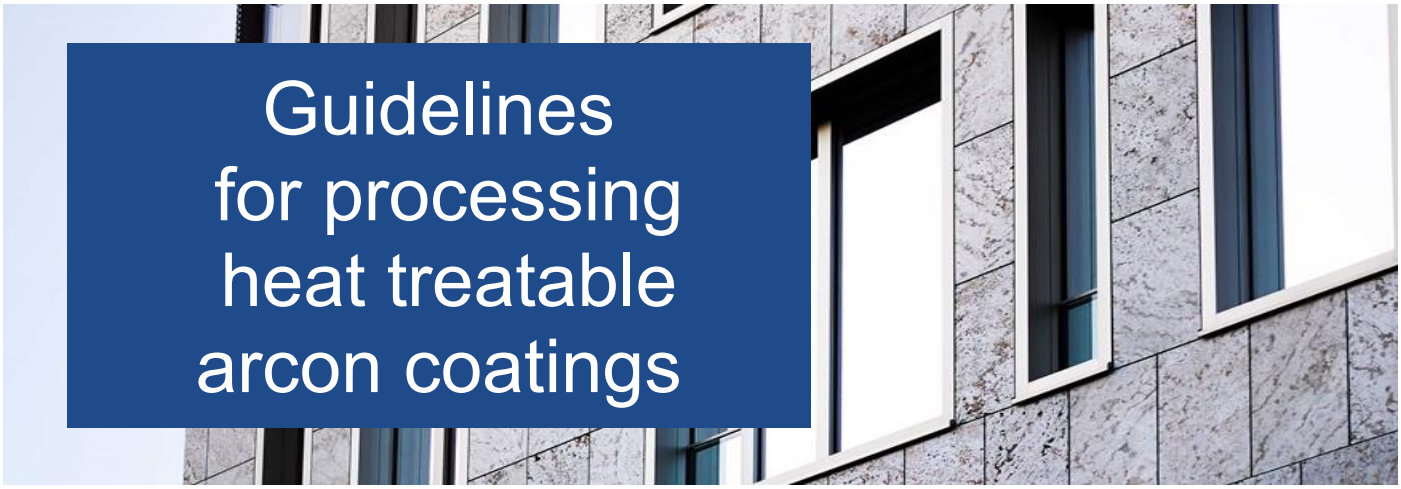
CUSTOMER INFORMATION



Guidelines for processing heat treatable arcon coatings

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arcon perfektion in glas

1 Introduction

Heat treatable glass products by arcon are produced by the magnetron sputter process. To improve the desired mechanical (bending tensile strength) and thermal (thermal shock resistance) properties of the glass, the coated glass is thermally treated.

Heat treatable arcon coatings are marked with “HT” (“heat treatable”) or oHT (“optional heat treatable”) and include the products listed in table 1.

tab. 1: heat treatable and optional heat treatable arcon coatings

Silver-containing coatings for use in insulated glass units (IGU)	Resistant coatings, can be used monolithically
arcon sunbelt A41 HT	arcon sunlite grey 45 oHT
arcon sunbelt A51 HT	arcon sunlite grey 65 oHT
arcon sunbelt A61 HT	arcon sunlite silver-grey 25 oHT
arcon sunbelt A71 HT	arcon sunlite bright oHT
arcon sunbelt E71 HT	
arcon N10 HT	
arcon N34 HT	

To process heat treatable glass products for their best performance, processing guidelines as detailed in this document must be followed.

The period between cutting – tempering – IGU assembling should be as short as possible and must not exceed 48 hours.

This document contains processing guidelines including information on specific steps for surface detection, handling and storage, glass cutting, washing, heat-treating, insulating and storage.

This document is permanently reviewed and updated. Ignoring and non-compliance can result in damage to coated surface.

Furthermore, regulations given in “Technical Specification for arcon Coatings” as well as requirements for uncoated glass have to be taken into consideration.

2 Package and storage

Heat treatable glass products by arcon are delivered in all commonly used packages. Sizes are available in jumbo stock sheets 3210 mm x 6000 mm and in split sizes of 3210 mm x 2250 mm. The available thicknesses are 4-, 6-, 8-, 10- and 12-mm float.

