SAINT-GOBAIN

EKO®ENERGY

Processing Guidelines

SAINT-GOBAIN GLASS

EKO®ENERGY

Processing Guidelines

SGG-QD-C-GUI-0020-ASGGQD-C-GUI-0015-B; March,23

SAINT-GOBAIN

Content

1. GENERAL

1.1. Product description

EKO®ENERGY is a heatable coated glass for industrial refrigeration developed to a specific market for climates with high temperature and high humidity as in South of USA, Central and South Americas. Two main applications were identified:

- Beverage coolers (DGU with internal cabinet temperature between -5°C and +5°C)
- Freezers (TGU with internal cabinet temperature below -20°C)
- There are 2 different coatings available in the **EKO®ENERGY** range, **EKO®ENERGY 75** and **EKO®ENERGY 255**. For more details, please see the technical data sheet.

The product is not designed to be used in residential or façade applications, **the aim of the product is to avoid condensation on the external face of the cabinet.** It is manufactured by vacuum cathodic sputtering of several metallic and ceramic layers on PLANILUX® clear glass.The coating can be heated due to a connection to an electrical circuit, through a contact between the coating and a busbar connector printed on the coating. See §3.13. It is manufactured by vacuum cathodic sputtering of several metallic and ceramic layers on PLANILUX® clear glass.

The product covered by this guideline is “to be tempered”. This product cannot be used in annealed form since it acquires its characteristics during the tempering process.

Contact your sales representatives for more information or please refer to our commercial documentations in our website **https://mx.saint-gobain-glass.com/es-MX.**

To improve customer satisfaction, we constantly improve the quality of our coatings. This could lead to improvement in the processability of our coating, so please make sure you have an up-to-date version of the processing guidelines.

1.2. Thickness and dimensions

EKO®ENERGY is available in 3.15mm thickness and in standard sizes (in case of other thickness specification, please contact your sales representative). For more details, please refer to the relevant product documentation from Saint-Gobain Glass or contact your local sales service.

1.3. Quality criteria

Without prior agreement between both parties, the standard EN 1096-1 will apply.

1.4. Position of the coating and identification of the coated face

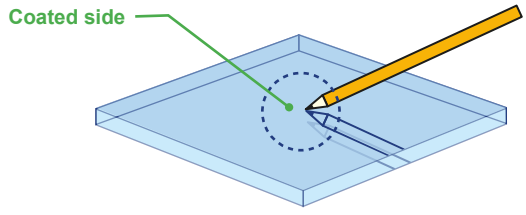
1.4.1. Position of the coating

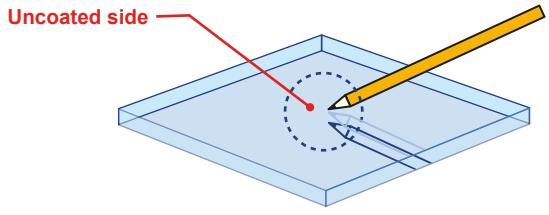
EKO®ENERGY products have been designed to be assembled in IGU with the coating facing the inert gas/air cavity surface 2.

EKO®ENERGY can be combined with one additional Low-E coating in face 3 in case of DGU. In case of TGU, it can be combined with additional Low-E coatings in face 3 and/or face 5.

1.4.2. Identification of the coated face

The coated side of a **EKO®ENERGY** is generally easy to identify as it exhibits a recognizable color shade. Otherwise, coating detectors can be used. Information is available from your local Technical Support Manager (TSM).





