

# EXTRA SELECTIVE AND SUPERNEUTRAL HEAT TREATABLE COATINGS WITH TEMPORARY PROTECTIVE FILM (SN AND SNX SERIES)

PROCESSING GUIDELINES



BUILD WITH LIGHT®

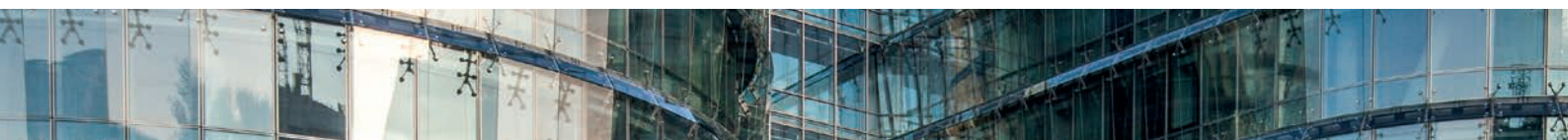
## Introduction

The Guardian SunGuard® eXtra Selective and SuperNeutral® products are high quality magnetron sputtered coated glass. They are available in annealed and in heat treatable (HT) versions.

SunGuard eXtra Selective and SuperNeutral HT glass are provided with a temporary protective film (TPF) in order to facilitate the processing of the coated glass. The TPF protects the coated surface from mechanical damage often experienced during general processing, and enhances the product's environmental stability, thereby significantly increasing processing yields.

The TPF is a full coverage, low adhesive tape based on polyethylene that can be easily removed from the glass prior to heat treatment. TPF can be processed on most standard glass processing equipment and can be disposed of in a variety of ways after removal from the glass. TPF is recyclable.

In order to maximise the benefits provided by the TPF, a couple of points need to be considered when processing SunGuard® eXtra Selective and SuperNeutral HT glass with TPF. This document provides specific instructions with respect to storage, handling and processing of coated products with TPF. Noncompliance with these processing guidelines may lead to poor product quality including damage of the glass or the coating, and will invalidate any claims.



## Characteristics of TPF

TPF is a polyethylene (PE) polymer sheet that is applied directly to the coated surface by Guardian during the manufacturing process. The adhesive used in the TPF is low tack and can be easily removed from large surfaces. The TPF preserves the coated surface by sealing it from contamination and protecting it from mechanical damage, until it is removed on the loading table of the furnace. TPF is provided with colour in the film for easy product identification.

It is important that the TPF is removed completely before the product is heat-treated. TPF should never be allowed into the furnace, as this would irreparably damage the coating.

TPF is applied to the coated surface. Although the TPF provides some protection of the surface from mechanical damage, it is strongly recommended to process the glass with the coated (TPF) side up.

TPF is recyclable and can be disposed of in a variety of ways, for efficient recycling it may be desirable to collect it separately from other waste products. In case the TPF is not removed from glass trims, Guardian recommends to throw it away together with the laminated glass waste. Please refer to local waste collection guidelines. According to the European List of Waste Products (Eural) the code for TPF is 20.01.39.

## Packaging / Storage

SunGuard eXtra Selective and SuperNeutral HT products are available in packs of jumbo size (3210mm x 6000mm) and a range of split (LES, or stock sheet) sizes. Standard thicknesses are 6, 8, and 10mm; please enquire with respect to other thicknesses through your Guardian sales contacts.

The first pane in each pack is uncoated and used for protection of the adjacent coated pane with TPF. All subsequent panes will be arranged with their coated (TPF) side in the direction of this pane. The type of packaging and the arrangement of the panes are indicated on a label attached to the first pane in each pack, the label should be retained for reference until the whole pack has been satisfactorily processed. A special separator powder is placed between the panes to ensure good separation and prevent damage during transportation.

Environmental conditions that affect coated glass products can also have adverse effects on coatings protected by TPF. It is important to note that TPF only provides protection from humidity for a limited amount of time - extended exposure to high humidity combined with high temperatures reduces the film's adhesion and can lead to the penetration of moisture under the TPF. Therefore, the products must not be stored outside. Storage should be in a dry and clean place, a suitable distance away from glass washers, external doors and corrosive chemicals. Relative humidity in the warehouse should not exceed 70% and a minimum temperature of 15°C should be maintained in order to prevent condensation. If a pack has become particularly cold during transportation to the warehouse, when sealed, do not open the pack until the glass has reached the ambient temperature in the warehouse, to avoid excessive condensation forming on the TPF. The warehouse should be well ventilated and all stock rotated (first in, first out).