The first pane in the package is an uncoated float pane that is used for protecting the coated surface. The subsequent panes are positioned in a manner that the coated surface faces the first float pane. The position of this float pane is clearly marked on the package label according to the customer’s request (on the front or rear side). A special powder (PMMA type with qualified grain size) is applied as a separating agent between the individual panes to avoid damage during the transport.

All heat treatable glass products by arcon must be stored in constant conditions. Relative humidity may not exceed 70 per cent. All heat treatable glass products by arcon must not be exposed to condensation. Open air storage must be avoided.

A sufficient distance to washing machines, external doors and chemicals (e. g. NaCl, HCl intended to be used for water preparation plants) must be maintained.

Heat treatable glass products by arcon can be sealed for long transport distances to avoid condensation on the exposed glass surface and inside a glass pack during transport. The foil must be removed after acclimatization to the hall environment, and the glass stacks must be checked carefully during incoming inspection. As moisture or wetness can affect the coating and the coated surface can become corroded, affected glass should be processed timely.

Obvious damages and defects must be reported to arcon immediately, as subsequent claims cannot be accepted.

Heat treatable glass products by arcon can be stored under normal conditions up to 6 months. Opened stacks should be processed within 2 months. However, first in first out principle should be adopted.

3 Labelling and traceability of packaging units

Each packaging unit is labelled with a tag containing a consecutive number, coating name, glass thickness, dimensions, number of jumbo as well as split sizes and the position of cover sheet. arcon coatings are in accordance with the harmonized European standard EN 1096 and therefore CE marked.

The package label must be kept since data are required for any warranty claims.

4 Identification of the coated side

During all processing steps it is important that the coated side remains towards the air side i.e. not facing cutting pad or conveyor systems. Coating can be clearly identified by using a coating tester or ohmmeter. Coating testers can be purchased from arcon.

At arcon sunlite oHT, on the other hand, the uncoated side (= tin bath side) can be determined with a tin bath side detector. In addition, the coated side reflects much more strongly than the uncoated side.

5 Handling

Before processing all workers must be informed about special requirements for heat treatable arcon coatings as well as trained in its handling.

During each processing step marking-free clean gloves must be used. Lubricants, oils, liquid drops or finger and glove prints can cause irreversible imperfections during the thermal process. Therefore, any kind of soiling must be avoided. Glass cutting pads should be frequently cleaned by compressed air to avoid scratches on the glass sur-face. Scratches that can scarcely be detected with the naked eye before the tempering process can become clearly visible after the glass tempering. Hence, all care must be taken to avoid scratches particularly on coated side. An additional risk is the use of vacuum cups on the coating. The vacuum cups should not be in contact with the coated surface when unstacking the glass sheets. However, if the manufacturing process requires the use of vacuum suction systems it must be ensured that they are always clean and silicone free. Therefore, we recommend the use of special clean protective covers for them. Protective covers must be replaced regularly!

Separators (e.g. cork) can leave irreversible prints on the coated surface. The coated side must not be marked or labeled.

All devices and tools which come into contact with coatings must be kept permanently clean.

6 Cutting and cutting fluids

To avoid damages caused by scratches, glass splinters or dirt, the coated glass surface must remain towards the air side during cutting and all other processing steps. Only soft cutting fluids that can easily be removed during the washing process are to be used for the cutting procedure. Avoid all excess of cutting fluid and remove any residual glass splinters or dust from the cutting table. Rulers or templates for cutting the glass should be avoided in order to reduce risk of scratches.

The cutting table must be cleaned regularly by using compressed air.

7 Edge deletion

Edge deletion is required for arcon heat treatable sunbelt- and low-e coatings to ensure a functional insulating edge seal.

In case of arcon sunlite oHT products edge deletion is not required if the adhesion of the sealant has been proved in accordance with EN 1279.

