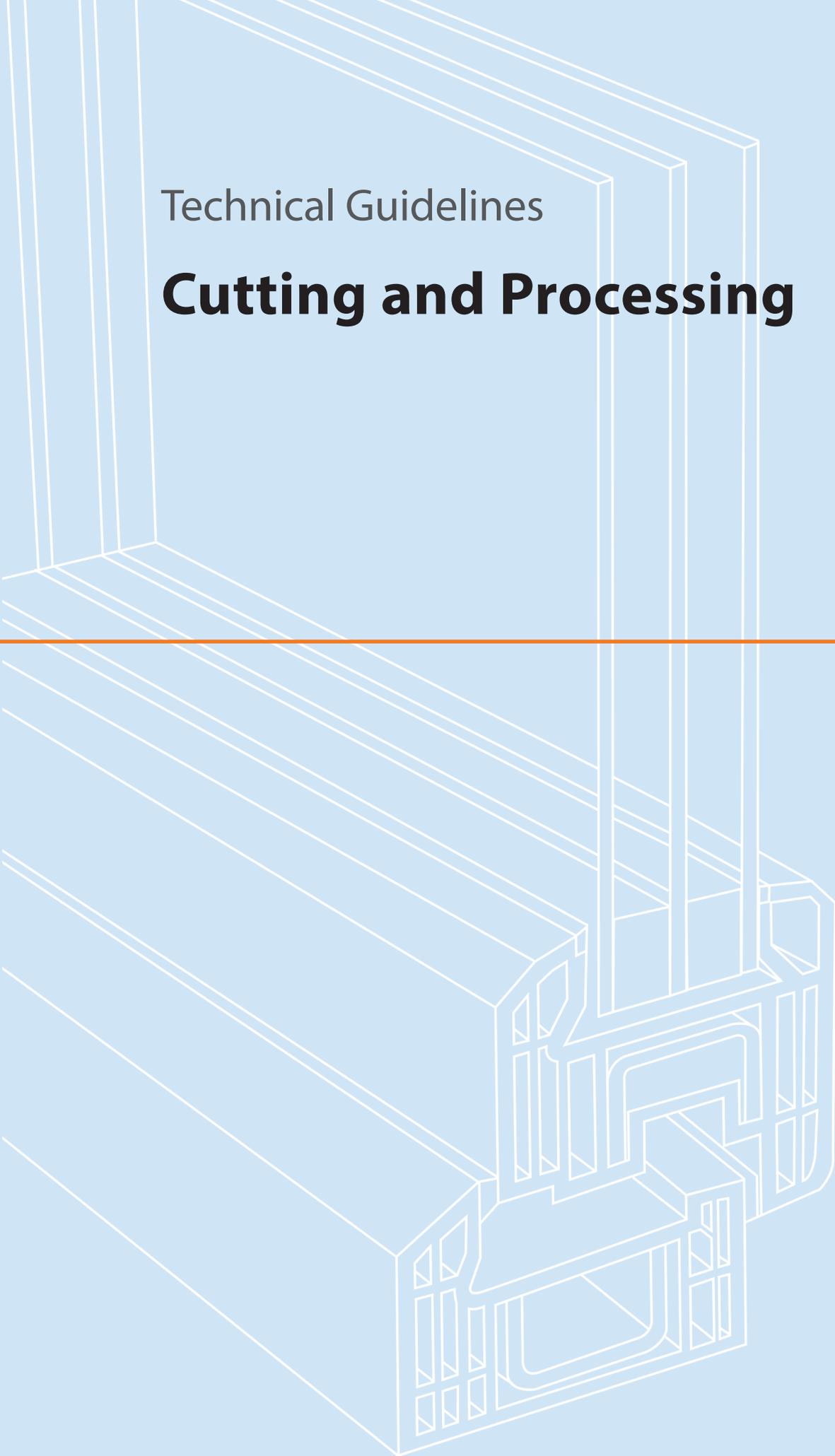


Technical Guidelines

Cutting and Processing



Cutting and Processing

Who will benefit from this guide:

A technical guideline for window manufacturers, profile system houses and machine and component suppliers. The guide was created by the Gütegemeinschaft Kunststoff-Fenster-profilsysteme.

