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Float + ThermaGuard 3Plus

ThermaGuard AR2 ds + ThermaGuard 3 Plus/AR2



Guardian ThermaGuard® AR2
Guardian ThermaGuard® 3PLUS
Guardian ThermaGuard® 3PLUS/AR2

Handling and Processing Guidelines

Introduction

Guardian ThermaGuard® AR2 glass is a high quality anti-reflective coated glass product (double-side coated) that provides minimal reflectance and maximum transmission in the visible range. The Guardian ThermaGuard AR2 coating has chemical and mechanical durability characteristics that make it suitable for use in a range of exposed and protected surface applications. However, in order to facilitate the processing of the coated glass, Guardian ThermaGuard AR2 is provided with a temporary protective film (TPF). The TPF protects the coated surface from mechanical damage often experienced during general processing, thereby significantly increasing processing yields.

Guardian ThermaGuard® 3Plus is a high quality, magnetron coated low-E product. Guardian ThermaGuard® 3Plus/AR2 glass combines the advantages of ThermaGuard AR2 low-reflection coating on one side with the ThermaGuard 3Plus low-E coating on the other side of the glass.

Guardian ThermaGuard 3Plus/AR2 is provided with a temporary protective film (TPF) on both sides of the glass or only on the ThermaGuard 3Plus coating.

The TPF is a full coverage, polyethylene-based, low adhesive tape that can be easily removed from the glass prior to heat treatment. The 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. The TPF is recyclable.

In order to maximize the benefits provided by the TPF, a couple of points need to be considered when processing Guardian ThermaGuard AR2 and ThermaGuard 3Plus/AR2 glass. This document provides specific instructions with respect to storage, handling and processing of these coated products with TPF. Non-compliance 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

The 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 the coated surfaces. The TPF preserves the coating by sealing it from contamination and protecting it from mechanical damage during processing before the glass is heat-treated.

It is important that the TPF is removed completely before the product is heat-treated.

The TPF should never be allowed into the furnace, as this would irreparably damage the coating.

The TPF could be applied to one or both coated surfaces. In case the Guardian ThermaGuard 3Plus/AR2 is delivered with TPF on the ThermaGuard 3Plus coated side, it is recommended to process the glass the same way as other TPF-covered products.

The 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.

Storage and Unpacking

Guardian ThermaGuard AR2, ThermaGuard 3Plus and ThermaGuard 3Plus/AR2 coated glass is available in packs of Jumbos and split sizes. Standard thickness is 4 mm; please enquire regarding other thicknesses through your Guardian sales contacts.

Guardian recommends that glass be unloaded under dry, indoor conditions. If outdoor unloading is required, care should be taken to avoid exposure to rain and snow, and glass should be moved indoors as soon as it is practical. Glass should be stored in a dry and clean place and be kept 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 which may damage the coating surfaces. If a pack has become particularly cold during transportation, do not open the pack until the glass has reached the ambient temperature in the warehouse, to avoid condensation forming on the coating. The warehouse should be well ventilated and all of the glass rotated (first in, first out).

Do not mark the coated surface with adhesive labels or wax crayons, and do not drag suction cups or metal objects across the surface. The Guardian ThermaGuard AR2 coating is resistant to damage by such materials, but handling practices that are more aggressive than those used with uncoated glass must be avoided. Case tags should remain with the original packaging and case tag numbers should be traceable to work-in process and finished goods. Although the coated surface of the Guardian ThermaGuard AR2 glass is resistant to staining and chemical degradation, Guardian's customer assumes responsibility for as-coated inventory that is held beyond 12 months from the original date of receipt from Guardian.

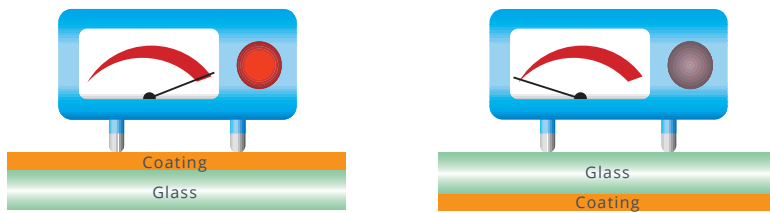
During normal storage condition, the shelf-life of the Guardian ThermaGuard 3Plus and ThermaGuard 3Plus/AR2 with the original unopened packaging is 6 months. The shelf-life of opened packs is 3 months. Once the TPF is removed from the Guardian ThermaGuard 3Plus coated surface of Guardian ThermaGuard 3Plus/AR2, the coating should be protected and must not be exposed during storage.

