

CERAMIC PRINT- SPANDREL GLASS

PRODUCT APPLICATION INFORMATION

Enamels have been carefully developed for printing and firing on normal soda-lime based float glass. During the tempering process of the glass, these enamels melt and fuse permanently to the glass surface to form a coloured ceramic layer.

Various Guardian SunGuard® coatings, equipped with the special Silacoat layer system, can be printed with ceramic paints*.

Glass enamels may react during firing with coatings causing some hazy appearance or even complete destruction of the coating. Therefore it is necessary to test the compatibility of enamels with coated glass, under production firing conditions in order to get optimum results. It is recommended to run preliminary tests with the selected ceramic paint/glass combination, using the intended production furnace, glass geometries and ceramic covered areas. Unfavorable temper conditions could be the reason to get poor results (low gloss, colour, homogeneity, durability, density, adhesion).

Compatibility and suitability tests are essential for each project. Any printing on a coated glass surface can create colour deviations after firing. Full size project mock-ups are advisable. The processor is responsible for the quality control and quality of the final product.

SunGuard products can be printed with ceramic paint for various purposes:

Decorative print

- Patterns (dots or lines) which are applied to the coating by silk-screen printing
- Must be used facing inside the cavity of insulating glass only - except SunGuard® HD (High Durable)

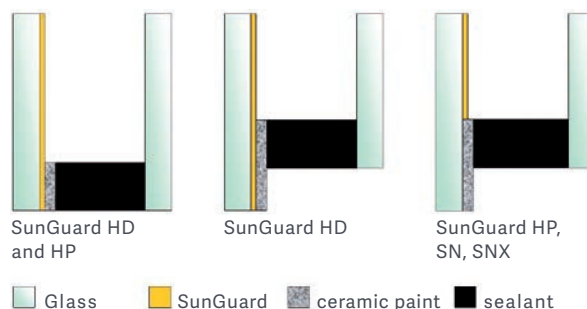
Parapet wall glazings / Spandrels (ceramic paint covering the whole coated surface)

- With SunGuard® High Durable coatings only
- Can be used as a single glazing
- Ceramic paint needs to cover the SunGuard coating in order to ensure an effective protection against any environmental influences

Edge enameling

- Covers up construction elements in the edge area
- Protects IG sealants against UV radiation
- No common approval in combination with SunGuard® High Performance. Please contact Guardian!
- Edge enameling of SunGuard High Performance with a width over 5 cm can create distortions during heat treatment caused by differential heating up of the glass
- Stepped insulating glass units with enameled SunGuard HP on the outer pane are not allowed unless the enameled surface is additionally protected by suitable sealing material.

Picture 1:



* Contact Guardian for the list of SunGuard coated glass that can be printed with ceramic paints.

Since there are various ceramic paints that may contain different chemicals, tests must be made in advance. Please check product compatibility before applying glue to the ceramic paint.

REQUIREMENTS ON ENAMELLING OF SUNGUARD®

After performing extensive internal tests, Guardian recommends the following procedures:

- All enamels must not contain following ingredients: lead, cadmium, graphite, lithium, carbonate.
- Minimum thickness of the wet coating after printing with correct adjusted processing viscosity:
 - 70 µm by silk-screen printing (e.g. silk-screen type PET 1500/32-100)
 - 90 µm by enameling with roller coating
- Complete drying through the entire thickness of the enamel has to be ensured before firing.
- The final thickness of the enamel coating after firing should not be less than 30 µm.
- The ceramic frit must melt without bubbling, under normal temper conditions for flat glass, in order to ensure a dense and uniform cover with a minimized porosity.
- Minimum quality control of the final product:
 - All test methods recommended by the enamel manufacturer
 - Scratch resistance and adhesion (test with Erichsen-pen)
 - Porosity and adhesion (iso-propanol test)
 - Melting behavior and surface roughness (gloss test with gloss meter)
 - Uniform and dense coverage (detection of pinholes in transmission – halogen lamp test **)
- The processor must follow specific processing instructions supplied by the enamel producer.