2. TRANSPORT, ACCEPTANCE, STORAGE AND HANDLING

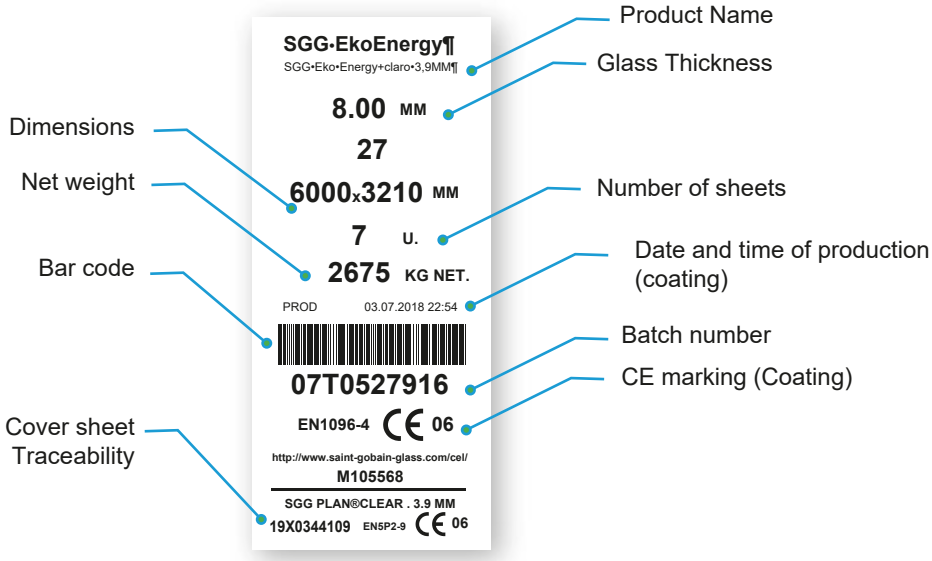
2.1.Transport

- Coated glass sheets are usually transported in 2.8 ton packs (jumbo or split sizes).
- Glass sheets must be transported vertically.
- The individual sheets are packed with the coated side towards the inside of the frame unless otherwise requested by the customer.
- The glass panes never come into direct contact with each other: the glass sheets are always separated by neutral polymeric powder.
- In each pack, a clear 3.15mm float glass pane is placed as the first sheet during loading to protect the first coated glass sheet.
- The pack and its contents must be protected from water.
- If the glass is wrapped and sealed, the seal should remain closed until the product is used in the factory.
- During transport, violent and repeated shocks should be avoided.
- When handling with a hoisting apparatus, measures must be taken not to damage the pack.

2.2. Receipt of the delivery

Care must be taken concerning the orientation of the coating that has been ordered. Please check it before starting processing.

- Every pack must be opened with care in order not to damage the glass sheets or the coating(s) (contacts, scratches, etc.). Handling instructions on the packing must be respected, particularly the instructions for opening.
- Before processing, glass sheets should be checked in accordance with the specifications defined above. Any possible defect in the coating must immediately be reported to the supplier, accompanied by:
    - The date of delivery.
    - The data mentioned on the identification label.
    - All deliveries are identified with a label providing the following data:



2.3. Storage

2.3.1. General

All glass products may degrade (become stained or corroded) when stored in humid conditions. The iridescence may take the appearance of a "rainbow" or milky white haze on the surface of the glass, or corrosion pitting on the coated side.

EKO®ENERGY glass sheets must be stored, as float glass, vertically (at 3 to 7 degrees) under the following conditions:

- In a dry, well-ventilated warehouse, to prevent any condensation on the surface.
- Away from glass dust.
- Protected from rain and running water (e.g. any roof leakage must be rectified).
- Never outside or in the open air (even when packed).
- Protected from wide changes in temperature and humidity levels (coated glass products should be stored far from opening doors).
- In case the coated glass is delivered packed (aluminum, PE):
  Before breaking the seal, to avoid condensation, one should ensure that the temperature of the pack has reached the temperature of the environment of the warehouse.

2.3.2. Shelf life

If the above (§ 2.3.1) storage conditions are respected, **EKO®ENERGY** is guaranteed for two months from the date of reception at the customer's premises if the glass is not sealed. Only sealed (peripheral protection tape) packs can be stored until 6 months and when open, glass have to be processed in coming 2 months.

In case the date of reception is lost by the customer, the date of the delivery note will serve as evidence. A first-in-first-out (FIFO) system must be adopted.

