



Color Considerations: Managing Color Expectations for High-Performance Metal Coatings

Metal coatings have come a long way. Not only have their protective and environmental qualities improved dramatically in recent years, but so have the range of colors and effects now available.

Thanks to these new innovations and technologies, architects can choose from an extraordinary palette of decorative colors, glosses and sheens for commercial office buildings, retail stores and entertainment complexes.

While these developments are, on the whole, overwhelmingly positive, they also have heightened the need for more vigilant color-matching and quality control measures on the part of coating applicators and their customers. As the number of coatings, glosses and sheens have

expanded, so have the opportunities for color variation. Even subtle differences in color, which may look negligible when building components arrive on a job-site, can be exaggerated when components are actually installed on a building.

This paper is intended to help architects and other building professionals more effectively manage color expectations so that:

1. Building components arrive on the job site coated in the colors specified, and;
2. Components produced by different coating applicators appear as a coordinated whole when installed together on a building.

Managing Color Variation: Avoiding the Checkerboard Effect

A new generation of coatings, incorporating natural materials such as metallics and micas, has helped contemporary architects create some truly extraordinary buildings. Unfortunately, coordinating coatings across numerous building components can present difficulties that prevent architects from achieving their intended vision.

In most instances, the differences between the architect's original vision and the finished coatings on a building are minimal. In extreme cases, however, a number of small variations throughout the coatings process — from concept to finished product — can accumulate. This produces noticeable and unacceptable color differences among coated building components. When installed on a building, these mismatched components may demonstrate a "checkerboard effect."

These problems can often be traced directly to the original color specification. To minimize color-matching problems at the specification phase, architects should remember the following:

1. Colors chosen for a particular project are usually selected from a collection of printed chips or samples; then viewed in lighting conditions different from those in the field. To achieve the truest match, color samples should be viewed in the environment of the coating's finished setting.
2. Time of day and time of year can also affect the appearance of individual colors. Natural light is neither uniform nor constant, and its characteristics will also vary according to atmospheric conditions.

(continued)



3. The height, angle or distance from a light source can also alter the appearance of a color. So can its surrounding environment. The color on a building surrounded by trees will look different next to an open landscape, an interstate highway or another collection of buildings.
4. This is also true of certain solid colors, micas and metallics, which can reflect different appearances according to the surrounding light and the orientation of individual flakes.
5. Finally, consider the gloss and the surface character of the sample chip itself. One coating manufacturer may provide coating samples on galvanized steel substrate, while another may apply their coatings to an aluminum substrate. To ensure the truest color representation, insist that color samples be coated on the actual substrate from which the actual building panel or extrusion will be manufactured.

Applicators and Application Methods

Color matching problems are also common when multiple coating applicators are used. The methods of applying paint — and the equipment used to do so — can vary widely from one coating applicator to the next.

Another variable is the shape of the metal substrate. The coil coating process produces colors that look different from extrusion coatings — even when the color formulations are exactly the same.

Operating conditions at the time of manufacture can also affect a coating's final appearance. Temperature, humidity, the curing process and how thick the coating is applied are variables that can fluctuate daily, even within the same plant. Color differences can also be attributed to the line operator.

To minimize the potential color differences related to these variables, architects and contractors should adhere to the following guidelines:

1. Limit the number of coating applicators used on each project. Lessening the number of suppliers reduces the chances for color-matching and quality problems.
2. Once coating applicators have been identified, notify the coating manufacturer of who will be responsible for which building components.

This will facilitate better color coordination among the different applicators.

3. Use the primary applicator panel as the standard. That way, the coating manufacturer can make sure the standards for each coating applicator match one another. *Note: Do not use coil coating standards for spray coatings or vice versa. Each application method should have its own individual standard.*
4. For large projects, request sample ranges from each coating applicator. Use the samples to determine the capabilities of each applicator and apply that knowledge to more effectively manage the color-matching/coordination process.
5. Adjust the color match on coil coatings to the color of the spray coatings. Color control is more exact with coil coatings than with spray coatings. That means it is easier to establish a color standard with a spray coating; then formulate the coil standard to match it. The only exception to this rule is for white or light-colored coatings. In these cases, the coil coating should be used as the template since coil coatings are usually applied at a thinner film rate (which makes them more difficult to adjust).

