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Green Initiatives

POWDER COATED
GREEN
"Helping To Save The Planet"
Library Bureau Steel

Powder Coatings: Green from the Get-Go

Committed to Educating our Customers, Architects & Engineers on the Green and other Benefits of Powder Coating Technology

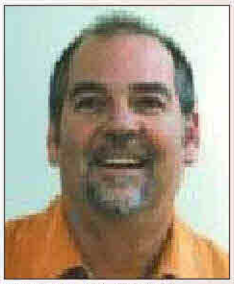
- **LBS List of Recycled Materials**
- Powder Coating Inst. Director's Message
- The Six E's of Powder Coating
- Powder Coating Institute Press Release
- Pollution Prevention Institute Paper
- AAMA 2605-05 Specifications

LIST OF RECYCLED & RECYCLABLE MATERIALS

- Steel - Approximately 40% Recycled Content
- Plastic Molded Parts – Made from 100% Reground Plastics
- Wire - Approximately 40% Recycled Content
- Powdercoating Process Reclaims 95% of all Powder used.
  - We also offer a specially formulated Grey Texture made from 100% Recycled Powder as a standard color.
- All Packaging Materials – Wood Skids, Cartons and Stretchwrap
  - Most products are stretchwrapped & labeled to eliminate boxes.
  - We also reuse wood skids and cartons received.
- All Paper Materials including all labels and sales literature
- All Process Cooling Water is Recycled and Recirculated

Library Bureau Steel is committed to the environmentally sound principles to Reduce, Reuse, Reclaim and Recycle all materials purchased, processed and disposal.

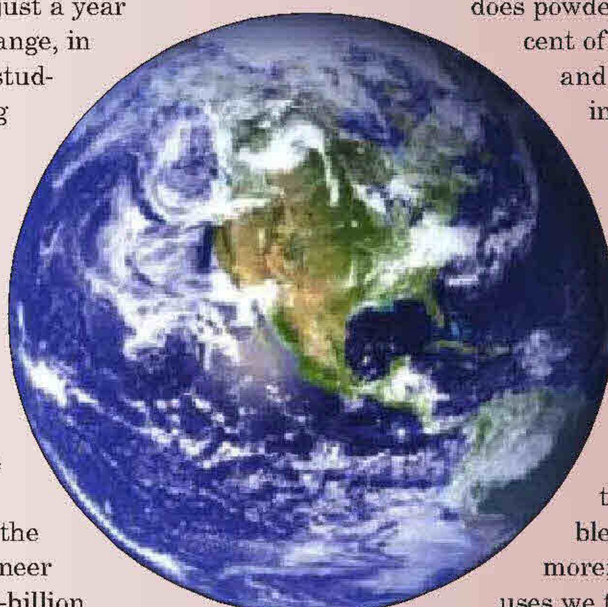
Always for the Good of Our Planet



STEVE HOUSTON

He told me that his charter was to research three alternatives: to reduce the percentage of solvents from 50 to 60 percent down to 20 to 30 percent; to substitute 90 to 95 percent of the solvents with water; and to substitute all of the solvents with air.

Ir. Pieter G. de Lange said this to me just a year before he died in 2005. Dr. de Lange, in the late 1950s and early 1960s studied in The Netherlands, focusing his efforts on the invention of a coating technology that would dramatically reduce or virtually eliminate the use of hazardous solvents. The interesting thing is that his third alternative of substituting all of the solvents with air—which seemed so farfetched back then—now generates more than $5 billion dollars annually and is used extensively all over the world. Dr. de Lange was the pioneer of powder coating and the multi-billion dollar idea I am talking about is the powder coating industry.



To me, the most interesting part of this glimpse into the past is that the original concept for powders was not financial—even though powder coatings are extremely economical. It was not performance-based—even though we know that powder coatings are extremely durable. It was strictly and exclusively driven from the desire to reduce VOCs, making a coating that is safer and much more environmentally friendly than alternative technologies. Today these same benefits remain, and when reaching for a "green" coating that will leave the least environmental footprint, there is no better option than powder.

You will find a green theme throughout this edition of *Powder Coated Tough*. Because the industry we serve is green, we want the magazine to follow suit. See Brett Ryden's *Tough Talk* on page 48 for a look at how this magazine is more kind to our planet.

The reason powder coatings were created nearly half a century ago is even more important today. We have to think about the impact that less green coatings can have on tomorrow. So, why—despite all its benefits—does powder still only represent about 5 percent of all coatings used around the world and approximately 20 percent of all industrial coatings globally? There is a lot of room for growth in powder coatings, and I truly think that as responsible stewards of Planet Earth, we need to consider, and in many cases reconsider, powder as our coating choice. Let's not limit its use. Although powder's primary substrate is metal, advancements in powder formulations and application equipment have made it possible to use on wood, plastic, glass and more; the list goes on, and the more uses we find for powder today, the better off our kids and grandkids will be tomorrow. So, the real question is, "Got Powder?" For the sake of humankind's future, you should.

