Properties	4331.2
Storage Stability (Filled Container)	3022.2
Transparent Liquids, Appearance of	4261.1

SECTION 4

NUMERICAL INDEX OF TEST METHODS

Title	Method No.
Contractor Inspection Responsibility	1031.1
Application of Sprayed Films	2131.2
Condition in Container	3011.3
Storage Stability (Filled Container)	3022.2
Nonvolatile Vehicle Content	4053.2
Drying Time	4061.3
Reducibility and Dilution Stability	4203.2
Color Specification from Photometric Tristimulus Data	4252.1
Appearance of Transparent Liquids	4261.1
Brushing Properties	4321.3
Spraying Properties	4331.2
Infrared Reflectance from Spectrophotometric Data	6241.2
Infrared Reflectance from Reflectometer	6242.2
Adhesion (Wet) Tape Test	6301.3
Knife Test	6304.2

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Inspection (General)	1011		
Sampling General	1021		
Sampling for Inspection and Testing	1022		D3925
Preparation of Steel Panels	2011.2		
Preparation of Tin Panels	2012.2		
Preparation of Aluminum Panels	2013.1		
Preparation of Magnesium Alloy Panels	2015		D1732
Preparation of Glass Panels	2021		D3891
Preparation of Wood Panels	2031		D358
Preparation of Fabric Panels	2041		
Preparation of Concrete Panels	2051		
Preparation Gypsum Wallboard Panels	2081		
Preparation of Cast Films	2111		
Application by Roller	2112		
Application of Dipped Films	2121		D823, Practice B
Application of Brushed Films	2141.1		
Application of Flowed Films	2151		
Application of Film with Film Applicator (Magnetic Chuck)	2161		
Application of Film with Film Applicator (Suction Panel Holder)	2162		
Freeze-Thaw Resistance of Latex and Emulsion Paints	3012		D2243
Package Stability of Latex Paints	3018		D1849
Storage Stability at Thermal Extremes	3019.1		
Skinning (Partially Filled Container)	3021.1		
Ease of Reincorporation	3027		
Pigment Content (Ordinary Centrifuge)	4021.1		D2371
Pigment Content (Supercentrifuge)	4022		D2698
Pigment Content of Cellulosic Lacquer	4023		
Nonvolatile Vehicle Isolation (Ordinary Centrifuge)	4031		
Vehicle Isolation (Supercentrifuge)	4032		D2698
Volatile and Nonvolatile Content (Ordinary Laboratory Oven)	4041.1		D2369
Volatile and Nonvolatile Content (Vacuum Oven)	4042.1		D2369
Volatile (Moisture) Content of Celluloses	4043		
Nonvolatile Content of Dopes and Lacquers	4044		
Nonvolatile Matter in Solvents and Diluents	4045		D1353
Volatile Matter in Hard Resins	4046		
Vehicle Solids (Ordinary Centrifuge)	4051.1		
Vehicle Solids (Super Centrifuge)	4052		

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Drying Time (Oil-Base Paints)	4062	4061.3	
Drying Time (Drying Oils and Resin Solutions)	4063	4061.3	
Moisture and Other Volatile Matter in Pigments	4071		D280
Moisture and Other Volatile Matter in Pigments that Decompose at 110°C	4072		
Water in Paints and Varnishes (Karl Fisher Titration Method)	4082.1		D1364
Water in Solvents and Thinners by Turbidity Method	4083		D1476
Coarse Particles and Skins in Oil-Base Paints and Pastes	4091.1		
Coarse Particles and Skins in Synthetic Vehicles	4092.1		D185
Coarse Particles in Dry Pigments (Ordinary Form)	4101		D185
Coarse Particles in Dry Pigments (Pellet Form)	4102		
Wet Hiding Power of Paint (B/W Checkerboard)	4111		
Wet Hiding Power of Paints (Impervious Chart)	4112		
Drying Opacity	4121.1		
Hiding Power (Contrast Ratio)	4122.2		D2805
Wet Opacity	4131		
Stability to Temperature Cycle	4144		
Kauri Reduction Test	4151		D1642 Test Method B
Rosin-Pentaerythritol Ester Reduction Test	4152		D1642 Test Method A
Gas Test (Bell Jar)	4161		
Gas Test (Oven)	4162		
Draft Test	4171		
Specific Gravity of Pigments (Vacuum Method)	4181		D153 Test Method A, Sections 4-9
Specific Gravity of Pigment (Centrifuge Method)	4182		
Specific Gravity of Solvents and Thinners	4183		D891
Weight per Gallon	4184.1		D1475
Specific Gravity of Solid Resins	4185		
Oil Absorption (Rub Out)	4191		D281
Oil Absorption (Gardner-Coleman)	4192		
Miscibility Tests for Pastes-in-Oil	4201.1		
Mixing Properties of Aluminum Mixing Varnishes	4202		

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Dilution Ratio (Lacquer Ingredients)	4204.1		D1720
Bronzing Test of Cellulose	4205		
Compatibility with Basic Pigment	4206		
Compatibility with Zinc Oxide	4207		
Evaluating Degree of Settling of Paint	4208		D869
Miscibility and Compatibility	4209		
Mass Color of Pigments and Pastes-in-Oil	4220.1		D387
Tinting Strength and Character of Tint of Color Pigments	4221		D387, Exclude Section 6 Sections 2, 4, 6, 7
Color Pigments (Dry) and Pastes-in-Oil Tinting Strength of White Pigments	4222		
Color of Transparent Liquids (Acid-Potassium Dichromate)	4241.1		
Color of Transparent Liquids (Hellige Scale)	4242		
Color of Transparent Liquids (Platinum-Cobalt Scale)	4243.1		D1209
Color of Transparent Liquids (Barrett Scale)	4244		
Color of Transparent Liquids (Lovibond Scale)	4245		
Color of Transparent Liquids (Saybolt Scale)	4246		D156
Color of Transparent Liquids (Water-Potassium Dichromate)	4247		
Color of Transparent Liquids (Gardner Color Std. 1953)	4248		D1544
Color Differences of Opaque Materials Visual Evaluation	4249.1		D1729
Color of Pigmented Coatings	4250.1		D1729
Color Specification from Spectrophotometric Data	4251		
Color Examination of Resins	4253		
Color of Lac Resin and Shellac by Comparison of Sols.	4254.1		
Color of Lac Resin and Shellac by Comparison of Dried Films	4255		D29
Appearance of Pigmented Materials	4262	3011.3	
Viscosity of Transparent Liquids (Gardner Tubes)	4271		D1545
Viscosity of Cellulose Derivatives by Ball Drop Method	4272.1		D1343
Penetration (Needle)	4273		D5
Penetration (Cone)	4273		D937
Consistency of Pigmented Materials (Krebs-Stormer)	4281		D562
Viscosity of Pigmented Materials (Ford Cup)	4282		D1200

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Consistency of Pigmented Materials (Gardner Mobilometer)	4283		
Viscosity of Pigmented Materials (ASTM Cups)	4284		
Viscosity (Saybolt Viscosimeter)	4285		D88
Viscosity (Brookfield)	4287		D2196 Test Method A
Flash Point of Volatile Materials (Tag Closed Tester)	4291		D56
Flash Points of Lacquer Solvents or Diluents of Low Flash Point (Tag Closed Cup)	4292		D56
Flashpoint of Pigmented Materials (Pensky-Martens Closed Cup Tester)	4293		D93
Flash and Fire Points (Cleveland Open Cup)	4294		D92
Distillation of Volatile Petroleum Solvents, Liquid Naval Stores and Aromatic Hydrocarbons	4301.1		D1078
Distillation of Liquid Naval Stores	4302		D1078
Distillation of Aromatic Hydrocarbons	4303		D1078
Roller Coating Properties	4335		
Dipping Properties	4341.1		D823, Practice B Sections 9-13
Separation of Volatile Matter (Ordinary Distillation)	4351		
Refractive Index	4371		
Odor Test	4401		D1296
Fineness of Grind	4411.1		D1210
Absorption Test	4421		
Heating Test (Gel Time)	4441		D1955
Quality Test (Tung Oil)	4442		D1964
Leafing Test (Aluminum)	4451.1		D480 Sections 2-7
Cloud and Pour Point	4452		D97, D2500
Loss on Heating (Fatty Oils)	4461		D1960
Loss on Ignition	4462		D1208 Section 4
Spot Test (Thinners and Solvents)	4491		
Evaporation Rate of Volatile Thinners	4492		D3539
Sag Resistance (Baker Method)	4493		
Sag Test (Multinotch Blade)	4494.1		