Understanding Coated Profiles

Profiles are extruded metal components used to construct curtain walls, louvers and other decorative accents. They usually contain intricate details, including angles, edges, grooves, recessed areas and other contours that make paint coverage difficult. Since paint thicknesses vary on these components, color consistency will, too.

Metal thickness on profiles presents another challenge for coating applicators. For a coating to cure properly, the metal underneath it must reach a minimum temperature. In places where the metal is thicker, it takes longer for the metal to reach the prescribed temperature. When that happens, pigments are exposed to heat longer. This can cause the coatings to “burn” or discolor, a problem more commonly found with white or light-colored coatings.

With these constraints in mind, here are some recommendations for minimizing color variation on profiles:

1. Understand the limits of the profile. Crevices and angles make complete coverage difficult and uniform coverage unlikely. If a profile demands complete coverage and uniform thickness or color across all surfaces, consider a different configuration.
2. The same rule applies to thick profiles. Final colors on thick profiles may vary slightly due to the extended curing requirements.
3. If color matching is paramount, avoid profiles with large differentials in metal thickness, such as parts with thin protrusions attached to thick walls. The temperature required to cure the thicker wall will “burn” the coating on the thinner protrusion, creating a different color on that part of the profile.
4. Before final approval, obtain a painted sample of the finished product from the coating applicator before the building material is painted.

Variations in the Coating Process

Beyond color and the quality of coating applicators, there are countless variables in the coating process itself. No quality control program, no matter how stringent or demanding, can account for all of the contingencies involved in the coatings process.

In fact, a number of factors that affect color consistency are beyond the coating manufacturer’s control. For instance, pigment manufacturers set strict tolerances for the formulation of their products. Yet, these pigments still present inherent variations that are ultimately passed on to the coating applicator.

Similar variability may apply to the micas and metallics. It is difficult to enforce strict tolerances for these products simply because they are based on “natural” raw materials.

Comparatively speaking, the impact of these raw material variations is small. The greatest potential for color-matching problems is found in the four major variables related to the application process. They are:

- Batch Variation
- Metal Substrates
- Paint Technology
- Panel Installation

Batch Variation

Problems with batch variation arise when coatings are produced by more than one coating manufacturer, or if one coating manufacturer has

to produce multiple batches of a coating to complete a job. Typically, variation between batches is minimal, and minor differences can be masked through proper application of the product. Nevertheless, there are several steps architects and contractors can take to minimize potential batch variation problems.

1. Determine the amount of coating that will be required up front. That may enable the coating manufacturer to produce all the coatings in a single batch, eliminating batch-to-batch variation. If a single-batch approach is not possible, the next best solution, obviously, is to minimize the number of batches needed.
2. Reduce the number of coating manufacturers and coating applicators. Trying to match batches and standards among different coating manufacturers and coating applicators is extraordinarily difficult. Raw materials vary from one coating manufacturer to another, as do the manufacturing processes, color measuring standards and equipment. When possible, specify all your coatings from a single coating manufacturer and coating applicator.
3. Try to get all metal painted at the same time. Again, one batch of paint with a single application run — using the same operator in the same operating conditions — is the most efficient way to eliminate variables.
4. Finally, if additional coatings are needed to complete a job, always specify that the new order matches the original batch number used. This gives the coating manufacturer and coating applicator a consistent reference to use during production.

Metal Substrates

When coatings are applied to metal, two variables can affect their final appearance. The first is the type of metal used (most commonly steel or aluminum). The second is how the metal was pre-treated. To promote color consistency across all the substrates used on a particular building, the architect or contractor should:

1. Make the coating manufacturer(s) aware of all the different metals being coated. This will allow the coating manufacturer to match colors across the entire range of substrates for a given project; and
2. Verify with the coating manufacturer(s) that their product has been engineered for use over the desired substrate(s) and that it is compatible with the pre-treatment method used by the coating applicator.