Under normal storage conditions, the shelf life of the glass in its original packaging is 3 months. The shelf life of glass originally delivered in an hermetically packaging is 2 weeks from the moment the packaging is opened. Sealed packs that are opened but not consumed completely should be re-sealed. Incoming product should be inspected for damage prior to acceptance and any problems reported immediately to the Guardian facility that supplied the product.

## Identification of the coated side

The coated surface is fully covered by TPF and can hence be easily identified. For detection of the coated surface after removal of the TPF please refer to Guardian's General Processing Guidelines for Architectural Coated Glass.

## Handling

When the glass pack is sealed, do not open it until all the people responsible for handling and processing the glass have been properly trained on the correct handling, storage and processing of coated products with TPF.

It is recommended to wear personal protective equipment, including gloves, when handling glass with TPF. Normal handling and transportation equipment can be used when processing TPF; however, avoid damaging or peeling back the TPF so that the coating underneath does not become exposed. Chemicals of any kind should not be in contact with the TPF and should be washed off immediately.

In order to prevent damage of the TPF, avoid contact with hard objects such as glass splinters, glass edges, metallic parts, abrasive particles, etc. Suction cups that are used on the TPF should be clean and preferably covered with overshoes. Always use separator material between individual panes of glass or separate the glass sheets with cardboard, cork pads or acid-free paper. Glass to TPF contact should be avoided. Do not stick or glue anything on the TPF.

## Cutting and edge deletion

SunGuard® eXtra Selective and SuperNeutral coatings require edge deletion. The coating should be removed completely from the perimeter of each finished cut size in order to prevent contact between the silver layer and the surrounding atmosphere to avoid corrosion (oxidation) of the coating in the long term. These coatings are not compatible with many sealants containing chemicals that can react with the silver. The coating should be removed using grinding equipment developed specifically for this purpose. More information about appropriate equipment is available upon request from Guardian.

Edge deletion can be performed either on the cutting table (recommended by Guardian) or post heat treatment on the insulating glazing (IG) production line. For aesthetical reasons, Guardian recommends to adopt only one of the two ways for the same project. The processing of glass with TPF depends on the choice of a process flow, with each route having different requirements. In all cases the TPF remains on the surface during cutting. The glass must be placed on the cutting table with the coated (TPF) surface facing upward in order to prevent permanent damage to the coating through scratching by glass splinters or dirt. The following suggestions detail Guardian's recommendations for the two types of process flow:



- Edge deletion is performed on the cutting table and consequently through the TPF. This requires an upgrade to the aspiration system of the edge deletion system in order to fully remove the resulting TPF particles. Please contact Guardian for additional details and vendors that can carry out the necessary modification to the cutting tables' edge deletion system. The cutting parameters remain unchanged in this situation and are identical to coated glass without protective film. Cutting fluid should be used in moderation. Guardian recommends easily evaporating cutting fluids in order to avoid chemical reactions with the TPF through extended exposure to cutting oils (for example: Acecut 5250). For the thick glass, non-evaporating cutting oils like Acecut 6000 have yielded good results.
  - o It is important to verify that the edge deletion wheel always rotates against the direction of movement of the bridge/head, i.e. TPF debris is thrown "in front of" the edge deletion wheel.
  - o It is recommended to use the maximum allowed rotation speed (around 1950 min<sup>-1</sup>).
  - o For optimum results it may be necessary to reduce the edge deletion speed (bridge/head movement) to about 20m/min till 25m/min and downward force of the edge deletion wheel to about 2.8 bars till 3.0 bars in order to obtain a clean TPF edge. Edge deletion speed and downward force affect each other and some fine-tuning may be required to achieve the best possible results.<sup>1</sup>
  - o The use of a coating detector is recommended to verify complete removal of the coating.
  - o Guardian has tested a range of edge deletion wheels. The best results were obtained using the grinding wheel from FISCHLER type 3009 or 3010 and from TYROLIT type A1507-BE15T F. For further information please contact Guardian. Guardian recommends this process route when non-rectangular shapes or particularly small glass sizes need to be cut.
- The coated glass is edge deleted after heat treatment. This makes it necessary to cut the glass through the TPF, which requires an adjustment of the cutting parameters. Guardian recommends the following changes with respect to the cutting parameters of coated glass of the same thickness without the TPF:
  - o Only very small amounts of cutting fluid are required and recommended when cutting through the TPF surface. Guardian recommends easily evaporating cutting fluids like Acecut 5250, or Acecut 6000 for thicker glass.
  - o Results from Guardian research indicate that pre-faceted cutting wheel with a diameter of 4.1 mm (0.161 in.) is optimal for cutting the TPF and scoring the glass consistently with a clean edge (for example: Bohle 12A145° 10HM 4, 1x1,08x1,42 145° S32 pre-faceted).
  - o The optimal angle for cutting is 145°. Wider tool angles than 145° are not recommended.
  - o It is recommended to increase the cutting pressure until a clean break across the whole length and width of a Jumbo is achieved. It may be necessary to increase the tool pressure by a substantial amount. It is possible that stress lines are visible after the break.
  - o The cutting speed may need to be reduced in order to optimise the quality of the score. Cutting speed and pressure affect each other and some fine-tuning may be required to achieve the best possible result.