Bonn, April 2023

Content

- Why this guideline?
- Prerequisites
- Machine interface
- Special processing
- Storage and internal transport
- Cut profiles correctly
- Protective film; adhesion and damages
- Regular cleaning/maintenance of the machines
- Dust extraction
- Processing of composite materials

Attachments

- Further information / applicable documents
- Practical tips for quality control

1. Why this guide

The processing of the profile bars of PVC-U window and door profiles, as supplied by the system provider, is a basic work step of a plastic window manufacturer. All these (preliminary) operations, which can be summarised as „cutting and processing“, are necessary before a sash or a frame can be produced in the welding process.

Our guideline is therefore intended to serve as an orientation aid: It clarifies terminology and thus simplifies the cooperation of all parties involved in the process. It is aimed at window manufacturers, profile system houses as well as machine- and component suppliers, e.g. for foil, reinforcement and gasket.

In our guide, we summarise the current „state of the art“ from the above-mentioned sectors. It takes into account all relevant standards and rules. In addition, the system descriptions for profile systems and the operating instructions of the machine manufacturers apply.

The guide starts with the prerequisites of the components and gives you information on the master data, 90° sawing / mitre sawing / milling and quality assurance.

2. Prerequisites

Cutting and processing in machining centres is a highly automated and fast running process. All components that are to be processed in the centres must meet the requirements of this automated process.

Quality-assured plastic profiles and automation-capable components for highly automated bar processing

With PVC-U profiles, care must be taken to ensure straightness and compliance with the tolerances on external and functional dimensions. Profiles that comply with the quality assurance according to RAL-GZ 716 or Technical Annex „A“ are considered suitable in this respect.

It also applies equally to screws and fittings that they must be automatable. The (reinforcing) steel used must also be automatable, and similar requirements apply as for the PVC-U. Special attention must be paid to the fact that any burr at the gate of the reinforcement profiles must not interfere with the material flow in the processing centre. Straightness and adherence to tolerances are other important parameters for the steel.

Attention: In general, pay attention to the above-mentioned requirements already during procurement and, if necessary,

Operator/window manufacturer

In addition to the machine, you as the user also have a major influence on the process. Therefore:

The user also has an influence on the process.

- Therefore: The applicable occupational health and safety laws must be complied with.
- Observe a room temperature of $\geq 17\text{ °C}$.
- Temper the profiles before processing when they come from the external storage or delivery (guideline value 24 hours/17 °C) to avoid condensation and excessive cooling of the welding surfaces.
- Maintain and clean your machines and equipment regularly. This will rule out any negative influence on welding.

Please note that steel can be contaminated by emulsions (water-oil mixture) or other lubricating fluids during sawing. For machining on loose bars (e.g. pre-assembly of fittings), please clarify this in advance with the machine manufacturer.

3. Machine interface

Consider the reconciliation of data sets at an early stage.

Interface descriptions for the respective machining centres are specified by the machine suppliers. The required, if necessary material-optimised data sets are generated by a window construction software. Coordination between the window manufacturer, machine supplier and software house is therefore mandatory.

In order to monitor the ongoing production, you need to plan which type of production- and machinedata acquisition and its further processing you want to aim for.

Possibilities are here:

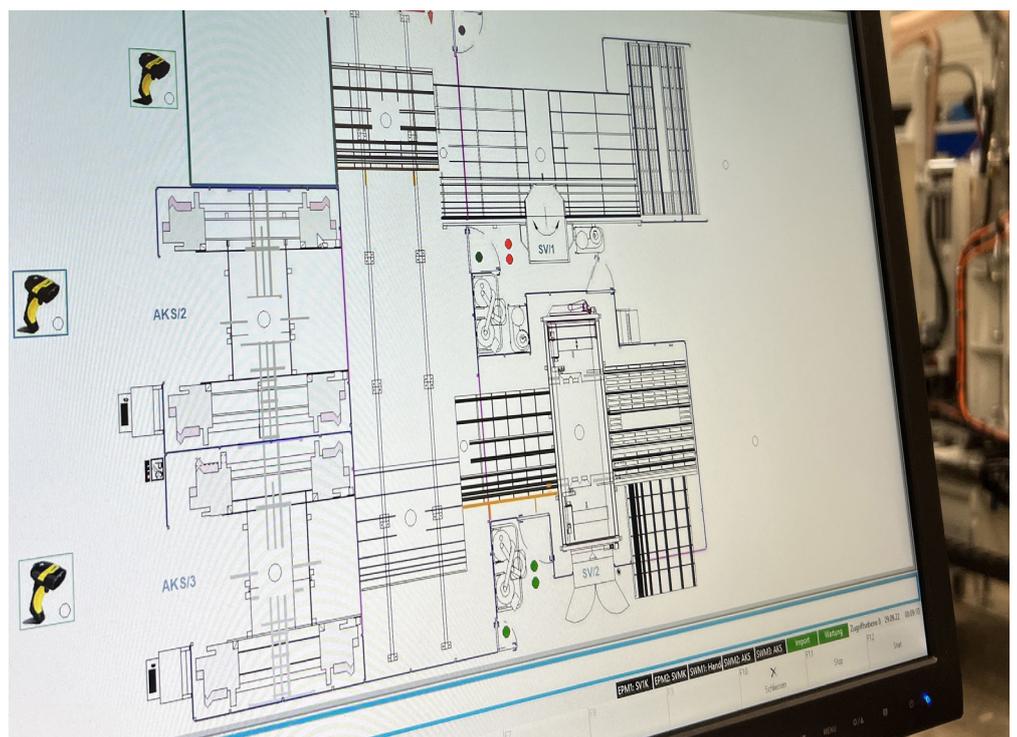
- Machine data collection (maintenance specifications, etc.)
- Production data acquisition
- Quality inspection

After the machining centre different types of labelling or marking become necessary depending on the profile itself, e.g. in terms of colour, and on the type of automated further processing.

These can be, for example:

- Labelling, incl. barcode / QR code if necessary
- Identification by means of RFID chip
- Subsequent identification of window elements for spare parts procurement

In all cases, early consultation between window manufacturer, machine manufacturer and, if necessary, printer manufacturer is required.



Example machine interface |
Image: Urban

4. Special machining

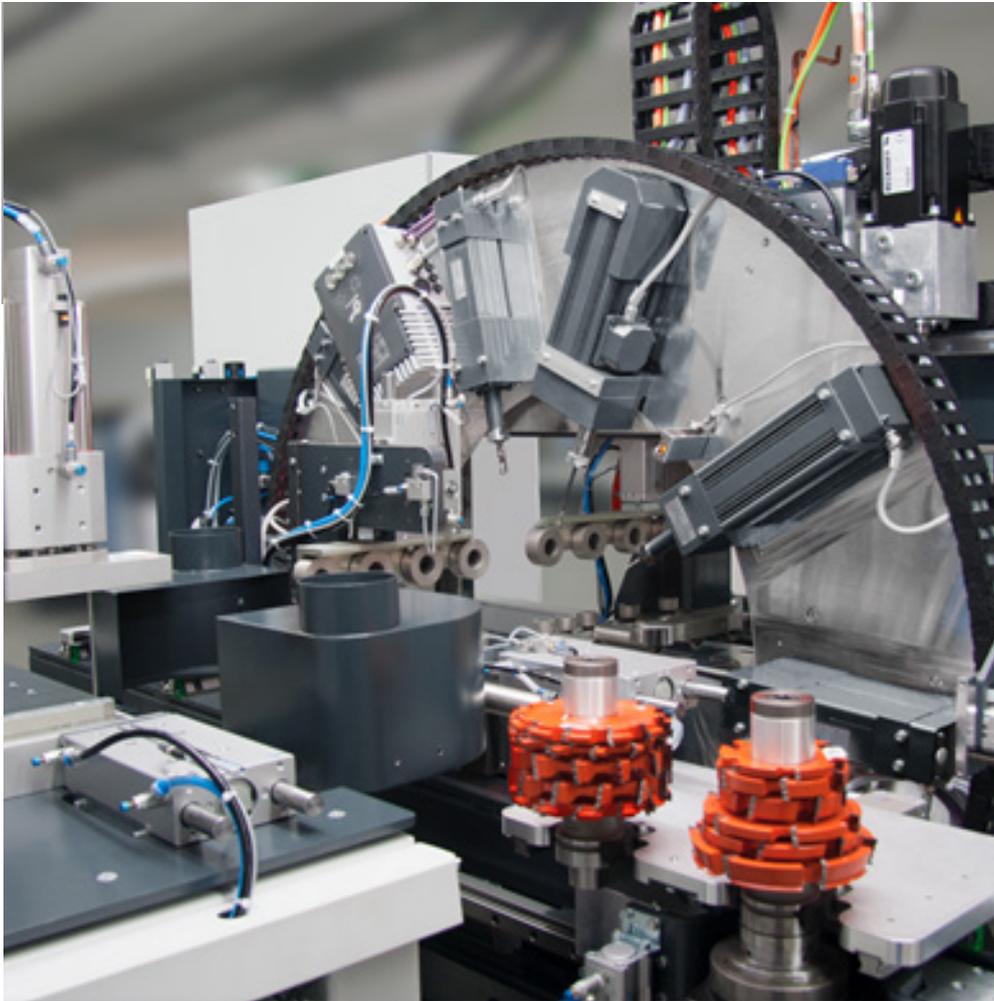
In addition to the standard machining of a window, the cutting and processing can be extended to almost infinite complexity.