Surface Identification

The type of packaging and the arrangement of the coating on 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.

Guardian ThermaGuard AR2 and ThermaGuard 3Plus/AR2 are always protected by blue color TPF on one or both sides. ThermaGuard 3Plus single side coated has no TPF protection film. The ThermaGuard 3Plus coating is electrically conductive (unlike the ThermaGuard AR2 coating), so may be easily identified with a commercial coating detector or ohmmeter (see Fig. 1). In case of doubt, please peel back the TPF foil from the edge of the glass carefully and place the coating detector on the coated surface within 12 mm of the edges whenever possible to prevent damage to the coating.

Fig. 1 - Detector Method



Handling

Do not open the glass pack until all the people responsible for handling and processing the glass have been properly trained on the correct handling, storage and processing of the particular type of glass. Always wear suitable clean, dry, lint-free cotton gloves when handling the glass.

The ThermaGuard 3Plus coating of the single side coated and hybrid product should not be touched. Any marks or scratches from suction cups, fluid droplets of any kind, fingerprints or glove marks can lead to irreversible defects that are particularly evident on the Guardian ThermaGuard 3Plus coating after toughening.

When using suction cups, contact with the coating should be avoided as this always poses an additional risk of surface damage. If contact is unavoidable, the suction cups should be cleaned regularly, has to be free of lubricants and have suitable, clean protective covers.

In order to prevent damage of the coating, avoid contact with hard objects such as glass splinters, glass edges, metallic parts, abrasive particles, etc. Always use separator material between individual panes of glass; adhesive-free cork pads or acid-free paper (contact supplier for confirmation of acid content) should be used. Glass to glass contact must be avoided. Do not stick, glue or write anything on the coated side.

Make sure all tools and appliances which may come into contact with coatings are absolutely clean.

After certain steps of processing, manual cleaning might become necessary. For information about the recommended cleaning agents and tools please request your copy of the separate Cleaning Guidelines from your Guardian contact.

Inspection

Upon receipt and after each processing step, Guardian ThermaGuard AR2, ThermaGuard 3Plus and ThermaGuard 3Plus/AR2 coated glass must be inspected both in reflected and in transmitted light.

Cutting

Do not start the processing until all the people responsible for processing the glass have been properly trained on the correct handling and processing of the particular type of glass.

Despite the fact that the coating is protected by TPF, Guardian ThermaGuard AR2 and Guardian ThermaGuard 3Plus/AR2 need special care when metal tape measures, straight edges or cutting bars come into contact with

the coated surface as abrasion or marking may occur. Multi-lite stacking should also be avoided to minimize abrasion or marking of the coated surface.

Guardian ThermaGuard 3Plus (single-side coated) is not protected with TPF. Therefore special attention is required to ensure that this coating will be not damaged.

The cutting table has to be cleaned with vacuum-cleaner before the start of the cutting process and after cutting each lite in order to avoid scratches of the coating caused by glass chips. Furthermore, it is crucial that the air cushion pressure is sufficient to support the Guardian ThermaGuard AR2 and Guardian ThermaGuard 3Plus/AR2 glass.

During cutting of Guardian ThermaGuard 3Plus and 3Plus/AR2 the ThermaGuard 3Plus coated surface must be placed facing up.

If for any reason Guardian ThermaGuard AR2 is processed without TPF, manual adjustment of positioning sensors may be necessary for cutting tables controlled on the principle of visible light reflection, since Guardian ThermaGuard AR2 has very low reflectance in the visible range.

The cut glass should be washed or processed immediately. In between steps of processing, the glass should be stored in clean and dry conditions.

Guardian ThermaGuard AR2 with TPF must be cut through the foil. In case of Guardian ThermaGuard AR2 and Guardian ThermaGuard 3Plus/AR2 with TPF on both coated surfaces, optimal cutting can only be performed with a cutting table designed for cutting laminated glass. In case a laminated-cutting table is not available Guardian recommends Guardian ThermaGuard AR2 and Guardian ThermaGuard 3Plus/AR2 with one TPF; however, only after cutting tests and approval by Guardian. During cutting, the TPF must be on the top side of the glass – away from the surface of the cutting table. The cut glass should be further processed as soon as possible.

