



Powder Coating Finishes for Steel and Aluminum Light Poles

DWM Holdings, November 2016

Executive Summary

While aluminum can be anodized and steel can be galvanized, the most prevalent finishing option for light poles, regardless of material, is powder coating.

Presently, powder coating represents “over 15% of the total industrial finishing market,” reports the Powder Coating Institute.¹ Kevin Biller, Founder and President of the Powder Coating Research Group, only sees this number increasing “due to the economy’s overall improvement, re-shoring back to the United States, and companies continuing to convert to the use of powder coating.”

This paper discusses what powder coating is and how it works, the different powder coating varieties, and some of the benefits of the finish. To offer some insight as to how powder coating is used on steel and aluminum light poles, the paper concludes with an overview of DWM Holdings’ powder-coating process and suggested maintenance to prolong a powder-coated finish in the field.

¹ “How Powder Coating Works.” Powder Coating Institute. <http://www.powdercoating.org/?page=WhatIsPC>. (8 February 2016)

What is Powder Coating?

Kevin Biller, Founder and CEO of the Powder Coating Research Group, defines powder coating as “an industrial coating that is applied electrostatically as dry particles to a conductive surface of an article.”

More technically, powder coating is an advanced method of applying a protective and decorative finish to virtually any type of metal. According to the Powder Coating Institute, powder coatings are based on polymer resin systems combined with curatives, pigments, leveling agents, flow modifiers, and other additives. These ingredients are melted, mixed, cooled, and ground into a uniform powder similar in texture to baking flour.¹ The flour-like powder is then electrostatically sprayed onto the surface of a material. The charged powder particles adhere to the electrically grounded surfaces until the powder is heated and fused into a smooth coating in the curing oven. The result is a uniform, durable, high-quality, and attractive finish.

The light poles produced by DWM Holdings brand companies are most often finished with a state-of-the-art powder coating process. This particular powder coating system, discussed beginning on page 3, leverages the latest technological advances in paint finishing and provides a number of benefits.

How Powder Coating Works

Powder is electrostatically applied to a surface using positive and negative charges. “The light pole has a positive charge while the powder has a negative charge,” says Bob Wesch, DWM Holdings Chief Operating Officer. Once electrically drawn to the pole the powder is then cured in an oven. Each powder coating variety requires a different temperature and length of time in the oven in order to bond to the surface appropriately.

Powder Coating Varieties

There are multiple varieties of powder coatings, each a chemical formulation of paint, available:

1. Polyesters provide industrial, outdoor durability. Polyesters are tough, UV- resistant, provide good corrosion resistance, are economical, and offer a multitude of colors. According to Wesch, polyester is the most widely used variety by DWM Holdings.
2. Epoxies provide the ultimate in corrosion protection and resistance to chemicals. However, epoxies are not UV-resistant, thus making them a less appealing option for use on light poles. A good use for epoxies would be oil and gas pipelines and “under the hood” auto parts. Epoxies are often used as a primer, reports Biller.
3. Polyurethanes are outdoor-durable; however, they are costly and cannot be applied as thick as other varieties.
4. Hybrids are useful as indoor-grade powder coatings and should not be used in outdoor applications.

Benefits of Powder Coating

Value is one of the primary drivers for selecting powder coating over other finishing options. Compared to anodizing, galvanizing, or painting, powder coating offers a relatively high-quality finish at a comparatively lower cost.

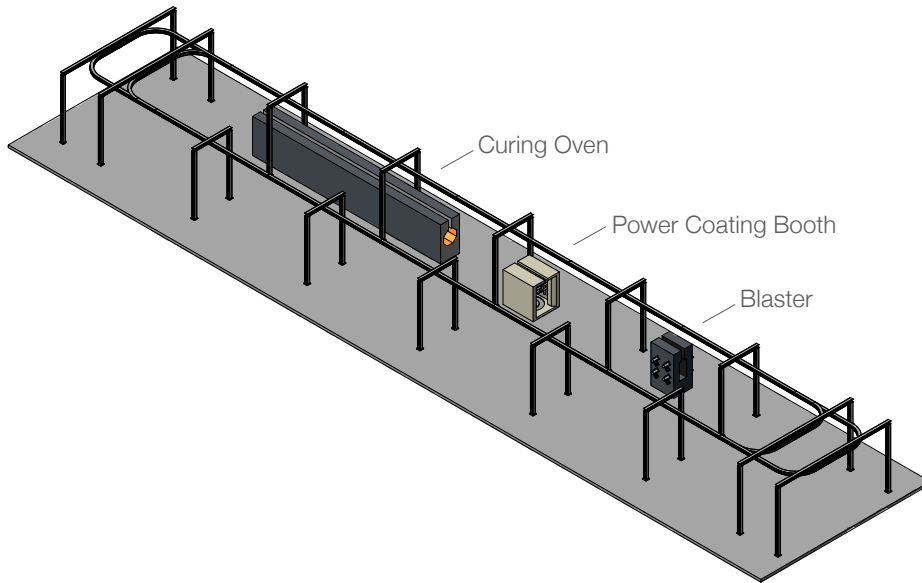
Other benefits of powder coating include:

