

A technical line drawing of window profiles, showing multiple overlapping profiles in a perspective view. The drawing is rendered in white lines on a light blue background. A horizontal orange line is positioned across the middle of the image, separating the title area from the main drawing area.

Technical Guidelines

Reliable lamination of window profiles

„Reliable lamination of window profiles“

PVC window profile laminating companies have the task of processing a range of materials of sometimes changing suppliers into a long-lasting, high-quality product. This guideline is intended to support manufacturing of laminated profiles which comply with the requirements of RAL-GZ 716.

Recommendations and general guidance on materials used and the lamination process

It gives recommendations on how to handle the materials and how to operate the lamination process as a whole. Since the guideline is only a general instruction, the product-specific manufacturers recommendations for use of the adhesives and components must be considered and complied with.

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The guideline is structured as follows:

- **Storage of the materials:** Following delivery and prior to use, the storage conditions specified by the supplier for the respective components must be observed.
- **Material staging and preparation:** This describes the preparation, treatment and storage of the materials prior to the start of production.
- **Lamination:** This point contains specifications for temperature, application quantity and cooling of the individual components.
- **Setting/curing:** This section covers the period after lamination.

Enclosures

- Lamination diagram
- Legal notice

1. Storage of materials

Listed below are the conditions under which the materials for a laminating process must be stored, from the time of manufacture to their staging for processing. This is because storage conditions have a significant influence on the ability to use the components without loss of quality.

1.1 PVC window profile

Profiles must be stored in accordance with the manufacturer's processing guide. To avoid difficulties in processing, the profiles must be protected against weathering influences – in particular direct contact with water – and dirt.

1.2 (Decorative) film

The film must be stored in a clean, dry place and processed in accordance with the FIFO (First In – First Out) principle. The films must be stored for no longer than specified by the manufacturer. Rolls should not be exposed to direct sunlight, heat radiation or high temperatures and/or high humidity. It is recommended that they are stored in halls at room temperature of approx. 20°C and in humidity of approx. 50% (ideal conditions).

1.3 Primer and adhesive

The airtight packaging protects the adhesive from premature setting and the primer from vaporization. Damage to the containers must be avoided.

Primer:

- Storage in closed, airtight original packaging
- Storage temperature: ideally 5°C–25°C

Adhesive:

- Storage in closed, airtight original packaging
- Storage conditions: cool, dry place, not permanently above 45°C

It must be ensured that the manufacturer's instructions for transport and storage conditions for the product used are followed.

1.4 Protective film, packaging material

Follow the manufacturer's instructions.

STORAGE CONDITIONS IN SHORT

1. Protect against weathering influences (sunlight, moisture) and dirt.
2. Avoid frost and overheating.
3. Note the maximum shelf life (manufacturer's requirements).
4. Note the FIFO principle ("First In – First Out").

2. Material staging and preparation

All materials used in the laminating process must be suitably preconditioned if they are to be able to be processed reliably. The material staging period begins when the materials are removed from storage and ends when they are led to the laminating process. The main requirements to be met concern temperature, humidity and cleanness.

The following are the parameters that must be reached during or at the end of preconditioning.

2.1 PVC window profile

If the profiles are brought from the storage to the line already pre-conditioned, they are usually ready for use. Otherwise they should be conditioned before processing.

Processing parameters:

- Profile temperature 18°C–25°C, fully temperature stabilised (temperature range for a reliable laminating process)
- Dry surfaces, free of contamination e.g. dust, adhesive residue, protective film (residue), oil/grease, moisture

Higher profile temperatures may be unavoidable on some days, due to the time of year. At temperatures over 25°C the parameters in the laminating process must be modified.

2.2 Film and cutting film

Before using the film, check that the expiration date and storage conditions have been observed in accordance with the manufacturer's instructions.