2.4. Handling

- **EKO®ENERGY** coated glass sheets must be handled with dry, clean, and appropriate safety gloves.
- In case handling operations with vacuum cups on the coated side cannot be avoided, make sure that the vacuum cups are perfectly clean. Not all solutions are suitable for cleaning vacuum cups, see manufacturer documentation for details. A sheet of interlayer paper (acid and chlorine free, thin, soft, and air-permeable) or suitable suction-cups caps can also be placed on the coated side, between the vacuum cups and the surface, but care must be exercised as this may reduce the vacuum level (especially in the case of thick and heavy panes).
- Each coated glass pane must be released from the next pane before being lifted from the pack. Any relative movement of the coating with the next glass pane must be avoided.
- Automatic unstacking of glass sheets or removal using a glass clamp is possible, but the gripping area should be kept to a minimum and condemned from the cutting pattern.
- In case of doubt, the position of the coating must be checked (see § 1.5.2). Do not place the coating in contact with a rough surface or hard objects.
- Try to avoid wiping the coating. If necessary, the coating may be gently wiped with a soft dry cloth and a suitable solution (e.g., isopropyl alcohol (IPA)).
- When stacking cut sizes prior to further processing, separate the panes by either:
  - New cork pads (recommended).
  - Foam pads.
  - Avoid stacking glass panes with hard polystyrene spacers.
  - Don't put pads in the top and bottom busbars area to avoid surface contamination or scratches.

3. PROCESSING OF EKO®ENERGY

3.1. Handling on the production lines

All the recommendations outlined in § 2.4 remain valid.

- Ensure, as much as possible, that the coating does not come in contact with guide rollers on the line; the coating must be turned towards the operator when facing the line. If it has to go through, make sure the conveying belts are perfectly clean and free from any abrasive material / particle.
- Hoisting and handling instruments, tools and vacuum cups must be kept perfectly clean (or covered with adapted caps) so as not to leave traces on the coating.
- Wear dry and clean safety gloves when lifting the glass sheet manually. Limit area of contact as much as possible.
- The coating must be protected from any contact with greasy substances.

3.2. Glass cutting

EKO®ENERGY is cut in the same way as any other ordinary coated glass. However, the following recommendations have to be respected:

- The cutting table must be clean to avoid scratches on the bottom of the glass.
- Cutting must be done with coating face up.
- Any irregularity or damage of the edges must be avoided since it is likely to increase the risk of breakage during the toughening process.
- Use only light vaporizing cutting oil (for instance Acecut 5503 or 5250) adapted to coated glass.
- Do not dilute or mix the cutting oil.
- Avoid all excess of cutting oil: Max width: 1 cm.
- For cutting operation, avoid using natural latex coated gloves as latex tends to dissolve in cutting oil. This leaves a greasy residue on the coating which may be difficult to wash in the industrial washing machines. Grade 5 leather or PU palmed gloves as well as NBR nitrile dipped gloves should be preferred;
- Cutting templates can be used but great care must be taken not to scratch the coating. Soft protection (soft tissue, felt or cork pad) should be placed underneath the template;
- Avoid glass splinters between glass panes. Fine glass splinters on the coated surface should not be wiped off by hand, but blown off by dry and oil-free air;
- When stacking cut sizes prior to further processing, separate the panes by either:
    - New cork pads (recommended).
    - Foam pads.
    - Avoid stacking glass panes with hard polystyrene spacers.
    - Don't put pads in the top and bottom busbars area to avoid surface contamination or scratches.

This is especially important with glass of different dimensions. Do not put additional separating powder.

- The use of so-called "harp carts" to store the cut sizes must not be used as the contact of the wires on the coating may damage the latter when the cut sizes are pulled from or pushed in between the wires.

3.3. Edge deletion

EKO®ENERGY must be edge deleted whatever the configuration of use.

- The removal of the coating from the edge of the individual panes is absolutely essential for all **EKO®ENERGY** panes processed into double or triple- glazed untis, to achieve secondary seal bond strength.
- The width of the removed coating edge should be adjusted to the depth of the secondary seal – the aim is to ensure that the deleted strip reaches at least the center of the butyl bead.

- This bead should not be completely on the coating. In any case the edge deletion width must be at least 10 mm.
- For **EKO®ENERGY** edge deletion can be done before of after heat treatment.
- The coating may be removed manually or automatically. The edge deletion can be performed with suitable grinding machines either on the cutting table, stand alone or as part of the double-glazed unit line, operating horizontally or vertically, using a normal grinding wheel.
- For wide edge deletion, manual grinding, or several passes with normal edge deletion equipment can be done. In this case, be aware of the aesthetics of the edge deleted area.
- Take care that grinding dust is sucked away to avoid scratching.
- Any coating trace perpendicular to the glass edge must be totally prevented.
- Check the quality of the edge deletion with a coating tester or visually by placing a sheet of white paper behind the glass.