1. **Durability:** Powder coating provides one of the strongest, long-lasting, and color-durable quality finishes available. Applied in mils, powder coating creates a tough, even, protective coating with no drips, sags, runs, or solvent popping. When compared to traditional paint—where bonding occurs through the evaporation of liquid—powder coating is significantly more resistant to chipping, scratching, fading, and wear.
2. **Minimal environmental impact:** Traditional liquid finishes contain chemical solvents that release pollutants known as volatile organic compounds (VOC) into the environment. Powder coating, however, is an environmentally-friendly alternative that emits nearly zero VOC and results in zero hazardous waste. Now one of the fastest-growing finishing technologies in North America, the growth of the powder coating industry has been propelled by the implementation of stringent air pollution control legislation over past decades.
3. **Safety:** Powder coating allows production teams to work in a safe environment; it is a material that is less flammable and combustible than more traditional, liquid finishes. Powder coating also has lower electrical requirements. Inbound-shipping issues related to bringing hazardous materials on-site become a non-issue. Powder coating also results in lower insurance premiums.
4. **Aesthetics:** Powder coatings are available in a virtually unlimited color selection through the RAL System, the industry standard for paint and coatings ([Click here](#) to view RAL color options).
5. **Efficiency:** “Electrostatic application equals high transfer efficiency and the reclamation of the overspray provides excellent utilization,” says Biller. Bottom line, the elimination of VOCs and the reduction of waste saves time and money. Powder coating also allows users greater flexibility in tailoring purchase quantities to fit their needs. By purchasing only the necessary amount of powder coat, the amount of wasted material is reduced.

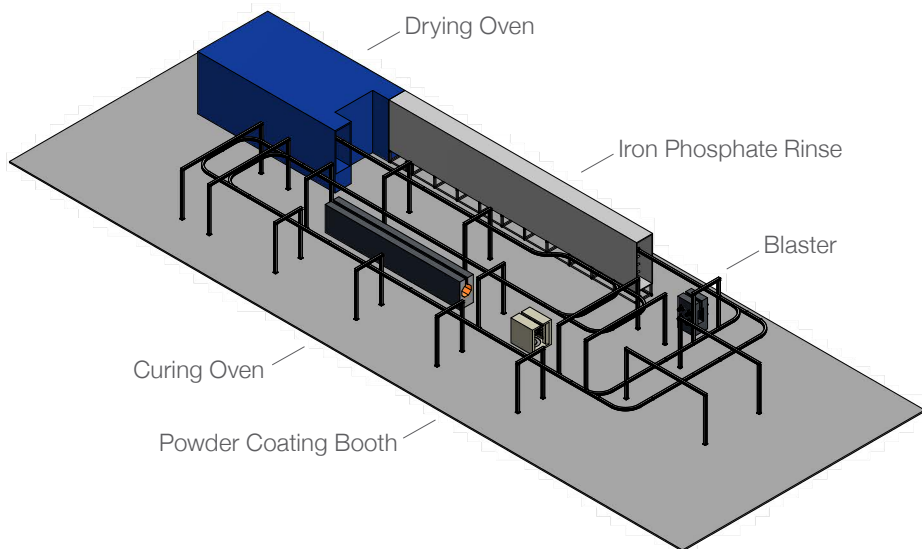
Powder Coating Process

All of the light poles produced by DWM Holdings have the option of undergoing a state-of-the-art, multi-stage, powder coating process. This process varies depending on the material being coated and the warranty selected. DWM Holdings has two separate paint lines; one paint line is used for aluminum poles and the second paint line is used for steel poles.