Plan for special processing from the very beginning.

In this respect, it must be clarified in detail and separately in advance whether and which special aggregates are desired and are to be planned in by the machine manufacturer.

The following special processing can be mentioned here as examples:

- Overlap machining
- Transom milling
- Frame tip milling (cross-cut)
- Timber window look
- Gasket (back) milling
- Seal punching and cutting
- Preparations for seamless welding
- Place metal fitting
- Automatic stacking



Example of special machining | Image: elumatic

5. Storage and internal transport

Important are temperature, cleanness and a full-surface support.

In general, before processing the bars, ensure that they are tempered and clean, that the protective film is not damaged, that dirt and moisture are avoided, and that they are not exposed to direct sunlight or heat sources. Profiles should generally be stored on a horizontal support over their entire surface. After bar processing, it is particularly important that the (ready-to-weld) bar is undamaged and traceable.

Before processing the bars, it is recommended to store them indoors for 24 hours at a minimum temperature of 17 °C. Coloured / foiled profiles should generally be stored indoors or protected from the weather. For further information, please refer to the system descriptions of the profile system providers.

Temperature during machining

Bear in mind that temperatures and solar radiation must be taken into account at different points in the process.

Worth mentioning here are:

- Hall temperature
- Ambient temperature outdoors, as well as locally in and around the machining centre
- Observe solar radiation on machine parts, such as interference with optical control and regulating elements as well as linear expansion of metal and plastic parts.

6. Cut profiles correctly

Sharp, correctly adjusted and clean cutting tools ensure optimum cutting performance.

Precise cutting is a basic prerequisite for fulfilling the quality characteristics of vinyl windows/doors. Furthermore, the cut has a decisive influence on the flawless appearance and function of the element.

Therefore, take into account when cutting the profiles:

- Dimensional and angular accuracy
- Smooth, clean, grease-free, silicone-free and chip-free cut surfaces also in the gasket area
- Splinter-free inner webs of the water-bearing chambers

The quality of the cut depends on various parameters: These include profile geometries and their tolerances as well as machine parameters, saw blades, welding blocks and profile position.

It is important that the equipment is regularly maintained and cleaned in order to be able to process the profiles precisely. It is also important to ensure that the tools are sharpened.

For requirements on tools to be used and machine settings, please contact the manufacturer of the machines. For the machining of some profiles, the use of special tools (clamps/profile supports/welding blocks) may be necessary. Machining quality can be ensured by means of factory production controls (FPC). See point 11 „Practical tips for quality control“.

To check the cut, we recommend suitable aids and, for example, a procedure as shown below (see figs. 1 to 3).