3.4. Edge working

It is good practice to edge work the glass directly after cutting. Provided the glass is stored under above defined conditions, the glass must be edge worked within 24 hours from cutting.

- Wet edge-working: it is essential to keep the glass fully wet during the whole grinding process and to wash the glass directly afterwards so that the grinding water is not able to dry on the coated surface.
- Dry edge-working: such processing is generally not recommended as small glass dust particles may be sprayed on the dry coated surface. In case of use, make sure the suction is powerful enough to avoid a too important dispersion of dust.

3.4.1. Manual Edge Working

Generally carried out using manual cross belts to achieve arrissed edges (100 - 120 grit belts are recommended):

- The top belt should run downwards to minimize grit deposited on the coated surface.
- Horizontal roller backstops can be fitted to ensure consistent pressure and arriss width.
- The glass should be handled (with glass dust free gloves) at the edges to avoid damaging the coating.

3.4.2. Automatic Edge Working

It is possible to grind the coated glass on vertical, CNC and double edger machines provided that the handling instructions are observed and adaptations of the machines are made (if necessary, contact your local Technical Support Manager). For double-edger and vertical machines, cleanliness and perfect synchronization of the pressure belts must be checked.

3.5. Drilling

The drilling of **EKO®ENERGY** has not been validated. If necessary, contact your local Technical Support Manager - TSM.

3.6. Washing

It is recommended to wash the glass immediately after edge working. In case **EKO®ENERGY** is submitted to several processing steps (edge working + grinding +...) each of them followed by washing, it is recommended to pass the cut sizes in the same direction for each washing phase (to avoid possible generation of multiple crossed scratches).

We recommend the use of the following installation. If the washing installation differs from the one described here, we recommend that tests be carried out to check the washing quality (traces, rings, dust, etc.) and to ensure that the installation does not damage the coating. Please contact your local TSM.

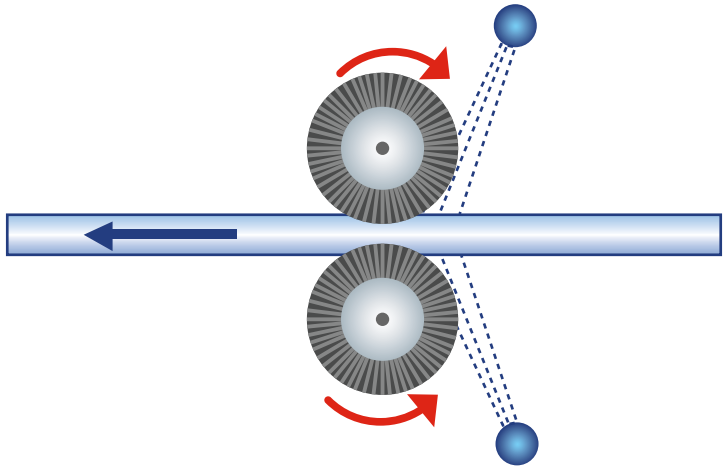
- Pre-washing area:
  - Prewash ramp followed by one pair of cylindrical brushes.
  - Tap water between 30 and 40°C, preferably close to 40°C, without any detergent.
  - The prewash ramp is particularly important for the removal of the glass dust and splinters created during the edge-working process.

- Washing area:
  - 2 pairs of cylindrical brushes.
  - Demineralized water at temperature between 30 and 40°C.
  - Maximum chloride concentration 3mg/L.
  - PH value comprised between 6 and 8.