Aluminum pole paint line



Steel pole paint line



Anodizing as an Alternative Aluminum Finish

Anodizing is an electrochemical process that converts aluminum surfaces into a decorative, durable, corrosion-resistant, anodic oxide finish and is an alternate finish option available on aluminum light poles. Extremely time-intensive, anodizing is becoming less evident in the light pole manufacturing industry as a whole due to issues with color uniformity, cost, and environmental regulation.

Anodic films are generally stronger and more adherent than most type of paint and metal plating, but also more brittle. This makes anodized aluminum poles less likely to crack and peel from aging and wear, but more susceptible to crack from thermal stress.

When the aluminum light poles are chemical dipped, it is often extremely difficult to match colors across poles because of the precise timing in the solution bath that is required. "If a pole is in the tank a second longer than another, the colors will be off," reports Wesch. Also, the weld lines turn a different color due to the prior processing. Anodizing also presents what some see as an EPA-reporting nightmare given the reclamation requirements around aluminum finishing sludge.

Stage 1: Cleaning and SSPC-SP10

The overall success of the finishing process depends entirely on the quality of the product at the beginning of the process. DWM Holdings' coating process begins with a visual inspection of the pole and removal of any oil, grease, or other contaminants. Surface imperfections such as sharp fins and edges, weld spatter, or burning slag are removed.

Once any visual imperfections have been addressed, the piece is sent through a four-wheel shot blaster system designed to clean steel and aluminum poles. The shot system removes rust, mill scale, oxides, or other unwanted particles from the shaft or bracket. As the pole exits the blaster, compressed dry air is used to remove any remaining shot.

Compliance with the Society for Protective Coatings (SSPC) SP10 requires that, "When viewed without magnification [a pole] shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides."² DWM Holdings' removal of any visible impurities or imperfections, followed by its four-wheel shot blast treatment, results in the "near white" finish specified by SP10.

Stage 2: Phosphate Rinse (Steel Poles Only)

"After reaching SP10, steel poles are then subjected to a two-stage clean/coat and rinse system," states Gerald Molnar, DWM Holdings Production Manager. In this stage, the pole is coated with iron phosphate, which creates an iron oxide base followed by a flat or amorphous metal phosphate topcoat. This phosphating, or conversion coating, is a critical part of the pretreatment process for steel poles, adding significantly to the performance of the finished coating. A phosphate coating converts the metal substrate to a uniform, inert surface, which improves bonding, minimizes the spread of oxidation if the coating is scratched, and improves the overall corrosion resistance of the final part.



Stage 2: Phosphate Rinse (Steel Poles Only)

Stage 3: Powder Coat Application

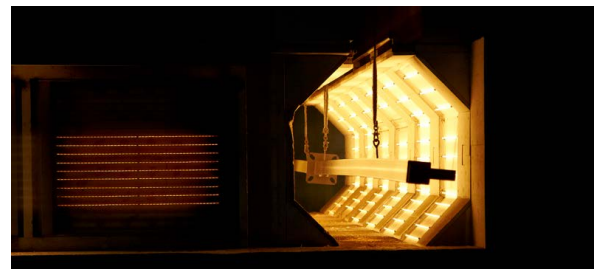
The powder coating used by DWM Holdings is a specially formulated triglycidyl isocyanurate (TGIC) polyester. This formula consists of polymers, pigments, and fillers that form a fine, dry powder for electrostatic application. The electrostatic application is performed automatically by negatively charging the powder at high voltage and low amperage, while electrically grounding the pole. This creates a magnetic effect that enables the powder to be applied consistently and uniformly to all exposed surfaces of the pole. Powder coating provides superior edge coverage and creates a high-quality, durable finish with virtually no drips, runs, or sags. A minimum of 3 mils thickness of powder coating is applied. "... The optional warranties offered typically come with higher mils," states Wesch.



Stage 3: Powder Coat Application

Stage 4: Curing

DWM Holdings cures its powder coated poles using a unique combination of infrared and convection heat. The pole is heated to temperatures exceeding 450°. When the powder is exposed to this heat, it begins to melt, flows out, and then chemically reacts to form a higher molecular weight polymer in a network-like structure. This curing process, called cross-linking, requires a certain temperature for a certain length of time in order to reach full cure and establish the full film properties for which the material was designed.