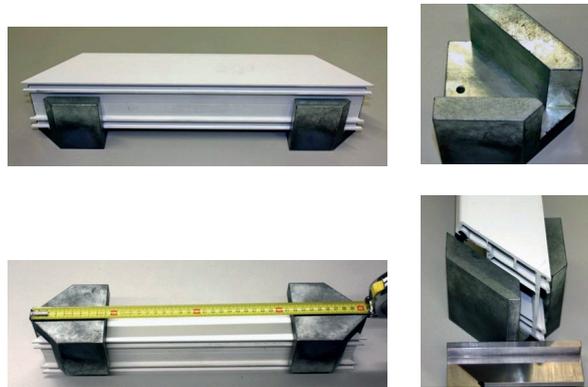


Fig. 1: Manual measurement | Pictures: Rotox

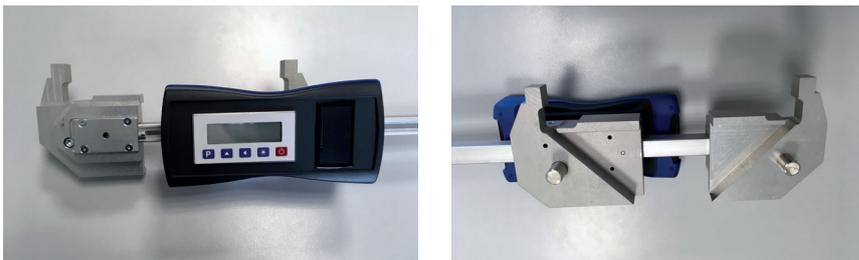


Fig. 2: Electronic measuring device | Pictures: Rotox



Fig. 3: Example of different measurement positions: Outer and inner dimension, angular deviation and cut surface (f. l.) | Graphics: Veka

Gaskets

When processing weldable gaskets, a number of specifications must be taken into account to prevent errors such as those shown in Fig. 4.

Fig. 4: Error when processing seals (from left: seal frayed or too short) | Pictures: Veka



Note:

- An exact, clean cut of the gasket (in the correct length)
- No detachment of the seal from the profile
- An intact seal: On the other hand, a slight fraying that does not affect the welding process and the function is permissible.

To achieve a clean gasket cutting surface, use the saw blade suitable for the profile and gasket type and observe the cutting direction. The use of profile supports, gasket hold-downs/clamps or gasket cutters may also be necessary. You can discuss the necessity with your machine manufacturer and with your system provider.

Depending on the design and condition of the seal, additional back milling of the seal before welding can improve the flexibility of the seal corner. It is important that the milling process does not negatively influence the subsequent function of the seal and thus the agreed performance properties (e.g. airtightness, resistance to heavy rain) of the window are guaranteed.

Fig. 5: Material accumulation without back milling (r.) | Exemplary back milling (l.) | Pictures: Veka



7. Protective film; adhesion and damage

The trend towards coloured profile surfaces is unbroken. In the meantime, there are countless types of surface design for window profiles (foils with a wide variety of layer structures, lacquers, painted foils, etc.) with an equally wide variety of surface structures and haptics. The finish of the surface and its material influence the adhesion of the protective film applied to it.

A peeling protective film means machine standstill.

For cutting and processing, this means that damage or detachment of the protective film must be avoided at all stages of the material flow (positioning, preparation, processing, handling).

Therefore:

- Discuss with your system provider and with your machine manufacturer the scope of cutting and processing planned in your house.
- Pay attention to the different adhesion of the protective film on different profile surfaces.
- Make sure that no profile bars with partially detached protective foils are brought into the machining centres.

8. Regular cleaning/maintenance of the machines

Routine cleaning, maintenance and servicing of the machines and equipment are the basic prerequisites for a stable and high-quality processing operation. In this respect, observe the corresponding instructions you receive from your machine manufacturer.

Regularly maintain your tools and production equipment.

To ensure the highest possible machine availability, integrate preventive maintenance into your operating procedure. This includes the replacement of wear parts and defective parts.

Please note that blunt tools lead to a loss of quality. A preventive tool change is essential to maintain machine availability.

Consider the following points:

- The possibility of an automatic tool breakage control
- A maintenance contract with your machine supplier
- Machine data collection for preventive maintenance

9. Dust extraction

A well-planned dust extraction system supports trouble-free manufacturing.

Just as important as the regular maintenance described above is the effective extraction of plastic chips for the long-term maintenance of machine availability and product quality.

