



SILVERSTAR FREE VISION T

Processing guidelines



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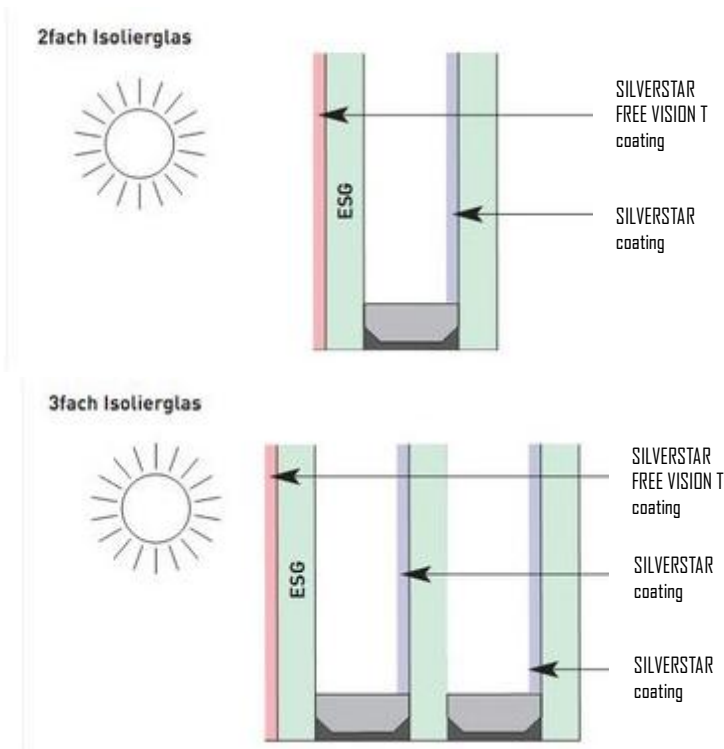
Properties of SILVERSTAR FREE VISION T

Intelligent layer design

- prevents external condensation in all cases known so far
- the coating is optimally suitable for insulating glasses with low U_g -value
- it is an environmentally friendly anti-fog glass manufactured in a high-vacuum magnetron production process
- SILVERSTAR FREE VISION T stands for many years of unclouded functionality

In both double and triple glazing constructions, the outer pane must always be thermally tempered.

- The SILVERSTAR FREE VISION T layer is operable only in combination with single-pane safety glass (SPSG) or thermally tempered glass
- Glasses are tempered after coating at the processor's
- For triple insulating glass constructions, it is recommended that the middle pane be tempered.





Properties of SILVERSTAR FREE VISION T

SILVERSTAR FREE VISION T is a transparent coating for use on position 1 (outward layer) and applied by cathode sputtering.

SILVERSTAR FREE VISION T is a hard layer which is resistant to environmental influences.

SILVERSTAR FREE VISION T coated glass is free from condensation.

Prior to its use on insulated glass, the coating must undergo a hardening process (single-pane safety glass/heat strengthened glass) in order to achieve its final characteristics.

SILVERSTAR FREE VISION T, in hardened condition, conforms to the specifications and tests pursuant to the following standards:

Classification of the product under	EN1096 1-4
Abrasion	ISO 9211-4
Adhesion	ISO 9211-4
Moisture	ISO 9022-2
Solvent resistance	ISO 9211-4
Solar characteristics	EN 410
Temperature	ISO 9022-4

Even though, unlike Low-E, the product is intended for use as a hard layer on the exterior side, all work processes should be handled as carefully as with temperable Low-E coating.

These guidelines do not claim to be exhaustive and are intended to give our customers a first impression of the product and its handling. These processing guidelines apply as last revised; revised versions are available on the Euroglas website at www.euroglas.com.

Any further information, e.g. information required within the framework of the CE marking, is also available at www.euroglas.com.



Technical data

Given that the luminous and solar characteristics of SILVERSTAR FREE VISION T change during the tempering process, i.e. the nominal condition is achieved only after tempering, technical data depend not only on the coating, but on the entire process chain, including storage, cutting, edge finishing, washing and tempering.

If the process chain is managed accurately, the solar characteristics of correctly tempered SILVERSTAR FREE VISION T will be within the tolerances indicated by Euroglas.