Paint Technology

Coatings are formulated using a variety of base resins and pigments. When coatings are mixed, subtle differences in color and metamers* can be exposed. That is why viewing color samples under actual lighting conditions is vital.

Paint chemistries can also change according to the performance specification required for the coating. The same pigment deposited in a PVDF coating will usually produce a color that looks different from the same pigment in an acrylic coating.

For this reason, it is essential that architects and contractors communicate to their coating manufacturer(s) all performance specifications related to a project. If more than one performance specification is required, colors must be matched in each resin chemistry prior to application.

Installation of Panels and Extrusions

Even when the three variables detailed above are monitored closely, problems can still arise during installation to produce the checkerboard look. In fact, such problems are more likely to occur during installation than at any other part of the process.

* A metamer is a pigmentation effect that causes the same color to look different under one light source that it does under another.

In most instances, the primary failure is “directionality.” A single panel coated with the same paint may be cut into six different pieces prior to installation. If one or more of the pieces is oriented in the wrong direction, the pattern of the entire panel can be disrupted.

This effect can be greatly exaggerated in panels and extrusions coated with micaceous and/or metallics. That’s because the pigments and flakes on a given panel (or collection of panels) will lay in a certain direction. If these panels are cut and laid “opposite to the grain,” the color will appear incongruent.

For this reason, proper panel directionality during installation is essential. Here are several steps architects and contractors can take to help ensure good panel matching:

1. Make sure the coating applicator marks the panel with a directional marking, typically an arrow. This will help the installer orient the panels properly when they are being attached to the building.
2. Avoid putting sheet panels and extrusions in the same plane. Since they are coated using different processes, color matching is difficult. If these components must be in the same plane, design the structure to include a visual break. This will help mask any color differences that exist between the two elements.
3. When panels arrive on the job site, have the installers inspect and segregate them by color. That way, when the panels are actually being attached to the building, the installers can use similar colors on specific sections of the building, using lighter colors on the lower floors of a building, for instance, and darker panels on top.
4. Finally, if two adjacent panels appear to be mismatched, do not install them. Find panels that match or call the architect, contractor or applicator to address the issue.

PPG Certified ApplicatorSM Program

As discussed above, consistency and efficiency in the application of coatings may be critical factors in the attempt to optimize color matches.

For architects and contractors who have neither the time nor resources to manage the coating process, PPG has developed the PPG Certified ApplicatorSM Program (CAP). Modeled after the popular PPG Certified FabricatorSM Program (CFP) for architectural glass, the CAP Program encompasses a select group of applicators whose facilities and processes are quality audited to help achieve color consistency and deliver the highest possible level of product quality, customer service and technical expertise.

PPG Certified Applicators are also electronically integrated into the company's *Kaleidoscope*TM Color Management Program, which features a uniform color calibration system and the mandated use of PPG-designated software and equipment.

The result for architects and contractors is a level of color consistency and product quality that is usually unattainable through the traditional acquisition of high-performance coatings (which typically involves multiple coating applicators employing a disparate array of color and quality standards).

In addition to enhanced coating consistency and quality, CAP members provide a heightened level of customer service, typified by the following benefits:

- **Priority Service on Color Samples** — Unlike other coating manufacturers, PPG applies coatings/color to samples with the actual substrate for which they are being specified. That means when you order a color sample from a PPG Certified Applicator, the color is actually coated on the specified substrate.
- **Preferred Access to Proprietary PPG Coatings** — These include new products such as *Coraflon*[®] EX and *Duranar*[®] XL.
- **Major Project Assistance** — Including job site visits and consultations when necessary.
- **Regional sourcing** — From a nationwide network of integrated CAP participants.
- **Accelerated Delivery Schedules** — For fast-track construction projects.
- **Access to the World's Largest Color Database** — The PPG master color standards database already encompasses more than 75,000 colors that are available in a variety of glosses and tints, a list that is expanding every day to meet customer needs.

To learn more about the PPG Certified ApplicatorSM Program, or to find a PPG Certified Applicator in your area, call 888-PPG-IDEA or visit www.ppgcap.com.



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PPG Industrial Finishes

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