Guardian recommends the following changes with respect to the cutting parameters of coated glass of the same thickness without protective film:

- Only very small amounts of cutting fluid are required and recommended when cutting through the TPF surface. Guardian recommends slowly evaporating cutting fluids to avoid shrinking of the TPF.
- Results from Guardian research indicate that pre-facetted cutting wheels are optimal for cutting the TPF and scoring the glass consistently with a clean edge (for example: MDI Penett SC 060/130 for 4 to 6 mm glass, and SC 060/140 for 8 and 10 mm glass).
- The optimal angle for cutting depends on the thickness of glass and both the make and model of the cutting wheel.
- 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.
- The cutting speed may need to be reduced in order to optimize 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.

Cutting quality is considered satisfactory if the TPF foil is not ripped or delaminated at the edges. This is crucial in order to avoid problems during further processing steps (edgework, washing, etc.)

Washing and Cleaning

Do not start the processing until all the people responsible for processing the glass have been properly trained on the correct handling and processing of the particular type of glass.

Automatic washing machines using de-ionized ($< 30 \mu\text{S}$) water can be used with Guardian ThermaGuard AR2, 3Plus and 3Plus/AR2. The diameter of the bristles of the brushes should be max. 0.20 mm. The water must not contain any cleaning agents or non-dissolved particles (such as lime). During the washing process the panes 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 from drying onto the coating. Air used for drying must be clean and free of dust or any particles.

The washing machine must be checked, cleaned and maintained at regular intervals in order to ensure proper operation. 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.

It is crucial to avoid water drying to the coated surface, as watermarks will later be difficult to remove.

To keep the optical cleanness, manual cleaning might become necessary with a clean, soft cloth. See separate Cleaning Guidelines for the recommended cleaning agents and tools. Cerium oxide is not allowed for cleaning any Guardian ThermaGuard product.

Razor blades and steel wool must not be used on the coated surface.

Edgework

Do not remove the TPF foil from the glass surface prior to the edgework operation. The glass should be washed immediately after the edgework operation is completed. In between steps of processing, the glass should be stored in clean and dry conditions.

Bonding, Gluing for Interior Applications

Transparent, glass-to-glass bonding of Guardian ThermaGuard AR2 for interior applications is approved with neutral silicones and UV-glues only. Regardless of the material used, it needs to be ensured, that excess material is removed from the ThermaGuard AR2 coating immediately and without causing mechanical damages.

Edge-Deletion Requirements

In case of Guardian ThermaGuard 3Plus and 3Plus/AR2, the 3Plus coating requires edge-deletion. This coating must be completely removed from the perimeter of each finished cut size in order to prevent excessive contact between the Guardian ThermaGuard 3Plus coating and the sealants of the insulating glazing edge bond.

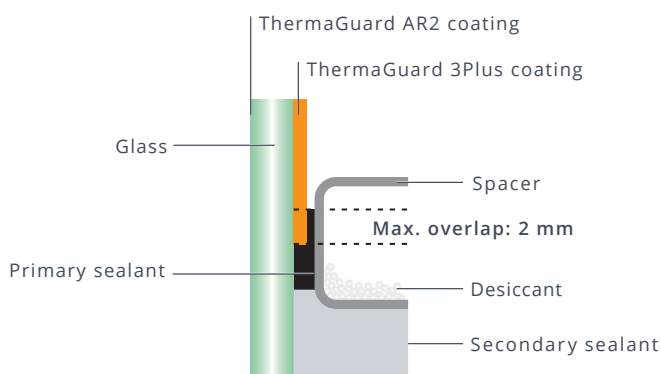
This coating is not compatible with many sealants containing chemicals, which can react with the silver in it.

The Guardian ThermaGuard 3Plus coating should be removed using grinding equipment developed specifically for this purpose. More information about the appropriate equipment is available on request from Guardian.

Any overlapping of coatings and sealants should be limited to a maximum width of 2 mm.

Fig. 2 illustrates this requirement.

Fig. 2



Edge deletion of the Guardian ThermaGuard AR2 coating is not required.

Enameling, Silk-Screen Printing

Guardian ThermaGuard AR2 can be painted for decorative purposes or to cover up certain fixing/hardware elements behind the glass. Ceramic frits - requiring firing -, as well as organic paints - requiring drying only - may be used under certain conditions, after compatibility and suitability tests. It is advisable to carry out tests to verify the color appearance of the painted area. A certain color difference in the residual reflection between the painted and the non-painted areas of the glass is to be expected. For projects with painted ThermaGuard AR2 it is recommended to use glass out of the same batch.

In case of ThermaGuard AR2, paint should be applied to the coating on the air side of the glass. Guardian delivers ThermaGuard AR2 with the tin side marked.