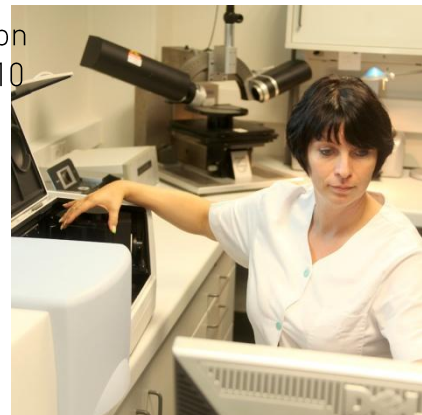
Quality control by the manufacturer

The luminous and electric values of non-tempered SILVERSTAR FREE VISION T are continuously controlled by Euroglas during the manufacturing process.

Random samples are taken from each manufacturing campaign, tempered and subsequently tested in the laboratory for technical and mechanical characteristics.

The most important characteristics tested are:

- colour values (L, a, b) upon reflection and transmission
- luminous and solar characteristics pursuant to EN 410
- electrical surface resistivity of functional layer
- scattered light (haze)
- mechanical load-bearing capacity
- chemical resistance
- long-term durability



Thus, Euroglas ensures best conditions for the reproducibility of the tempered final product at the customer's.

Tempered thermal insulation glasses are assessed with regard to defects in the SILVERSTAR FREE VISION T layer after visual inspection prior to their further processing pursuant to DIN EN 1096.



Packaging and delivery

SILVERSTAR FREE VISION T is delivered in standard in-stock dimensions. Such standard dimensions regularly include formats between 3210 mm and 6000 mm and thicknesses between 3 and 12 mm.

Coating is possible on both Eurofloat and Eurowhite.

Euroglas holds the above named formats in stock in thicknesses between 4 and 10 mm, executed as standard coating on Eurofloat, with single unit weights per parcel varying between 2.5 and 5.7 tons.

For further thicknesses, dimensions and unit amounts available, please contact your customer service or visit www.euroglas.com.

Packaging

Depending on the technical requirements of our customers, the product SILVERSTAR FREE VISION T can be delivered with the layer facing towards the transport rack or towards the outside. In any case, open coatings are protected by a cover sheet.

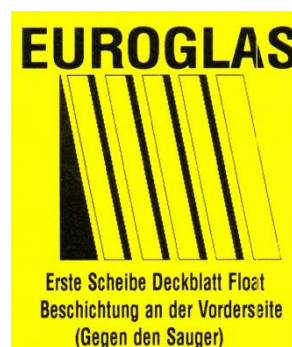
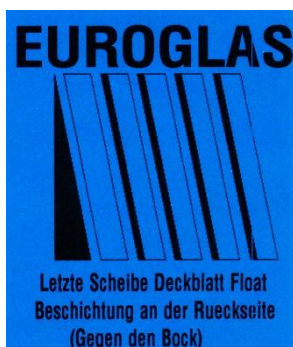
The individual sheets are kept apart from each other by a separating medium. The separating medium serves to facilitate both the transport to the customer and subsequently the suction of sheets taking place at the customer's.

The separating media used by Euroglas will later be removed without residues in the washing process taking place at the customer's.

Due to our experiences in the European countries, we do not seal the edges of parcels by adhesive materials.

In case of delivery outside Europe, we can rely on our expertise in the area of packaging to ensure a safe delivery. Please contact us.

Each individual parcel is marked with a bar code attached on one of the face sides of the parcel. Here, the most important basic information such as thickness, dimensions, quantity, type of product and the batch ID can be found.



Delivery

SILVERSTAR FREE VISION T is regularly delivered by special inloader lorries on L-frame racks (loading from one side only) and/or on A-frame racks (loading from both sides). The racks have a loading weight of 22.5 tons each. To facilitate the unloading of parcels with a fork lift, the individual parcels are delivered separated from each other by spacers. For environmental reasons, Euroglas uses cardboard spacers which may be returned to Euroglas after delivery.

The customer has to carry out a first examination of the goods delivered in the presence of the carrier. If defects are found to exist, such defects must be noted in the shipping documents (CMR waybill) and be countersigned by the driver. If such documents are incomplete or missing, Euroglas cannot accept any complaints relating to apparent causes for complaint which arise as a result of the transport.



L-frame rack, unloading from left/right side



A-frame rack

Storage

The following guideline values apply as to times of storage of SILVERSTAR FREE VISION T by the customer:

Storage of goods delivered in an unsealed parcel: < 6 months

We recommend constant indoor ambient conditions of around 20° C and a humidity of < 60% to limit the occurrence of condensation.

It is also recommended to follow the first-in-first-out principle in the storage management.

