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HANDLING GUIDELINES

GROGLASS ANTI-REFLECTIVE GLASS

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INTRODUCING GROGLASS ANTI-REFLECTIVE PRODUCTS

Groglass anti-reflective (AR) products are soda-lime, borosilicate or organic glass coated with metal oxides using a vacuum sputtering method. Combination of multiple layers of the coating reduces residual reflection to ~ 1%.

Because of the AR coating, fingerprints or stains are more visible on anti-reflective glass than on normal float glass. They can be easily removed following the instructions in the section "[Cleaning of Anti-Reflective products](#)". We recommend that Groglass anti-reflective glass is handled with extra care, especially during product processing, since fingerprints, dirt, imprints etc. can appear more pronounced. Physical handling should be minimized at every step of the processing process.

TRANSPORTATION, PACKING AND UNLOADING

Delivery can be made in the following packaging options: End Caps (max. 2,2 t), A-frame, Rocket frame, Crate or OSB box. Typically, Groglass anti-reflective glass stock sheets are delivered with separating powder as interleaving material. Upon customer request, 0.7mm thick low density polyethylene foil sheet interleaving material can be used.

When one-sided AR coated glass is delivered, the coated side is identified on the packaging. While processing, if possible, the coated side should be facing upwards to minimize the risk of damaging the coating due to scratching.

When stacking the glass products between processing steps, it is necessary to separate the glass panels with interleaving material. We recommend using polyethylene foil, clean paper, cork pads or cotton string. It is essential to minimize abrasive particles in the contact with the coating, therefore, it is suggested to use fresh interleaving material every time. Avoid any movements that may scratch the glass such as sliding the glass panels along the supporting surfaces.

The delivered glass must be inspected upon arrival. Groglass accepts no liability for faults arising after delivery or during handling, processing, or installation of the finished product. To minimize the risks, follow this procedure:

- Set glass vertically on the long edge and transport and store it in a vertical position.
- The rack must be positioned on a perfectly even surface.
- Use the appropriate handling equipment.
- The grab lift must be perfectly centered.
- Avoid damaging the packaging during handling.
- Ensure CLEAN rubber surfaces for vacuum lifters. We recommend using clean suction-cup covers (from cotton) to avoid coating damage.
- When picking up glass from an end-cap with vacuum-lifter, first, move the glass up only a small distance (~5mm), then move it carefully away from the other pieces of glass in the package and only then lift it completely up to take it out of the case. Picking glass sheets up immediately (without separation from other sheets) may result in scratching the coating.



Clamps, slings, lifting beams and other handling equipment must comply with prevailing regulations and be approved by the relevant authorities. Always ensure the safety of the personnel. Keep all unnecessary personnel out of the handling area. Wear appropriate personal protective equipment. Personnel must have received the required training.

STORAGE

Groglass anti-reflective glass can be stored 12 months indoors and max. 2 months outdoors in a dry environment. Glass should be installed in the final application no later than the maximum allowed storage time (depending on storage conditions describe above). After this period, no claims will be considered.

Racks used for packaging during transport are not designed to be used for storage. Consequently, the products must be stored on racks with spacers between the packages. Store the products correctly to reduce the risk of mechanical damage to the glass.

Care should be taken to avoid major fluctuations in temperature and humidity that may cause condensation on the glass. Water must not be allowed to come into contact with the sheets of coated glass. Care should be taken to ensure that ambient air is not polluted by any corrosive elements such as chlorine or sulfur. Sources of such elements include machinery fitted with heat engines and battery-charging points.

Store the glass in its original packaging. Restacking the glass even with the original interleaving material can introduce harmful dust particles between the panes, leading to potential damage of the coating.

HANDLING / CUTTING

When handling Groglass anti-reflective glass, always wear clean gloves that don't leave sweat, stains, grease residues or similar smears on the coating (rubber gloves or gummed gloves are OK, but] cotton or leather gloves are not recommended).

When working with one-sided coated glass products, the coated side has to face upwards on the worktable.

