VIRACON TECH TALK

CERAMIC ENAMEL VISUAL CHARACTERISTICS

Recommendations to minimize undesirable aesthetic outcomes when designing with ceramic enamel—frit or ink.

Photo: Young Living Essential Oils, Global Headquarters

INTRODUCTION

When printing on glass with ceramic enamel through a silkscreen, spandrel or DigitalDistinctions® process, the design details require careful consideration. High density print patterns, dual-surface designs , first surface enamels and unconventional product applications can lead to unintended aesthetic results including moiré pattern, visible print marks, or an uneven appearance.

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WHAT IS MOIRÉ?

Moiré is an optical phenomenon that typically appears as a wavy, rippled or circular pattern. It is formed when two regularly spaced, non-aligned patterns overlap. Moiré is not a defect in the glass or printing process but rather a pattern formed by the eye (Figure 1).

Figure 1: Moiré Pattern Example

Although it is impossible to identify when a moiré pattern may appear, the following architectural glass applications, colors and patterns are generally more prone to exhibiting moiré patterns.

Applications

Insulating glass units utilize two or more plies of glass separated by a space. Glass reflects light from each of its surfaces and a pattern applied to the #2 surface (Figure 2) will cast a shadow on the #3 surface. The misalignment between the pattern and its shadow may cause a moiré pattern to appear.

Moiré potential is further increased with spandrel applications. When full coverage ceramic enamel is applied to the #4 surface, the appearance of the shadow cast on the #3 surface is enhanced. The same is true with a shadowbox application where a metal panel, or alternate material, is installed behind the insulating glass unit.

Dual-Surface Designs

Designers may specify insulating glass units with print patterns on two surfaces to create aesthetic depth. Dual-surface designs increase moiré potential and are especially problematic when the pattern on one surface is the exact inverse of the pattern on the alternate surface such as 40% coverage 1/8” dots on surface #2 and 60% coverage 1/8” holes on surface #3 (Figure 2). Due to viewing angles, weather conditions, sun angles and manufacturing tolerances, the two patterns and their shadows will always exhibit some misalignment and will be susceptible to forming a moiré pattern.

Figure 2: Dots #2 and Holes #3

A dual-surface design utilizing a random pattern on both surfaces may reduce moiré. This minimizes repetitive misalignment, thus reducing the potential for moiré to appear. Shown here is an example with randomly spaced vertical lines of varying width applied to the #2 and #3 surface of an insulating glass unit (Figure 3).

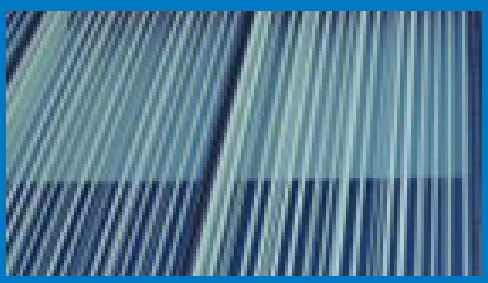

Figure 3: Random Pattern on Surfaces #2 and #3

Colors

The potential for moiré is also influenced by color selection. Light colored patterns on the #2 surface may accentuate the visibility of the pattern’s shadow on the #3 surface due to the contrast between the #2 surface pattern and its #3 surface shadow. The shadow on the #3 surface will typically appear dark gray. The increased contrast increases the potential for moiré, especially in cases where the #4 surface full coverage spandrel is also a white or light gray color.
Selecting a darker color for the #2 surface pattern or #4 surface full coverage spandrel can help minimize the contrast and decrease moiré potential.

HIGH DENSITY PRINT PATTERNS

Viracon offers a variety of standard print patterns and endless custom print patterns to satisfy design requirements. All print patterns have associated print coverages. Print coverage is defined as the amount of glass surface covered by a printed color within one square foot area.

Figure 4: Striations and Non-Uniformity from High Density Print Pattern

Viracon limits print coverage based on the print color(s) used to reduce the ability to see inherent print processing marks. Processing marks include pinholes, striations, or color non-uniformity. These marks are more noticeable on high density print patterns with greater than 60% coverage, especially with gray and darker colors (Figure 4). Therefore, Viracon limits color combinations with print patterns. Please refer to our Print Design Guidelines for details.

FIRST SURFACE ENAMELS

Primarily used in bird-friendly applications, first surface enamels can help designers minimize exterior reflection. First surface enamels have enhanced durability compared to other enamels used in most printed or spandrel applications, which cannot be exposed directly to the exterior environment.

The additional durability of first surface enamels ensures adhesion with the glass surface. However, appearance changes may occur as a result of surrounding environmental conditions. Pollution, dirt and other building residue contacting first surface enamels may affect the appearance. The appearance change cannot be quantified; however, lower density print patterns (<20%) and bi-annual cleaning can help prevent changes in appearance. Please refer to our Glass Cleaning and Maintenance Recommendations and Warranty Information for details.

PROPERLY USING SPANDREL GLASS

Viracon's spandrel glass has been developed specifically to clad spandrel areas of a building façade. Viracon does not recommend using this product for any other application. If used in another application the potential for an uneven or checkerboard appearance increases.

Applications

The proper application for ceramic enamel spandrel glass is to install it in an opening that has a uniformly colored insulation or back-pan that eliminates the possibility of read-through or viewing the glass in transmission. When done properly, the glass may only be viewed from the exterior of the building, with daylight reflecting from the glass surface.

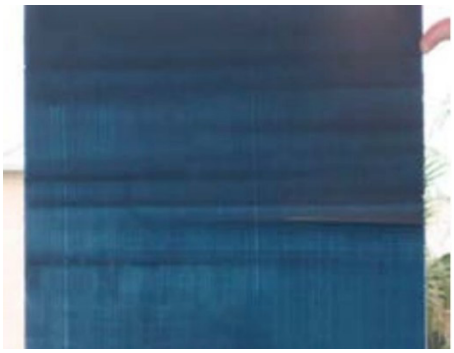

Figure 5: View Through Spandrel Glass

Spandrel glass is not for vision wall areas and should not be used in any application where it can be viewed with daylight or artificial light on the opposite side. Examples include interior partitions, mechanical rooms, screen walls or parking garages.

Glass by its nature is highly transparent and it is impossible to make it uniformly opaque. Ceramic enamel is applied by conveying glass under a rubber application roller. This results in striations from the roll that are highly visible when viewing the glass in transmission with light on the opposite side (Figure 5).

CONFIGURING A SPANDREL GLASS UNIT

Due to the inherent striations, variations in paint opacity and thickness, Viracon's full coverage spandrel product should not be placed on an odd numbered surface. Placing the frit on an even numbered surface minimizes potentially objectionable aesthetics by allowing the enamel to be viewed from the exterior of the building with daylight reflecting from the glass surface.

MOCK-UP REQUIREMENT

Due to the complexity of designing with ceramic enamel, Viracon requires evaluation of a full-size mock-up when utilizing the following products:

1. DigitalDistinctions®
2. Custom silkscreen patterns
3. Custom ceramic frit colors

In addition, a mock-up is recommended for any application where moiré potential may be a concern.

The mock-up should be installed at the building site and viewed under a variety of lighting and temperature conditions.

CONCLUSION

When printing on glass with ceramic enamel through a silkscreen, spandrel or DigitalDistinctions® process, it is important to carefully consider each design detail. Review all elements including the type of pattern, color and placement of these within the glass unit. Specify a mock-up and view it on-site to avoid unintended visual characteristics.

FOR ADDITIONAL INFORMATION

Learn more about Viracon's glass solutions. Visit viracon.com or contact your Viracon sales representative or architectural glass team at viracon.com/contact.

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