

# 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 Guardian SunGuard® High Durable (HD).
- The part to be covered by IG sealant should remain free of printed pattern, otherwise compatibility tests must be carried out to ensure sufficient adhesion.

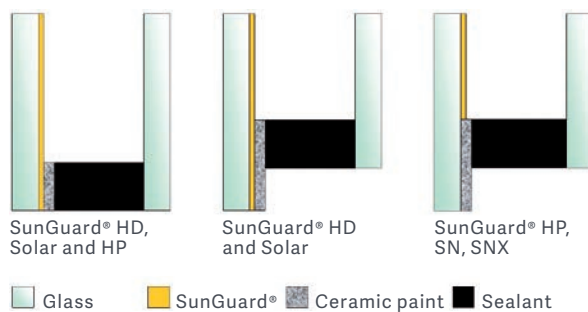
#### Parapet wall glazings / Spandrels (ceramic paint covering the whole coated surface)

- With most SunGuard® HD and SunGuard® Solar coatings only (see compatible products at page 3).
- 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 enamelling

- Covers up construction elements in the edge area.
- Protects IG sealants against UV radiation.
- No common approval in combination with Guardian SunGuard® High Performance (HP). Please contact Guardian!
- Edge enamelling of SunGuard® HP 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 enamelled SunGuard® HP on the outer pane are not allowed unless the enamelled surface is additionally protected by suitable sealing material.
- If the edge enamelled surface will be part of the IG seal, the sufficient adhesion must be tested.

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®

### 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:

- **Guardian SunGuard® High Performance**
  - all SunGuard® HP types for edge enamelling (no structural glazing) or design print in standard IGU applications
- **Guardian SunGuard® High Durable**
  - HD Silver 70, HD Neutral 67, HD Diamond 66, HD Light Blue 52, HD Silver Grey 32, HD Silver 20, HD Silver 10 for edge enamelling, design print and full coverage for spandrels (for structural glazing applications please contact Guardian)
  - Important: SunGuard® HD Royal Blue 20 is not suitable for any enamelled application
- **Guardian SunGuard® Solar**
  - Solar Royal Blue 20, Solar Bright Green 20, Solar Bronze 20 for edge enamelling and design print in standard IGU applications and full coverage for spandrels (Bright Green 20 and Bronze 20 are not suitable for structural glazing)

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 15 4001 (colour similar to RAL 7031 Blue grey)
- For edge enamelling: 14014 4001 (colour similar to RAL 9005 Deep black)  
140 14 4011 (colour similar to RAL 9005 Intensive black - more pigments)

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 enamelling 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.

\*\* 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 / dm<sup>2</sup>, 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

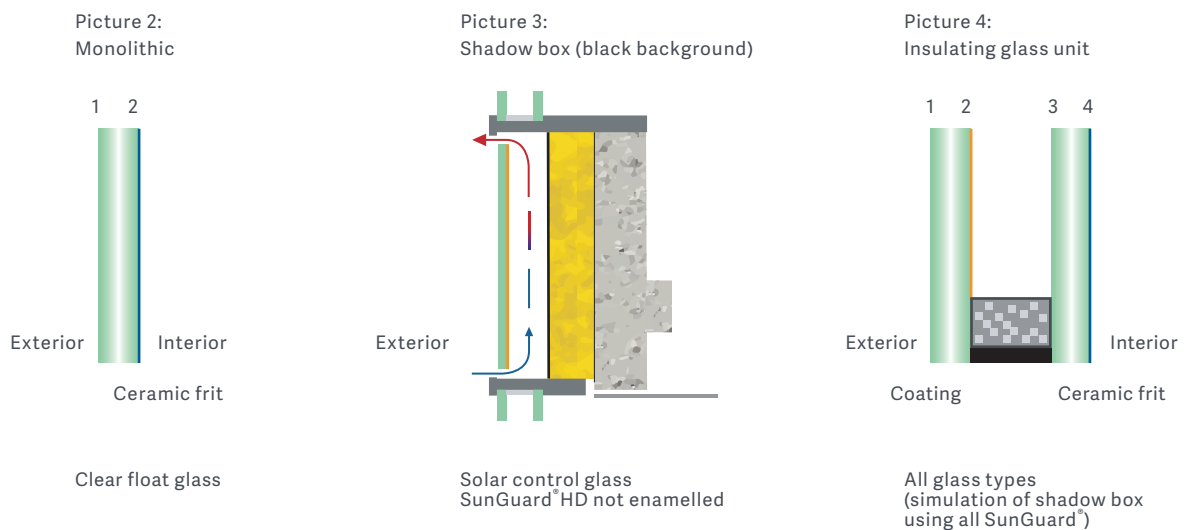
Spandrel glass is the glass that conceals structural building components such as columns, floors, air conditioning systems, electrical wiring, plumbing, etc. Spandrel glass is typically located between vision glasses on each floor of a building.

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, a reflective coated glass in a shadow box construction or can be an insulating glass unit composed of a solar control glass as the exterior pane and an opacified uncoated interior pane.

Beside enamelling of uncoated float glass (picture 2), a selection of Guardian SunGuard® HD or Guardian SunGuard® Solar reflective coated glass allows for the application of ceramic frit directly to the coated surface for a monolithic spandrel. This provides an economical solution that is suitable for many applications. If the desired match cannot be realized with the monolithic spandrel solution a shadow box construction using a monolithic SunGuard® HD coated glass (picture 3) or an insulation glazing spandrel can be considered (picture 4).