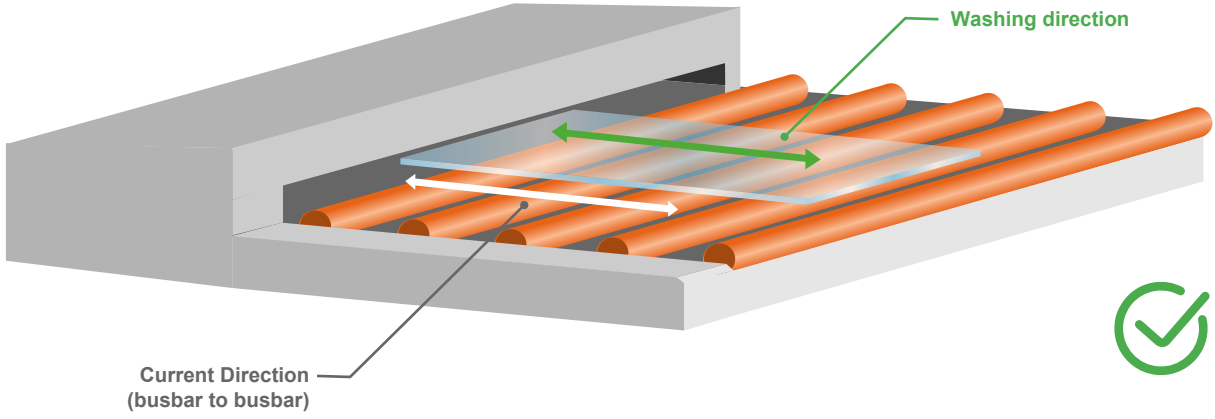
- Rinsing area:
  - Demineralized water at room temperature.
  - Maximum conductivity 20 QS/cm.
  - Maximum chloride concentration 3mg/L.
  - PH value comprised between 6 and 8.

- Brushes:
  - Flexible (soft) clean polyamide bristles
  - Maximum diameter of 0.2 mm and 20 - 40 mm long.
  - Take care that all the brushes are perfectly clean and regularly maintained. Any hard brush must be lifted. Failing to do this may cause scratches.
  - Compatible rotation speed with soft coatings.

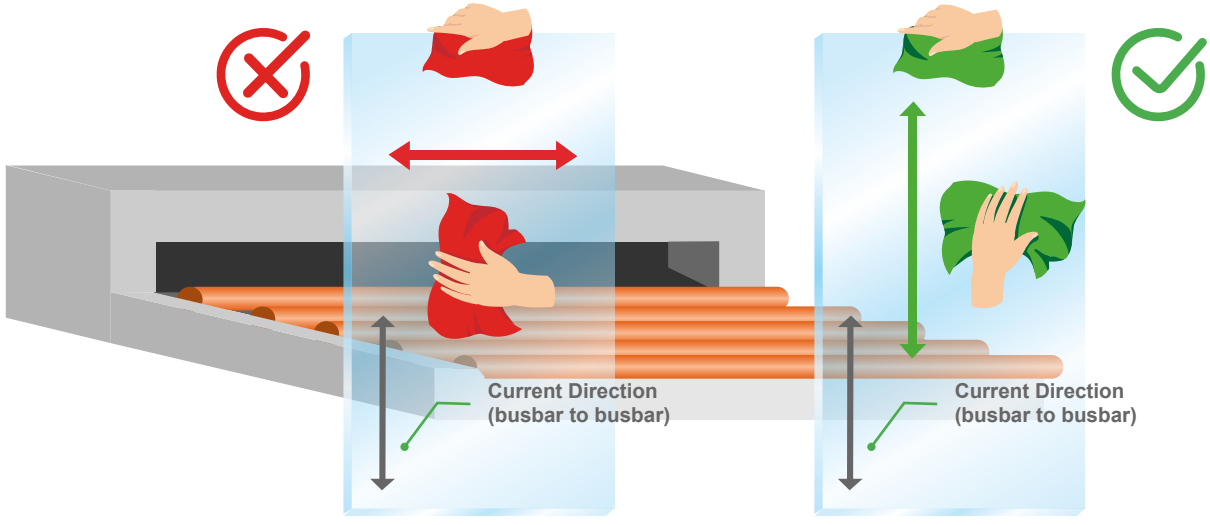
- Drying:
  - Use an air-blowing installation equipped with filters.
  - Clean and regularly maintained filters.
  - Water should be sprayed directly onto the glass, not onto the brushes (as per below drawing.
  - The glass sheet does not stop inside the washing machine. The washed panes should not remain in the washing unit for any length of time, especially not while the brushes are rotating.