CERAMIC PRINT WITH FERRO SYSTEM 140

Ferro and Guardian have tested "System 140" colours using recommended solvent "Medium 80 1022" or "Medium 80 1026" on Guardian SunGuard products:

- [SunGuard High Performance](#)
- [SunGuard High Durable](#)

The Ferro System 140 includes various types of ceramic paints, composed of partially different chemical components. In relation to the glass products indicated above, Guardian recommends the following types:

- For spandrel glass: 140 12 4061 (colour similar to RAL 5007 Brilliant blue)
140 12 4060 (colour similar to RAL 5014 Pigeon blue)
140 15 4001 (colour similar to RAL 7031 Blue grey)
- For edge enameling: 140 14 4001 (colour similar to RAL 9005 Deep black)
140 14 4011 (colour similar to RAL 9005 Intensive black - more pigments)

** Installation of a halogen lamp (min. 100 W) in a distance of max. 50 cm from the glass. Evaluation of the glass pane in transmission, viewing on the enamelled side regarding number, dimension and distribution of the pinholes (selection of the worst area, not more than 30 pinholes / dm², single holes not larger than 0.2 mm in diameter). The distance of the observer to the glass should be not more than 50 cm.

SPANDREL GLASS

Spandrel glass is the glass that conceals structural building components such as columns, floors, air conditioning systems, electrical wiring, plumbing, etc. Spandrel glass is typically located between vision glasses on each floor of a building.

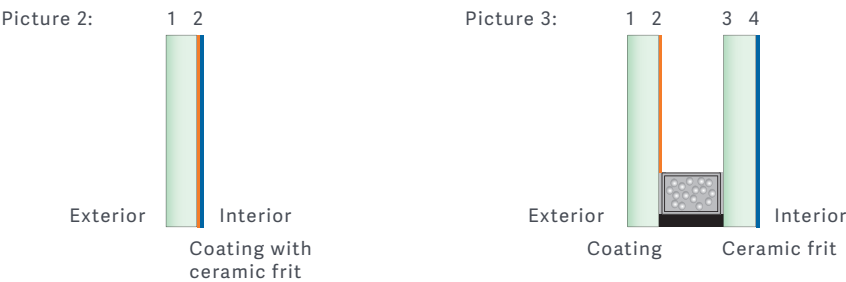
Curtain wall and structurally glazed designs often require the use of spandrel glass to achieve a designer’s vision of the finished project. Spandrel glass applications can be complementary or contrasting in colour when compared to the vision glass appearance. Spandrel glass must be heat treated to avoid thermal stress breakage. Guardian has experience with spandrel glass applications and can help architects and building owners achieve the desired appearance while minimising the risk of thermal stress breakage.

When vision glass is specified with a high light transmission or low external reflection, an exact colour match between spandrel and vision glass is challenging. Daylight conditions can have a dramatic effect on the perception of vision to spandrel appearance. For example, a clear, bright sunny day provides a higher reflective appearance, which will improve the vision to spandrel match. A grey, overcast day may allow more visual transmission from the exterior and produce a greater contrast between the vision and spandrel glass. Guardian recommends that a full size outdoor mock-up be prepared and approved in order to confirm the most desirable spandrel option for a specific project.

Spandrel glass can consist of an opacified uncoated glass, an opacified reflectively coated glass or can be an insulating glass unit composed of a solar control glass as the exterior pane and an opacified uncoated interior pane.

SunGuard High Durable reflective coated glass allows for the application of ceramic frit directly to the coated surface for a monolithic spandrel (picture 2).

This provides an economical solution that is suitable for many applications. If the desired match cannot be realized with the monolithic spandrel solution an insulation glazing spandrel can be considered (picture 3).



The following table provides guidelines for the use of SunGuard products in both monolithic and insulated glass spandrel applications. All glass configurations are with the coating on surface #2, on single glass the frit is directly applied to surface #2 and the frit or other opacifier on surface #4 of an insulated glass unit.

