



CERAMIC ENAMEL VISUAL CHARACTERISTICS

VIRACON TECH TALK

This Tech Talk provides recommendations to minimize undesirable aesthetic outcomes when designing with ceramic enamel—frit or ink.

CERAMIC ENAMEL VISUAL CHARACTERISTICS

When printing on glass with ceramic enamel through a silk-screen, spandrel or DigitalDistinctions™ process, the design details require careful consideration to avoid an unintended aesthetic result such as a moiré pattern or an uneven, checkerboard appearance.

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).

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.



FIGURE 1: MOIRÉ PATTERN EXAMPLE

Applications

Insulating glass units utilize two plies of glass separated by a space. Glass reflects light from each of its surfaces so 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 sometimes want to place a pattern on two surfaces within an insulating unit to create aesthetic depth. Extreme caution should be taken because dual surface designs increase moiré potential. They 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.

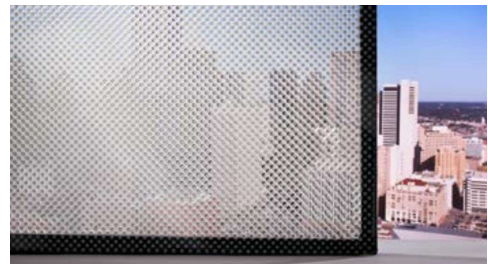


FIGURE 2: DOTS #2 AND HOLES #3

A dual surface design with less moiré risk can be achieved by utilizing a random pattern on both surfaces. 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).

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.

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.

Application

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.

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 4).

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.



FIGURE 3: RANDOM PATTERN ON SURFACES #2 AND #3

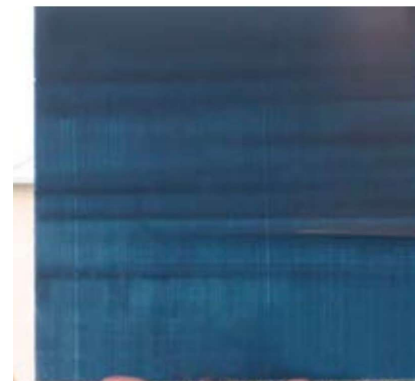


FIGURE 4: VIEW THROUGH SPANDREL GLASS

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 Silk-screen 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 silk-screen, 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.



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