Sincerely,

Steve Houston
Executive Director, PCI

LIBRARY BUREAU STEEL

The 6 E's of LBS Powder Coating

Powder coating may have gotten its start as a superior finish for metal products, but technology now makes powder coating the choice for wood and plastic as well. In fact, powder coated products are everywhere—in your libraries, schools, home, office, shopping mall, automobile and SUV, stadium and playground and in countless architectural applications. Regardless of the product or use, you can always count on powder coating to deliver a superior finish with the **Six E's** always in mind:

- **E**nvironmental Compliance
- **E**nergy Savings
- **E**fficiency
- **E**conomy
- **E**xceeds Architectural Standards
- **E**xcellence of Finish

LIBRARY BUREAU STEEL OFFERS 48 STANDARD COLORS THE LARGEST IN THE INDUSTRY ---SEE COLOR CHART BELOW--- CUSTOM COLOR MATCHING OFFERED ON ANY SIZE ORDER

Environmental Compliance
Powder Coating's efficiency, economy, and energy savings works for the **E**nvironment as well, as this process eliminates VOCs – meaning the air is environmentally safer. Installation, expansion and running of a powder coating operation is significantly simplified, creating the potential to place a powder coating finishing operation in areas where other production systems would not be permitted. The employees also love powder coating's reduced housekeeping problems and minimum contamination of clothing, since dry powder does not emit the kinds of fumes liquid paint does.

Energy Savings
Utilizing the strength of powder coating's efficiency and economy, the exhaust required in powder coating ovens is lower and therefore helps reduce **E**nergy consumption. While ovens that cure solvent-based coatings must heat and exhaust huge volumes of air to protect against potentially explosive fumes, the exhaust volume of a powder coating oven is lower and more manageable. So much so that the air is able to be recycled into the plant.

Efficiency
With powder coating as the finishing process there are no runs, drips, or sags. Since no drying or flash-off time is required, a powder coating production line will move more efficiently than a standard paint line. More parts are able to be coated automatically, too, with significantly lower reject rates. And, with the use of appropriate application equipment, materials, and recovery methods, a 95% - 98% powder utilization **E**fficiency rate is readily available.

Economy
In addition to its efficiency, powder coating offers a simplified line process that allows for minimum operator training and supervision. Parts can be racked closer together on the conveyor and pass more quickly through the production line, allowing for lower per unit costs which means greater **E**conomy. Powder coating also offers easier compliance with federal and state regulations, increasing cost-effective savings.

Exceeds Architectural Standards
Library Bureau Steel's powder coating materials and application **E**xceeds the rigorous American Architectural Manufacturers Association's performance standards as specified in AAMA 2603, 2604 and 2605 on steel.

Excellence of Finish
Above all else, powder coating's efficiency, economy, energy savings and environmental friendliness produce an **E**xcellence and superiority of finish that customers will come to know and count on. With its two application types (Thermoplastic and Thermosetting), powder coating offers a wide range of both extreme and decorative performance properties. Color selection is virtually unlimited, and is available in both high and low gloss. Textures can be varied as needed. Significant breakthroughs in powder coating technologies has even led to the development of systems that are designed to meet the diverse practical and aesthetic needs of today's demands for a superior finish on metal, wood and plastic.

Powder coating delivers **Environmental Compliance, Energy Savings, Efficiency**, **Economy, Exceeds Architectural Standards** and **Excellence of Finish.**
The right choice in finishing to meet today's demanding manufacturers and consumers.

Fast Facts About Powder Coating

- Powder coating is a completely dry finishing process used on a wide range of materials and products.
- Finely ground particles of pigment and resin are electro-statically charged and sprayed onto products to be coated. The parts to be coated are electrically grounded so the charged particles adhere to them until melted and fused into a solid coating in a curing oven.
- Attributes of powder coating:
    - Tough
    - Attractive
    - Durable
    - Scratch/Mar-resistant
    - High-Quality
    - Colorful and Colorfast
    - Versatile
    - Long-Lasting
    - Special Industry Applications such as textured, anti-graffiti, antimicrobial, chemical and weather resistance

- Unlike liquid paint, no solvents are used, so only negligible amounts of VOCs, if any, are released into the air.
- Unused or over-sprayed powder can be recovered, so any waste is minimal and can be disposed of easily and safely. Outdated color powder stock can be recycled into new current colors and uses.
- The powder coating process is environmentally friendly and virtually pollution-free.
- Thousands of different kinds of parts and products are now powder coated.

THE LARGEST STANDARD POWDER COATING COLOR SELECTION IN THE INDUSTRY

Note: All color samples are affected by age, light, heat and the printing process. Therefore, the colors shown on this selector chart will vary in color, gloss, or finish from actual coatings. Color appearance will also be influenced by size, texture and lighting at the final installation.