Please note:

- Take dust extraction into account in your planning right from the start.
- Central dust extraction is preferable to decentralised extraction on the individual machines.
- Plastic chips can become statically charged and adhere to profile bars, machine parts and (optical and mechanical) control elements. Possible solutions must be agreed with the machine manufacturer.

10. Composite material processing

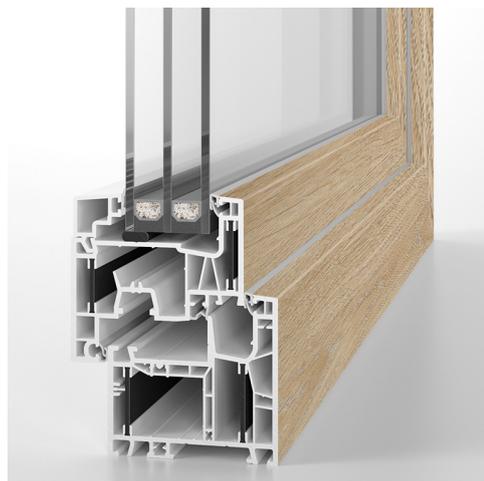
Plan the processing of composite materials from the beginning.

The processing of composite materials may require special planning, mechanical equipment and workmanship. If you wish to process composite materials, please consult your machine supplier at an early stage.

Please note:

- Plant engineering equipment
- Machining/processing waste (chips, dust) on/inside guide rail/guide bearing and electronic components
- The use of appropriate tools
- Possible effect on recycling e.g. due to the service life

Fibre-reinforced profile (l.) and profile with integrated continuous fiberglass strands (grey) | Images: aluplast (l.) and Deceuninck (r.)



11. Practical tips for quality control

In this section, we provide you with information on the practical quality control of the entire production process of bar cutting and processing. We recommend that window manufacturers include this in their factory production control - if it is not already in place.

Depending on the market, there may be differences in the requirements regarding quality control, specifications and process control.

Note: In addition to in-house quality specifications, the specifications from the processing guidelines of your system suppliers, other component suppliers (e.g. fittings and glass), the machine suppliers and, if applicable, the quality associations must be taken into account.

Possible test points are:

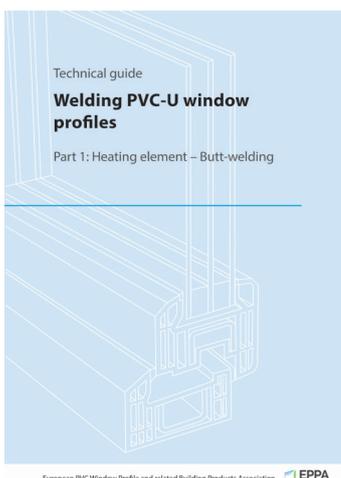
- Completeness of the processing on the window/door
- Cleanliness of the machining carried out
- Dimensional accuracy of the machining carried out
- Check the angular deviation and length of the cut profile bar using suitable measuring equipment.
- Check for damage to the machined bar
- Further tests may be necessary in accordance with the processing guidelines of the system suppliers.

Internal quality control, supplemented by external certification if necessary, ensures high product quality

Annex 01

Further information / applicable documents

For the welding process, please refer to the corresponding technical guide „**Welding of PVC-U profiles. Part 1: Mirror welding**“, available on gkfp.de under „Publications“ or via the following QR code.



Annex 02

List of typical errors

Error description	Proposed solution / correction
Cut lengths do not fit.	<ul style="list-style-type: none">• Storage and temperature of the profile bar• Check saw setting• Check data set/interface (melting loss)• Check the clamping and transport systems (slipping out of the bars is possible, depending on the machine design).
Cutting angles do not fit.	<ul style="list-style-type: none">• Check the adjustment of the clamping system (position of the profile in the saw).• Check profile tolerances
Machining is unclean.	<ul style="list-style-type: none">• Check tools• Check the temperature of the profile bars• Check the position of the profile bars in the system and the clamping system.• Check and adjust machining parameters
Machining is missing.	<ul style="list-style-type: none">• Check the tools to see if they are broken off.• Check the interface file to see whether processing has been transferred to the system.
Damage to the parts.	<ul style="list-style-type: none">• Clean machining center• Locate where damage may have occurred

A thank you to the contributing members.

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Your notes



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