### Recommended Enamel combinations for SunGuard® spandrels

<table>
<thead>
<tr>
<th>SunGuard® Value</th>
<th>Ceramic Fit - Monolithic Glass</th>
<th>Ceramic Fit - Insulating Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>neutral. 67</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Neutral 67 on #2 + Frit on #4</td>
</tr>
<tr>
<td>light blue 52</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Light Blue 52 on #2 + Frit on #4</td>
</tr>
<tr>
<td>water grey 32</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Water Grey 32 on #2 + Frit on #4</td>
</tr>
<tr>
<td>brown 10.5</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Brown 10.5 on #2 + Frit on #4</td>
</tr>
<tr>
<td>brown 20</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Brown 20 on #2 + Frit on #4</td>
</tr>
<tr>
<td>bronze 20</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Bronze 20 on #2 + Frit on #4</td>
</tr>
<tr>
<td>bronze 30</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Bronze 30 on #2 + Frit on #4</td>
</tr>
<tr>
<td>bronze 40</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Bronze 40 on #2 + Frit on #4</td>
</tr>
<tr>
<td>bronze 50</td>
<td>SSG 10 on #2 + Ferro System 15 003 on #4</td>
<td>SSG Bronze 50 on #2 + Frit on #4</td>
</tr>
</tbody>
</table>

**Verification**

The signature below verifies that the customer has read and understands the full contents of these technical information: **SunGuard® - Ceramic Print / Spandrel Glass** (EUI-2011).

Name/Signature: __________________________

Company/Stamp: __________________________

Date: __________________________

Title: __________________________

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*SunGuard® Products are available at several locations situated throughout Europe from GUARDIAN's independent network of Processors. Please contact your local GUARDIAN representative for further information.*
Silk-screen printing or enameling on the whole coated surface
• Must be used facing inside the cavity of insulating glass only
• Edge enameling of SunGuard
• No common approval in combination with SunGuard
• Protects IG sealants against UV radiation
• Covers up construction elements in the edge area
• With SunGuard protection against any environmental influences

Fuse permanently to the glass surface to form a coloured ceramic layer. 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.

Since there are various ceramic paints, that may contain different chemicals, tests must be made in advance. Do not glue anything on the enamelled coating without making compatibility tests.

Requirements on Enamelling of SunGuard®

After performing extensive internal tests, GUARDIAN recommends the following procedures:
• All enamels must contain the following ingredients: lead, cadmium, graphite, lithium, carbonate.
• Minimum thickness of the wet coating after printing with correct adjusted processing viscosity:
  - 90 µm by enameling with roller coating (e.g. silk-screen type PET 1500/32-100)
  - 100 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 enamelled coating after firing should not be less than 20 µm.
• The ceramic frit must melt without bubbling, under normal temper conditions for the glass, in order to ensure a dense and adherent cover with a minimal porosity.
• Minimum quality control of the final product:
  - All test methods recommended by the enamel manufacturer
  - Scratch resistance and adhesion (test with Erichsen-pen)
  - Edge enameling of SunGuard® HP with a width over 5 cm is not recommended
  - Complete drying through the entire thickness of the enamel has to be ensured before firing.
  - The final thickness of the enamelled coating after firing should not be less than 20 µm.
  - The ceramic frit must melt without bubbling, under normal temper conditions for the glass, in order to ensure a dense and adherent cover with a minimal 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)
  - Scratch resistance and adhesion (test with Erichsen-pen)
• All test methods recommended by the enamel manufacturer
• The processor is responsible for the quality control and quality of the final product.

Decorative coating
• Patterns (as in lines) which are applied to the coating by sile-screen printing
• Must be used facing inside the cavity of resulting glass only

Parapet wall glazings / Spandrels
• With SunGuard® Solar coatings only
• Silk-screen printing or enameling on the whole coated surface
• 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
• Provides US safety against SH radiation
• No common approval in combination with SunGuard® HP Please contact GUARDIAN!
• Edge enameling of SunGuard® HP with a width over 5 cm is not recommended

Ceramic print with FERRO System 140

**Ferro and GUARDIAN have tested all “System 140” colours using recommended solvent “Medium 60 1022” or “Medium 60 1026” on GUARDIAN SunGuard® products.