TRADITIONAL		COMMERCIAL		DESIGNER	
#05 ANTIQUE WHITE	#10 WHITE WHITE	#560 MOON ROSE	#290 SNOW WHITE	#552 BLUE STREAK	#540 CRIMSON RED
#75 LIGHT GRAY	#45 LIGHT ROSE	#310 VANILLA	#350 NATURAL TAN	#530 SAFETY ORANGE	#561 LAWN GREEN
#25 SLATE BLUE	#97 GRAY MIST	#370 ROSE BROWN	#430 TERRACOTTA	#521 SUN YELLOW	#HP HOT PINK
#35 LIGHT TAN	#95 DESERT TAN	#340 ALMOND	#330 WARM TAN	#TS TEXTURED SILVER 100% Recycled Product	#MC METALLIC CHROME
#24 COFFEE	#23 FAWN BEIGE	#410 CADET BLUE	#420 GRANITE	#AW ARCTIC WHITE Also Available In #CC PROTECTIVE CLEAR COAT For Added Protection	#MB METALLIC BRONZE
#06 PUTTY	#12 BURGANDY	#440 MAHOGANY	#380 PLATINUM	#FG FOOD GRADE GRAY For Food Contact Applications	#HS HAMMERTONE SILVER
#93 HEATHER BEIGE	#85 GRAYRITE	#390 BANKERS GRAY	#450 RACING GREEN	#LB LABORATORY BLACK Chemically Resistant Formula	#TB TEXTURED BLACK
#15 SATIN BLACK	#40 MOSS GREEN	#460 BLACK	#320 DESERT SAND	#TW TEXTURED WHITE	#GB GLOSS BROWN

Custom color and finish is available per sample, Pantone color number, RAL color, liquid paint manufacturer number, and U.S. Federal Government color number. Textured and cratered surfaces are rough and uneven.

THE ADVANTAGES OF POWDER COATING

FINISH QUALITY - The powder coating process produces finishes with enhanced color richness due to more consistent and uniform application. They are also free of sags, drips, runs, and bubbles.

FINISH DURABILITY - Powder finishes are more resistant to impact, abrasion, staining and corrosion than conventional liquid paints. Tested to resist permanent marring caused by abrasive book bindings.

ENVIRONMENTALLY FRIENDLY - Powder coating is a dry, thermosetting process and does not require the use of solvents. It emits no volatile organic compounds (VOC), no liquid or solid waste, and is in accordance with EPA guidelines. We recycle waste powders to formulate new and standard colors.

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POWDER COATED TOUGH®

For Immediate Release
February 18, 1997

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POWDER COATING: POLLUTION CONTROL MEANS PROFITS, TOO
'Dry Painting' Combines Environmental Benefits, Economic Performance

Washington., D.C. — As Congress kicks off the debate on amending the Clean Air Act, one of the nation's newest high-tech industries is showing how environmental protection plus performance can be a formula for profits.

"Powder coating proves that you don't always have to choose between fighting pollution and growing your business," says Greg Bocchi, Executive Director of The Powder Coating Institute. "Our industry helps companies meet EPA's tough air pollution regulations, and helps them operate leaner and more profitably."

In powder coating, often called "dry painting," electrostatically-charged dry particles of pigment and resin are sprayed onto products ranging from automobile parts and vacuum cleancrs to roofing tiles and decorative glass bottles. The powder particles are then heated in an oven, permanently fusing them to the surface.

"It's a virtually pollution-free process," says Bocchi, "that meets the strictest EPA Clean Air Act standards on volatile organic compounds (VOCs) or hazardous air pollutants (HAPs). That means companies don't have to sustain large capital outlays on pollution control equipment."

Particles that wind up on the floor or walls of the spray booth instead of the part are not wasted—they can be recovered and reused, saving more money and conserving resources.

"As important as it is, however, environmental protection is just part of the story," adds Bocchi. "Powder coating combines pollution prevention with efficiency, high quality and a healthy bottom line."

Powder coating creates strong, colorful, finishes that are more durable than liquid paints, and resist corrosion, scratching, wear and fading. Powder coating costs less to apply than liquid paint, operating costs are lower, and less overall labor is required.

"Companies start out looking at powder coating to comply with the clean air laws, but wind up choosing it to raise their profits," says Bocchi.

Powder is now used in a wide and growing range of industries, including major appliances, power tools, motorcycles, automotive parts, lawn and garden furniture, sporting goods, toys, aircraft parts, architectural parts, office equipment, and baby strollers and furniture. And more widespread use of powder is on the way. The Big Three automakers have launched an historic collaboration on a facility to test spraying powder clearcoats on their automotive bodies.

"Powder coating is truly the technology of the future, here today," says Bocchi.

# # #

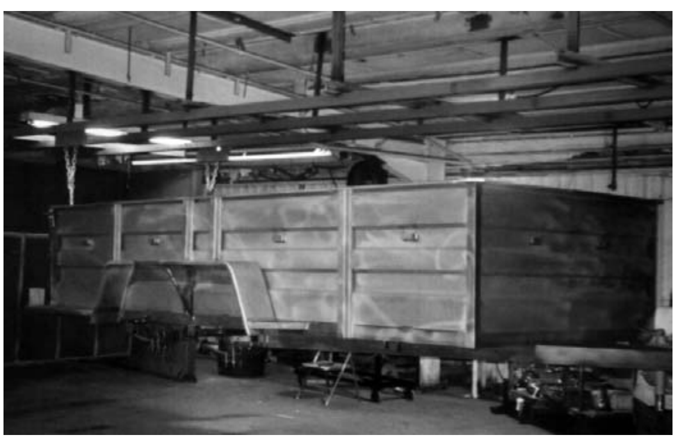
Return to The Latest News From PCI

Powder coating
Technology for the 21st century
How to do a powder vs. liquid cost analysis

In the 1960s, a new coating technology was developed called powder coating. Instead of wet paint, the coating as manufactured and applied is totally dry. Its constituents are practically identical to wet paint except for the absence of solvent. Like a liquid paint, powder coatings contain a resin, pigment (colorant), and additives. Upgrading to powder coating can improve safety as well as be environmentally beneficial, and reduce total operation costs.