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Softening Point by Ring and Ball Apparatus	4495		E28
Working Properties and Appearance of Dried Film	4541		
Baking Properties	4542		
Light Fastness of Pigments	4561.2		
Bleeding of Pigments	4571.2		
Bleeding (Oil Base Vehicle)	4572		D279
Qualitative Test for Fish Oil	5011.1		
Qualitative Test for Organic Colors or Lakes	5021		
Qualitative Test for Rosin (Lieberman-Storch)	5031		D1542 Sections 1 - 4.1
Qualitative Test for Rosin (Halphen-Hicks)	5032		D1542 Exclude 4.1
Qualitative Test for Unsaponifiable Matter in Fatty Acids	5041		
Preparation of Paint - Oil, Fatty Acids	5051.1		
Iodine Number of oils and Fatty Acids	5061		D1959
Acid Number (Oils)	5071		D1639
Acid Number (Resins)	5072		D1639
Acid Number (Varnishes)	5073		D1639
Saponification Number	5081		D1962
Qualitative Test for Benzene	5091 *		
Copper Corrosion (Aliphatic & Aromatic Hydrocarbons) Copper Strip Test	5101.1		
Copper Corrosion (Aromatic Hydrocarbons)	5102		
pH Value of Pigments	5111		D1208
Polymerization Residue	5121		D233
Aromatic Hydrocarbon Content (Spectrophoto. Method)	5131.1		
Chlorinated Compounds	5132		
Test for Presence of Methanol	5133		
Qualitative Test for Phenolic Resins & Bisphenol Epoxies	5141.1		
Acetone Extract	5151		
Break Test (Oils)	5161		D1952
Foots Test	5162		D1954
Ester and Ketone Content of Lacquer Thinner	5171		
Ester and Ketone Content (Dopes and Lacquers)	5172.1		
Aniline Point	5181		D611
Mixed Aniline Point	5182		D611
Kauri-Butanol Value	5191		D1133

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Nitrocellulose in Floor Sealer	5201		
Nitrocellulose in Nonvolatile Vehicles	5202.1		
Nitrocellulose in Presence of Glycol Sebacetate, No. 1	5203		
Nitrocellulose in Presence of Glycol Sebacetate, No. 2	5204		
Nitrocellulose in Lacquers	5205.2		
Extraction of Rubber Base PPT (Chlor. Rubber & S-A Type)	5211.2		
Extraction of Rubber Base PPT (S-B Type)	5212		
Material Insoluble in Hot Solvents	5221.1		
Wax in Shellac	5231		
Water Solubility	5241		D1208 Section 5
Water Solubility (Alcohols)	5242		
Water Solubility (Solvents and Plasticizers)	5243		
Water Solubility (Finished Materials)	5244		
Acidity (Dopes)	5251		
Acidity (Lacquer Solvents and Diluents)	5252		D1613
Acidity - Mineral Acid	5253		
Acidity - Mineral Acid (After Distillation)	5254		
Acidity of Aromatic Hydrocarbons	5255		D847
Ash (Pigments and Other Solids)	5261		D1208 Section 4
Ash (Clear Materials)	5262		D1951
Ash (Vehicle extracted from Pigmented Materials)	5263		D1951
Ash (Celluloses)	5264		
Ash (Liquid Driers)	5265		D1951
Silica Content of Silicone Resin Vehicles	5266		
Matter Insoluble in Acid	5271		D215 Section 20
Plasticizer and Resin in Nonvolatile Solvents	5291		
Sulfur Compounds in Volatile Thinners	5311		D853
Acid Wash of Volatile Thinners	5321		
Sulfuric Acid Solubility and Paraffin Content Of Volatile Thinners	5331.1		
Doctor Test	5351		
Nitro Compounds in Cellulose	5391		

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Spot Test for Nitrate in Doped Fabrics	5392		
Paraffin Content of Aromatic Hydrocarbons	5411		
Solidification Point of Benzene	5421		
Immersion Resistance	6011		D1308 Exclude 7.2, 7.3
Cellulose Film Test	6021		
Heat Resistance	6051		
Salt Spray (Fog) Test	6061		B117
Testing Coated Metal Panels at 100% Relative Humidity	6071		D2247
Spotting Resistance	6081		D1308 Exclude 7.4
Blush Resistance	6091		
60-Degree Specular Gloss	6101.1		
Flatness	6102		
85-Degree Specular Gloss (Sheen)	6103		
20-Degree Specular Gloss	6104		
45-Degree, 0-Degree Directional Reflectance	6121		
Lightness Index Difference	6122.1		
Color Difference of Opaque Materials (Instrumental Method)	6123		
Underwater Reflectance of Camouflage Coatings	6124		
Luminance Factor of Retroreflective Materials, Instrumental Measurements	6125	Use FTMS 370	
Yellowness Index	6131		
Accelerated Yellowness	6132		
Washability	6141.1		
Scrub Resistance	6142		
Scrubbing Resistance of Oil Paints	6143		
Accelerated Weathering (Open Arc Apparatus)	6151		G23, D822
Accelerated Weathering (Enclosed Arc Apparatus)	6152		G23, D822
Conduct of Exterior Exposure Tests of Paints on Metals	6160		D1014
Conduct of Exterior Exposure Tests of Paints on Wood	6161.1		D1006
Brittleness of Doped Fabrics	6162		
Moisture Vapor Permeability of Organic Coating Film	6171		D1653
Dry Film Thickness (Magnetic Type Gage)	6181		D1186
Dry Film Thickness of Cast Films	6182		
Dry Film Thickness (Mechanical Type Gage)	6183		D1005
Abrasion Resistance (Falling Sand)	6191		D968

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Abrasion Resistance (Taber Abraser)	6192.1		D4060
Abrasion Resistance (Jet Abrader)	6193		
Humidity Test	6201		
Print Test	6211		D2091
Indentation Hardness of Organic Coatings	6212		D1474
Blocking Test	6216		
Flexibility	6221		
Flexibility (Percent Elongation)	6222		D522, Test Method A
Flexibility (Cold Cracking)	6223.1		
Elongation of Tensile Strength of Free Films	6224.1		D2370
Elongation of Cast Films	6225		D2370
Impact Flexibility	6226		D2794
Infrared Reflectance (from Photograph)	6243		
Instrumental Measurements of Photometric Performance of Retroreflective Beads	6244		
Lacquer Lifting Test	6251		
Self-Lifting Test	6252.1		
Primer Absorption and Topcoat Holdout	6261.1		
Mildew resistance	6271.2		
Tautness of Doped Fabrics	6281		
Bursting Strength of Doped Fabrics	6291		
Adhesion (Parallel Groove Method)	6302.1		
Adhesion of Coatings with Scrape-Adhesion Apparatus	6303.1		D2197
Marking of Masking Tape	6311		
Adhesion and Strippability	6317		
Sanding Characteristics	6321		
Performance Tests for Floor Sealers	6331		
Rubbing Test	6332		
Removal Power and Removability	6352		
Degree of Resistance to Chalking of Exterior Paints	6411		
Degree of Resistance to Checking of Exterior Paints	6421		D660
Degree of Resistance to Erosion of Exterior Paints	6431		D662
Degree of Resistance to Flaking (Scaling) Exterior Paints	6441		D772
Rusting Obtained with Paint on Iron or Steel Surface	6451		D610
Degree of Blistering	6461		D714
Degree of Resistance to Cracking of Exterior Paints	6471		D661

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Unsaponifiable Matter in Drying Oils and Fatty Acids	7011		D1965
Unsaponifiable Matter in Alkyd Resins and Resin Solutions	7012.1		D1397
Analysis of Unsaponifiable Matter, Oil Acids and Phthalic Anhydride in Alkyd Vehicles	7014		
Chlorine Content of Vinyl-Alkyd Resins	7015		
Chlorine Content of Resin Vehicles	7016		
Phthalic Anhydride Content of Alkyd Resins	7021		D563
Phthalic Anhydride Content of Alkyd Resins and Esters	7022		D1306
Phthalic Anhydride Content of Vinyl Alkyd Resins	7023		
Phthalic Anhydride in Lacquer Vehs. (UV-Spec. Method)	7024		
Phthalic Anhydride Content of Alkyd Resins (Spectrophotometric)	7025		D563
Nitrogenous Resins and Phthalic Anhydride in Baking Enamels	7026.1		
Melamine-Formaldehyde Resin in Alkyds	7027		
Oil Acid Contents of Alkyd Resins	7031		D1398
Analysis of Basic Carbonate White Lead Pigment	7041		D1301
Analysis of Basic Sulfate White Lead Pigment	7051		D1301
Determination of Lead by X-Ray Emission Spec. Analysis	7060		
Analysis of Blue Lead	7061		
Red Lead in Pigments	7071.1		
Colorimetric Determination of Red Lead	7072		
Analysis of Pure Red Lead Pigment	7073		
Analysis of TiO_2 Pigment (Jones Reduction)	7081		D1394
Analysis of TiO_2 Pigment (Zinc Amalgam)	7082		
Analysis of TiO_2 Pigment (Aluminum Reduction)	7083		D1394
Analysis of TiO_2 Pigment (Titration w/Ferric Salt Solution)	7084		
Analysis of Zinc Oxide Pigment (Outside Indicator)	7091		D34
Analysis of Zinc Oxide Pigment (Inside Indicator)	7092		
Analysis of Lithopone Pigment	7101		
Analysis of Antimony Oxide Pigment	7106		D2350
Analysis of Chrome Green Pigment	7111.1		
Analysis of Chrome Green Pigment (Perchloric Acid)	7112		
Analysis of Chromium Oxide Green Pigment	7121		D126
		Sections 1, 2, 3.2, 4-7, 25, 29, 30, 38, 41	