- No water must remain on the coated surface after the drying process
- It is strongly recommended that the washing machine is regularly cleaned, especially for the brushes and in areas where demineralized water is used. Clean the filters every day, and the tanks every week. For the brushes, steam cleaning gives good results, but do not spray the bristles with high temperature and high pressure water.
- For interim stacking of washed panes, use cork pads near the edge of the sheets. Stacking with clean strips of 2mm thick polyethylene foam film is also possible.
- As **EKO®ENERGY** will be tempered, it is of the highest importance that no residues or marks are left on the coating surface after the exit of the pre-processing washing machine. Pollutions left on the coating may induce hot corrosion (giving the aspect of pinholes) of the coating in the tempering furnace. Such marks may not be washable.
- Avoid to wash glass panes perpendicularly to current direction (busbar to busbar direction).
- Washing direction parallel to the current direction (busbar to busbar direction).



- Manual drying is not recommended, it could be a source of scratches disturbing the final function of the product, in any case, drying movements by the operator should be also parallel to the current direction (busbar to busbar direction).



- In case dirt / stains are still present on the coating after the washer, cleaning may be performed using a soft cloth and isopropanol (IPA) or ethanol followed by rapid drying, provided this is done carefully and immediately after contamination has occurred. Please contact your local TSM.

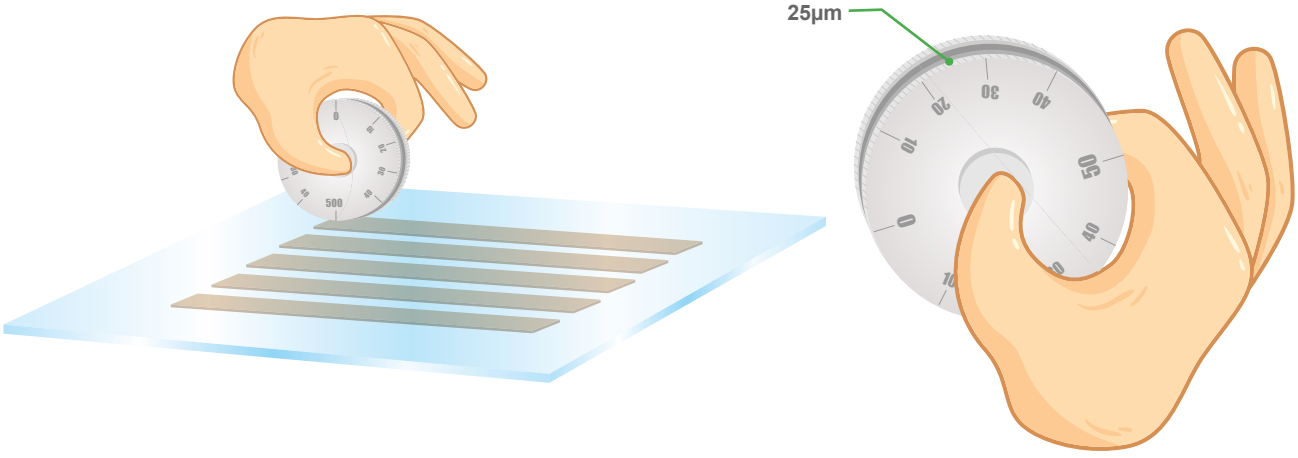
3.7. Screen printing

Saint-Gobain Glass cannot commit on the enamelling of any **EKO®ENERGY** product. The capability to supply enamelled **EKO®ENERGY** glazing would be on the processor's sole responsibility.

Saint-Gobain Glass recommends to connect **EKO®ENERGY** busbar with silver paste. Contact your supplier for validation of the application. You can also contact your local TSM.

- Use a roller mixer to homogenize the silver paste in order to avoid bubbles in the silver paste and silver sedimentation (ie: allows to have constant silver paste viscosity and silver content with time, as shown in the picture below).

- Use a clean 77 yarn sieve for screen print and perform regularly cleaning before paste application.
- Use a large enough screen with the two busbars to avoid turning the glass between both busbars screen printing.
- Use dedicated screen for each model with the good busbar design.
- Measure the busbar thickness after screen printing with Erichsen wheel. Typical thickness for this application is about 25 micrometer in wet condition.



3.8. Tempering / Heat-Strengthening

3.8.1. General

EKO®ENERGY must be heat-treated to get a tempered flat coated glass. These coatings are designed to withstand the heat-treatment process. During the process, the color and the spectrophotometric / thermal characteristics change.