Powder vs. liquid

As the name implies, powder coatings are composed of tiny, flowable, powder particles as compared to a pourable liquid. Nearly all resins used in liquid coatings can be used in powder coatings. Epoxies, acrylics, polyesters, and polyurethanes are used the most. Other materials, such as Teflon, nylon, and polypropylene, can be used in powder coatings, although they cannot be dissolved or readily dispersed in liquid systems. Resins used in powder coatings may be either thermoplastic (flow when heat is applied) or thermosetting (cross-linked and solidified when enough heat is applied). Thermoplastic coatings are used for functional purposes such as outdoor use; thermosettings are used for decorative applications, more for indoor use.



Entire trailer is powder coated. Part size is limited by curing oven.

Powder coating is ideal for small items such as outdoor furniture.

A potential drawback to powder coating is the temperature required for the coating to be cured. There is no such thing as room-temperature curing for powder coatings. In fact, the lowest cure temperatures are in the 275° to 300°F range, although lower cure temperature coatings are being developed. Most powder manufacturers recommend their materials be stored in a refrigerator or an air-conditioned room, as a minimum. Failure to store material properly may result in particles fusing together, which causes application problems.

Surface prep

Surface preparation requirements for powder coatings are generally the same as liquid coatings. The degree of pretreatment needs vary with end-use requirements. This is true for both powder and liquid. For severe end-use requirements, such as outdoor exposure in high humidity, maximum cleaning, a good conversion coating, and a quality sealer rinse are recommended. Because powder coatings tend to be thicker than liquid coatings, you can usually get by with less pretreatment. Some powder coating end-use requirements may just need grit blasting.

Application method

Electrostatic spraying is the most common method of applying powder coating. The part to be coated needs to be grounded, and this is accomplished by hanging the part on a properly grounded overhead conveyor. Powder in bulk form needs to be fluidized before it can be pumped to the spray gun. Fluidizing is accomplished by placing a quantity of powder into a container with many perforations in its bottom. Air at a controlled rate is forced up through the bottom, gently agitating (fluidizing) the powder. Powder exiting the gun tip is charged electrostatically in ways similar to charging atomized liquid paint. The charge hangs on and holds the particle to the part through electrostatic attraction. The attraction forces are sufficient to hold the powder onto the part while it goes into the oven where the particles melt into a fused, continuous coating. With some powder coating systems, parts are preheated to help film buildup. Most electrostatic spray powder systems apply powder in a confined booth. Powder not attaching to the part accumulates on the booth bottom and is returned to the fluidized bed to go through the spray gun again.

Powder application can be performed manually or with automated electrostatic spray guns.

Environment and safety

Since powder is 100% solid material, no solvent-type vapors are released into the atmosphere. It is more environmentally friendly to the people applying the material. Powder is classified as a non-flammable material, which may help reduce insurance premiums. Spills can be swept up or vacuumed. Cleaning clothes, skin, and equipment is greatly simplified with powder. Before disposing any of the unwanted powder into a landfill, operators should verify, through testing or from suppliers, the absence of hazardous ingredients in it.

Cost/savings analysis

Powder coating systems have three key advantages over traditional liquid-spray applications: material savings, lower operating costs, and reduced cost of environmental compliance. If powder coating appears attractive to you, perform a cost analysis to compare your current operation to a powder coating operation. The Powder Coating Institute (PCI) offers you an opportunity to use its work sheet entitled, “Powder vs. Liquid Operational Cost Analysis,” to help identify potential sources of cost savings that can occur with a change to powder coating. The work sheet is available on its Web site at www.powder-coating.org or by calling 800-988-COAT for a copy of the computer disc. Thorough instructions are provided along with examples of completed cost analyses.

Credits

Information for this fact sheet was obtained from Industrial Painting: Principles and Practices by Norman R. Roobol, Gardener Publications, Inc., and from The Powder Coating Instiitute, 2121 Eisenhower Avenue, Suite 401, Alexandria, Va.

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AAMA 2605-05

Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

MANUFACTURERS ASSOCIATION

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AAMA. The Source of Performance Standards, Product Certification and Educational Programs for the Fenestration Industry.

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PREFACE

For years, the architectural community has recognized AAMA 603 and AAMA 605 as the standards for testing and performance of organic coatings on architectural aluminum extrusions and panels. Significant advances have been made in technology which has created the need to revise these specifications.

AAMA 2603, "Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels;"

AAMA 2604, "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels;"

AAMA 2605, "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

SUPERCEED

AAMA 603, "Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum;" and

AAMA 605, "Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels;" as well as all revisions to these documents.

AAMA 2605 is a new ten-year superior performing specification with increased performance to AAMA 605.2-92. Significant upgrades have been made in the areas of ten-year weathering performance, abrasion resistance, salt spray and humidity.

1.0 SCOPE

1.1 This specification describes test procedures and performance requirements for superior performing organic coatings applied to aluminum extrusions and panels for architectural products.

1.2 This specification covers factory-applied spray coatings only.

1.3 The primary units of measure in this document are metric. The values stated in SI units are to be regarded as the standard. The values given in parentheses are for reference only.