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Analysis of Chromium Oxide Green Pigment (Perchloric Acid)	7122		
Analysis of Chrome Yellow and Chrome Orange Pigments	7131.1		
Analysis of Molybdate Orange	7133		
Analysis of Cadmium Pigment	7135		
Analysis of Yellow Ocher	7141		D50
Analysis of Metallic Brown	7151		D50
Analysis of Synthetic Black and Brown Iron Oxide	7161.1		
Analysis of Copper Phthalocyanine Blue Pigments	7171.1		
Analysis of Iron Blue Pigment	7181		
Analysis Para Red, Toluidine Red, and Lithol Red Toner Pigments	7191		
Analysis of Ultramarine Blue Pigment	7201		D1135
Analysis of Zinc Yellow Pigment	7211		D444
Analysis of Zinc Dust (Metallic Zinc Powder)	7221		
Metals Content of Driers	7231		D564
Analysis for Total Copper in Pigments	7232		D283
Analysis of Aluminum in Aluminum Powder or Paste	7233		D480
Analysis of Cement-Water Paint Powder	7241		
Analysis of Magnesium Silicate Pigment	7251		
Analysis of Calcium Carbonate	7253		D34
Analysis of Pigment Extracted from White-Base, Composite-Pigment Exterior Paints	7261		
Analysis of Pigment Extracted from Chrome Yellow And Chrome Orange Paints	7271		
Analysis of Pigment Extracted from Chrome Green Paints	7281		
Analysis of Pigment Extracted from Iron Oxide Paints	7291.1		
Analysis of Pigment Extracted from Wood-Sash Putty	7301		
Analysis of Pigment Extracted from Black Paints	7311		
Analysis of Pigments Extracted from Graphite Paints	7321		
Analysis of Pigment Extracted from Iron Oxide-Zinc Chromate	7331		
Zinc Oxide and Zinc Chromate in Paint Pigments	7340.1		
Ketone Content of Paint Solvents	7345		
Analysis of Vinyl Modified Alkyd Resins	7351		
Distillation of Solvents from Enamels and Lacquers	7355		D3272

SECTION 5

NUMERICAL INDEX OF CANCELED TEST METHODS

Title of Canceled Test Method	Canceled FTMS 141 Method No.	Use FTMS 141 Method No.	Use ASTM Method No.
Solvent Content of Enamels and Enamel Thinners (Gas Liquid Chromatography)	7356.1 *		
Solvent Content of Lacquer and Lacquer Thinners (Gas Chromatography)	7360 *		
Solvent Content of Lacquers Containing Naphtha Diluent (Gas Liquid Chromatography)	7361.1		
Determination of Plasticizers in Lacquers (GLC)	7371.1		
Solvent Content (Including Amines) of Water Based Paints by Gas Chromatography	7375		
Hydroxyl Number	7381		
Amine Nitrogen Content	7391 **		
Epoxy Resin Coating Vehicles	7401		
Epoxy Content of Epoxy Resins	7403		D1652
Epoxy Resin Content in Paints Containing an Acrylic Latex Resin	7409		
Available Isocyanate (NCO) in Urethanes	7421		D2572
Free Toluene Diisocyanate in Urethane	7426		
Free Diisocyanate in Urethane Materials or Prepolymers (Volumetric Distillation Method)	7427		
Identification of Drying Oils (Gas-Liquid Chromatography)	7501		D2800, D2245 D1983

* Use EPA Method 311.
** Use Shell Chemical Method HC-715-88.

SECTION 6

NUMERICAL INDEX OF ASTM METHODS TO BE USED IN PLACE OF CANCELED FED. TEST METHOD STD. 141 TEST METHODS

ASTM Method No.	FTMS 141 Method No.
B117	6061
D5	4273
D29	4255
D34	7091
D34	7253
D50	7141
D50	7151
D56	4291
D56	4292
D88	4285
D92	4294
D93	4293
D97	4452
D126, Sections 1, 2, 3.2, 4-7, 25, 29, 30, 38, 41	7121
D153, Test Method A, Sections 4-9	4181
D156	4246
D185	4092.1
D185	4101
D215, Section 20	5271
D233	5121
D279	4572
D280	4071
D281	4191
D283	7232
D358	2031
D387, Exclude Section 6	4220.1
D387, Sections 2, 4, 6, 7	4221
D444	7211
D480, Sections 2-7	4451.1
D480	7233
D522, Test Method A	6222
D562	4281
D563	7021
D563	7025
D564	7231
D611	5181
D611	5182
D660	6421
D661	6471
D662	6431
D714	6461
D772	6441

SECTION 6

NUMERICAL INDEX OF ASTM METHODS TO BE USED IN PLACE OF CANCELED FED. TEST METHOD STD. 141 TEST METHODS

ASTM Method No.	FTMS 141 Method No.
D822	6151
D822	6152
D823, Practice B	2121
D823, Practice B, Sections 9-13	4341.1
D847	5255
D853	5311
D869	4208
D891	4183
D937	4273
D968	6191
D1005	6183
D1006	6161.1
D1014	6160
D1078	4301.1
D1078	4302
D1078	4303
D1133	5191
D1135	7201
D1186	6181
D1200	4282
D1208, Section 4	4462
D1208	5111
D1208, Section 5	5241
D1208, Section 4	5261
D1209	4243.1
D1210	4411.1
D1296	4401
D1301	7041
D1301	7051
D1306	7022
D1308, Exclude 7.2 and 7.3	6011
D1308, Exclude 7.4	6081
D1343	4272.1
D1353	4045
D1364	4082.1
D1394	7081
D1394	7083
D1397	7012.1

SECTION 6

NUMERICAL INDEX OF ASTM METHODS TO BE USED IN PLACE OF CANCELED FED. TEST METHOD STD. 141 TEST METHODS

ASTM Method No.	FTMS 141 Method No.
D1398	7031
D1474	6212
D1475	4184.1
D1476	4083
D1542, Sections 1 - 4.1	5031
D1542, Exclude 4.1	5032
D1544	4248
D1545	4271
D1613	5252
D1639	5071
D1639	5072
D1639	5073
D1642, Test Method A	4152
D1642, Test Method B	4151
D1652	7403
D1653	6171
D1720	4204.1
D1729	4249.1
D1729	4250.1
D1732	2015
D1849	3018
D1951	5262
D1951	5263
D1951	5265
D1952	5161
D1954	5162
D1955	4441
D1959	5061
D1960	4461
D1962	5081
D1964	4442
D1965	7011
D1983	7501
D2091	6211
D2196, Test Method A	4287
D2197	6303.1
D2243	3012
D2245	7501
D2247	6071
D2350	7106
D2369	4041.1
D2369	4042.1

SECTION 6

NUMERICAL INDEX OF ASTM METHODS TO BE USED IN PLACE OF CANCELED FED. TEST METHOD STD. 141 TEST METHODS

ASTM Method No.	FTMS 141 Method No.
D2370	6224.1
D2370	6225
D2371	4021.1
D2500	4452
D2572	7421
D2698	4022
D2698	4032
D2794	6226
D2800	7501
D3272	7355
D3539	4492
D3891	2021
D3925	1022
D4060	6192.1
E28	4495
G23	6151
G23	6152

SECTION 7

NOTES ON THE USE OF THIS STANDARD

1. PRODUCT SPECIFICATION. Product specifications for paint, varnish, lacquer, and related materials should specify by number the test method to use to test for a particular property. Many of the test methods in this standard give desired conditions for the test involved, in which case, assuming they are applicable to the product under test, no further information need be specified. In some instances, the specification should stipulate the test conditions, properties to be checked (if there are more than one), and the test periods involved.

2. SOURCE FOR SECURING FEDERAL SPECIFICATIONS AND STANDARDS. Activities outside the Federal Government may obtain copies of Federal specifications, standards, and handbooks as outlined under General Information in the General Service Administration's Index of Federal Specifications, Standards, and Commercial Item Descriptions and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
Federal Government activities may obtain copies of Federal specifications, standards, and handbooks and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.

SECTION 8

REAGENTS, WATER, AND ETHYL ALCOHOL

1. SCOPE. This section covers the general requirements for the purity of reagents and water used in the test methods of this standard. Detailed information for a particular reagent is given in the method in which it is used.

2. REAGENTS. Unless otherwise indicated, all reagents should conform to the American Chemical Society specifications for reagent chemicals, published in the latest edition of "Reagent Chemicals, ACS Specifications," and available from the American Chemical Society, 1155 Sixteenth Street, NW, Washington, DC 20036. The Society can be contacted by telephone (202) 872-4600, or (800) 227-5558, or Internet address: http://www.acs.org. Where such specifications are not available, use commercial chemicals having the highest purity, and if necessary, analyze these chemicals before use by proper analytical methods.

3. WATER. Unless otherwise indicated, references to water for use in the preparation of reagents and in the analytical procedures should be understood to mean freshly distilled water.

4. ETHYL ALCOHOL. Ethyl alcohol should be absolute ethanol (100 percent or 200 proof), 95 percent ethanol (containing 5 percent water, 190 proof), or alcohol denatured according to formulas of the Internal Revenue Service (see 5). The particular grade of ethanol to be used should be specified in each method.