After cutting, the glass should be processed as soon as possible, preferably within 3 working days. TPF provides only limited protection from environmental humidity. The glass should be kept in a dry place when immediate processing is not possible when no chemical reaction has been noticed between the TPF and the cutting oil.

<sup>1</sup> Best settings can deviate from the recommendations and will depend on the make and technical details of the cutting table and edge deletion unit.

# Cleaning

Cleaning can be performed with glass washing machines, which are already commonly used in insulating glass manufacturing. However, there are specific details to be considered:

- It is recommended to place the glass with the coated side (TPF side) away from the conveyors.
- Always use clean and de-ionised water ( $< 30 \mu\text{S}$ ). The water must not contain any cleaning agents or non-dissolved particles (such as lime).
- Standard float glass washer settings may be utilized on TPF products.
- During the washing process the glass must not remain stationary in the washing machine with the brushes revolving as excessive brushing may damage the TPF protected surface.
- The glass panes must exit the washing machine completely dry, in order to prevent water droplets getting onto the coating when the TPF is removed on the furnace loading table.

The washing machine must be checked, cleaned and maintained at regular intervals in order to ensure that it operates correctly. The brushes, in particular, must be checked for cleanliness, alignment and ample supply of water. The brushes must not operate dry, as this could damage the TPF. TPF must remain on the surface during post-washing transport when the washer is not directly in line with the furnace entry conveyor.

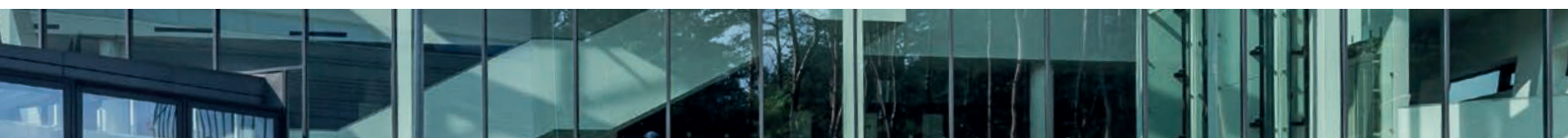
# Edge working

Edge work of coated glass with TPF can be carried out manually or on automated machines. Glass with TPF is suitable for edge grinding, polishing, as well as arrising.

Special care is required when the TPF edge extends right up to the glass edge, e.g. when the coated glass has been cut through the TPF because edge deletion is done post heat-treatment. If the TPF edge is dislodged by the grinding wheels or the cross belts during the processing of the glass edge, Guardian recommends to manually trim back the edge of the TPF. A few millimetres are sufficient and can be achieved with a suitable cutter, for more details please contact Guardian.

The coated glass surface is protected from mechanical damage by the TPF, however, contact with the TPF surface by clamping or conveyor devices should not be excessive and automatic machines should be in good working order. When using any type of grinding equipment always ensure an adequate supply of clean water.

In order to prevent damage to the coating or the protecting TPF layer by glass debris accumulation from either arrising or grinding, the glass should be rinsed with copious amounts of water before washing directly after the edge processing operation.



## TPF Removal

The TPF must be removed before the glass is indexed into the furnace for heat treatment. The best location for removing the TPF is the loading table of the tempering furnace.

The removal of the TPF is facilitated by the film's "easy-peel" effect. It is recommended to peel back about 20 to 30cm of the TPF in a first step (Fig. 1), and then in a second step hold the TPF tightly and pull swiftly (Fig. 2). This fast pull substantially reduces the force required to remove the film from the coated glass.

For the removal of the TPF it is recommended to start in a corner of the glass. If it proves difficult to get a good grip of the corner of the TPF, a strip of strongly adhesive tape applied to the TPF can help lift the protective film off the coated glass.