It must be made absolutely sure that water is prevented from penetrating into the parcels, e.g. through gates or rooflights.



Cutting

SILVERSTAR FREE VISION T is cut to size from the coated side. The product is thus cut while resting on the cutting machine on its uncoated side.

As residues of cutting oil stick to the layer and may in some cases not be completely removable in the washing machine, such residues may become visible as stains after tempering. Therefore, the amount of cutting oil has to be reduced to the minimum and the type of cutting oil used must have high / rapid evaporation characteristics (analogous to the usual processing of Low-E).

The time between cutting and further processing should be relatively short. For cut-to-size formats, we recommend a duration of intermediate storage of < 8 hours.

To avoid scratches, it must be made sure that glass splinters are constantly removed from the cutting table.



Our experience has shown that good cutting results can be achieved for SILVERSTAR FREE VISION T with the following cutting angles for cutting wheels:

on Eurofloat 3 – 5 mm	135°
on Eurofloat 6 – 8 mm	145°
on Eurofloat 10-12 mm	155 °

It is impossible to specify any general information regarding the cutting pressure because cutting machines are equipped with different cylinders so that the effective force used to apply the cutting wheel varies from machine to machine.

Coating removal on edges

Coating removal on the edges as usually carried out for Low-E is dispensable for SILVERSTAR FREE VISION T.

Transport at the customer's

The coated side of SILVERSTAR FREE VISION T must not be touched without wearing suitable clean gloves. Where suction on the coated side of SILVERSTAR FREE VISION T is inevitable, suction cups must either be absolutely clean and degreased or used with special protective sleeves or covering which are suitable for thermal insulation glasses.



After cutting, the glass may be transported pane to pane as the separation medium will normally still be on the surface, however, the glass should be separated using suitable spacers no later than after washing.

Transport devices and equipment such as rack trolleys must be tested to ensure their suitability before using them.



Edge finishing and washing before tempering

Although the layer structure of SILVERSTAR FREE VISION T is a relatively hard coating, scratches on the layer may be caused by glass splinters or unsuitably hard or insufficiently cleaned brushes. As a result of the reduced reflection of the coating, scratches are more clearly visible than on float glass surfaces. The washing process should therefore be carried out under the same conditions analogous to thermal insulation glass.

With regard to edge finishing, the glass should likewise not be touched from the coated side. If the glass is to be clamped, that may leave marks on the layer which cannot be removed. Automatic devices used for such purposes must be tested to ensure their suitability.

After edge finishing, the glass must be washed immediately. Any residues from the edge finishing process should be prevented from drying up on the surface of the layer before washing. The glass should further be sufficiently rinsed with water before being polished by the brushes in order to ensure that any glass dust is removed from the surface of the layer. In case of interruptions, the glass must not be allowed to remain stationary under rotating brush rollers. We recommend against the use of disc brushes on the coated site.

Do not use steel wool or abrasive detergents to clean the coated side. We recommend to use a soft cloth with some rubbing alcohol for subsequent cleaning (see also page 14).

Key data

The brushes used must be suitable for soft thermal insulation layers (bristle diameter 0.15 mm or 0.25 mm). The water should be pre-treated in a suitable water treatment facility and have a conductivity value under 20 μS . The water temperature during the washing process should be between 25 and 40 °C. These values should be checked at least once per week. Good water quality is of crucial importance for all coatings and regular cleaning of the washing machine ensures best conditions for further treatment.



Tempering facility

In principle, all glasses are conveyed through the line with the coated side (fire side) facing up while being heated up and tempered.

SILVERSTAR FREE VISION T can be heated up at furnace temperatures of approx. 700 °C. As a rule of thumb, 60 seconds of heating time should be calculated for 1 mm of glass thickness. This is, however, given for the furnace operator's rough guidance only.

During the heating process, the emissivity of the coated glass decreases. Depending on the type of furnace, the process can be optimised by continuously increasing the convective heat transfer. It is therefore not possible to precisely measure the temperature of the pane surface, even with measurement devices using emissivity correction factors. Given the differences in temperature measurement and points where such measurements are taken, it is not possible to give any precise information regarding machine settings for individual types of furnaces.

Given the large number of furnace suppliers and different furnace designs –

- furnaces without supported convection
- furnaces with supported convection
- high-convection furnaces
- etc.

we are unable to specify any standard program for SILVERSTAR FREE VISION T for all customers. The product will be adjusted to the customer's furnace on site working together with a technician. The result will be examined on site and subsequently evaluated in the Euroglas laboratory with regard to the specifications.