Stage 4: Curing

Stage 5: Onyx Wrap

Once completely cooled, the pole is then expertly protected by our Onyx wrap — a thick, needlefelt-layered poly film that is both puncture and tear resistant — to preserve the quality finish during travel to the final destination.

²"SSPC-SP10." Society for Protective Coatings. http://www.cmtcoatings.com/sites/default/files/SSPC_surface_prep_specs.pdf.

Why Separate Paint Lines?

The DWM Holdings powder coating process requires a four-wheel shot blaster system, powder coating paint machine, and a curing oven in the two separate paint lines—one line is used for aluminum poles, while the other is used for steel.

The use of separate paint lines is primarily driven by chemical differences between steel and aluminum. Over time, oxygen in steel creates rust, which can cause the powder coating to peel. Aluminum does not present the same oxygenation issues that steel does. As a result, steel requires additional treatments that aluminum does not.

Prior to having the separate paint lines, DWM Holdings had to thoroughly clean the line when switching between the two metal materials, which caused a delay in the overall powder coating process. Lengthening the coating process increased the probability of rust forming on the steel. There is less chance of oxygenation with the separate lines. The use of separate coating systems also allows for a tighter bond of the coating to the steel, which “decreases the likelihood of any coating issues occurring down the road,” reports Wesch.

Maintenance

Powder coating is a very durable, hard finish that should be maintenance free if applied correctly. However, if the coating is damaged, its protective qualities are diminished considerably.

Careful attention must be given to shipping and installation, as either process could result in chipping or scratches, which could increase the pole’s likelihood of failure.

Once installed, powder coated poles should be inspected yearly, at a minimum. During an annual inspection, a visual inspection of the powder coating should be included: fading, chalking, cracking, and peeling are signs of coating failure. “Touch-ups early on can prevent a total overhaul needed later,” says Wesch. Touch-ups in the field must be done carefully because of color matching. When DWM Holdings delivers a new pole, aerosol cans filled with the perfect color match may be included, depending on the color of the finish.

If the powder coating ever needs to be completely removed, options include: shot blasting, pyrolysis, solvents shares Biller. “Full powder coating removal can be a costly, time-intensive process,” states Biller. For these options, the light pole must be shipped away from and back to the field. To keep costs down, minor repairs can be made in the field. “A sand-blaster and/or sandpaper can be used before the pole is painted over, touched-up, or grinded off,” states Wesch.

For additional information, visit www.dwmholdings.com or call 586-541-0013.

Galvanized Steel as a Finishing Option

A finishing option for steel light poles is galvanization, where the pole is dipped into an 815-degree, molten-zinc bath. During the dipping process, zinc attaches to the metal itself, which creates a corrosion-resistant coating on both the inside and outside of the pole. The pole can then be powder coated on top of the galvanizing for aesthetic purposes.

Galvanizing is a long-term, additive finishing solution that comes at an additional cost. Wesch says, “Galvanizing alone will last, for example, 25-years; powder coating alone around 7-10 years depending on the environment. Combined, this process will get you 32-35 years of life.”

The galvanization process can be costly, however. Before the dip, the pole has to be processed to make sure it has a perfectly smooth finish. People usually only request galvanization in very harsh weather environments and those who want the highest warranty DWM Holdings’ brand companies offer.

Bios

Kevin Biller began his successful career in powder coatings in 1978. He established the Powder Coating Research Group in 2007. This R&D laboratory provides powder coating evaluation, testing and product development. Kevin has four US Patents in powder coating technology. He has published numerous papers and written many articles on powder coatings. He has recently published a handbook, "Powder Coatings: Foundation for the Novice Formulator" by BNP Media.

Gerald Molnar is the former Production Manager of DWM Holdings, the umbrella company of a portfolio of light pole manufacturing brands: United Lighting Standards; General Structures, Inc.; Lyte Poles; and UniPost Systems.

Robert Wesch is former Chief Operating Officer of DWM Holdings, the umbrella company of a portfolio of light pole manufacturing brands: United Lighting Standards; General Structures, Inc.; Lyte Poles; and UniPost Systems.

Resources

"How Powder Coating Works." Powder Coating Institute. <http://www.powdercoating.org/?page=WhatIsPC>. (8 February 2016)

<http://www.globalmetalfinishing.com/anodizing-faqs>

<http://www.sspc.org/>