Fig. 1



Fig. 2

In order to cover a whole Jumbo with TPF two films are overlapped and sealed with organic glue. The organic glue unfortunately does not exhibit the aforementioned "easy-peel" effect. It is hence recommended to make use of the "easy-peel" effect by pulling the film back from both sides right up to the overlap area. The overlapping film is subsequently peeled back slowly to avoid tearing of the film (Fig. 3) due to the glue which seals the two films together. Most of the glue is removed with the TPF from the coated glass surface; however, some organic residue will remain on the coating in a stripe of about 10cm width (Fig. 4). Do NOT try to clean this residue, unless enamel is to be applied in this area (for more information please contact Guardian)!

The residue of the organic glue evaporates cleanly and without leaving a trace during heat treatment, visual inspection of the glass should therefore only be carried out post heat treatment.

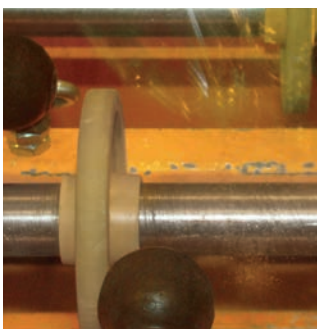


Fig. 3

Organic glue



Fig. 4

In the unlikely event that spot cleaning is required after TPF removal, Guardian recommends the use of mild fast drying household glass cleaners. Dab or blot the surface (avoiding wiping) with a clean, soft cloth to remove any excess cleaning solution. Do not wipe the surface, as this may damage the coating.

Recommended cleaners are e.g.:

- A mixture of approximately 50% isopropyl alcohol and 50% water
- A mixture of approximately 10% ammonia and 90% water

## Heat treatment

The SunGuard® eXtra Selective and SuperNeutral HT designation indicates that this product is the heat treatable version of the annealed SunGuard® eXtra Selective and SuperNeutral families of coatings. **The annealed version must never be heat treated, and vice-versa the "HT" product must not be used in annealed applications.** The high performance characteristics and low emissivity of the SunGuard® eXtra Selective and SuperNeutral HT coatings may require some process adjustments to the furnace profile for a successful heat treatment.

SunGuard® eXtra Selective and SuperNeutral HT coated products contain silver functional layers. For a successful heat treatment it is essential to keep in mind that the heat reflection of the coating counteracts the warming of the coated surface by radiation. The bottom of the glass, which is uncoated, absorbs the heat much more effectively than the coated side with a very low-emissivity coating. This leads to asymmetrical heating of the glass in the furnace where the uncoated bottom side of the glass heats up more quickly. Any modification of coated side emissivity (edge-enameling, silk-screening, etc.) could lead to inhomogeneous heating of the glass in the furnace and therefore some tests should be run prior to acceptance of any firm order. More information about special applications on SunGuard® eXtra Selective and SuperNeutral HT coated products may be directly requested to Guardian's technical department.

When first heat-treating SunGuard® eXtra Selective and SuperNeutral HT products, it is best to start with a recipe established for a high performing soft coated (magnetron sputtered) product with a comparable emissivity and to run a few test pieces to obtain the optimum furnace settings. The use of forced air convection furnaces will enable improved heating control of the glass. It may be necessary to apply longer heating times to ensure that the glass is heated uniformly.

The coating must always be on the side that is away from the conveyors in order to avoid damage or the rollers leaving imprints. SO<sub>2</sub> (sulphur dioxide) must not be used at any time during the heat treatment. The SO<sub>2</sub> flow must be discontinued at least 2 hours prior to starting heat treatment of the glass.

Heat treatment of SunGuard® eXtra Selective and SuperNeutral families of coatings is possible to be processed as fully tempered (FT) or heat strengthened (HS) glass. Heat strengthened glass requires different and particular settings compared to fully tempered glass. If needed, Guardian can assist to run processing tests. Please contact Guardian technical for further information.

A subtle change in outdoor reflected color and visible light reflectance/transmission may occur after heat treatment of SunGuard® eXtra Selective and SuperNeutral coatings. This minor variation is due to the heat treating process and is within the normal production tolerance of coated annealed glass. Full size mock up are advisable when annealed and heat treatable versions of the same product are mixed in a façade.

If the glass panes are intended for glazing in one project, ensure that all of the panes are processed with the correct dimension in the same direction during the heat treatment as the direction they will be installed in the facade. Whenever possible it is advised that roller waves should be installed horizontally.