2.0 PURPOSE

The specification will assist the architect, owner and contractor to specify and obtain factory-applied organic coatings, which will provide and maintain a superior level of performance in terms of film integrity, exterior weatherability and general appearance over a period of many years.

3.0 DEFINITIONS

3.1 The terms "film" and "coating" are used interchangeably in this specification and are defined as meaning the layer of organic material applied to the surface of the aluminum.

3.2 Exposed surfaces are those surfaces which are visible when the coated product is installed. These may include both closed and open positions of operating sash, ventilators, doors or panels.

3.3 Spray Coating: The process of applying a resinous coating by atomizing it into a spray or mist, and curing it into a continuous film.

4.0 GENERAL

4.1 To qualify as meeting this specification, products tested shall meet all requirements as specified herein.

4.2 Coatings shall be visibly free from flow lines, streaks, blisters or other surface imperfections in the dry-film state on exposed surfaces when observed at a distance of 3 m (10 ft) from the metal surface and inspected at an angle of 90 degrees to the surface.

4.3 The total dry-film thickness shall be assessed utilizing the ASTM D 1400 method. Eighty percent of measurements on primary exposed surfaces shall meet or exceed 30 microns (1.2 mil) total film thickness. Paint process capability may result in readings below 25 microns (1.0 mil). No more than 5% of the total readings, on primary exposed surfaces, shall be below 25 microns (1.0 mil) (or, 85% of film thickness specified), assuming appropriate color and hide. Film thickness specified may be increased to be consistent with color selection and type of coating as recommended by the coating manufacturer.

NOTE: *Due to the complexities of extrusion dies and limitations of application equipment, it may not be possible to achieve minimum recommended dry film thickness on all areas of an extrusion, such as inside corners and channels. For details of these affected areas, contact the coating applicator prior to painting.*

4.4 Cleaning and metal preparation shall be in compliance with Section 6 of this document.

4.5 Minor scratches and blemishes shall be repairable with the coating manufacturer's recommended product or system. Such repairs shall match the original finish for color and gloss and shall adhere to the original finish when tested as outlined in Section 7.4.1.1, Dry Adhesion. After application, allow the repair coating to dry for at least 72 hours at 18°C to 27°C (65°F to 80°F) before conducting the film adhesion test.

NOTE: *The size and number of touch-up repairs should be kept to a minimum.*

4.6 Sealant used in contact with an organic coating shall be compatible with the organic coating and meet the performance requirements of AAMA 800 sealant specification. There shall be no evidence of deleterious effects in the organic coating such as staining, coating separation, lifting, discoloration or loss of adhesion of the coating from the substrate.

NOTE: *It is strongly recommended that the fabricator of the finished products consult with the sealant manufacturer in the selection of the appropriate sealant. Pell adhesion testing as described in AAMA 800 is suggested. It is important to understand that the AAMA 800 sealant specification does not ensure adhesion to a specific coating. The best way to ensure adhesion is to submit panel specimens of the specific coating to the sealant manufacturer or an AAMA accredited independent laboratory for tests and recommendations.*

5.0 TEST SPECIMENS

5.1 Test specimens shall consist of finished panels or extrusions representative of the production coated aluminum. A sufficient number of specimens on which to conduct instrument measurements with flat coated surfaces of at least 150 mm (6 in) long and 75 mm (3 in) wide, shall be submitted to the testing laboratory. The coating applicator or fabricator shall indicate exposed surfaces or submit drawings. Tests shall be performed on exposed areas as indicated on drawings or as marked on test specimens.

6.0 METAL PREPARATION AND PRE-TREATMENT

NOTE: *A multi-stage cleaning and pre-treatment system is required to remove organic and inorganic surface soils, remove residual oxides, and apply a chemical conversion coating to which organic coatings will firmly adhere.*

6.1 The pre-treatment when used in conjunction with a baked organic coating shall produce a total finishing system capable of meeting impact, adhesion, detergent, humidity and salt spray performance as specified in the appropriate test method.

6.2 CHEMICAL CONVERSION COATING WEIGHT

6.2.1 Procedure
Measure in accordance with the latest issue of ASTM D 5723 using x-ray fluorescence or other standard methods for determining coating weights.

6.2.2 Performance
Chrome containing conversion coating weights should be a minimum of 431 mg/m^2 (40 mg/ft^2).

Non-chrome conversion coating weights should be maintained according to supplier’s recommendations.

NOTE: *Frequent in-plant testing and control of pretreatment is required to insure satisfactory performance of the coating system.*

7.0 TESTS

7.1 COLOR UNIFORMITY

7.1.1 Procedure
Check random samples visually under a uniform light source. Viewing should be done at multiple angles. In conjunction, instrumental methods are imperative.

7.1.2 Performance
Color uniformity shall be consistent with the color range or numerical value established between the approval source and the applicator. Suggested range is 2ΔE per ASTM D 2244, Section 6.3, from agreed upon color standard.

NOTE: *Color and finish appearance may vary upon factory application due to differences in spray equipment, line conditions or day-to-day process variations. It is strongly recommended that final color approval be made with actual production line samples or mock-ups, not laboratory prepared panels*

Pearlescent mica and metallic flakes reflect and scatter light in random patterns; therefore, exact color uniformity should not be expected. Slight color shifting should also be expected when viewing from varying angles and distances. Equipment considerations affect color and are especially critical with multiple applicators.