In case of ceramic fritting, the settings for firing the enamel must be adjusted compared to regular clear float glass. Excess heating may lead to enamel discoloration and may damage the ThermaGuard AR2 coating as well. Please see chapter Heat-treatment for more information.

Enameling/silk-screen printing of the Guardian ThermaGuard 3Plus coating of the single side coated or the hybrid product is not allowed with regular ceramic frits, only with Guardian System TEA. In this case please refer to the corresponding guidelines: System TEA (Guardian System for True Edge Application).

Heat-Treatment

All 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.

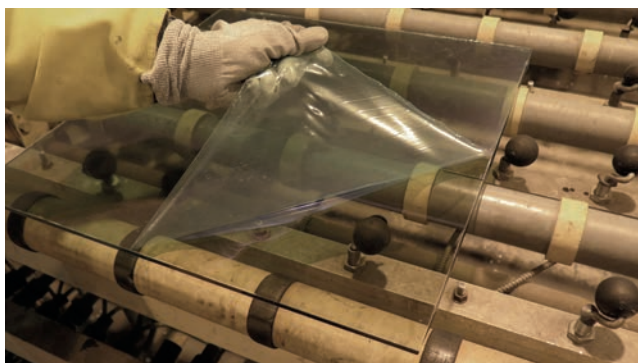
The removal of the TPF is facilitated by the film's "easy-peel" effect. It is recommended to peel back about 20 to 30 cm of the TPF in a first step (Fig. 3), and then in a second step hold the TPF tightly and pull swiftly (Fig. 4). This fast pull substantially reduces the force required to remove the 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.

In the unlikely event that spot cleaning is required after TPF removal, please refer to the separate Cleaning Guidelines.

Fig. 3



Fig. 4



The outstanding optical characteristics of Guardian ThermaGuard AR2 may require some process adjustments to the furnace profile for heat-treatment in good quality. As a rule, furnace temperatures should be decreased compared to clear float glass of the same thickness, and the furnace dip time increased proportionately. In case of Guardian ThermaGuard 3Plus and 3Plus/AR2, the Guardian ThermaGuard 3Plus coating has a functional silver layer. Due to this reason, it is essential to take into account that the heat reflection of this coating limits the warming of this coated surface. The bottom side of the glass, absorbs the heat much more effective than the ThermaGuard 3Plus coated side. This leads to asymmetrical heating of the Guardian ThermaGuard 3Plus coated glass in the furnace.

As a rule, furnace temperatures should be decreased and the furnace dip time increased in direct proportion to the infrared reflection performance (emissivity) of the coated surface. In general it is recommended to apply forced top air convection and longer heating time to ensure a uniform heating of the glass.

The 3Plus coated side of Guardian ThermaGuard 3Plus and 3Plus/AR2 must not be facing the conveyors in order to avoid damage or imprints to the coating.

SO₂ (Sulphur dioxide) must not be used at any time during the heat treatment. The SO₂ flow must be discontinued at least 2 hours prior to starting heat-treatment of any ThermaGuard product. In order to obtain good optical quality of heat-treated glass, attention to the uniform heating and cooling of the glass is critical. Non-uniform heating and cooling of glass can lead to permanent deformations.

In case of external applications, Guardian strongly recommends Heat-Soak process to be carried out, to limit potential risk of spontaneous breakage of tempered glass.

Guardian does not warrant glass against breakage or failure of any kind as well as any consequences that can occur or result from such breakage or failure.

Bending

Guardian ThermaGuard AR2, 3Plus and 3Plus/AR2 coated glass can be bent. For each project it is important to carry out bending tests in advance.

During the bending process, optimum results will be obtained by placing the Guardian ThermaGuard 3Plus and 3Plus/AR2 glass on top of a multi-lite stack, always with the 3Plus coating facing upward. The recommended glazing configuration places the coating in compression. The bending radius should not be less than 600 mm.

Insulating Glass Assembly, Installation

Guardian ThermaGuard AR2 may be used as monolithic application or in insulated glass units.

Guardian ThermaGuard 3Plus and 3Plus/AR2 glass may only be used in insulated glass. The 3Plus coating must be on a surface facing towards the space between the panes. For edge deletion requirements please see the relevant chapter above.

Attention is required during the following assembling steps:

- The rollers in the washing machine at the IG unit line must be clean and uncorrupted.
- Before IG unit assembly the intended sealant material must be tested – adhesion and compatibility tests have to be done.
- Always use separator material between individual IG units such as adhesive-free cork pads or acid-free paper (contact supplier for confirmation of acid content).