5. DENATURED ALCOHOL. Denatured alcohol corresponding to the following formulas is prepared by adding the designated denaturant to 100 gallons of 95 percent (190 proof) ethyl alcohol:

Formula Number	Denaturant (gallons)
1	wood alcohol (5)
2B	benzene (0.5)
3A	methyl alcohol (5)
12A	benzene (5)
13A	ethyl ether (10)
23A	acetone (10)
28	benzene (10)
30	methyl alcohol (10)
32	ethyl ether (5)
35	ethyl acetate (35)
35A	ethyl acetate (5)

6. NIST STANDARD REFERENCE MATERIALS. Information, prices, and ordering instructions for NIST standard reference materials are given in NIST Special Publication 260, entitled “Catalog of NIST Standard Reference Materials”, available from the U.S. Department of Commerce, Technology Administration, National Institute of Standards and Technology, Standard Reference Materials Program, Building 202, Room 204, Gaithersburg, MD 20899. NIST can be contacted by telephone 301-975-6776, or e-mail: srminfo@nist.gov, or Internet address: http://ts.nist.gov/srm.

SECTION 9

ROUTINE AND REFEREE TESTING CONDITIONS

1. CONDITIONING AND TESTING

1.1 Routine testing. Unless otherwise specified in the product specification or test method, perform all physical tests on coating materials or dried test films thereof at 21 to 32°C (70 to 90°F).

1.2 Referee testing. In case of dispute or disagreement between laboratories, and unless otherwise specified, condition the coating, material or test film thereof in an atmosphere of 50 ± 4 percent relative humidity and at a temperature of 23°C ± 1°C (73°F ± 2°F). It is intended that the laboratory be maintained as closely as possible to 23°C (73°F) and a relative humidity of 50 percent. The tolerances indicated are meant to cover variations from the specified conditions that may occur at different locations in the room.

1.3 Time of conditions. Unless otherwise specified in the product specification or test method, allow the coating material or test film thereof and the testing equipment to reach equilibrium and then test at the conditions specified in 1.2.

1.4 Lighting and ventilating. Unless otherwise specified, lighting and ventilating conditions should be those normally maintained in a room used for paint testing purposes.

CONCLUDING MATERIAL

Custodians:
Army - MR
Navy - SH
Air Force - 11

Preparing activity:
Army - MR

(Project 8010-0149)

Review activities:
Army - MI
Navy - AS, CG
Air Force - 03, 84, 99

Section 1000

SAMPLING FOR INSPECTION AND TESTING

CONTRACTOR INSPECTION RESPONSIBILITY

1. SCOPE.

1.1 Scope. This method covers the requirements for contractor inspection responsibility.

2. APPARATUS. Not applicable.

3. REAGENTS. Not applicable.

4. REQUIREMENTS

4.1 Quality control provisions.

4.1.1 Inspection and testing. The contractor is responsible for the performance of all inspection and testing requirements as specified in the specification for the commodity. Except as otherwise specified, the contractor shall utilize his own or any other inspection and testing facilities and services acceptable to the Government. Records of the examination and tests shall be kept complete and available to the Government. The Government reserves the right to perform any of the inspection and testing set forth in the specification and contractual documents where such is deemed necessary to ensure that supplies conform to prescribed requirements

4.1.2 Quality control system. The contractor shall maintain an effective quality control system. This system shall provide for adequate controls of quality throughout all areas of contract performance. Descriptive procedures shall be provided and maintained to illustrate the entire process of receipt and handling of ingredient materials, and the manufacture, inspection, testing, packaging, packing, marking, and shipping of finished product. The contractor shall provide for or maintain at least a minimum of accurate laboratory testing equipment in satisfactory operating condition sufficient to perform the required acceptance tests and to ensure that the products conform to contract requirements.

4.2. Extent of testing.

4.2.1 Over 250 gallons or 2,000 pounds, as applicable (see 6.1). The contractor shall have all acceptance tests made as required by the specification and the contract and shall submit the laboratory test report when the contract or order provides for more than 250 gallons or 2,000 pounds of one material. When the contractor has a past history of good quality control as determined by the Government quality control activity:

a. With 90 percent of the quantity completely conforming to specification requirements;
b. With the 10 percent of the quantity nonconforming having only minor discrepancies with no gross divergence from specification requirements;
c. With reasonable conformity with Government test results;

then testing of up to four lots in five of the same material, regardless of contract or order, shall be reduced to that of 4.2.2.

4.2.2 50 to 250 gallons or 400 to 2,000 pounds. Reduced testing will be permitted on contracts of 50 gallons or 400 pounds and over but not exceeding 250 gallons or 2,000 pounds, provided the formulation used has been shown to comply with all requirements by prior testing. For paints and similar pigmented and clear products, the submitted test report shall cover the following characteristics, as applicable:

a. Application properties.
b. Drying or curing time.
c. Appearance of dry film (gloss, color, and so forth).
d. Opacity.
e. Fineness of grind.
f. Weight per gallon.
g. Viscosity.
h. Percent nonvolatile.
i. Strength properties (adhesives).

For other materials, tests shall be reduced to generally accepted plant control procedures and other tests indicative of quality that can be completed within 2 days time with common laboratory equipment.

4.2.3 Under 50 gallons or 400 pounds. When the quantity is less than 50 gallons or 400 pounds, the contractor shall furnish a certificate indicating compliance with all requirements of the specification in lieu of a test report, provided the formulation used has been shown to comply with all requirements by prior testing. Unless otherwise specified in the contract or order, material furnished shall have a 1 year unqualified shelf life beginning with date of manufacture marked on container, and must be guaranteed usable for the intended purpose after normal mixing, stirring, or shaking.

4.2.4 Government testing. If at any time Government testing indicates significant differences when checked against the contractor's test reports, the contractor shall be advised and the quality control system shall be considered to be in a noncomparable status. The contractor shall then be required to submit laboratory tests on a more complete testing basis on each lot, dependent on the nature of the difference, until comparability is reestablished. This action shall be effective regardless of material then being manufactured or the contract under which it is being procured.

4.3 Paint chip.

4.3.1 Coated card. For each lot of all coatings, the contractor shall furnish the Government representative a coated card that shows the color, gloss, and general appearance of the material covered by the lot. The card shall be no smaller than 3 by 5 inches. For acceptance, the color must match, within specification limits, the color card furnished for the contract or order by the Government representative.

4.4. Ingredients-certificate of compliance.

4.4.1 Ingredient requirements. When the specification has mandatory ingredient requirements and the quantity of finished product is 50 gallons or 400 pounds or over, the contractor shall make available to the Government representative a certificate of compliance from the ingredient supplier for each ingredient, as applicable. The certificate of compliance shall cite the data or the location and availability of data, that is the quality control data upon which the certificate is based. For frequently replenished ingredients, normally mixed, blended, or combined in tanks or bins, the contractor shall make available a record of ingredient supplier's certificate of compliance for each replenishment. For products of critical end use such as ship-bottom paints, ingredients shall be sampled and subjected to verification tests in a Government laboratory prior to start of manufacture, when so required by the specification.

4.5. Testing and sampling.

4.5.1 Tests. All tests performed shall be in accordance with the applicable specifications. The contractor is cautioned to refer to and to comply with all modifications of the specifications cited in the contractual documents. If the contractor does not do testing, it shall be his responsibility to furnish his designated testing facility with all pertinent contract information and modifications to make certain that the testing establishment is adequately informed to accomplish all tests and make accurate reports. Quantitative test results shall be reported to the same number of significant digits as are used in stating the requirements of that property in the commodity specification. Qualitative values shall be definitely stated. Results shall not be reported simply as "complies" or "satisfactory," but in the same manner as the requirements. The test methods shall be reported by reference to the applicable paragraph in the product specification or the method number when referenced to a Federal or other test method standard.

4.5.2 Sampling. Unless otherwise specified, sampling shall be in accordance with ASTM D3925.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Paints and related products. While most paints and related products are bought by volume (gallons and so forth), some products such as pigments, hard resins and, possibly, pastes are bought by weight (pounds and so forth). The weights called out in this method are considered convenient and representative amounts or lots for determining the extent of testing required. No specific mathematical relationship is implied by the gallons and pounds called out in this method.

Section 2000

PREPARATION OF PANELS AND APPLICATION OF TEST FILMS

APPLICATION OF SPRAYED FILMS

1. SCOPE

1.1 Scope. This method covers procedures for both the manual and automatic application of finishing materials by using spraying apparatus.

2. APPARATUS. Not applicable.

3. REAGENTS. Not applicable.

4. PROCEDURE

4.1 Manual application.

4.1.1 Cold spray.

4.1.1.1 Reduction of material. When dilution is necessary, the material shall be reduced with the specified thinner to the required solids content or viscosity. Where no viscosity is specified, spray-outs performed with standard type guns shall be done at a viscosity of 17 to 25 seconds in a No. 4 Ford cup at 25°C (see ASTM D1200*)* for pigmented materials, and 0.65 to 1.00 stokes at 25°C (see ASTM D1545) for clear materials.

4.1.1.2 Application. The air pressure shall be kept constant and the air line provided with a moisture trap. The flow, gun distance from the test panel, and spray pattern shall be so adjusted that the deposited film is kept smooth, level, and wet. Application shall be made so as to produce a dry film thickness of (a) 0.0008 to 0.0011 or (b) 0.003 ± 0.0003 inch depending on the nature of material applied or the number of coats and thickness specified in the product specification.