7.2 SPECULAR GLOSS

7.2.1 Procedure
Measure in accordance with the latest issue of ASTM D 523 using a 60 degree gloss meter. Samples must meet minimum dry film thickness requirements.

7.2.2 Performance
Gloss values shall be within ± 5 units of the manufacturer's specification.

__NOTE:__ Standard gloss range reference values are:

Gloss Colors	Specular Gloss Value
High	80-Over
Medium	20-79
Low	19 or less

7.3 DRY FILM HARDNESS

7.3.1 Procedure
Strip the wood from a Berol Eagle Turquoise pencil or equivalent, grade F minimum hardness, leaving a full diameter of lead exposed to a length of 6 mm minimum to 10 mm maximum (1/4 in minimum to 3/8 in maximum). Flatten the end of the lead 90 degrees to the pencil axis using fine-grit sand or emery paper. Hold the pencil at a 45 degree angle to the film surface and push forward about 6 mm (1/4 in) using as much downward pressure as can be applied without breaking the lead. Reference ASTM D 3363.

7.3.2 Performance
No rupture of film per ASTM D 3363.

7.4 FILM ADHESION

7.4.1 Procedure

7.4.1.1 Dry Adhesion
Make 11 parallel cuts, 1 mm (1/16 in) apart through the film. Make 11 similar cuts at 90 degrees to and crossing the first 11 cuts. Apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over area of cuts by pressing down firmly against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. Test pieces should be at ambient temperature [approximately 18°C to 27°C (65°F to 80°F)].

7.4.1.2 Wet Adhesion
Make cuts as outlined in Section 7.4.1.1. Immerse the sample in distilled or deionized water at 38°C (100°F) for 24 hours. Remove and wipe the sample dry. Repeat the test specified in Section 7.4.1.1 within five minutes.

7.4.1.3 Boiling Water Adhesion
Make cuts as outlined in Section 7.4.1.1. Immerse the sample in boiling distilled or deionized water 99°C to 100°C (210°F to 212°F) for 20 minutes. The water shall remain boiling throughout the test. Remove the sample and wipe it dry. Repeat the test specified in Section 7.4.1.1 within five minutes.

7.4.2 Performance
No removal of film under the tape within or outside of the cross-hatched area or blistering anywhere on the test specimen. Report loss of adhesion as a percentage of squares affected, (i.e., 10 squares lifted is 10% failure).

7.5 IMPACT RESISTANCE

7.5.1 Procedure
Using a 16 mm (5/8 in) diameter round-nosed impact tester 18 N-m (160 in-lb) range such as a Gardner impact tester, apply a load directly to the coated surface of sufficient force to deform the test sample a minimum of 3 mm ± 0.3 mm (0.10 in ± 0.01 in). Apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over area of deformation by pressing down firmly against coating to eliminate voids and air pockets. Sharply pull tape off at a right angle to the plane of the surface being tested. Test pieces should be at ambient temperature approximately 18°C to 27°C (65°F to 80°F).

7.5.2 Performance
No removal of film from substrate.

__NOTE:__ Minute cracking at the perimeter of the concave area of the test panel is permissible but no coating pick-off should be apparent.

7.6 ABRASION RESISTANCE

7.6.1 Procedure
Using the falling sand test method, ASTM D 968, the Abrasion Coefficient shall be calculated according to the formula which follows.

ABRASION COEFFICIENT - LITERS PER MIL = V/T

where: V = volume of sand used in liters
T = thickness of coating in mils

7.6.2 Performance
The Abrasion Coefficient Value of the coating shall be 40 minimum.

7.7 CHEMICAL RESISTANCE

7.7.1 Muriatic Acid Resistance
(15-Minute Spot Test)

7.7.1.1 Procedure
Apply 10 drops of 10% (by volume) solution of muriatic acid (37% commercial grade hydrochloric acid) in tap water and cover it with a watch glass, convex side up. The acid solution and test shall be conducted at 18°C to 27°C (65°F to 80°F). After a 15-minute exposure, wash off with running tap water.

7.7.1.2 Performance
No blistering and no visual change in appearance when examined by the unaided eye.

7.7.2 Mortar Resistance
(24-Hour Pat Test)

7.7.2.1 Procedure
Prepare mortar by mixing 75 g (2.6 oz) of building lime (conforming to ASTM C 207) and 225 g (7.9 oz) of dry sand, both passing through a 10-mesh wire screen with sufficient water, approximately 100 g (3.5 oz), to make a soft paste. Immediately apply wet pats of mortar about 1300 mm^2 (2 in^2) in area and 12 mm (1/2 in) in thickness to coated aluminum specimens which have been aged at least 24 hours after coating. Immediately expose test sections for 24 hours to 100% relative humidity at 38°C (100°F).

7.7.2.2 Performance
Mortar shall dislodge easily from the painted surface, and any residue shall be removable with a damp cloth. Any lime residue should be easily removed with the 10% muriatic acid solution described in Section 7.7.1.1. There shall be no loss of film adhesion or visual change in appearance when examined by the unaided eye.