Guardian advises that there is a risk with all tempered glass of nickel sulfide inclusions (NiS), which can cause the glass to break spontaneously. Provided that after tempering of the glass the processor arranges a heat soak test of the glass, and provided that the processor notifies Guardian immediately after any incident of breakage and gives Guardian an opportunity to inspect the broken glass, then Guardian will at its discretion either deliver free of charge replacement for glass that suffered spontaneous breakage

after installation or refund the purchase price of such glass. Guardian will not pay for removing the broken glass or installing the replacement glass.

Guardian and the processor are aware that, with the current state of the art in glass manufacturing, it is not possible to eliminate nickel sulfide inclusions. Therefore, there is no warranty against breakage. However, provided that heat soak test has been conducted, if Guardian is given prompt notification and an opportunity to inspect the glass while still in place, Guardian is pleased to offer replacement glass without installation or refund of purchase price as described above. Guardian will have no obligation whatsoever with respect to spontaneous breakage if the customer did not conduct a heat-soak test or even if a heat soak test was conducted, Guardian does not receive prompt notification and an opportunity to inspect the broken glass.

## Heat Soak Test

Heat Soak Test (HST) is an offline process that is performed by placing the glass that has been fully tempered into an oven that has been specially designed, calibrated and certified for the heat soak test process.

In Europe the HST is based on compliance with the European standard EN 14179.

Outside of Europe there is no established standard for HST process.

As with any offline process, HST carries with it certain risks associated with the additional handling of glass. This includes scratching, abrasion, chipping and breakage. In addition, during the process, breakage may occur due to the presence of NiS or due to uneven heating if the HST is not conducted properly.

The separation material should not leave any traces or mark (coated and uncoated side) after the HST process. Suitable and compatible materials should be used like teflon. Please contact your local Guardian representative for further information.



Fig. 5

Example:

Teflon separators are placed only in the edge deleted area of the glasses and are not in contact with the coating.

Recommended loading instructions:

- A clear float glass is placed first on the HST-rack and then the coated glasses with the coating facing to the rack - glass side to the operator. Stack order from big size glasses to smaller glasses if possible.
- The distance between the single glass panes in the stack combined with the alignment of the glass stack are the most important parameters decisively determining the quality of the test. The separators shall assure optimized airflow between the glass panes without hindering the airflow themselves. A minimum separation of 20mm is recommended (glass-to-glass contact is not allowed).

Guardian recommends to carry out some tests of separation material before any further processing decision.

Other precautionary measures:

- The tempered coated glass, must be placed in the HST oven as soon as possible. (recommended the same day after tempering). Longer exposure to humidity and dust can lead to delamination of the coating.
- The coated glass to be heat soak tested may require machine washing prior to and – or after the heat soaking cycle.
- Thermal couples leads measuring the coated surface must be attached to the uncoated surface.
- After HST process the coated glass must be processed to IGU as soon as possible (recommended the same day after HST).

## Lamination process

Please refer to the document "Processing SunGuard to Laminated glass", available on our website [www.sunguardglass.com](http://www.sunguardglass.com) or through your Guardian Technical Advisory Center.

## Ceramic silkscreen / frit

SunGuard® eXtra Selective and SuperNeutral coatings (only heat treatable version HT) can be printed with ceramic paint for decorative purpose only, with some restrictions and limitations.

Please contact your Guardian Technical Advisory Center for further information and assistance.

## Bending

SunGuard® eXtra Selective and SuperNeutral products (only heat treatable version HT) can be bent with some restrictions and limitations.

Please contact Guardian technical department for further information and assistance.

## Installation

All SunGuard® eXtra Selective and SuperNeutral (annealed and HT) coated products may only be used in insulated glass units. No monolithic application is allowed. The coating must be on a surface facing towards the space between the panes. The optimum position for SunGuard® eXtra Selective and SuperNeutral HT in terms of their solar control properties and correct visual appearance is on surface 2. For more information please also refer to the Guardian's General Processing Guidelines for Architectural Coated Glass.

## Transportation of monolithic lites

Any transportation by the processor of monolithic SunGuard® eXtra Selective and SuperNeutral HT products outdoors is not recommended. If this is unavoidable, it is entirely at the processor's risk and Guardian suggests a whole production process simulation including packaging, transport, and storage of the glass. The glass should be thoroughly inspected for coating damage and corrosion at the receiving site in order to determine the feasibility of the chosen packaging materials and transportation method.