RECOMMENDED ENAMEL COMBINATIONS FOR SUNGUARD® SPANDRELS

| SunGuard® Vision | | Ceramic Frit - Monolithic Glass | Ceramic Frit - Insulating Glass* |
|----------------------------|-----------------------|--|---|
| SunGuard® High Durable | HD SILVER 70 | - | SG HD Silver 70 on #2 + Frit on #4 |
| | HD NEUTRAL 67 | - | SG HD Neutral 67 on #2 + Frit on #4 |
| | HD DIAMOND 66 | - | SG HD Diamond 66 on #2 + Frit on #4 |
| | HD LIGHT BLUE 52 | - | SG HD Light Blue 52 on #2 + Frit on #4 |
| | HD SILVER GREY 32 | SG HD Silver Grey 32 on #2 + Ferro 140 15 4001 on #2 | SG HD Silver Grey 32 on #2 + Frit on #4 |
| | HD ROYAL BLUE 20 | SG HD Royal Blue 20 on #2 + Ferro 140 12 4060 on #2 | SG HD Royal Blue 20 on #2 + Frit on #4 |
| | HD SILVER 20 | SG HD Silver 20 on #2 + Ferro 140 15 4001 on #2 | SG HD Silver 20 on #2 + Frit on #4 |
| | HD SILVER 10 | SG HD Silver 10 on #2 + Ferro 140 15 4001 on #2 | SG HD Silver 10 on #2 - Frit on #4 |
| SunGuard® Solar | SOLAR BRIGHT GREEN 20 | SG Solar Bright Green 20 on #2 + Ferro 140 15 4001 on #2 | SG Solar Bright Green 20 on #2 + Frit on #4 |
| | SOLAR BRONZE 20 | SG Solar Bronze 20 on #2 + Ferro 140 15 4001 on #2 | SG Solar Bronze 20 on #2 + Frit on #4 |
| | SOLAR GOLD 20 | - | SG Solar Gold 20 on #2 + Frit on #4 |
| | SOLAR GREY 20 | - | SG Solar Grey 20 on #2 + Frit on #4 |
| SunGuard® High Performance | HP LIGHT BLUE 62/52 | - | SG HP Light Blue 62/52 on #2 + Frit on #4 |
| | HP NEUTRAL 60/40 | SG HD Silver Grey 32 on #2 + Ferro 140 15 4001 on #2 | SG HP Neutral 60/40 on #2 + Frit on #4 |
| | HP NEUTRAL 50/32 | SG HD Silver Grey 32 on #2 + Ferro 140 15 4001 on #2 | SG HP Neutral 50/32 on #2 + Frit on #4 |
| | HP SILVER 43/31 | - | SG HP Silver 43/31 on #2 + Frit on #4 |
| | HP NEUTRAL 41/33 | SG HD Silver Grey 32 on #2 + Ferro 140 15 4001 on #2 | SG HP Neutral 41/33 on #2 + Frit on #4 |
| | HP ROYAL BLUE 41/29 | SG HD Royal Blue 20 on #2 + Ferro 140 12 4060 on #2 | SG HP Royal Blue 41/29 on #2 + Frit on #4 |
| | HP AMBER 41/29 | - | SG HP Amber 41/29 on #2 + Frit on #4 |
| | HP BRIGHT GREEN 40/29 | SG Solar Bright Green 20 on #2 + Ferro 140 15 4001 on #2 | SG HP Bright Green 40/29 on #2 + Frit on #4 |
| | HP BRONZE 40/27 | SG Solar Bronze 20 on #2 + Ferro 140 15 4001 on #2 | SG HP Bronze 40/27 on #2 + Frit on #4 |
| | HP SILVER 35/26 | SG HD Silver 10 on #2 + Ferro 140 15 4001 on #2 | SG HP Silver 35/26 on #2 + Frit on #4 |
| SunGuard® SuperNeutral™ | SN 75 HT | Option 1: SG HD Light Blue 52 + WO-E-14-6996 on #2 Option 2: Clear float + WO-E-14-7065 on #2 (type greyish) Option 3: Clear float + WO-B-14-7066 on #2 (type blueish) | SG SN 75 HT on #2 + Frit on #4 |
| | SN 75 | Option 1: SG HD Light Blue 52 + WO-E-14-6996 on #2 Option 2: Clear float + WO-E-14-7065 on #2 (type greyish) Option 3: Clear float + WO-B-14-7066 on #2 (type blueish) | SG SN 75 on #2 + Frit on #4 |
| | SN 70S | Option 1: SG HD Light Blue 52 + WO-E-14-6995 on #2 Option 2: Clear float + WO-E-14-7063 on #2 | SG SN 70S on #2 + Frit on #4 |
| | SN 70/37 | Option 1: SG HD Light Blue 52 + WO-E-14-6994 on #2 Option 2: Clear float + WO-E-14-7063 on #2 | SG SN 70/37 on #2 + Frit on #4 |
| | SN 70/35 | Clear float + WO-B-14-7067 on #2 | SG SN 70/35 on #2 + Frit on #4 |
| | SN 63 HT | Option 1: Clear float + WO-E-14-7063 on #2 Option 2: Clear float + WO-B-14-7064 on #2 | SG SN 63 HT on #2 + Frit on #4 |
| | SN 63 | Option 1: Clear float + WO-E-14-7063 on #2 Option 2: Clear float + WO-B-14-7064 on #2 | SG SN 63 on #2 + Frit on #4 |
| | SN 51/28 | Option 1: Clear float + WO-E-14-7063 on #2 (type greyish) Option 2: Clear float + WO-B-14-7064 on #2 (type blueish) | SG SN 51/28 on #2 + Frit on #4 |
| | SN 40/23 | SG HD Royal Blue 20 on #2 + Ferro 140 15 4001 on #2 | SG SN 40/23 on #2 + Frit on #4 |
| | SN 29/18 | SG HD Royal Blue 20 on #2 + Ferro 140 15 4001 on #2 | SG SN 29/18 on #2 + Frit on #4 |
| SunGuard® extra Selective | SNX 60 | SG HD Royal Blue 20 on #2 + Ferro 140 15 4001 on #2 | SG SNX 60 on #2 + Frit on #4 |
| | SNX 50 | SG HD Royal Blue 20 on #2 + Ferro 140 15 4001 on #2 | SG SNX 50 on #2 + Frit on #4 |