NOTE: *A slight staining or discoloration may be apparent on orange, yellow or metallic coatings. This should be discussed with the specifying source prior to selection of color.*

7.7.3 Nitric Acid Resistance

7.7.3.1 Procedure
Fill an eight-ounce wide-mouth bottle one-half full of nitric acid, 70% ACS reagent grade[(1)]. Place the test panel completely over the mouth of the bottle painted side down, for 30 minutes. Rinse the sample with tap water, wipe it dry, and measure any color change after a one-hour recovery period.

[(1)]The assay of the nitric acid (HNO_3) should be Fisher A-200 or equivalent; minimum 69.0%, maximum 71.0%.

7.7.3.2 Performance
Not more than 5ΔE Units (Hunter) of color change, calculated in accordance with ASTM D 2244, when comparing measurements on the acid-exposed painted surface and the unexposed surface.

7.7.4 Detergent Resistance

7.7.4.1 Procedure
Prepare a 3% (by weight) solution of detergent as prescribed in ASTM D 2248, and distilled water. Immerse at least two test specimens in the detergent solution at 38°C (100°F) for 72 hours. Remove and wipe the samples dry. Immediately apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide by pressing down firmly against the coating to eliminate voids and air pockets. Place the tape longitudinally along the entire length of the test specimens. If blisters are visible, then the blistered area must be taped and rated. Sharply pull off at a right angle to the plane of the surface being tested, per ASTM D 3359. A typical solid detergent composition is as follows:

	Parts by Weight
Tetrasodium pyrophosphate ($Na_4P_2O_7$) anhydrous	53.0
Sodium sulfate (Na_2SO_4), anhydrous	19.0
Sodium metasilicate (Na_2SiO_3), anhydrous	7.0
Sodium carbonate (Na_2CO_3), anhydrous	1.0
Sodium salt of a linear alkylarylsulfonate (90% flake grade)	20.0
Total	100.0

7.7.4.2 Performance
No loss of adhesion of the film to the metal. No blistering and no significant visual change in appearance when examined by the unaided eye.

7.7.5 Window Cleaner Resistance

7.7.5.1 Procedure
Prepare a solution of glass cleaner. Apply 10 drops of the window cleaner to the painted surface and immediately cover it with a watch glass, convex side up. Let the test sit for 24 hours, then rinse the specimen with running tap water. Record visual appearance. Let the specimen sit for four hours before conducting the dry adhesion test outlined in Section 7.4.1.1

All purpose glass cleaner composition is as follows:

Raw Materials	**% By Weight**
Dowanol PM*	5
Propylene glycol	5
Isopropanol	35
Water	55
*Dow Chemical, propylene glycol methyl ether	

The solution and test should be conducted at 18°C to 27°C (65°F to 80°F).

7.7.5.2 Performance
There shall be no blistering or noticeable change in appearance when examined by the unaided eye and no removal of film under the tape within or outside of the cross-hatched area.

7.8 CORROSION RESISTANCE

7.8.1 Humidity Resistance

7.8.1.1 Procedure
Expose the sample in a controlled heat-and-humidity cabinet for 4,000 hours at 38°C (100°F) and 100% RH with the cabinet operated in accordance with ASTM D 2247 or ASTM D 4585.

7.8.1.2 Performance
No formation of blisters to extent greater than "Few" blisters Size No. 8, as shown in Figure No. 4, ASTM D 714.

7.8.2 Salt Spray Resistance

7.8.2.1 Procedure
Score the film sufficiently deep to expose the base metal using a sharp knife or blade instrument. Expose the sample for 4,000 hours according to ASTM B 117 using a 5% salt solution. Remove and wipe sample dry. Immediately apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over scored area by pressing down firmly against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested.

7.8.2.2 Performance
Minimum rating of 7 on scribe or cut edges, and a minimum blister rating of 8 within the test specimen field, in accordance with the following Table 1 and Table 2 (Reference ASTM D 1654).

TABLE 1 – Rating of Failure at Scribe (Procedure A)

Representative Mean Creepage From Scribe		
Millimeters	Inches (Approx.)	Rating Number
Zero	0	10
Over 0 to 0.5	0 to 1/64	9
Over 0.5 to 1.0	1/64 to 1/32	8
Over 1.0 to 2.0	1/32 to 1/16	7
Over 2.0 to 3.0	1/16 to 1/8	6
Over 3.0 to 5.0	1/8 to 3/16	5
Over 5.0 to 7.0	3/16 to 1/4	4
Over 7.0 to 10.0	1/4 to 3/8	3
Over 10.0 to 13.0	3/8 to 1/2	2
Over 13.0 to 16.0	1/2 to 5/8	1
Over 16.0	Over 5/8	0

TABLE 2 – Rating of Unscribed Areas (Procedure B)

Area Failed, %	Rating Number
No Failure	10
0 to 1	9
2 to 3	8
4 to 6	7
7 to 10	6
11 to 20	5
21 to 30	4
31 to 40	3
41 to 55	2
56 to 75	1
Over 75	0

NOTE: *The use of a ruled plastic grid is recommended as an aid in evaluating this type of failure. A 6 mm (1/4 in) grid is suggested as most practical for the usual specimen. In using the grid, the number of squares in which one or more points of failure are found is related to the total number of squares covering the significant area of the specimen to get a percentage figure as used in the tabulation. In some instances, the rating numbers may be used as factors with exposure time intervals related thereto, to produce a performance index number which very accurately indicates relative quality.*

7.9 WEATHERING

7.9.1 South Florida Exposure
The coating shall maintain its film integrity and at a minimum meet the following color retention, chalk resistance, gloss retention and erosion resistance properties. The architect, owner or contractor should request data relative to the long-term durability of the color(s) selected. Access to exposure panels must be made available to the architect and/or owner upon request.