3.8.2. Prerequisites for tempering / heat-strengthening

The cleanliness of **EKO®ENERGY** coating before entering the tempering furnace is essential. From the exit of the washer to the entrance of the tempering furnace, only the use of perfectly clean gloves should be permitted.

Special care and attention must be taken at every stage of processing, in particular before and during the toughening process. Please consult your local TSM if necessary. Washed panes should be tempered within 24 hours after washing. Follow recomendations in section § 3.6. for washing and cleaning.

3.8.3. Toughening instructions

From a general point of view, tempering of **EKO®ENERGY** can be carried out using appropriately adjusted furnace settings. This will obviously vary depending upon the type of furnace being used. The sheets should be handled as “cold” as possible to achieve a flawless coating after tempering and obtain the desired level of stress (breaking pattern). This means that the temperatures and heating times are set so as just to avoid breakage in the blower box and to meet the requirements for single-sheet safety glass.

- The sheets are always tempered with the coated side upwards, never place the coating against the furnace rollers.
- The emissivity has to be taken into consideration when tempering **EKO®ENERGY**, being much closer to float glass than low-E coating.

  EKO®ENERGY 75 = 45% emissivity
  EKO®ENERGY 255 = 75% emissivity
- Convection furnaces are recommended for the heat treatment of **EKO®ENERGY**. Use of thermal scanner is recommended to help adjustment and follow up of production. Contact your local TSM for the adjustment of the appropriate settings.
- Note: the high convection furnaces give much faster cycle times as well as improved optical quality of the end-product.
- Do not use SO2 in the furnace when tempering **EKO®ENERGY**. Stop SO2 at the right time as SO2 may remain in the furnace for up to 48h.

3.9. Heat-Soak testing

Heat soaking of toughened **EKO®ENERGY** cut sizes has not been validated. If necessary, contact your local Technical Support Manager - TSM.

3.10. Bending

The bending of **EKO®ENERGY** has not been validated. If necessary, contact your local Technical Support Manager - TSM.

3.11. Handling of heat-treated glass

Following toughening / heat-soaking or heat-strengthening, each pane should be separated with cork pads. It is also possible to stack the individual panes with strips of 2 mm thick polyethylene – stretch – foam film (in that case, particular care should be taken when stacking different glass dimensions).

- Glass panes must be stored vertically (at 3 to 7 degrees) under the following conditions:
    - In a dry, well ventilated store, to prevent any condensation on the surface;
    - Protected from rain and running water (any roof leaks must be rectified);
    - Never outside or in the open air;
    - Protected from wide changes in temperature and humidity levels (store coated glass products far from opening doors).
    - New cork pads (recommended).
    - Foam pads.
    - Avoid stacking glass panes with hard polystyrene spacers.
    - Don't put pads in the top and bottom busbars area to avoid surface contamination or scratches.
- Clean, dry and soft gloves must be worn for all handling.

3.12. Washing

The coated glass must be washed before making it into insulating glass units. Recommended washing conditions are described in § 3.6.

3.13. Electrical connection

Saint-Gobain Glass cannot commit on the soldering of any **EKO®ENERGY** product. The capability of the soldering process would be on the processor's sole responsibility.

Saint-Gobain Glass encourages a prototype manufacturing to validate functionality of the product. Contact your local Technical Support Manager - TSM.

3.14. Manufacture of Insulating Glass Units

It is recommended to assemble the panes in insulating glass units as quickly as possible and within 24 hours in storage conditions as described in section 2.3.1. When manufacturing double glazed units using **EKO®ENERGY** please follow the handling, cutting, and washing instructions detailed above.

The coated glass must be washed before making it into insulating glass units. Recommended washing conditions are described in § 3.6.

- In case the coating has to be placed against the rollers / conveyors, make sure they are all free of glass particles and free to rotate;
- All types of secondary seal can be used (polyurethane, polysulfide, silicone and hot melt).

The IGU unit should respect the electric safety standards for the country of installation, for example the type of spacer used for the IGU is important (electrical issues, etc).

3.15. Processing quality checks

It is the responsibility of the processing plant to define and adjust the quality process control to match the quality standards acceptable for its own market and in respect of relevant national requirements.

- **RECEPTION:**

Control of delivery document of the coated glass supplier. Visual inspection of the packs (breakages, condensation...);

- **AFTER CUTTING:**
  - Visual aspect control (scratches, oxidation/corrosion, splinters etc.).
  - Normal control of the cutting quality.