4.1.2 Hot spray.

4.1.2.1 Application. The packaged material shall be applied with an approved hot spray unit. When dilution is necessary, the material shall be reduced with the specified thinner to the required viscosity for hot spray application. The conditions of operation with respect to temperature of heating unit, at spray gun, and of atomization air; pressure of atomization air and feed tank; type and adjustment of air cap and fluid tip on spray gun; distance of gun from work; and rate of flow of material at spray nozzle shall be as specified.

4.2. Automatic application.

4.2.1 Spray. Any automatic spraying machine that combines reciprocating rectilinear motion with variable speed controls and means of adjusting distance from spray gun to test specimen shall be used. The speed of the traversing mechanism and the distance from the spray gun to the test specimen shall be varied until satisfactory spraying properties and the specified dry film thickness are obtained. There shall be no change in operating conditions after correct settings have been

determined. Application shall be the number of coats or thickness specified in the product specification or as specified in 2.1.2.

5. PRECISION. Not applicable.

6. NOTES. Not applicable.

Section 3000

PACKAGE STABILITY TESTS

CONDITION IN CONTAINER

1. SCOPE

1.1 Scope. This method covers procedures for determining changes in properties of paints and related materials after packaging.

2. APPARATUS

2.1 Apparatus. No special apparatus required.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURES

4.1 General. Before agitating the contents of the container in which the material was originally packaged or transmitted for test, open the container by suitable means and determine the condition of the material by one of the following applicable procedures against specified requirements.

4.1.1 Ready-mixed pigmented materials (paints, enamels, and so forth). Note whether skinning has occurred and remove any continuous skin with a spatula by first carefully cutting the skin free from the container. Lower a stiff spatula or paddle into the container and observe if the material is abnormally thick or livered and to what extent settling or caking exists. Just stirring can usually break up soft caking. When firm or hard caking is encountered, the supernatant liquid shall be poured into a clean container and then added back in small amounts with continuous stirring until the pigment has been reincorporated to form a homogeneous material suitable for use or until it is determined that the pigment cannot be reincorporated by hand stirring. After the material has been thoroughly stirred, examine for presence of gell bodies or undispersed conglomerates as it flows from the spatula or paddle. Immediately after stirring examine the surface of the material for floating pigments. Flow some of the material on a tin or glass panel; allow draining in a vertical position and examining for loss of drying ability, color drift, seeding, and coarse particle. Check for change in viscosity per applicable method such as ASTM D562.

4.1.2 Ready-for-use clear materials (varnishes, lacquers, oils, and so forth). Examine for skinning, thickening, livering gelatinous masses, ingredient separation, and other specially defined characteristics that may be objectionable for the specified material such as in 4.1.5. Examination shall be made with the use of a spatula or paddle or by transferring the material to a clear glass container.

4.1.3 Pastes-in-oil and concentrates. Lower the spatula or paddle into the material and pass it over the bottom of the container to determine the extent of caking. Add slowly with constant stirring the specified thinning material and determine whether the paste or concentrate breaks up readily to a smooth, homogeneous mixture of satisfactory brushing consistence.

4.1.4 Dry materials (pigments, toners, and so forth). Transfer a representative amount of the material from the container to a mixing sheet. Note whether the material is homogeneous and has the physical characteristics normal to it. Abnormal lumps or conglomerates shall be friable or capable of being broken up or separated to approximately individual particle size, normal for the material, by pressure between the thumb and fingers or by light tapping with a blunt instrument. Examine for discoloration, dirt and other signs of contamination or adulteration.

4.1.5 Undesirable qualities.

4.1.5.1 Characteristics in the material. The following characteristics in the material are considered undesirable and objectionable under all conditions.

a. Curdling.
b. Agglomerates.
c. Gelling.
d. Seeding.
e. Putrefaction.
f. Gassing.
g. Livering.

4.1.5.2 Excessive characteristics. The following characteristics are considered undesirable and objectionable if excessive and not capable of being reworked to an acceptable package condition per applicable method.

a. Caking (ASTM D869).
b. Settling (ASTM D869).
c. Separation.

4.1.5.3 Marked changes. Marked changes in the following characteristics are not desirable but small changes within specification limits shall be permitted.

a. Coarse particles.
b. Viscosity (ASTM D2196, Test Method A).
c. Loss of drying ability (method 4061.3).
d. Color drift.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

STORAGE STABILITY (FILLED CONTAINER)

1. SCOPE

1.1 Scope. It is the objective of this method to determine the storage stability (filled container) in terms of the undesirable qualities that may be produced during a specified time and condition of storage.

2. APPARATUS

2.1 Container. A suitable 8-ounce container, approximately 4-1/2 inches in height and 2 inches in diameter.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Procedure. The container shall be filled with the material under test. The cover shall be secured tightly. The container shall be placed in an upright position in the dark (placing it under a box or in a drawer is satisfactory). The test shall be made at 22.2 to 26.7°C (72 to 80°F). The sample shall not be agitated or disturbed until inspected.

4.2 Storage. The following is the recommended storage period for these products (see 5.1).

1. Lacquers and dopes - 6 months.
2. Enamels and varnishes - 6 months.
3. Oil paints - 12 months.
4. Other lengths of time peculiar to a product, its use or unusual storage conditions.

4.3 Undesirable qualities. The following characteristics in the material are considered undesirable and objectionable.

1. Caking (ASTM D869).
2. Curdling.
3. Agglomerates.
4. Coarse particles (ASTM D185).
5. Gelling.
6. Viscosity (ASTM D562).
7. Settling (ASTM D869).
8. Seeds.
9. Putrefaction.
10. Skinning.
11. Gas.
12. Livering.
13. Separation.

14. Loss of drying ability upon aging (method 4061.3).
15. Color drift upon aging.

4.4 Reincorporation of pigment in the liquid.

4.4.1 After inspection. After inspection without stirring for 1, 5, 7, 9, 10, 11, 12, and 13 of 4.3, reseal the container and agitate for 5 minutes on a paint shaker. Open container and examine for compliance with 2, 3, 4, 6, 8, 14, and 15 of 4.3. If pigment is not fully redispersed, agitate until full dispersion is reached, if possible, and reexamine.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. This is the recommended storage period for the test and has no relationship to the actual storage life intended.

Section 4000

PHYSICAL TESTS OF COATING MATERIALS AND COATING INGREDIENTS

NONVOLATILE VEHICLE CONTENT

1. SCOPE

1.1 Scope. This method gives a procedure whereby the nonvolatile vehicle content should be calculated using the sum of the volatile matter and pigment solids content.

2. APPARATUS

2.1 Apparatus. The appropriate apparatus from the specific methods chosen should be used.

3. REAGENTS

3.1 Reagents. The appropriate reagents from the specific methods chosen should be used.

4. PROCEDURE

4.1 Volatile matter. Add the percentage of volatile matter in the sample as determined by ASTM D2369 to its pigment percentage as determined by ASTM D2698. Subtract this sum from 100 to obtain the percentage of nonvolatile vehicle in the sample.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Limitation. This method is limited only by the limitations placed on the methods that are used.

DRYING TIME

1. SCOPE

1.1 Scope. This method determines the various stages and rates of film formation in the drying or curing of organic coatings normally used under conditions of ambient room temperature.

2. APPARATUS. Not applicable.

3. REAGENTS

3.1 Reagents. None.

4. REQUIREMENTS

4.1 Film thickness and manner of drying.

4.1.1 Thickness of dried film. The film thickness used shall be stated in the product specification. If the specification does not give this information, table I shall be used.

TABLE I. Dry film thickness.

Test Material	Dry Film (thickness, mils)	Notes
Clear coatings	1.2 ± 0.2	
Drying oils	1.2 ± 0.2	See 4.1. Add driers a minimum of 24 hours before test.
Varnishes	1.0 ± 0.1	
Lacquers	1.0 ± 0.1	
Resin solutions	1.0 ± 0.1	
Enamels	1.2 ± 0.2	
Oil-based paints	1.8 ± 0.2	See 4.1.
Water-thinned paints	1.2 ± 0.2	See 4.1.
Rubber-based paints	1.2 ± 0.2	
New synthetics	1.2 ± 0.2	

4.2 Air-drying.

4.2.1 Routine testing. Air-drying shall be done in a well-ventilated room or chamber free from drafts and dust, and in diffused light (not in direct sunlight). An illumination of approximately 25 foot-candles (270 lx) is preferred for drying oil films. The temperature of the air shall be between

21°C and 28°C and the relative humidity shall be 50 ± 5 percent. If the time of drying is not within the specified limits of the product specification, repeat the test under the atmospheric conditions specified in 4.2.2.

4.2.2 Referee testing. In case of dispute or disagreement between laboratories, air-drying shall be done in an atmosphere of 50 ± 4 percent relative humidity and at a temperature of 23°C ± 1°C.

4.2.3 Baking. Baking shall be done in a forced draft laboratory baking oven capable of maintaining the specified temperature within a range of ± 2°C. The product specification shall specify the specific temperature for the product.

4.3 Procedure.

4.3.1 Preparation of test specimens.

4.3.1.1 Specimens. All test specimens shall be prepared in duplicate and tested by an operator properly skilled in the methods to be used.