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

Guardian SunGuard® glazing	Monolithic spandrel		Insulating glass spandrel <sup>2</sup> (coating on #2 + enamel on #4) [pic. 4]
	enamelled <sup>1</sup> [pic. 2]	Shadow box (ventilated with black background) [pic. 3]	
<b>Guardian SunGuard® eXtra Selective</b>			
<b>SNX 60</b>	Clear float glass + WO-B-14-7067 SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG SNX 60
<b>SNX 50</b>	Clear float glass + WO-B-14-7067 SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG SNX 50
<b>Guardian SunGuard® SuperNeutral™</b>			
<b>SN 75</b>	Clear float glass + WO-E-14-7065 (greyish) Clear float glass + WO-B-14-7066 (blueish)	-	SG SN 75
<b>SN 70S</b>	Clear float glass + WO-E-14-7063	-	SG SN 70S
<b>SN 70/37</b>	Clear float glass + WO-E-14-7063	-	SG SN 70/37
<b>SN 70/35</b>	Clear float glass + WO-B-14-7067	-	SG SN 70/35
<b>SN 63</b>	Clear float glass + WO-B-14-7064	SG HD Light Blue 52	SG SN 63
<b>SN 51</b>	Clear float glass + WO-E-14-7063 (greyish) Clear float glass + WO-B-14-7064 (blueish)	SG HD Light Blue 52	SG SN 51
<b>SN 40/23</b>	Clear float glass + WO-B-14-7067 SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG SN 40/23
<b>SN 29/18</b>	Clear float glass + WO-B-14-7067 SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG SN 29/18
<b>Guardian SunGuard® High Performance</b>			
<b>HP Light Blue 62/52</b>	Clear float glass + WO-B-14-7067		SG HP Light Blue 62/52
<b>HP Neutral 60/40</b>	Clear float glass + WO-B-14-7064 SG HD Silver Grey 32 + Ferro 140 15 4001 on #2	SG HD Silver Grey 32	SG HP Neutral 60/40
<b>HP Neutral 50/32</b>	Clear float glass + WO-B-14-7064 SG HD Silver Grey 32 + Ferro 140 15 4001 on #2	SG HD Silver Grey 32	SG HP Neutral 50/32
<b>HP Silver 43/31</b>	-	SG HD Silver 70	SG HP Silver 43/31
<b>HP Neutral 41/33</b>	Clear float glass + WO-B-14-7064 SG HD Silver Grey 32 + Ferro 140 15 4001 on #2	SG HD Silver Grey 32	SG HP Neutral 41/33
<b>HP Amber 41/29</b>	-	-	SG HP Amber 41/29
<b>HP Royal Blue 41/29</b>	SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG HP Royal Blue 41/29
<b>HP Bronze 40/27</b>	SG Solar Bronze 20 + Ferro 140 15 4001 on #2	-	SG HP Bronze 40/27
<b>HP Bright Green 40/29</b>	SG Solar Bright Green 20 + Ferro 140 15 4001 on #2	-	SG HP Bright Green 40/29
<b>HP Silver 35/26</b>	SG HD Silver 10 + Ferro 140 15 4001 on #2	SG HD Silver 10	SG HP Silver 35/26
<b>Guardian SunGuard® High Durable</b>			
<b>HD Silver 70</b>	-	SG HD Silver 70	SG HD Silver 70
<b>HD Neutral 67</b>	Clear float glass + WO-E-14-7063 (greyish) Clear float glass + WO-B-14-7064 (blueish)	SG HD Neutral 67	SG HD Neutral 67
<b>HD Diamond 66</b>	-	SG HD Diamond 66	SG HD Diamond 66
<b>HD Light Blue 52</b>	Clear float glass + WO-E-14-7063 (greyish) Clear float glass + WO-B-14-7064 (blueish)	SG HD Light Blue 52	SG HD Light Blue 52
<b>HD Silver Grey 32</b>	Clear float glass + WO-B-14-7064 SG HD Silver Grey 32 + Ferro 140 15 4001 on #2	SG HD Silver Grey 32	SG HD Silver Grey 32
<b>HD Royal Blue 20</b>	SG Solar Royal Blue 20 + Ferro 140 15 4001 on #2	SG HD Royal Blue 20	SG HD Royal Blue 20
<b>HD Silver 20</b>	SG HD Silver 20 + Ferro 140 15 4001 on #2	SG HD Silver 20	SG HD Silver 20
<b>HD Silver 10</b>	SG HD Silver 10 + Ferro 140 15 4001 on #2	SG HD Silver 10	SG HD Silver 10
<b>Guardian SunGuard® Solar</b>			
<b>Solar Bronze 20</b>	SG Solar Bronze 20 + Ferro 140 15 4001 on #2	-	SG Solar Bronze 20
<b>Solar Gold 20</b>	-	-	SG Solar Gold 20
<b>Solar Grey 20</b>	-	-	SG Solar Grey 20
<b>Solar Bright Green 20</b>	SG Solar Bright Green 20 + Ferro 140 15 4001 on #2	-	SG Solar Bright Green 20

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.

<sup>1</sup> The indicated enamels (numbers) from Ferro and Wolbring (WO) are based on the enamel type FERRO System 140 and special colour mixtures to adapt best to the related vision. Please contact the Guardian Technical Advisory Center for more information.

<sup>2</sup> 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 you local Technical Advisory Center.

**Important:** It must be ensured that Guardian 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.

## **IMPORTANT NOTE**

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.

This document is the only valid one for the application of SunGuard® in spandrel glazing.  
Please visit [www.guardianglass.com](http://www.guardianglass.com) or contact Guardian for its most current version.

# 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\_1219

Name/Signature: \_\_\_\_\_ Title: \_\_\_\_\_

Company/Stamp: \_\_\_\_\_ Date: \_\_\_\_\_

Please return this page signed via e-mail at [information@guardian.com](mailto:information@guardian.com)

Guardian 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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