7.9.1.1 Test Site and Duration
Test sites for on-fence testing are acceptable as follows: Florida exposure South of latitude 27 degrees North at a 45 degree angle facing South for a minimum of ten (10) years. Time elapsed when the coating is off the test fence for evaluation, or other purposes, shall not be counted as part of the 10-year exposure minimum.

7.9.1.2 Color Retention

7.9.1.2.1 Performance
Maximum of 5ΔE Units (Hunter) of color change as calculated in accordance with ASTM D 2244, Section 6.3 after the minimum 10-year exposure test per Section 7.9.1.1. Color change shall be measured on the exposed painted surface which has been cleaned of external deposits with clear water and a soft cloth and corresponding values shall be measured on the original retained panel or the unexposed flap area of the panel. A portion of the exposed panel may be washed lightly to remove surface dirt only. Heavy scrubbing or any polishing to remove chalk formation or restore the surface is not permitted where color measurements are made. New colors, whether formulated by a paint manufacturer or blended by an applicator according to a paint manufacturer's specifications, may be qualified without the exposure test per Section 7.9.1.1, provided that they are produced with the same pigments in the same coating resin system as a color on which acceptable ten (10) year test data is available and which is within the ±10 Hunter Units in lightness (L).

7.9.1.3 Chalk Resistance

7.9.1.3.1 Performance
Chalking shall be no more than that represented by a No. 8 rating for colors, No. 6 for whites, based on ASTM D 4214, Test Method A (Method D 659) after test site (weathering) exposure (per Section 7.9.1.1) for ten (10) years. Chalking shall be measured on an exposed, unwashed painted surface.

7.9.1.4 Gloss Retention

7.9.1.4.1 Procedure
After weathering exposure (per Section 7.9.1.1), measure 60 degree gloss of exposed and unexposed areas of a test site exposure panel following ASTM D 523. The exposure panel may be washed lightly with clear water and a soft cloth to remove loose surface dirt. Heavy scrubbing or any polishing to restore the surface is not permitted where gloss measurements are made.

7.9.1.4.2 Performance
Gloss retention shall be a minimum of 50% after the 10 year exposure test per Section 7.9.1.1 expressed as:

$$\% \text{ Retention} = \left(\frac{60° \text{ gloss exposed}}{60° \text{ gloss unexposed}} \right) \text{X } 100\%$$

7.9.1.5 Resistance to Erosion

7.9.1.5.1 Procedure
After weathering exposure (per Section 7.9.1.1), measure dry film thickness of exposed and adjacent unexposed areas of exposure panels using an Eddy Current Meter as defined in ASTM B 244 or other instrumental methods of equal precision.

7.9.1.5.2 Performance

Less than 10 percent film loss after the exposure test per Section 7.9.1.1 expressed as a percent loss of total film:

$$\text{Loss} = 100\% - \left(\left(\frac{\text{Dry film thickness exposed}}{\text{Dry film thickness unexposed}} \right) \text{X } 100\% \right)$$

8.0 TEST REPORTS

8.1 Test reports on file with the applicator shall include the following information:

8.1.1 Date when tests were performed and date of issue of report.

8.1.2 Identification of organic coating and/or coating system tested, including production date, batch or lot number, cure conditions, pre-treatment data, manufacturer's name and name of company submitting coated samples used in test.

8.1.3 Copy of drawings submitted showing exposed surfaces.

8.1.4 Test results.

8.1.5 A statement indicating that the organic coating and/or coating system tested passed all tests or failed one or more.

8.1.6 In the case of a failure, which test(s) and a description of the failure(s).

8.1.7 Statement that all tests were conducted in accordance with this standard.

8.1.8 Name and address of the laboratory which conducted tests and issued the report.

9.0 REFERENCED STANDARDS

References to the standards listed below shall be to the edition indicated. Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as to referring to the latest edition of that code or standard.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 800-05, Voluntary Specifications and Test Methods for Sealants

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117-03, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B 244-97(2002), Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

ASTM C 207-05, Standard Specification for Hydrated Lime for Masonry Purposes

ASTM D 523-89(1999), Standard Test Method for Specular Gloss

ASTM D 714-02, Standard Test Method for Evaluating Degree of Blistering of Paints

ASTM D 968-93(2001), Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM D 1400-00, Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base

ASTM D 1654-05, Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 1730-03, Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

ASTM D 2244-02e1, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2247-02, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 2248-01a, Standard Practice for Detergent Resistance of Organic Finishes

ASTM D 3359-02, Standard Test Methods for Measuring Adhesion by Tape Test

ASTM D 3363-05, Standard Test Method for Film Hardness by Pencil Test

ASTM D 4214-98, Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 4585-99, Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation

ASTM D 5723-95(2002), Standard Practice for Determination of Chromium Treatment Weight on Metal Substrates by X-Ray Fluorescence

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