- Do not exceed the maximum shelf life of the film
- Film temperature: 18°C–25°C

Note: The film manufacturer's warranty will lapse at the end of the max. shelf life. If the film is still to be used anyway, the laminating company must carry out a processing test and the adhesive strength must be checked according to RAL-GZ 716 (Technical Appendix F).

The quality of the laminated profile is greatly influenced by how the film is cut and wound. It must be ensured that the film winding process produces rolls that have the optimum winding characteristics (particularly with regard to tightness).

To avoid lasting damage to the film in the form of tears caused by high radial stresses and telescoped rolls, it is recommended that the machine equipment and the conditions on the cutting machine meet the following minimum requirements:

- Set the braking force and thus the tension on ready-to-use film rolls as low as possible, but in such a way that lateral movement, also called "telescoping", is avoided.
- The number of rewinding processes must be kept as low as possible.
- Use the pneumatic tensioning shafts at the unwind unit.
- Constant web tension at unwind and rewind is best achieved with diameter-dependent controlled brakes and drives, ideally with sensors that control braking and winding torques.
- Use the friction shaft for winding films cut in different widths.

2.3 Primer and Adhesive

In general, a defined temperature range of the adhesives and primers to be used is not required. It is sufficient to pre-heat both approx. 24 hours before opening the containers in the laminating area at 18–25°C to prevent the formation of condensate.

Open the original container only immediately before placing it in the laminating machine to avoid contamination or a premature chemical reaction of the adhesive. Proceed with opened containers according to the instructions of the adhesive manufacturer.

2.4 Protective film

A clean winding up of the protective film rolls is necessary for a perfect processing of the protective film in the laminating machine. Telescoped rolls can lead to the protective film being positioned inaccurately on the laminated profile and not protecting it optimally.

Other parameters you should pay attention to:

- The adhesive of the protective film must be compatible with the laminating film.
- The adhesive strength of the protective film must be adjusted to the type of laminating film used and in particular to the embossing.
- The UV resistance of the protective film must be given.

Further information can be found in the manufacturer's specifications.

2.5 Packaging material

The main purpose of the packaging is to protect the laminated window profiles from damage such as scratches, impact marks or dirt.

The packaging material must be specified by the customer. The packaging must be suitable to prevent the penetration of water in order to exclude hydrolytic damage to the bonded composite. It must also be ensured that packaging material and content are compatible.

MATERIAL STAGING AND PREPARATION IN SHORT

1. Observe the temperature specifications of the manufacturer.
2. Pay attention to cleanliness.
3. Do not exceed the maximum storage time.
4. Pay attention to the specifications when cutting and winding the laminating film.

You will find the most important information about laminating at a glance on page 10.

3. Lamination

The laminating process covers all stages from the processing of the materials used to the finished, laminated profile. The entire laminating process must be protected from negative ambient influences such as dust. In particular, release agents such as silicones and greases must not be used in the lamination area.

3.1 Climatic influences

Compliance with the climatic parameters in the laminating process is an essential requirement for reliable lamination.

- Temperature: 18°C–25°C
- Relative humidity: 40%–70%
- Avoid an uncontrolled, fluctuating circulation of air

3.2 Preheating temperature of the profile surface before priming

Preheating of the profile surface depends on the type of primer used:

- No preheating is required for dichloromethane (DCM) or methyl ethyl ketone (MEK).
- For VOC-reduced primers it is in the range of 30°C–35°C.

3.3 Primer application

The following processing parameters must be observed according to the manufacturer's specifications for adhesive systems:

- Reaction time
- Reaction distance
- Suggestions for dosage

The dosage must be appropriate to the profile. Ensure that the primer is applied evenly and across the entire surface. The manufacturer's instructions must always be followed.

If priming on felt, a felt density of 0.32–0.36g/cm³, depending on the primer, is recommended. The felt contour must correspond to the contour of the profile. Felt thickness 10mm–20mm. In the case of double priming, the felts must be positioned at a distance of approx. 20cm from each other. Care must be taken to ensure that the set dosage of the primer is applied to all felts.