4.3.1.2 Materials. The materials to be tested shall be applied on clean glass panels or on another specific substrate of suitable dimension. The coated panels shall be placed in a horizontal position and shall be shielded from excessive dust accumulation while drying. Ground glass plates are more suitable for coatings that tend to crawl, such as low viscosity drying oils. Suitable plates can be prepared by roughening the surface of polished glass by grinding a paste of silicone carbide (Grit 1-F) and water between two glass plates.

4.3.1.3 Film. The test film preferably shall be cast with a doctor blade having a clearance sufficient to give the recommended dry film thickness in table I. The allowable dry film thickness variation obtained with the blade shall not lie outside the limit of 0.1 mils over the area of the film to be tested. When a suitable doctor blade is not available, or it has been agreed upon to apply the film in some other manner, the various conventional and automatic methods of spray, dip, and thickness shall conform to the above requirements.

4.3.1.4 Thickness. The dry film thickness of the test films shall be measured with the proper film thickness gauge. When plates of small area are used, measurement of dry film thickness can be made by weight of plates before and after coating and calculation from plate area and coating solids.

4.4 Performance of test.

4.4.1 Film test. The film shall be tested at points not less than 0.375 inches from the edges. Tests shall be made at regular drying intervals, such as 5 minutes, 15 minutes, or 1 hour, depending on the speed of drying. The different stages of drying, defined herein, shall be determined as follows:

4.4.2 Set-to-touch. An intermediate stage in the drying of coatings, paints, or varnishes which is reached when gentle pressure of the finger shows a tacky condition of the film, but none of the material adheres to the finger.

4.4.3 Dust-free. This stage of drying shall be determined by one of the following methods, as specified.

4.4.3.1 Cotton fiber method. Separate a number of individual fibers from a mass of absorbent cotton. At regular drying intervals, drop several of the cotton fibers from a height of 1 inch onto the film. The dust-free time is the earliest time that the cotton fibers shall be removed by blowing lightly across the surface of the film.

4.4.3.2 Calcium carbonate method. Lie off along its long edge equal portions of the test film and record the drying time of each portion before dusting. Sprinkle a small amount of finely powdered calcium carbonate on the film. Repeat the operation on different portions of the film at regular intervals. After the film has dried tack-free (see 4.5), remove the calcium carbonate dust by blowing with a gentle stream of air and wiping with a soft cloth or camel's-hair brush. The coating shall be considered dust free at the time interval that the calcium carbonate can be removed completely.

4.5 Tack-free.

4.5.1 Mechanical method (see 6.1).

4.5.1.1 Tack tester. The tack tester to be used in this method comprises essentially a base or surface-contacting portion 1-inch square and a counterbalancing portion 1 by 2 inches in area. Both portions are made up from a continuous metal strip 0.016 to 0.018 inches in thickness. To prepare the tack tester for use, the base is fitted with several thicknesses of masking tape and paper strips to provide a means of attaching aluminum foil, and the angle of the counterbalancing strip is so adjusted that a weight of 5 grams placed in the geometric center of the base is just sufficient to overcome the unbalanced force.

4.5.1.2 Procedure. At regular drying intervals make preliminary tests of the state of tackiness of the film by placing a strip of aluminum foil 6 by 1 by 0.0005 inches on the film and exerting firm finger pressure against the foil. Pressure of the fingertip against the foil shall not be greater than that required to obtain a contact area of 0.12 to 0.20 inches in diameter. When the foil can be removed without noticeable pull, proceed with the tack tester. Place the base of the tester on a portion of the film not previously used and place a 300-gram weight on the base. Remove the weight at the end of 5 seconds. The film shall be considered tack-free when the tack tester tips over immediately upon removal of the weight.

4.5.1.3 Free from after-tack. Some varnishes retain a tacky condition after the dry-through period (see 4.7) has been reached. This condition shall not be confused with the tack-free drying stage (see 4.5.4) that occurs previously to the dry-through stage. This state of drying shall be determined by the following method.

4.6 Requirements.

4.6.1 Test paper. Kraft paper test sheets (90# basis weight) that when conditioned in accordance with the standard method of the Technical Association and the Pulp and Paper Industry, conforms to the following requirements (see 5.2).

Basis weight (24 x 36/500), pounds		90 ± 4.5
Thickness, inches		0.0070 ± 0.0005
Smoothness, Gurley, R.C.	T.S.	40 ± 15
	W.S.	60 ± 20
Smoothness, Sheffield	T.S.	210 ± 50
	W.S.	130 ± 30
Water resistance, average, seconds		120 ± 30
Bursting strength, points		75-105

4.6.2 Bearing weight. Use a steel cylinder 2 inches in diameter, weighing 6.2 pounds.

4.6.3 Procedure. Lay a 2.0 by 2.8 inch piece of the test paper on the film, and place the cylinder on the paper. At the end of 5 seconds remove the cylinder and invert the test panel. The film shall be considered free from after-tack when the paper drops off the test film within 10 seconds.

4.7 Dry.

4.7.1 Paints and enamels. Test the film with a finger using moderate pressure. The film shall be considered dry when the soft tacky condition no longer exists and the film feels firm.

4.7.2 Drying oils. Lightly rub the finger across the surface of the test films. The film shall be considered dry when it no longer adheres to the finger and does not rub up appreciably.

4.7.3 Dry-through for varnish, lacquers, and enamels. Place the test panel in a horizontal position at a height such that, when the thumb is placed horizontally on the film, the arm of the operator is in a vertical straight line from wrist to shoulder. Bear downward on the film with the thumb, exerting the maximum pressure of the arm, at the same time turning the thumb through an angle of 90 degrees in the plane of the film. The film shall be considered dry-through when no loosening detachment, wrinkling, or other distortion of the film occurs.

4.7.4 Dry-hard time. With the end of the thumb resting on the test film and the forefinger supporting the test panel, exert a maximum downward pressure (without twisting) of the thumb on the film. Lightly polish the contacted area with a soft cloth. The film shall be considered dry-hard when any mark left by the thumb is completely removed by the polishing operation.

4.7.5 Dry-to-recoat. A film shall be considered dry for recoating when second coat or specified topcoat can be applied without the development of film irregularities, such as lifting or loss of

adhesion of the first coat, the drying time of the second coat does not exceed the maximum specified (if any) for the first coat.

5. PRECISION

5.1 Agreement. Because of the subjective nature of the drying time test, the agreement to be expected between laboratories depends upon their understanding of the terms used, and cannot be established with certainty. Within any laboratory, the agreement depends upon the material being tested, some coatings being much sharper in their end point than others, but duplicate determinations shall agree within 10 percent of the time of drying.

5.2 Measurement of drying time. Critical factors in the measurement of drying time of coatings are room temperature, relative humidity, and rate of airflow over the sample.

6. NOTES

6.1 Patent. The standard tack tester is fully described in U.S. Patent 2,406,989, dated September 3, 1946.

REDUCIBILITY AND DILUTION STABILITY

1. SCOPE

1.1 Scope. This method provides a procedure for determining the reducibility of a coating material with the recommended solvent for that material.

2. APPARATUS

2.1 Cylinder. A 100-ml graduated cylinder with stopper.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Material preparation. The material shall be diluted with the amount of the solvent required in the product specification or according to the manufacturer's instructions, whichever applies. Unless otherwise specified, all materials used in and during the test shall be at a temperature of 23°C ± 1.1°C (73.4°F ± 2°F).

4.2 Observations upon mixing. The material shall mix readily and easily without excess stirring or shaking.

4.3 Observations upon standing. Let the diluted material stand undisturbed for 4 hours unless otherwise specified in the product specification. At the end of the standing period, freedom from these defects, curdling, precipitation, and separation shall be observed.

4.4 Condition of material. If doubt exists as to the condition of the material after the standing period, flow an amount of the material onto a glass panel without agitating it. Any of the defects mentioned in 4.3 will then be observable.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

COLOR SPECIFICATION FROM PHOTOELECTRIC TRISTIMULUS DATA

1. SCOPE

1.1 Scope. This method utilizes data from photoelectric tristimulus calorimeters to specify colors of nonfluorescent specimens, in approximate accord with the 1931 CIE (I.C.I.) standard observer and standard source C (average daylight). Accurate color measurement of test specimens by this method is possible only when the instrument is properly calibrated using manufacturer supplied color standards that have spectral characteristics similar to those of the specimens.

2. APPARATUS

2.1 Components. The apparatus, in which specimens are illuminated and viewed under controlled geometric conditions, should consist of an incandescent lamp source, one or more photocells, and an appropriate tristimulus-filter set.

2.2 Illuminating and viewing conditions. The directions of illuminating and viewing measured from the perpendicular to the illuminated face of the test specimen should be within 10 degrees of those indicated in table I. The illuminating and viewing conditions may be interchanged without altering results.

2.2.1 Reflectance measurements. For reflectance measurements, instruments having either of the viewing geometries listed in table I are permitted. Diffuse reflectance measurements of glossy specimens should be made with or without inclusion of the specular component of reflected flux.