The information provided above is a general recommendation only based on visual mock-ups and compatibility tests performed with the indicated Ferro ceramic frit system. Other ceramic frit systems/paints can consist of different components; this can lead to compatibility issues with the Guardian SunGuard coatings and/ or can modify the final esthetic appearance of the relevant paint-coating combination. It is the responsibility of the users of this information to assure that appropriate compatibility tests in a real size mock-up are performed to verify the colour matching between vision and spandrel.

* In insulating glass spandrels, based on our experience, black or dark grey are the enamel colours that better match with the vision areas. For more information you can contact your local Technical Advisory Center.

Increased energy absorption in IGU spandrels may result in both lites requiring heat treatment. The air gap should be limited, where possible, to 8 mm.

It must be ensured that SunGuard spandrels are not exposed to any aggressive media before, during and after installation.

SUNGUARD® HD IN COMBINATION TO CERAMIC FRIT ON SURFACE #1

Special applications, such as ceramic frit on surface #1, may require the tempering of the glass with the coating facing down.

Such a particular application requires sufficient processing equipment. Especially the ceramic rollers of the furnace must be clean of dirt and the glass should not be slid over stationary machine parts (rollers, castors, etc.).

Production set-up as well as a mock-up are mandatory. However, Guardian will have no responsibility whatsoever and will not be held liable for any damages whatsoever such as but not limited to surface damages resulting from this type of processing.

Provided that the tempering got performed properly, the overall glass performance, such as light transmission or shading coefficient should not deteriorate.

For special applications, please consult Guardian.

These guidelines are for information purpose only and Guardian does not provide any warranty with respect to their content. Guardian provides only a limited warranty for SunGuard products and not regarding the intended further processing or end product, which remains the full responsibility of the processor.

VERIFICATION

The signature below verifies that the processor has read and understands the full content of the Ceramic Print - Spandrel Glass / Product Application Information / SUNGUARD_Spandrel_TI_EN_1218

Name/Signature: _____

Title: _____

Company/Stamp: _____

Date: _____

Please return this page signed via e-mail at information@guardian.com

SunGuard Products are available at several locations situated throughout Europe. Please contact your local Guardian representative or your local Technical Advisory Center for further information.

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This document is the only valid one for the application of SunGuard in spandrel glazing.
Please visit www.guardianglass.com or contact Guardian for its most current version.

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