Correct application of the primer must be monitored. The laminating company must determine the replacement interval to suit the choice of components. Irrespective of the components, an interval of under 8 hours is recommended.

3.4 Primer drying

Since the primer must have dried sufficiently over the entire surface before bonding, the following parameters apply to the drying performance:

- Drying time
- Air convection
- Temperature on the profile surface: 35°C–55°C

For specific details, please contact the manufacturer of the primer/adhesive system.

3.5 Profile surface temperature before lamination

The temperature of the profile surface in the area between the primer drying section and the laminating roll should be between 45°C–55°C.

3.6 Film tension

The tension of the film between the unwind station and the laminating roll must be set so that the adhesive is applied homogeneously/evenly at the slotted nozzle. Stretching of the film must be avoided.

3.7 Film preheating

For film preheating prior to adhesive application, the recommended temperature is approx. 45°C, depending on the type of film used.

To ensure that the adhesive and the film form a bond after application, it is important that the temperature specified for the particular film is actually achieved. The optimum film temperature for the film quality used (e.g. PVC or acrylate based) must be agreed with the film supplier.

3.8 Adhesive application

For optimum adhesion, certain conditions must be provided in the immediate laminating area, which are characterized by the following parameters:

- Environmental temperature and relative humidity: see point 3.1
- Quantity of adhesive to apply: approx. 50g/m²
- Premelt temperature
- Tube temperature
- Nozzle temperature
- Maximum time in the heated state: Reduce temperature or switch off completely when the system is at a standstill, as specified by the supplier

The relative humidity in the area the adhesive is applied is important for the optimum setting of the adhesive. The optimum temperatures of the adhesive must be agreed with the supplier. The adhesive must be permanently protected against humidity when in the molten state in the melting unit.

Further information on how to handle the adhesives must be obtained from the adhesive manufacturer, as the various adhesives behave differently with regard to “operating temperature range” and “behaviour at machine standstill”.

3.9 Film temperature before the laminating roll

The temperature of the film-adhesive composite before the laminating roll should be approx. 50°C.

The general rule is that, when wrapping, the film-adhesive composite must have a particular temperature on all surfaces and at all profile edges in order to ensure an optimum bond with the profile. The extent to which the film has to be heated again to obtain greater flexibility depends on the type of film, the type of adhesive, the profile geometry and the distance between the gluing nozzle and the end of the laminating section. It is recommended that the relevant manufacturer be consulted.

3.10 Film wrapping

The films are applied and pressed on evenly and with homogeneous contact pressure across radii and surfaces, beginning from the laminating roll. The roll geometry used must be appropriate for the laminating detail (surface, radii, sink marks). No creases or bubbles must be allowed to form between the film and the profile.

Additional heating can be provided at the edges if there are sharp edges or the film is very stiff. However, the extra energy applied should be kept as low as possible.

- Film heating temperature just before the edge: approx. 55°C (PVC-based film)
- Film heating temperature just before the edge: approx. 65°C (acrylate-based film)

If additional heating is provided at the edges, the energy applied after the film edges have been wrapped must be removed again. Cooling must take place immediately after wrapping. The distance between heating and cooling of the edge must be kept as short as possible. The maximum temperature of the finished laminated profile should not exceed 35°C.

3.11 Markings

Markings are provided for the purpose of traceability throughout the life of the laminated profile. All materials used and the entire laminating process must be verifiable.

LAMINATION IN SHORT

1. The “temperature balance” of all materials used and the surroundings plays a critical role in the laminating process.
2. Reaction times and primer drying must be precisely observed.
3. Specifications for adhesive and primer quantities must be met.
4. The specified humidity must be ensured in the area between where the adhesives is applied and the lamination.
5. Stretching of the film must be avoided.

3.12 Profile discharge

Generally the profile should have a max. temperature of 35°C on discharge from the machine. Higher profile temperatures may be unavoidable on some days, due to the time of year. This must be compensated by adjusting the process parameters accordingly.