2.3 Tristimulus-filter set. Filters of the tristimulus-filter set should be interposed in succession either between the source and the test specimen or between the test specimen and the viewing photocell. Alternatively, several photocells should be used and each filter of the set should have its own photocell. The filter set should be designed to produce source-filter photocell response functions that will give calorimeter readings directly proportional to the CIE tristimulus values, X, Y, and Z, or to produce response functions such that the CIE tristimulus values can be derived from the calorimeter readings.

TABLE I. Illuminating and viewing conditions.

Measurement	Geometric directions	
	Illuminating	Viewing
Transmittance	0°	180°
Reflectance	0°	45°

2.4 Standard source. The equivalent of CIE standard source C should be used to obtain the colors of specimens for average daylight.

2.5 Standards.

2.5.1 Primary standards.

2.5.1.1 Transparent specimems. For transparent specimens, the primary standard is the source.

2.5.1.2 Opaque specimens. For opaque specimens, the primary standard is a freshly prepared layer of magnesium oxide of 0.5 mm minimum thickness identically irradiated and viewed.

2.5.2 Secondary standards. Secondary standards having spectral characteristics similar to those of the test specimens should be used since the usual source-filter-photocell combinations only approximate the CIE functions. Tristimulus values, X, Y, and Z for source C for master secondary standards should be obtained according to manufacturer supplied software. Working standards having nearly the same spectral character as a master standard should be calibrated by direct photoelectric comparison of tristimulus values.

2.5.2.1 Transparent specimens. For transparent specimens, glass filters should be used as secondary standards.

2.5.2.2 Opaque specimens. For opaque specimens, porcelain-enameled plaques known to be reasonably permanent in color characteristics should be used repeatedly or impermanent materials such as Munsell papers should be used and discarded frequently. The geometric conditions of standardization for reflectance standards should be the same as those of the calorimeter.

3. DEFINITIONS

3.1 Color. An appearance characteristic of a specimen determined by the relative spectral irradiance from the source, the relative spectral radiance factor of the specimen, and the spectral tristimulus values of the CIE standard observer.

3.2 Relative luminance factor. The ratio of the luminance of a specimen for specified geometric conditions of illumination and view to the luminance of a standard. If the luminance of the standard is unity, the relative luminance factor is the tristimulus value, Y.

3.3 Tristimulus-filter set. A set of filters designed to provide receptor response functions for a specified source approximating the spectral tristimulus values of the CIE standard observer for source C.

4. PROCEDURE

4.1 Standard selection. Select a standard having spectral characteristics similar to those of the test specimen.

4.2 Calorimeter. Set the calorimeter to read the values assigned to this standard based on calibration relative to a primary standard.

4.3 Test specimen. Read the values of the test specimen.

4.4 Calculations.

4.4.1 Tristimulus values. Calculate the tristimulus values, X, Y, and Z, as prescribed in the instructions for use of the calorimeter.

4.4.2 Chromaticity coordinates. If required, calculate the chromaticity coordinates, x and **y,** from the following definitions:

$$x = X/S, \quad y = Y/S, \quad S = X+Y+Z$$

4.5 Report.

4.5.1 Values, factors, and coordinates. Report the tristimulus values, X, Y, and Z, or the luminance factor, Y, and the chromaticity coordinates, x and y.

4.5.2 Conditions of measurement. Report the illuminating and viewing conditions of measurement.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

APPEARANCE OF TRANSPARENT LIQUIDS

1. SCOPE

1.1 Scope. This method provides a procedure for determining the appearance of clear materials of both a drying and nondrying nature. The materials are checked upon decantation, standing 24 hours, and after agitation.

2. APPARATUS

2.1 Tubes. Gardner bubble tubes made of clear glass with a closed flat, even bottom, a diameter of 0.43 ± 0.001 inches and an internal length of 4.48 ± 0.002 inches.

2.2 Water bath. A water bath capable of maintaining the specified temperature ± 0.5°C and equipped with a stirring device.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Preparation. Thoroughly mix the sample. Fill two 6-inch test tubes with the sample to within 1 inch of the top of the test tubes. Stopper the tubes with clean corks.

4.2 Materials other than drying oils. Immediately examine the contents of the tubes by transmitted light for haze, turbidity, hair, grain, clots, gell bodies, skins, and other insoluble matter that may be in suspension. Tilt one of the tubes at a small angle from the horizontal so that the air bubble will move slowly and permit observation in the thin moving film of any fine particles that might otherwise escape notice. Let the tubes stand undisturbed for 24 hours at 21°C to 32°C and examine for sediment. Shake one of the tubes vigorously and as soon as the air has escaped from the liquid compare the appearance of the liquids in the two tubes.

4.3 Drying oils. If the oil is cloudy at room temperature, warm the tubes and their contents in a water bath to 65°C and hold for 5 minutes. Examine while warm by transmitted light and tilting the tubes as described in 4.2.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

BRUSHING PROPERTIES

1. SCOPE

1.1 Scope. This method provides a means for determining the brushing properties of coatings. This test is quite subjective; however, someone experienced in the art can produce quite consistent results, particularly in the determination of the “drag” properties.

2. APPARATUS

2.1 Brush. A 2-1/2-inch wall brush of good quality.

2.2 Panel. A 2 by 2 foot cold-rolled steel or aluminum panel.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Application to metal panels.

4.1.1 Panel preparation. The panel shall be solvent cleaned.

4.1.2 Application of material under test. Pre-wet the brush with the coating to be applied. The idea is to have as much of the coating in the brush prior to beginning the test as there is at the finish of the test. The coating shall be applied at 500 square feet per gallon unless otherwise specified.

4.2 Application to sheet rock panels.

4.2.1 Panel preparation. The panel shall be a 2 by 4-foot piece of 1/4 inch gypsum sheet rock meeting ASTM C36. Unless otherwise specified, the panel shall be primed with an undercoater meeting the minimum requirements of A-A-2994 (see 6.1). Allow to dry at least 24 hours prior to applying the material under test.

4.2.2 Application of material under test. Apply the material at a spreading rate of 500 square feet per gallon unless otherwise specified. The material shall be applied in sections, first brushing the coating using back and forth strokes, then coming back and leveling the material by brushing to 90 degrees of the first strokes. Proceed to the next section always working to a “wet edge”. Repeat this. Place the panel in a vertical position.

4.3 Observations. Note whether the material under test brushes easily and has good flowing and spreading qualities. After the film has dried, the surface shall be inspected for freedom of lap marks (see 6.1). Take notice of gloss variations and obvious brush marks.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Undercoater. It should be realized that when the undercoater is the material under test, the topcoat should be a standard product and will be specified in the product specification. Depending upon the product being tested, different characteristics will of necessity be stressed in the product specification.

SPRAYING PROPERTIES

1. SCOPE

1.1 Scope. The following method outlines a procedure for checking the spraying properties of coating materials. The method is very subjective and should be performed by an individual skilled in the art of using a spray gun.

2. APPARATUS

2.1 Panel. A steel panel 4 by 12 inches or larger.

2.2 Spray gun. A spray gun capable of spraying the material under test.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Panel preparation. The steel panel shall be solvent cleaned.

4.2 Performance of test. The material shall be reduced according to the instructions in product specification. While spraying, the gun shall be held perpendicular to the panel and moved in a straight line across the face of the panel. The product specification shall state the distance from the test panel to the gun. For lacquer and other quick drying materials the distance shall be between 6 and 8 inches. For slower drying materials the distance shall be 8 to 10 inches. Immediately place the panel in a nearly vertical position.

4.3 Observations.

4.3.1 Wet panel. On the wet panel freedom from running, sagging, and fogging shall be noted.

4.3.2 Dried film. The dried film shall be free of dusting, pin holing, floating, cratering, mottling, orange peel, bubbling, blushing, wrinkling, blooming, streaking, and silking.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

Section 6000

PHYSICAL AND CHEMICAL TESTS OF DRIED FILMS

INFRARED REFLECTANCE FROM SPECTROPHOTOMETRIC DATA

1. SCOPE

1.1 Scope. This method is designed to provide a measure of infrared reflectance. The effective infrared reflectance of a specimen for a specified wavelength interval and for specified geometric conditions is dependent upon the spectral composition of the incident energy, the spectral sensitivity of the receiver, and the spectral reflectance of the specimen. This method should be the basic method for the measurement of infrared reflectance and in case of dispute; the results obtained under this method should govern.

2. APPARATUS

2.1 Spectrophotometer. Use a spectrophotometer that determines the spectral characteristics of the test specimen within the applicable limits of the infrared spectrum. Use a photoelectric type apparatus suitable for determinations throughout the applicable wavelength interval. Design the apparatus to minimize the effect of stray energy by introducing stray energy filters or use double dispersion prisms (see 6.1). Adjust the direction of irradiation to be nearly perpendicular to the irradiated face of the test specimen and view hemispherical or the converse. Use split widths of the monochromator that are sufficiently narrow throughout the applicable infrared spectrum to insure that the spectral characteristics of the specimen are not appreciably altered when narrower slit widths are used.

2.2 Standard. Smoked or pressed MgO or pressed $BaSO_4$ prepared according to Recommended Practice for Preparation of Reference White Reflectance Standards, ASTM E259.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Irradiating and viewing. If glossy samples are to be measured, the specular components of reflected energy shall be excluded wherever possible.