Cleaning of the tempering facility

A clean furnace is another important prerequisite for the successful tempering of SILVERSTAR FREE VISION T. Regular cleaning of the rollers used in the heating process ensures an unclouded view through the product.

It must also be made sure that any glass particles are removed from the tempering facility in order to prevent such particles from being blown onto the panes during the blowing process.



Bending capacity

Euroglas has successfully carried out relevant tests with bending furnaces. In those tests, SILVERSTAR FREE VISION T coating was shaped in both concave and convex forms. However, no clearance can be given for any such use within the framework of these processing guidelines.



Any such use by customers in their production facilities is subject to prior examination based on the individual case.

Heat-soak test pursuant to EN 14179

Separation of individual SILVERSTAR FREE VISION T glasses should be carried out in the same way as for heat-treatable thermal insulation layers.



Quality control at the customer's

Measuring tempered glasses poses numerous problems for today's standard laboratory measuring instruments. The maximum dimensions of samples for the measurement of solar characteristics are 200 x 200 mm. For precise FTIR measurements (determination of emissivity), glass surfaces must not have undulations. For these reasons and due to other restrictions, it is impossible for the customer to carry out any precise measurement of tempered glasses.

Therefore, Euroglas supports its customers in setting up their process chain. If the customer adheres to the processes and machine settings agreed with Euroglas, specified values will be achieved. The surface reflectivity can be monitored on the part of the customer using suitable measurement equipment; it allows conclusions to be drawn regarding the quality of the tempering process and is sufficiently reproducible. The visual appearance of the coating is assessed pursuant to EN 1096. The fracture behaviour and planarity are assessed pursuant to EN 12150 and/or EN 1863.

Packaging and transport by the customer

In principle, Euroglas recommends that the further processing of heat-treated SILVERSTAR FREE VISION T into insulating glass should take place in the same location.

If such further processing of SILVERSTAR FREE VISION T into insulating glass does not take place in the same location immediately after tempering, it must be packaged very carefully for further transport:

- One clean suitable spacer (e.g. paper interlayer / cork pads) must be put in between every two clean glasses.
- The glasses must be packed in plastic foil with a drying agent and be hermetically sealed off with adhesive material.
- The glasses must be protected against slipping, shifting or movement during transport. Otherwise, abrasive marks may occur.



Production of insulating glass

SILVERSTAR FREE VISION T is designed for use within multi-layer insulating glass units. Its effect has been proved for two- and multi-layer constructions.

As the coating is applied to position 1, it does not need to be removed on the edges.

The coated side can be identified with suitable test instruments (layer tester) as the coating is electrically conductive.

Any soiling which is almost inevitably caused by sealants must be removed from the SILVERSTAR FREE VISION T surface immediately after the sealing process to ensure that it is not allowed to harden: e.g. by spraying glass cleaner and wiping it off with a clean and soft cloth. Do not use any mechanical cleaning methods such as abrasive detergents, steel wool, glass scrapers, etc. as they may damage the coating.

Adhesive labels should be attached to the interior pane (facing towards the inside of the building).

Alternatively, adhesive labels can be attached with acrylic adhesives which are removable from the coated pane without residues.

For purposes of assessing the visual quality of the finished insulating glass, it may be referred to the **guideline for the evaluation of the visual glass quality for the building industry** "*Richtlinie zur Beurteilung der visuellen Qualität von Glas für das Bauwesen*". The latter applies as last amended as at the time of the production of the insulating glass by the technical advisory committee of the glass trade institute for glazing technology and window construction "*Technischer Beirat im Institut des Glaserhandwerks für Verglasungstechnik und Fensterbau*", Hadamar/Germany, and the technical committee of the federal association of the flat glass industry "*Technischer Ausschuss des Bundesverband Flachglas*", Troisdorf/Germany.

Assembly of insulating glass units in frames

The frame sealants set forth in the following have been tested for compatibility and cleared by Euroglas for use for SILVERSTAR FREE VISION T:

Permapack

Permabond 140 black, Permabond 145 black, Permabond 145 transparent

Dow Corning

DC 794 F



Products by further manufacturers are currently being tested.

CE marking

For the relevant data for SILVERSTAR FREE VISION T single glass, please see the Euroglas website at www.euroglas.com. For further determination of key glazing data, please use the calculation program glaCE which is also available on the above named website. The program also permits calculations of complex insulating glass constructions.