The worktable must be free from abrasive particles and other contaminants. CLEAN OFF the worktable before each new piece of glass (we recommend using a vacuum cleaner). Groglass anti-reflective glass can be cut dry or with an evaporating cutting oil (i.e. [ACPE 5503](#) from Aachener Chemischen Werke). The dose and atomization of the oil should be kept at the minimum.

Don't use high lubrication cutting fluids to avoid leaving irremovable stains. Always keep the cutting table clean and cutters sharp to reduce the incidence of scratches.

EDGE WORKING

Edges can be grinded, polished or beveled like any float glass. Wash the glass immediately after the wet edge work. The glass must be totally dry after washing (remaining water on the glass causes water spots as it dries).

WASHING

Glass cleaning devices with cylindric brushes (equipped with soft brushes) are suitable for Groglass anti-reflective glass. Bristles of diameter <0.15mm and 20-40mm of length should be used. Be careful with 0.5 mm thick bristles and plate-bristles (normally used for a hard pre-cleaning), as they can scratch the glass. Therefore, clean without plate-bristles.

The glass products must be washed with warm (about 40°), clean, deionized water with pH of 7 (+/-1) and conductivity of <30 µS/cm. No hard particles (such as calcium) or acidic/detergent agents should be present in the water used for washing as these may damage the coating.

If high-lubrication cutting fluids have been used before, it may be necessary to perform cleaning procedure on the washing machine and corresponding conveyors to get rid of excess oils and contaminants to get pristine washing results and a clean surface finish.

Groglass anti-reflective glass should not be left in the washing machine. After washing, please immediately dry the anti-reflective glass. Water left on the glass causes water spots.

CLEANING OF ANTI-REFLECTIVE PRODUCTS

Fingerprints and dirt can be wiped off with ammonia-free aqueous solution, neutral and weakly alkaline window cleaner without abrasive substances and a clean, dry, soft cotton or microfiber cloth. Do not use rags, tools or cleaning detergents which scratch or scour. Isopropanol mixture with deionized water also can be used as a cleaning agent.

Products NOT to use:

- Do not use strong alkalis, acids, detergents with fluoride, ammonia, or solvents as they will damage the coating.
- Do not use detergents with mechanical devices (sand etc.) or other mechanical millinery.
- Do not use blades; steel blades may hurt the surface and cause scratches.

PRINTING ON GLASS

When printing on the uncoated side of a single-sided AR glass, any print method can be used, including ceramic enamels, organic paints and UV cured paints (AR coating can block the UV radiation needed for curing, therefore illumination should be performed from the printed side).

When printing on the AR-coated side, not all ceramic enamels are compatible with sputtered coatings. This is especially noticeable with black paint – by using wrong enamel, the printed area becomes hazy grey, instead of deep black. We recommend using “Pemco DV175140” paint. Other enamels might work, but we cannot guarantee the optimal result.

Minor surface printing (e.g. frame printing for electronic displays) can be performed on the surface #1 of two-sided anti-reflective glass. When printing is performed on surface #2 (the surface facing away from the viewer), some distortion of reflected color will occur when viewing the printed area. One-sided coated glass can be printed on either side. Please contact Groglass with any questions and clarifications.

MANUFACTURING OF INSULATION GLASS

Insulation glass, consisting of two Groglass anti-reflective coated glass sheets, can be built together as it is. It is not necessary to remove the coating on the border, because two-component sealings like polyurethane, polysulfide or silicone connect well with Groglass anti-reflective glass, according to our test results. The only exception is Soft Low E AR glass, which requires edge deletion.

Please ask your sealant producer to confirm tests with Groglass anti-reflective glass. It is necessary to test sealants (which haven't been tested by Groglass) together with the producer – against adhesion, water-resistance and climatic-shocks (DIN 1286 part 1).

Processing recommendations:

- Unpack carefully to avoid scratching the glass.
- Wear clean gloves not to leave fingerprints.
- To minimize the chance of damaging the coating, don't touch the glass surfaces with any objects.