Guardian recommends paying particular attention to the compatibility of all involved packaging and separation materials with the coating. In addition, the following points are considered important and should be taken into account:

- Heat-treated glass must be hermetically sealed within a very short period of time, including suitable desiccants in the package. The glass should be at ambient temperature when being packed.
- Transit and storage times should be kept as short as possible, and any movement or rubbing of the lites against each other must be avoided during transit and loading/unloading of the glass.
- At the receiving site the glass must be manufactured into insulating glazing units within the shortest possible time. After opening the pack the glass should be processed within one day. Cold glass packs must not be opened before the glass has reached the ambient temperature.

The following gives an example for packaging of monolithic lites:

The monolithic lites must always be manipulated with clean gloves suitable for soft low-e coatings. Before starting to load the glass on the rack please place dry non-acid paper on the back. The glass is positioned on the rack with the coating facing the operator (first glass with the glass side against the paper and the rack) see Fig. 6. For the separation of the lites Guardian recommends cork pads to be placed on the edges of the glass. If bigger sizes are mixed with smaller sizes, these should also be separated by dry and non-acid paper. This is to avoid scratching the bigger lites by the corners of the smaller lites.

When all the glass is packed, wrap the rack with stretch foil all around to get a solid pack (see Fig. 7).



Fig. 6



Fig. 7

# Quality Features of Coated Glass

The European Standard EN 1096-1 characterises defects on coated glass.

When the glass is inspected in reflection the observer must view the glazing from outside the building. Examination in transmission is effected from the inside of the building looking through the glass. In order to characterise defects it is necessary to maintain a minimum distance of 3m between the observer and the coated glass (see Fig. 8). Daylight (evenly covered sky without direct sunlight) should be used as the light source.

## Stains and defects in homogeneity

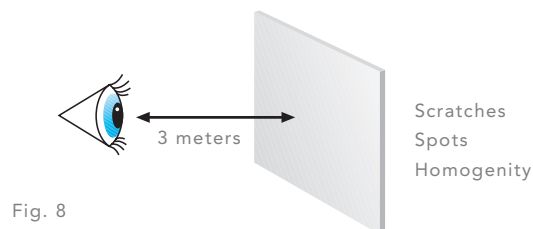
These defects are acceptable if an unbiased observer does not regard coating variations as disturbing.

## Spot-shaped defects

Defects of all kinds larger than 3mm are inadmissible. Separate defects measuring between 2 and 3mm are acceptable provided the number of defects does not exceed one per square meter. The concentration of small defects is only admissible in areas outside the normal field of vision.

## Line-shaped defects

Scratches longer than 75mm are inadmissible in the centre of a lite. Scratches in the edge area (10% of length and width) are acceptable if located 50mm distant from each other. If an unbiased observer does not feel disturbed by the local accumulation, scratches smaller than 75mm are reasonable.



## Warranty

The processing guidelines contained herein are for information purposes only and Guardian does not assume any responsibility for the accuracy or completeness hereof, unless otherwise stipulated by applicable law. It is the sole responsibility of the user to adequately inspect the SunGuard® eXtra Selective and SuperNeutral HT products before each step of fabrication and prior to installation. Failure to apply professional standards, customary instructions and these processing guidelines will automatically void any warranty given by Guardian regarding SunGuard® eXtra Selective and SuperNeutral HT products and no claim in relation to SunGuard® eXtra Selective and SuperNeutral HT products will be admissible against Guardian if 1) the user's processing capabilities have not been certified by Guardian and 2) SunGuard® eXtra Selective and SuperNeutral HT products are damaged in fabrication, handling or due to improper storage, installation or maintenance.

Guardian reserves the right to inspect any product claimed to be defective.

Sales by Guardian are subject to the latest Guardian Conditions of Sale and Guardian SunGuard Limited Warranty.

Important advice:

When using several production batches for one project, the processor shall be responsible for the colour homogeneity of his product. For this reason, we recommend that a sample of the first production should be kept for purposes of comparison.

## Verification

The signature below verifies that the processor has read and understood the full content of the EXTRA SELECTIVE AND SUPERNEUTRAL HEAT TREATABLE COATINGS WITH TEMPORARY PROTECTIVE FILM (SN AND SNX SERIES) / Processing Guidelines / SUNGUARD\_SN\_SNX\_HT\_PG\_EN\_0216

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

Title: \_\_\_\_\_

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

Date: \_\_\_\_\_

Please return this page signed via email at [info.europe@guardian.com](mailto:info.europe@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 processing of eXtra Selective and SuperNeutral Heat Treatable Coatings with Temporary Protective Film (SN and SNX series).  
Please contact your Guardian Technical Advisory Center for the most current version.

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