Assembly recommendations

In case of concrete or clinker facades, the design should ensure that for instance in case of any leaching of plaster, mortar or concrete occurs on the facade, such materials are prevented from being washed over the glass surface.

It is to be made sure before and during assembly that the coated glass surface is not mechanically damaged. During transport, unloading, storage and glazing, it is to be made sure that any coverings, interlayers, suction cups, tools, etc. are clean.

Before assembly, insulating glass coated with SILVERSTAR FREE VISION T has to be stored indoors in a dry place. During the construction phase, the glasses must be protected against splatters of lime, concrete, paint or cement. Suitable protection can be ensured by using e.g. foils or wooden coverings.

If any soiling occurs on the glass anyway, it has to be made absolutely sure that it is prevented from drying up or hardening and has to be removed with a sufficient amount of water and without using any further auxiliary means.

Cleaning after the construction phase

The frequency of cleaning depends upon the place of installation and the degree of soiling.

Normal soiling should first be rinsed with water to remove any hard solid particles from the coating. Afterwards, normal soiling can be removed by ordinary wet cleaning with water, sponge, cloth, chamois leather. It is important to ensure that any auxiliary means used are clean and free from solid residues. Standard neutral surfactants (glass cleaner) may be added to the water.

We recommend against attaching adhesive stickers or decorative foils to the coating as their removal may cause damage to the layer.

Unsuitable cleaning agents

All strongly alkaline suds and acids, particularly hydrofluoric acids and/or fluoride-containing cleaning agents, corrode the SILVERSTAR FREE VISION T layer and cause irreparable damage.

The general rule is (!):

- Do not use abrasive or corrosive cleaning agents or auxiliary means such as
 - o glass scrapers (razor blades)
 - o abrasive detergents



- steel wool (not even 0000 or finer)
- materials containing metal threads
- silicone-containing cleaning agents (e.g. 'Hara')
- Do not clean in dry condition and/or with dry equipment. Always moisten sponges, cloths, etc. with water before cleaning.

In case of non-compliance with technical instructions, the supplier accepts no liability and any resulting fault or damage shall be excluded from the supplier's warranty.

Nickel sulphide inclusions in the base glass

The glass manufacturing process may cause the formation of very small nickel and sulphide crystals in the glass. Such inclusions are referred to as nickel sulphide inclusions.

Such inclusions occur very rarely and mostly are not visible as their size is smaller than 0.2 mm.

Exposure to extreme temperatures may cause changes to the state and condition and thus the size of such nickel sulphide inclusions. This may cause an increase of tension within the glass and, in extreme cases, may result in breakage without any further external influence.

Such breakage is referred to as spontaneous breakage; this form of breakage occurs only in single-pane safety glass.

To minimise the risk of breakage in single-pane safety glass caused by nickel sulphide inclusions, we recommend to perform a Heat Soak test.

However, even heat-soak tested glass will always have a residual risk of spontaneous breakage.

We therefore recommend to use heat strengthened glass where that is possible within the individual building project. To our knowledge to date, no breakage caused by nickel sulphide inclusions has ever occurred in heat strengthened glass.

If the use of single-pane safety glass should be indispensable, we have hereby advised you of the risks involved.



Technical standards for glass in the building industry

DIN EN 356: Glass in building

Security glazing - Testing and classification of resistance against manual attack

DIN EN 410: Glass in building

Determination of luminous and solar characteristics of glazing

DIN EN 572-1: Glass in building

Basic soda lime silicate glass products. Part 1: Definitions and general physical and mechanical properties

DIN EN 572-2: Glass in building

Basic soda lime silicate glass products – Part 2: Float glass

DIN EN 673: Glass in building

Determination of thermal transmittance (U value) –

Calculation method

DIN EN 1096: Glass in building - Coated glass

DIN EN 1279: Insulating glass units.

DIN 1249-10: Flat glass in building, chemical and physical properties

DIN 1249-10: Flat glass in building – glass edges, edge shaping and execution

DIN EN 1863-1: Glass in building

Heat strengthened soda lime silicate glass

DIN EN 12150: Glass in building

Thermally toughened soda lime silicate safety glass

DIN EN 14179: Heat-soaked thermally-toughened soda lime silicate safety glass

ISO 9211: Abrasion, adhesion, solvent resistance

ISO 9022: Humidity, temperature

Complete texts and further provisions on glass in the building industry are available for instance at www.beuth.de.