- Protect the coated surfaces from aggressive materials such as silicone, grease, oil, adhesives, aluminum, paint, glues, lubricants, cement, mortar, glue, paint, varnish plaster, fragments or sparks of welding/grinding devices.
- Clean all excess sealant from the glass immediately after the unit is complete.

Note: Do not write (e.g. with crayon or felt-tip pen) or put stickers/tape on the coated side of glass.

MANUFACTURING OF LAMINATED GLASS

For manufacturing laminated glass, one-side coated Groglass anti-reflective glass is used. The Groglass anti-reflective coating needs to be on the #1 and #4 surfaces. As stated before, look for markings on packaging for the uncoated side. *The uncoated side of one-sided anti-reflective glass has a higher reflection, e.g. place a white paper against the glass, or look through the edge to observe the reflectance.*

Laminating Groglass anti-reflective glass:

- Refer to the washing instructions in Section 6.
- Ensure that the transport rollers are clean.
- Devise a marking system where the operator can clearly identify the coated versus uncoated sides.
- Remove any marks or stickers after having laminated the pieces of glass.
- To reduce the risk of scratching, the coated side should, if possible, face upwards.

Pre-compound-pressing:

- In this process, the AR-coated side of the glass must be facing outwards. The surfaces of the rollers should be cleaned frequently. It is necessary to control and clean the rollers regularly.
- Fast rolls (passage from slow pressing to fast transportation) can damage the coating.

In the autoclave:

- Use suitable distance-holders. Cork distance-holders will leave stains on the glass.
- Otherwise, handle the Groglass anti-reflective glass like normal laminated glass in the autoclave.

THERMAL TEMPERING

Both one and two side coated Groglass monolithic anti-reflective glass can be tempered. The glass and the furnace must be clean. It is necessary to work at a determined temperature and maintain intervals to prevent destruction of the coating and glass.

Processing recommendations:

- Groglass anti-reflective glass have different heat exchange dynamics than regular float. Processing parameters should be adjusted accordingly.
- Grind or polish the edges of anti-reflective glass before tempering.
- The coated side of one-sided coated anti-reflective glass should face up.

- Two-sided Groglass anti-reflective glass must be absolutely clean and dry, transported on clean rollers. Water stains and dirt are NOT allowed on the glass, as they can “burn into the glass” during the tempering.
- To ensure that the coating doesn’t crack („cobwebbing“, crazing), adjust the temperature of the top, bottom and the cycle time of the furnace to ensure an even distribution of heat.

Recommended tempering conditions:

- Start with standard tempering parameters used for regular float or low-iron glass (typically low-iron glass requires higher temperature);
- If cracking appears, reduce the temperature in 10C° increments while increasing time in furnace or/and raising the quench pressure or/and reducing the quench air temperature.
- Experiment with placing glass on a different side (except for Low E glass).
- To avoid glass breakage in the furnace, ensure the exit glass temperature (in the center of the glass sheet) of at least 640C° for regular float and 650C° for low iron glass. If the glass doesn’t break, lower the temperature further until cracking disappears or glass starts breaking.

It is difficult to make a precise guideline for different furnaces, because the measurements of the temperature and the placements of these measurements are different. Be especially careful with thermal tempering of glass with holes or edge-outbreaks.

CHEMICAL TEMPERING

Groglass has a product that can be chemically tempered. This product is available in both single- and double-sided AR configurations. The AR coating does impede the ion exchange process, therefore, tempering time should be increased. We recommend 435°C to 450°C temperature and approximately 30% longer tempering time than for regular soda-lime float glass.

ANGLE OF VIEW

Groglass anti-reflective glass must be viewed at near normal (perpendicular to the surface) angle of incidence. Sometimes, under special light conditions and angles of view, one can see small differences in the reflection and small iridescent light effects. These effects are inherent to the manufacturing process of Groglass anti-reflective glass and are not subject for a claim.