Edge deletion could be on line during cutting or prior to insulating respectively manually using handheld grinding systems. Suitable grinding wheels must be used (recommendations are given in chapter “production aids”). Parameters are to be adapted (rpm, rate of feed, grinding pressure).

arcon recommends soaking off the wheel swarf to avoid the scratching of the panes by fine glass splinters in the follow processing steps.

The width of edge deletion depends on the insulating glass system which is used. Minor overlapping of coating and sealant should not affect the functionality of the IGU edge seal. Because of processors responsibility for IGU edge seal, regularly testing of edge deletion quality is recommended.

The effectiveness of edge deletion can be checked by using coating testers.

8 Coating-Dissolving Enamel/Ink

A special method for edge coating removal is printing with coating-dissolving enamel or digital printing ink. During the firing process, the entire coating dissolves and is then passively embedded in the enamel/ink matrix. This provides a cost-effective and high-quality process, which is particularly suitable for edge printing on coated architectural glass.

The following types of enamel/ink systems are available:

- Vibrantz GSGF TEA Black 14 4400AL-6687 (screen printing, roller coating)
- Fenzi AFE600-654-63 Black glass enamel (screen printing, roller coating)
- TECGLASS 1C009_MMH - Jetver Black DDTC 4-A/ inkjet (digital printing)

These innovative technologies require special attention regarding handling, processing, and quality control. Therefore, specific instructions and requirements apply.

Several enamel/ink-coating combinations have been tested by arcon or the enamel/ink manufacturer and the compatibility has been confirmed.

The following instructions must be considered during processing and for application. The documents are available from arcon or the enamel/ink manufacturers:

- Screen printing/roller coating:
  - "arcon-System TEA 14 4400AL-6687 PVD Coating, dissolving enamel paint from Vibrantz Technologies Inc."
  - "Fenzi AFE600-654-63-TDS Black glass enamel for flat coated glass"
- Digital printing:
  - "Technical Information edgeprint HT (eHT)"

Please ensure that the most up-to-date version of the processing guidelines is used.

In all cases, arcon and the enamel/ink manufacturer must be consulted before initial processing of arcon coatings with the above-mentioned enamel/ink systems, and the procedure must be coordinated accordingly.

It is always the sole responsibility of the processor to ensure the compatibility of the respective coatings and enamel/ink systems.

9 Edge working

Prior tempering glass edges have to be processed in order to avoid glass breakage during the tempering process. There are different possibilities for edge working.

- Automatic
  During automatic edge working all relative movement on the coated surface as well as too much pressure of the upper belts have to be avoided. The glass surface should remain fully wet during the whole operation and should be washed immediately after edge working. The belts should be cleaned continuously.
- Manual
  Manual edge working increases the risk of having scratches due to soiled washing machine brushes, rollers and water. The surface is more sensitive for scratches even when wearing gloves. Gloves should be checked and changed regularly. Wet in wet processing is recommended.

The coated side remains always towards the air side on conveyor systems.

Gloves should be checked regularly for cleanness and replaced as necessary.

10 Washing process

Horizontal washing machines as well as washing machines normally used for the insulation glass production can be used for cleaning purposes. When washing the glass the following specific aspects are to be taken into consideration.

- The period between cutting and tempering should not exceed 24 hours. After the washing process the heat treatment has to be applied immediately. Longer storage of the coated and washed glass can cause stains after heat treatment.
- The coated glass surface must not be moved directly on the transport rollers.
- It is necessary to use clean demineralized water (conductivity < 30 µS/cm, pH value 6.0 – 7.5). Washing agents must not be used.
- A water temperature of + 30°C is recommended.
- The brushes directly in contact with the coating must be particularly suited for coated glass (bristle diameter of 0.15 – 0.20 mm) to avoid scratches on the coating.
- Ensure the best possible continuous flow of production to avoid scratches on the coated surface if the washing process is stopped and restarted on one pane.
- Leaving the washing machine the panes must be completely drying to avoid remaining water- drip stains on the coating.
- After the washing process, the glass should be visually inspected at the test station using an appropriate illumination in transmittance and reflectance.
- Rubber lips or brush bars must not rub against the coated surface and should be removed if necessary.