Packing and Manipulation of Monolithic Lites

When packing Guardian ThermaGuard AR2 glass for shipping with the coating exposed, it is preferable to use a slot-racking system that prevents glass-to-glass contact. It is acceptable to stack individual lites of Guardian ThermaGuard AR2; however, care must be taken to ensure proper interleaving is used to avoid the potential for abrasion to the coated and uncoated surfaces.

Recommended	Not recommended
Foam pads	Newsprint
Polyfoam sheets	Cardboard and other hard papers
Lucite beads	Powder separators containing acid
Acid-free paper (contact supplier for confirmation of acid content)	Coconut powders

Any transportation or manipulation of monolithic Guardian ThermaGuard 3Plus and 3Plus/AR2 glass outside the factory environment is not recommended. If this is unavoidable, it is entirely at the processor's risk and Guardian suggests a production simulation including packaging, transport, and storage of the glass.

The following also has to be considered as an absolute minimum:

Separate the lites with smooth and soft, acid-free paper or suitable foam foil.

Seal the pack around the edge with airtight tape or stretch foil and incorporate bags of desiccant in the package to keep the glass dry.

Cold glass packs must not be opened until the glass reached the ambient temperature.

Heat-treated glass must be hermetically sealed within a very short period of time. Packaged glass with included desiccant must be manufactured into insulating glass units within two weeks, after opening the pack within two days.

Quality Features of Coated Glass

The European Standard EN 1096-1 characterizes 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 when looking through the glass from the inside of the building. It is necessary to maintain a minimum distance of 3m between the observer and the coated glass (see fig. 5) in order to characterize the potential defects.

Daylight (evenly covered sky without direct sunlight) should be used as the light source.

Stains and defects, inhomogeneity

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

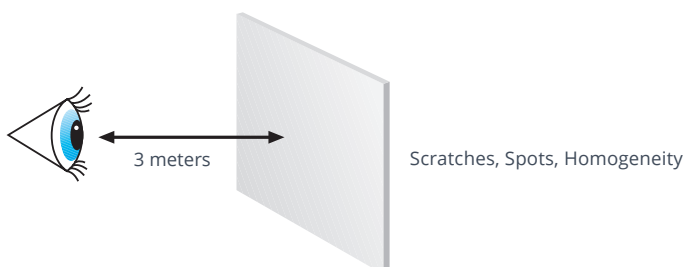
Spot-shaped defects

All defects larger than 3 mm are inadmissible. Separate defects measuring between 2 and 3 mm 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 75 mm are inadmissible in the center of a lite. Scratches in the edge area (10% of length and width) are acceptable if located 50 mm distant from each other. If an unbiased observer does not feel disturbed by the local accumulation, then scratches smaller than 75 mm are allowable.

Fig. 5



Important advice:

Guardian ThermaGuard AR2 provides a residual reflection of less than 1% (exact number depends on glass configuration and/or thickness) and provides a viewing experience through the glass that is virtually distortion free. However, under specific natural and artificial lighting conditions and in some specific viewing angles, a slight reflection may be seen by the naked eye, which cannot be considered as a reason for complaint or claim. It is recommended that a sample is viewed in the actual location to understand which of these factors may be present in your particular application.

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 Guardian ThermaGuard AR2, Guardian ThermaGuard 3Plus and Guardian ThermaGuard 3Plus/AR2 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 Guardian ThermaGuard AR2, Guardian ThermaGuard 3Plus and Guardian ThermaGuard 3Plus/AR2 and no claim in relation to Guardian ThermaGuard AR2, Guardian ThermaGuard 3Plus and Guardian ThermaGuard 3Plus/AR2 products will be admissible against Guardian if 1) the user's processing capabilities have not been certified by Guardian and 2) Guardian ThermaGuard AR2, Guardian ThermaGuard 3Plus and Guardian ThermaGuard 3Plus/AR2 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 AR2 Glass Limited Warranty.

Verification

The signature below verifies that the customer has read and understood the full content of these processing directives: Handling and Processing Guidelines / „Guardian_ThermaGuard_AR2_PG_EN_0822“.

Name / Signature: _____ Title: _____

Company / Stamp: _____ Date: _____

Please return this page signed by mail: information@guardian.com.

For additional information regarding storage, handling, fabrication, limited warranty coverage or use of any Guardian glass product, please contact the Guardian Technical Service.

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