- **AFTER GRINDING / WASHING:**
  - Visual aspect control (scratches, oxidation/corrosion, splinters etc.).
  - Visual control (as to whether the pane is completely dry).
  - Check for suction cups or cork pad marks etc.
  - Normal control of the grinding quality.

- **AFTER EDGE DELETION:**
  - Check that edges are evenly removed.
  - Use a coating detector to make sure that the coating has been fully removed.

- **AFTER SCREEN PRINTING:**
  - Visual check of the busbar uniformity (no scratches, lines, voids).
  - Check that the busbar measures matches the drawings.
  - Thickness measurement of wet enamel

- **PRIOR TO TOUGHENING (OR HEAT-STRENGTHENING):**
  - Check for glass splinters (if present, remove them by rewashing).
  - Check for marks, dirt... If any remove them by gently wiping the coating with a soft cloth and IPA.

- **AFTER TOUGHENING (OR HEAT-STRENGTHENING):**
  - Visual aspect control (burns, cracks, scratches, oxidation/corrosion, haze...).
  - Optical quality (distortion, bow etc.).
  - Visual detection of roller wave.
  - Normal control of the toughening quality (break pattern etc.).

- **AFTER SOLDERING / ELECTRICAL CONNECTION:**
  - Test pin soldering electrical connection robustness.
  - Visual aspect of the soldering position within the busbar area.

- **AFTER HEAT-SOAK TESTING:**
  - Visual aspect control (scratches, oxidation/corrosion, splinters etc).
  - Check that no damage has been caused by separating blocks.

- **ON THE INSULATING GLAZING UNIT LINE:**
  - Visual aspect control in conformity with the relevant national quality standard for double-glazed units.
  - Check the final performance of the IGU (heating performance, total resistance, etc).

For plants just starting to use coated glass products, a system of "first off" inspection after each process can be useful until experience is gained. Operator training and experience in identifying faults (which are often difficult to see, especially before toughening) is important. In any case, a visit from your local TSM should be organized.

4. ENVIRONMENT / WASTE GLASS / HEALTH ISSUES

EKO®ENERGY coated glass product can be disposed of as per clear float glass.

Edge working residues have to be continuously and completely collected during the grinding process. These residues must be further treated in compliance with national legislation about industrial wastes. In some legislation, residues from grinding process have to be treated as toxic wastes.

As for any dust coming from the grinding process, any inhalation or skin contact of these residues must be avoided. On request, a Safety Use Instruction Sheet (SUIS) relating to the EC Directive 91/155/EEC can be supplied.

The IGU unit should respect the electric safety standards for the country of installation, for example the type of spacer used for the IGU is important (electrical issues, etc).

5. GLAZING INSTRUCTIONS

Framing

It is the responsibility of the processor to ensure the compatibility of its framing materials with **EKO®ENERGY**. The use of clean and adapted gloves (see §3 .2) is recommended to handle **EKO®ENERGY** single glass during IGU assembly.

6. PROTECTION, CLEANING AND MAINTENANCE OF THE END PRODUCTS

6.1. Removal of labels and markings

- On cut-sizes, the label is to be found on the face opposite to the coating.
- The identification labels on the glass sheets must be removed before or immediately after installation. Do not use sharp tools for this purpose. Acetone and alcohol are the approved solvents.
- To indicate the presence of the glass sheet, do not use materials such as lime, chalk or soap on the coating. If warning signs must be placed, we suggest fixing a notice or streamer to the frame, making sure they do not touch the glass.

7. DISCLAIMER

SAINT-GOBAIN GLASS has taken every reasonable measure to ensure that the information contained in the present leaflet was exact at the time of its publication.

However, SAINT-GOBAIN GLASS keeps the right to modify or add any information without previous notice. SAINT-GOBAIN GLASS is not liable for the possible lack of information on **EKO®ENERGY** product that would not be contained in the present document.

No claim can be accepted for damages caused during and after processing due to a lack of adherence to these guidelines. Therefore, glass processor should ensure that the process is adapted for coated glass and that the quality control is relevant to detect any quality problem as soon as possible. In case of claim, samples will be required and a visit from a SGG representative may be requested.

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