The washing machine is to be maintained at regular intervals. During this inspection particularly the brushes are to be checked for their cleanness and correct adjustment. The washing water must be renewed regularly.

Before the tempering process, the coating must not be soiled (fingerprints, oil) because these impurities will become visible after the tempering procedure. Therefore, the coated surface must not be touched with bare and dirty hands. Clean gloves must be used during all steps of processing.

To remove stains, use a mild, quick-drying cleaning agent. For this purpose, dab the surface carefully with a clean, soft cloth without applying any pressure onto the coating. Cleaning agents must not remain on the coated surface.

Recommendations for cleaning agents are given in chapter “production aids”.

Cleaned sizes are to be stacked after washing by using proper separating materials (e. g. cardboard stripes).

11 Heat Treatment

Unlike the processing of uncoated glass types, the processing of heat treatable coated glass types requires the proper adjustments in the heating and cooling parameters.

The panes should be heat treated under temperature conditions as low as possible to obtain a high-quality surface after the process. On the one hand temperatures and heating time must be adapted to avoid breakage in the quenching zone and, on the other hand, requirements for safety glass must be fulfilled. If the heat is too high when processing HT coatings the scratch resistance of the coating is affected. This may result in problems during IGU assembling.

The low emissivity and the resulting high infrared reflection properties of the coating almost avoid the heat transfer by radiation. The uncoated bottom side of the glass absorbs the radiation more effectively than the coated side. Thus, the bottom surface heats up more rapidly than the upper surface.

The normal emissivity of the coating variable differs, depending on the product accordingly from table 2 below.

tab. 2: declared emissivity of arcon heat treatable coatings

product	normal emissivity ε_n[1]
arcon sunbelt A41 HT	0,01
arcon sunbelt A51 HT	0,01
arcon sunbelt A61 HT	0,01
arcon sunbelt A71 HT	0,01
arcon sunbelt E71 HT	0,01
arcon N10 HT	0,01
arcon N34 HT	0,03
arcon sunlite oHT	0,5 – 0,8
uncoated float (for comparison)	0,89

General parameters for furnaces cannot be given. Approx. 20 per cent longer heating time in convection furnaces is required for heat treatable coatings in comparison to uncoated glass to heat up the glasses homogeneously. Higher temperatures and short heating time often lead to better results than lower temperatures and long heating time. Experiences with other heat treatable coatings are often useful.

When tempering arcon sunlite oHT, furnace parameters based on uncoated glass should be used or need to be adjusted slightly.

Forced air convection furnaces simplify the thermal treatment of heat treatable coatings. The higher the convection, the better is the result. Tempering in infrared radiation furnaces is not recommended.

The coated side remains toward the air side to avoid damages or scratches from the conveyor system.

SO2 (sulphur dioxide) is not recommended as silver corrosion can be initiated. The SO2 flow must be interrupted in time before processing arcon heat treatable coatings. The use of sulphur dioxide occurs at own risk.

Heat treatable products must never be applied without heat treatment, because the product-specific inherent colors as well as the photometric and radiometric physical properties are only achieved after the heat treatment.

The requirements for fracture behaviour are the responsibility of processor and should be monitored regularly.

[1] The specified normal emissivity, determined according to EN 12898, is achieved after proper tempering within the permissible tolerances.

12 Troubleshooting

The following measures can be helpful in solving any problems (see table 3).

tab. 3: Troubleshooting

Problem	Reason	Measures
Optical Distorsion („roller waves“)	Glass temperature too high Reversal speed	If necessary, adaption of heating time and temperature If necessary, adaption of reversal speed
Imprints in glass surface („roller pick-up“)	Glass temperature too high	If necessary, adaption of heating time and temperature
“bowl”	Too much heat input from the bottom; Furnace maintained, Sulphur dioxide does not yet protect the rollers	Increase of the upper convection part, reduce of the bottom heat
”dome”	Too much heat input from above	Reduction of the upper convection, increase of the bottom heat
Glass breakage in quench	Glass temperature too low	Check heating time and temperature
	Improper edge working	Rework glass edges
Cracks in glass	Glass temperature too low	Check heating time and tempe-rature
Frequent small scratches on the surface of tempered heat treatable coatings	Surface pressure of brushes in washing machine	Reduction of surface pressure of brushes in washing machine
	Brushes in washing machine contaminated	Cleaning brushes in washing machine
	Rubber lips in washing machine contaminated	Cleaning rubber lips in washing machine