4.2 Test specimen. The area of the test specimen viewed shall be sufficiently large to be representative of the test specimen, textured specimen in particular.

4.3 Calibrations. The calibration of the photometer scale shall be carefully checked at reasonable time intervals in a manner to insure accuracy over the entire range. Glass filters shall be used for this purpose. The wavelength calibration shall be checked frequently to insure accuracy. Spectrum lamps shall be used for this purpose.

4.4 Performance of test.

4.4.1 Preparation of test specimen. The test specimen shall be prepared as indicated in the product specification.

4.4.2 Determination of reflectance. Determine the spectral reflectance relative to the reference standard at the wavelength given in tables I and II or at sufficiently close intervals so that interpolation will permit accurate determination of the spectral reflectance at these wavelengths.

TABLE I. Thirty wavelengths at which spectral reflectance values are to be obtained in red and near infrared.

No.	Wavelengths micrometer	No.	Wavelengths micrometer
1	0.6975	16	0.7742
2	.7077	17	.7787
3	.7144	18	.7831
4	.7200	19	.7878
5	.7253	20	.7925
6	.7301	21	.7973
7	.7347	22	.8022
8	.7392	23	.8071
9	.7436	24	.8122
10	.7479	25	.8171
11	.7522	26	.8232
12	.7566	27	.8292
13	.7609	28	.8357
14	.7653	29	.8434
15	.7697	30	.8542

TABLE II. Ten wavelengths at which spectral reflectance values are to be obtained in the infrared.

No.	Wavelengths micrometer	No.	Wavelengths micrometer
1	0.929	6	0.998
2	.945	7	1.012
3	.959	8	1.030
4	.972	9	1.053
5	.985	10	1.099

4.5 Calculation of reflectance from spectrophotometric data. Tabulate spectral reflectance data for the specimen for the 30 wavelengths listed in table I and the 10 wavelengths in table II. Calculate the average of the 30 spectral reflectance values in table I and the 10 values in table II.

4.6 Report. Report the average infrared reflectance of the specimen for the wavelength intervals specified in tables I and II. If required, report the spectral reflectance of the test specimen either as a plotted curve or as tabulated data. Report the method of specimen preparation, if any. Report the reference standard and spectrophotometer used for the measurements.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. The General Electric (Hardy) recording spectrophotometer, the Beckman Model DK-2A spectrophotometer, and Cary Model 14 spectrophotometer should be used. The specular component should be excluded. The Beckman DU spectrophotometer does not use hemispherical viewing and, therefore, does not meet the geometric requirements of the method, but it should be used if no other instrument is available.

INFRARED REFLECTANCE FROM REFLECTOMETER

1. SCOPE

1.1 Scope. The reflectometer test method is designed to provide a simple photoelectric means for evaluating the infrared reflectance of a specimen by comparison with a spectrophotometrically calibrated standard. This method is supplementary to the spectrophotometric method 6241.2. When results obtained by those two methods disagree, the results from the spectrophotometric method will govern.

2. APPARATUS

2.1 Apparatus. Use an apparatus that provides a means for irradiating the test specimen and of indicating the radiation reflected by the test specimen. Use an appropriate spectral irradiation from the source and the spectral sensitivity of the receiver to cover the spectral band in which the measurements are made.

2.1.1 Geometry. Use the following geometry of irradiating and viewing that is measured from the perpendicular to the irradiated face of the test specimen:

Irradiating	Viewing
0°	Hemispherical
Hemispherical	0°

The area irradiated should be sufficiently large to be representative of the test specimen. Other geometries of irradiating and viewing may be employed provided the results obtained are comparable to the results obtained by specified geometries. Any reflectometer that yields results comparable to those obtained from the spectrophotometric method may be used.

2.1.2 Reflectometer for the spectral region covered by the 30 wavelengths listed in table I, method 6241.2. Although it does not have the preferred geometry, a Hunter Multipurpose Reflectometer using a Wratten 88 or 89B filter and photovoltaic-type photocell with standards described in 2.2 may be used. Another photometer employing an S-l phototube has been found to be satisfactory when employed with a suitable source and filter combination. Use a source consisting of a tungsten lamp operating at a color temperature between 2,800° and 2,950° Kelvin. An interference-type filter having a peak transmission at 0.79 micrometer in combination with a Wratten 89B filter is placed in front of the phototube, which provides hemispherical irradiation and perpendicular viewing.

2.1.3 Reflectometer for the spectral region covered by the 10 wavelengths listed in table II of method 6241.2. The photometer described in 2.1.2, employing the S-l phototube and tungsten light source together with a suitable filter is satisfactory. A glass filter having the following transmission characteristics has been found to be adequate: 3 ± 1 percent at 0.9 micrometer, 29 ± 3 percent at 1.0 micrometer. A Corning glass filter No. 2540 can be obtained to meet these requirements.

2.2 Standards. Prepare standards by painting or otherwise finishing metal or wood panels in order to obtain a suitable range of infrared reflectance values. The gloss and texture properties of the standards should be nearly the same as those of the test specimens. Calibrate the standards according to method 6241.2. Replace the standards when they show signs of deterioration.

3. REAGENTS

3.1 Reagents. None required.

4. PROCEDURE

4.1 Calibrations. The photometer scale shall be carefully calibrated for linearity over the range of reflectances to be measured. The standards shall be recalibrated at reasonable time intervals.

4.2 Performance of test.

4.2.1 Preparation of test specimen. The test specimen shall be prepared as described in the product specification.

4.2.2 Determination of reflectance. The instrument readings for the test specimen shall be compared with those of the standards and the reflectance value of the test specimen determined. Linear interpolation is permissible if the instrument response is linear or if the scale interval between reflectance standards is small. Upper and lower limit standards shall be used for a go no-go type of measurement.

4.3 Report. The report shall include the reflectance values of the specimen for the two wavelength regions and their acceptability as required by the governing specification. The instruments and standards used shall be designated or described. Any unusual condition of the test specimen or situation under which the test was conducted shall be reported. Any deviations from the specifications shall be reported.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Instruments. Other instruments meeting the prescribed irradiating and viewing geometry of the method are: (1) the Hunter Associates Laboratory Color Difference Meter D25P, and (2) the Zeiss Elrepho Photoelectric Reflectance Photometer. These instruments have to be modified to provide detector and filter for measurements according to the method.

6.2 Measurements. Measurements made in the spectral region covered by 2.1.2 are useful when data applicable to infrared photography are required. Measurements covered in 2.1.3 are intended to be relatable to infrared image tubes.

ADHESION (WET) TAPE TEST

1. SCOPE

1.1 Scope. This method covers a procedure suitable for establishing acceptability of intercoat and surface adhesion of an organic coating system immersed in water. This procedure may be utilized as a production test.

2. APPARATUS

2.1 Masking tape. A masking tape that has a 1-inch wide strip of flatback paper tape having an average adhesion of 60-ounces/inch widths with a code number 250 or equivalent.

2.2 Roller. A 4-1/2-pound rubber covered roller, having a surface Durometer hardness value within the range of 70 to 80. A roller approximately 3-1/2 inches in diameter and 1-3/4 inches in width.

3. REAGENTS

3.1 Reagents. Distilled water.

4. PROCEDURE

4.1 Preparation. Apply the coating system to the substrate and allow drying as specified in the product specification. Immerse the test specimen in distilled water for 24 hours. Remove the test specimen from the water and wipe dry with a soft cloth. Within 1 minute after removal from the water make two parallel scratches, one inch apart, through the coating to the metal with a stylus. Immediately apply a 1-inch wide strip of the masking tape with the adhesive side down across the scratches. Press the tape against the surface of the coating by passing the roller across the tape eight times. Remove the tape with one quick motion and examine for damage to the intercoat or surface adhesion.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

KNIFE TEST

1. SCOPE

1.1 Scope. This method should be limited to testing the brittleness and quality to ribbon when a film is cut with the knife. This method should not be used as a test for adhesion as other methods are more accurate.

2. APPARATUS

2.1 Knife. A serviceable knife with a very sharp blade.

3. REAGENTS

3.1 Reagents. None.

4. PROCEDURE

4.1 Preparation. Apply and dry the film of the coating material to be tested as specified in the product specification. Test for brittleness, toughness and tendency to ribbon by cutting a narrow ribbon of the coating from the test panel with the standard knife while holding the blade at an angle of approximately 30 degrees to the panel. Determine if the cut film conforms to the specified requirements.

5. PRECISION

5.1 Data. No data.

6. NOTES

6.1 Notes. None.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter must be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** FED. TEST METHOD STD. 141D	**2.DOCUMENT DATE**(YYMMDD) 010322

3 DOCUMENT TITLE
PAINT, VARNISH, LACQUER AND RELATED MATERIALS: METHODS OF INSPECTION, SAMPLING AND TESTING

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) DSN (If applicable)	**7. DATE SUBMITTED** (YYMMDD)

8. PREPARING ACTIVITY

a. NAME U.S. Army Research Laboratory	b. TELEPHONE (Including Area Code) (1) Commercial (410) 306-0725 (2) DSN 458-0725
c. ADDRESS (Include Zip Code) Weapons & Materials Research Directorate ATTN: AMSRL-WM-M Aberdeen Proving Ground, MD 21005-5069	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340