- SunGuard® HP
- SunGuard® Solar
- ECG 52**

Since there are various ceramic paints, that may contain different chemicals, tests must be made in advance. Do not glue anything on the enamelled coating without making compatibility tests.

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 eliminating the risk of thermal stress breakage.

When vision glass is specified with a high light transmission or low external reflectance, an exact colour match between spandrel and vision glass is challenging. Daylight conditions shall also affect the appearance of vision spandrel glass. For example, a clear, bright sunny day provides a higher reflective appearance, which will improve the vision spandrel match. A grey, overcast day may allow more visual transmission from the exterior and produce a greater contrast between the spandrel and vision 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 specified coated glass, an specified reflectively coated glass or can be an insulating glass unit composed of a solar control glass as the exterior pane and an specified coated interior pane.

SunGuard® Solar reflective coated glass allows for the application of ceramic frit directly to the coated surface for a monolithic spandrel (picture-2). This provides an aesthetic solution that is suitable for many applications. If the desired match cannot be realized with the monolithic spandrel solution an insulation glazing spandrel (picture-3) can be considered.

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 to other opaque on surface #4 of an insulated unit.

- 1 Intersection of a halogen lamp (60 100 W) at a distance of max. 50 cm from the glass. Evaluation of the glass pane in proportion - viewing on a white uniform, radiant surface. Adherence and homogeneity of the painted behaviour of the outer pane, not more than 50 pinholes / dm², single hole not larger than 0.3 mm is claimed. The distance of the observer to the glass should be no more than 50 cm.


Since there are various ceramic patterns, that may contain different chemicals, tests must be made in advance. Do not glue anything on the enamelled coating without making compatibility tests.

**Requirements on Enamelling of SunGuard®**

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

- **All enamels must contain the 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 150/02-100).
- **90 µm by enameling with roller coating (e.g. PET 150/02-100)**.
- **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)
  - Scratch resistance and adhesion (test with Erichsen-pen)
  - Melting behavior and surface roughness (glaze test with glass meter)
  - Penetration of the enamel into the substructure (detection of pinholes in transmittance – halogen lamp test *)

- **The processor must follow specific processing instructions supplied by the enamel producer.**

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**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.

Certain 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 complimentary 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 minimizing the risk of thermal stress breakage.

When vision glass is specified with a high light transmission or low external reflectance, an exact colour match between spandrel and vision glass is challenging. Daylight conditions, surface finishing effects, and the use of different reflective properties all contribute to the challenge. For example, a clear, bright sunny day provides a higher reflective appearance, which will improve the vision 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 coated glass, an opacified reflectively coated glass or a combination of both. GUARDIAN recommends 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 (glazing spandrel) can be considered.

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**Ceramic print with FERRO System 140**

Ferro and GUARDIAN have tested all “System 140” colours using recommended solvent “Medium 60 1022” or “Medium 60 1026” on GUARDIAN SunGuard® products.

- **SunGuard® HP**
- **SunGuard® Solar**
- **66 G2**

![Picture 1](image1.png)

![Picture 2](image2.png)

![Picture 3](image3.png)

The following table provides guidelines for the use of SunGuard® products in both monolithic and insulated spandrel applications. All glass configurations are possible with the coating on surface #2, on single glass the frit is directly applied to surface #2 and for the HP or other opaque on surface #4 of an insulated unit.
Ceramic paint needs to cover the SunGuard
- Can be used as a single glazing
- Silk-screen printing or enameling on the whole coated surface
- Must be used facing inside the cavity of insulating glass only
- Patterns (dots or lines) which are applied to the coating by silk-screen printing
- Edge enameling of SunGuard
- Protects IG sealants against UV radiation
- Covers up construction elements in the edge area

SunGuard® products can be printed with ceramic paint for various purposes:
- Protection against any environmental influences
- Edge enameling
- Advisable. The processor is responsible for the quality control and quality of the final product.