13 Heat Soak Test

If a Heat Soak Test is required, the processor must ensure that appropriate spacers are used to avoid marks on the coated side. Moreover, requirements of standards must be fulfilled (e.g. EN 14179-1).

14 Bending

arcon heat treatable coatings can be bended but longer heating times are required in comparison with flat glass. Slight optical distortions can appear and must be tolerated. Hence, arcon recommends the making of mock-ups in advance.

15 IGU assembling

Tempered glass sizes must be processed into insulating glass units (IGU) within 24 hours.

Silver-containing arcon treatable arcon coatings must be used as IGU and the coating must face the space between the panes. The inner space is filled with dry air or an inert gas. To achieve their best performance arcon sunbelt HT products must be placed on #2 surface of an IGU and low-e coatings on #3 surface of an IGU. Their monolithic use is not allowed.

The edge seal of an IGU consists basically of a two-stage sealing system – the butyl as the primary sealant, and a secondary sealant. This permanently elastic edge seal must take up the strain exerted upon the IGU and ensure that the IGU remains airtight and gastight respectively throughout its lifetime.

The processing guidelines of the sealant manufacturer need to be followed.

Air-filled and gas-filled IGU must comply with the EN 1279 family. There are different types of gas-filling techniques on the market. The most modern and rational gas filling technique is the on-line filling. Filling gases are argon, krypton and mixtures.

Ensure the best possible continuous flow of production to avoid scratches or abrasions on the coated surface if the washing process is stopped and restarted on one pane.

A water temperature of + 30°C is recommended.

After assembling, the glass should be visually inspected at the test station using an appropriate illumination in transmittance and reflectance.

The requirements for proper IGU production are the responsibility of the processor.

16 Transport of monolithic panes

arcon does not recommend the transport of coated monolithic panes outside the processing company because this is an additional risk. However, if such a transport is necessary, the following guidelines need to be followed:

- The panes are to be separated by separating powder. Soft, acid-free paper or a suited foam foil can be used as well after testing.
- The package should be provided with air-proof foil and drying agents to prevent moisture penetration. The package should only be opened again, if the glass has reached environmental temperature.
- It must be ensured that all coated surfaces are protected within the package. To do this, use “protective panes” of the same size made of clear and clean float glass.
- The panes must be tied down so that they cannot move against each other during their transport.
- The glass is to be processed into insulating glass units in the shortest possible period of time. The maximum storage time for air-proof packed units with drying agents (check the degree of moisture via the indication colors!) is 1 week, after being opened it is 1-2 days.

17 Quality features of coated glass

The coating or other defects of heat treatable coated glass is based on European Standard EN 1096-1. The acceptance criteria for defects described in Section 7.4 of this standard are listed in Table 4.

tab. 4: Acceptance criteria for coated glass defects

Defect types	**Acceptance criteria**		
	Pane to pane	**Individual pane**	
Uniformity[2]/stain	Allowed as long as not visually disturbing	Allowed as long as not visually disturbing	
		Central area	**Edge zone**
Punctual:	Not applicable		
Spots/Pinholes:			
> 3 mm		Not allowed	Not allowed
>2 mm and ≤ 3 mm		Allowed if not more than 1/m²	Allowed if not more than 1/m²
Clusters:		Not allowed	Allowed as long as not in area of through transmis-sion
Scratches:			
> 75 mm		Not allowed	Allowed as long as they are separated by > 50 mm
≤ 75 mm		Allowed as long as local density is not visually dis-turbing	Allowed as long as local density is not visually dis-turbing

The glass pane to be examined is viewed from a distance of at least 3 m. Daylight (uniformly cloudy sky without direct sunlight) is agreed as the light source.