4. Setting/Curing

The laminated profiles require a certain temperature and length of time for curing in order to reach their full strength/long-term stability: The following parameters are relevant here:

- Storing temperature: at least 18°C
- Curing time: depends on the adhesive

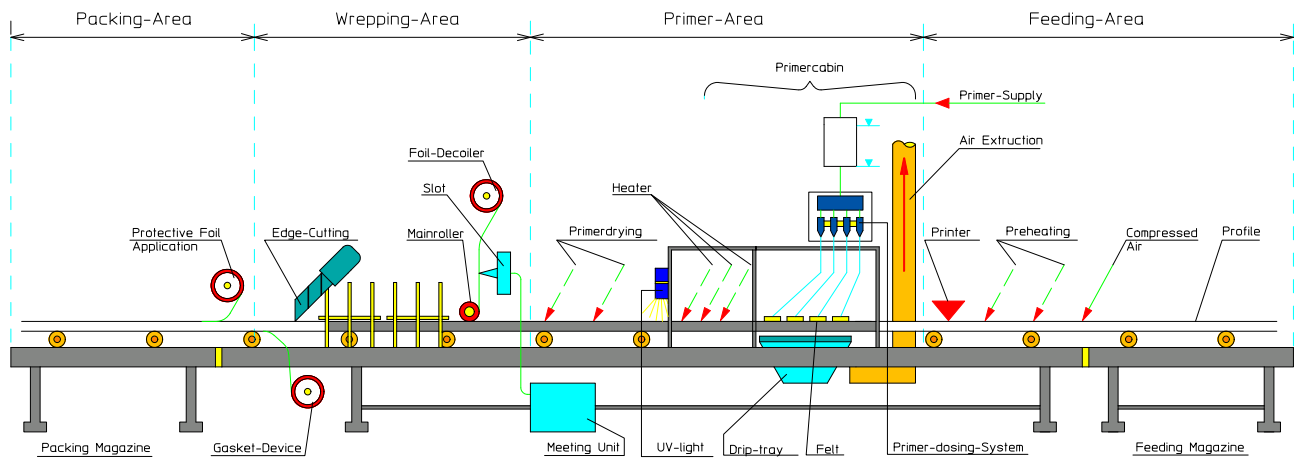
The peel strength can be checked not later than after 72 hours, depending on the adhesive system used.

SETTING/CURING IN SHORT

1. The profile/adhesive system/film structure does not reach its full adhesive strength until after several hours.
2. The time span depends on ambient temperature and the adhesive system used.

Enclosures

Lamination diagram



This is what the above mentioned technical terms for lamination mean.

Definition of terms

FIFO	"First In – First Out", i.e. the goods that are delivered first are also to be consumed first
PVC	Polyvinyl chloride
Acrylate-based	Film based on acrylate polymers
UV	Ultraviolet radiation
MEK	Methyl ethyl ketone
DCM	Dichlormethane, methylene chloride
Solvent primer	Primers based on the use of MEK or DCM
VOC	Volatile organic compound
Telescoping	Lateral variation of the film edge

Legal notice

The information contained in these Technical Guidelines has been compiled to the best of our knowledge from practical experience and testing. It does not constitute any warranty of product characteristics and does not establish any contractual relationship.

The suitability of the products with regard to use and processing must be checked by the laminating company itself.

The manufacturers of adhesive systems and films reserve the right to make changes to improve material properties and processing.

Use on other substrates and for applications other than those described above must be verified in the individual case and agreed with the relevant manufacturers/suppliers to ensure suitability.

The recommendations and instructions regarding the transport and storage of the materials and the preparation and processing instructions of the relevant manufacturers of the materials, technologies and services described must be followed at all times.

No warranty is given for the correctness and completeness of the content. All liability is excluded.

The information contained in this document does not constitute a guarantee of product characteristics and does not establish a contractual legal relationship.

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