Requirements on Enamelling of SunGuard®

- All enamels must contain the 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 150/100)
  - 80 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 20 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 minimal porosity.
- Minimum quality control of the final product:
  - All test methods recommended by the enamel manufacturer
  - Scratch resistance and adhesion (test with Erichsen-pen)
  - Melting behavior and surface roughness (glass test with glass tester)
  - Porosity and adhesion (iso-propanol test)
  - Scratch resistance and adhesion (test with Erichsen-pen)
  - All test methods recommended by the enamel manufacturer
  - The process must follow specific processing instructions supplied by the enamel producer.

Ceramic print with FERRO System 140

- Fero and GUARdian have tested all "System 140" colours using recommended solvent: "Medium 60 1020" or "Medium 60 1024" on GUARdian SunGuard® products.
  - SunGuard® HP
  - SunGuard® Solar
  - LED 52

Since there are various ceramic paints, that may contain different chemicals, tests must be made in advance. Do not glue anything on the enamelled coating without making compatibility tests.

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 the designer’s vision of the finished project. Spandrel glass applications can be complimentary 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 reducing the risk of thermal stress breakage.

When vision glass is specified with a high light transmission or low external reflectance, an exact colour match between spandrel and vision glass is challenging. Daylight conditions surfaces a structural effect that can cause a change in the perceived appearance. For example, a clear, bright sunny day provides a more reflective appearance, which will improve the vision spandrel match. A grey, overcast day may allow more visual transmission from the exterior and produce a greater contrast between the spandrel 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 coated glass, an opacified reflectively coated glass or an insulating glass unit composed of a solar control glass at the exterior pane and an opacified exterior pane.

SunGUARD Solar 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 insulating 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. Ceramic frit can be complementary or contrasting in colour when compared to the vision glass to achieve a designer’s vision of the finished project. Spandrel glass applications can be complimentary or contrasting in colour when compared to the vision glass appearance.
### Recommended Enamel combinations for SunGuard® spandrels

<table>
<thead>
<tr>
<th>SunGuard® Visit</th>
<th>Ceramics fit - Monolithic Glass</th>
<th>Ceramics fit - Insulating Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>SG Solar Black 52 on #2</td>
<td>SG Solar Black 52 on #2</td>
</tr>
<tr>
<td>102</td>
<td>SG Solar Black 67 on #2</td>
<td>SG Solar Black 67 on #2</td>
</tr>
<tr>
<td>103</td>
<td>SG Solar Black 69 on #2</td>
<td>SG Solar Black 69 on #2</td>
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<tr>
<td>104</td>
<td>SG Solar Black 70 on #2</td>
<td>SG Solar Black 70 on #2</td>
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<td>105</td>
<td>SG Solar Black 71 on #2</td>
<td>SG Solar Black 71 on #2</td>
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<tr>
<td>134</td>
<td>SG Solar Black 100 on #2</td>
<td>SG Solar Black 100 on #2</td>
</tr>
</tbody>
</table>

**Notes:**
- Enamels with an EN classification (e.g. EN610) and corresponding colour codes are required.
- 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® spandrel are not exposed to any aggressive media before, during and after installation.
- 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 customer has read and understands the full contents of these technical information: “SunGuard® - Ceramic Print / Spandrel Glass” (2011).

**Name/Signature:**

**Company/Stamp:**

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### Recommended Enamel combinations for SunGuard® spandrels

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<thead>
<tr>
<th>SunGuard® Value</th>
<th>Ceramic Fit - Modulating Glass</th>
<th>Ceramic Fit - Insulating Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>neutral 67</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>light blue 62/52</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>white 52</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>white 20</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>green 20</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>white 20</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>white 08</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>light blue 62/52</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>neutral 62/41</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
<td>SSG 52 on #2 + ferro System 15 4060 on #2</td>
</tr>
<tr>
<td>neutral 62/52</td>
<td>SSG 52 on #2 + ferro System 15 4001 on #2</td>
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</tr>
</tbody>
</table>

Increased energy absorption in ISG 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.

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.

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**Name/Signature**

**Company/Stamp**

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