The examination of coated glass in reflection is performed by the observer looking at the side which will be the out-side of the glazing. The examination of the coated glass in transmission is performed by the observer looking at the side which will be the inside of the glazing.

Differing individual agreements apply only if these were agreed in writing.Assembled architectural glass units, used in building shells and in finishing of buildings, shall be assessed for optical and visual faults as described in EN1279-1 and the “Guidelines to Assess the Visible Quality of Glass in Buildings”[3].

[2] Uniformity defect: slight visible variation in colour, in reflection or transmission, within a coated glass pane or from pane to pane

[3] issued by Bundesinnungsverband des Glaserhandwerks, Hadamar, VFF Verband Fenster + Fassade, Frankfurt/Main, Bundesverband Flachglas e.V., Troisdorf

18 Quality Assurance

The processor of heat treatable arcon coatings has to ensure that the requirements of those guidelines are permanently fulfilled. It's glass processor's responsibility to implement a quality assurance system. Attention should be paid to visual inspection of tempered glass panes.

If you intend to use the heat treatable version and the non-heat treatable version of one product jointly in one project please consult our sales department in advance. Furthermore, arcon strongly recommends the fabrication of samples and the comparison among each other. When using triple glass units with two coated panes in the glazing this aspect should be considered too.

19 Warranty

Compliance with aforesaid processing guidelines will ensure the production of high-quality insulating glass units. Failure to comply with the aforesaid processing guidelines and other procedures introduced by arcon will render product warranty in-valid.

If there is a cause for complaint, arcon reserves the right to control all claims. Claims cannot be accepted, if

- The glass panes are broken due to improper storage, installation or maintenance.
- The requirements of the present guidelines are not fulfilled.

Informative glass samples need to be provided by customer in case of claims.

20 Confirmation of knowledge

The signatory confirms that it has read and understood the content of these guidelines.

Name / Signature: …… Position: ……

Firm / Stamp: …… Date: ……

Please return the completed page by email to: tt@isolar.de

21 Production Aids

The following list of production aids gives recommendations for processing of coated glass into insulating glass units.

arcon emphasizes that only materials checked for their compatibility are used in IGU production. arcon cannot guarantee the quality of the recommended production aids. Production aids from other suppliers can also be suitable.

- **Gloves**

  Type: KCL-Protective cloves
  Supplier: Kächele-Cama Latex GmbH
  36124 Eichenzell
  Germany

- **Cutting Fluids**

  Type: CUTTING FLUID AC PE 5503, 5250
  Supplier: Chemetall GmbH
  41199 Mönchengladbach
  Germany

  Type: DIONOL GT 641, 644-1
  Supplier: MKU-Chemie GmbH
  63322 Rödermark
  Germany

- **Protection Cover**

  Type: Protection cover type MTC
  Supplier: euroTECH Vertriebs GmbH
  72351 Geislingen
  Germany

- **Separating agent**

  Type: AC Separol type G, TN
  Supplier: Chemetall GmbH
  41199 Mönchengladbach
  Germany

- **Glass Cleaner**

  Type: ACECLEAN 6147
  Supplier: Chemetall GmbH
  41199 Mönchengladbach
  Germany

  Type: Mixture 50 per cent by volume Isopropanol and 50 per cent by volume deminer alised water

- **Grinding Wheels for Edge Deletion**

  Type: FISCHLER Profilschleifscheibe Typ 3055
  Supplier: Franz Fischler GmbH & Co. KG
  86343 Königsbrunn
  Germany

  Type: ARTIFEX SK 120 HT
  Supplier: Artifex Dr. Lohmann GmbH & Co. KG

24568 Kaltenkirchen
Germany

Type: NORTON RapidFinish art.no. 69957387512
Supplier: Saint-Gobain
Germany

- **Manual Devices for Edge Deletion**

  Supplier: HEGLA
  37688 Beverungen
  Germany
  R&R Sondermaschinen GmbH
  90579 Langenzenn
  Germany