

FINEO

Retrofit Glazing Instructions

August 2023¹

¹ This document is subject to change. Please refer to the LMS for the most up-to-date version.

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1. INTRODUCTION

There is a growing need for highly insulating glazing that can be retrofitted into existing window frames, a practice which is very common in Europe when homeowners renovate older houses. In response to this need, AGC has launched its highest-performance vacuum-insulated glass on the European market, FINEO. This product combines the best thermal insulating coating technology and the best glass processing techniques with recently developed leading-edge vacuum technology. This vacuum-insulating glazing delivers thermal insulating performance equivalent to triple glazing for a total thickness 4 times lower, meaning it can be installed in existing frames when replacing the glass of a window.

However, this FINEO glass can only achieve the advertised performance level if it is correctly installed in a compatible environment, without the use of any products that might damage it.

This document specifies the optimum conditions for installing Fineo.

It should be noted that compliance with these instructions is required in order to ensure the validity of FINEO Warranty.

The FINEO Certified Installer or Reseller must:

- ensure that the products used to hold the glazing in place and to ensure the weather tightness of the glazing are compatible with the glazing and with each other;
- install the glazing in accordance with applicable standards, building codes and codes of good practice and also with the specific instructions for FINEO;
- avoid anything that could damage the glazing such as impact, scratches and corrosion caused by the use of unsuitable products during installation or cleaning.

The FINEO Certified Installer or Reseller and Architects or Engineering Office must ensure that:

- the correct dimensions are used for FINEO glass in accordance with maximum manufacturing dimensions and maximum weights , the loads to which the glazing is subjected and in accordance with the performance required;
- the national standards and building regulations on thermal insulation, safety, security, acoustics, , etc. are respected.

2. INSTALLATION IN EXISTING REBATES USING GLAZING BEADS

The basic principles set out in this section must be respected for glazing FINEO in rebates using glazing beads.

2.1. BASIC PRINCIPLES

Compliance with the instructions mentioned above and further expanded on below is required in order to ensure the FINEO is correctly installed.

1. Correct glazing dimensions
2. State of Frame
 - a. Rigidity
 - b. Drainage
 - c. Hardware and tightness
 - i. Hardware: handles, hinges, locking mechanisms
 - ii. Weather tightness, seals, putty, gaskets, etc.
3. There must be no contact between the glass and frame (appropriate setting blocks and dimensioning of setting blocks) or any hard material and there must be adequate clearance between the frame and the glazing.
4. FINEO must not be subject to any intentional or accidental deteriorations or modifications after it has been installed, e.g. chipping, cutting, edge processing, painting or application of films.
5. When retrofitted, the glazing must be installed using a sealant with specific properties, having a total modulus of elasticity of less than 0.5 MPa at 100% elongation and compression and belonging to class ISO 11600 F + G 25 LM. The seals must be at least 4mm wide.
6. It is possible to install the glazing in a full putty. Similarly, FINEO can be installed in an undrained, unventilated rebate, subject to the limitations of the usual rules.
7. In all other cases, please contact FINEO technical assistance service for an assessment.
8. The seal must be and remain totally waterproof.
9. All materials used to install the glazing must be compatible with each other, with the glazing and with the frame. Special attention must be paid to the silicone used.

2.2. DETERMINING THE DIMENSIONS OF FINEO

Glass dimensions are determined taking into account:

- edge clearance
- rebate depth
- any grooves in the bottom of the rebate (clip grooves)
- the tolerances of the frames and glazing

2.3. DETERMINING THE THICKNESS OF FINEO

The thickness of FINEO glazing depends on their dimensions and the loads to which they are subject. For facade glazing (i.e. inclined at a maximum of angle of 15° from the vertical), these stresses are mainly wind load and the difference between inside and outside temperatures.

To determine loads, the installer or reseller and architects or the engineering office must refer to ETA (No. 20/0048 2020-01-22) and applicable standards, regulations and/or good practices in the construction industry, and define the specific factors that need to be considered (e.g. height and shape of the building, location of the construction site, etc.).

These criteria are used to establish the required thickness of the glazing, which can be validated by using the Configurator in the LMS. The FINEO team can assist the Installer or Reseller and Architects or Engineering Office in this operation.

2.4. WINDOW REQUIREMENTS

2.4.1. General condition of the window frames

Prior to retrofitting a window with FINEO, the general condition of the frame must be assessed. The frame must be strong enough to withstand deformation when the existing glazing is replaced with Fineo glazing.

The hardware fittings (hinges, locking mechanisms) must also be able to withstand the retrofit operation.

Additional instructions may be issued by national bodies/authorities, or project specific requirements.

2.4.2. Rebate drainage

In cases where drainage of the rebate is necessary, assuming the ideal profile height of 6mm, the following must be used or implemented:

- drained rebates, i.e. the bottom of the rebate must be fitted with a drainage channel and either a drainage opening (wooden frames) or drainage outlets (metal or PVC frames).
- ventilated rebates which, in addition to draining water from the rebate, have decompression openings in the upper part of the frame to allow air to circulate.

This allows any water that might enter or condense in the rebates to escape.

Ways of draining the rebate are listed below. Any other validated solutions are of course also acceptable.

- When installing with putty:
 - o an opening with a diameter of at least 6mm at a distance of between 5cm and 20cm from the corners of the frame
 - o no more than 80 cm between two openings
- When installing with a gasket:
 - o an opening no larger than 35 mm x 5 mm close to the corners of the frame
 - o no more than 80 cm between two openings.

It is advised to have a drainage channel at the bottom of the rebate, ideally 6mm wide and a 5-6mm depth.

If ventilated rebates are used, the decompression openings at the top of the frame must have a diameter of at least 5mm. There must be at least two openings.

Particular care must also be taken when installing the glazing beads to prevent any infiltration of water.

Figure 1 outlines these principles and gives an example of weather tightness between the opening and non-opening parts of a frame.

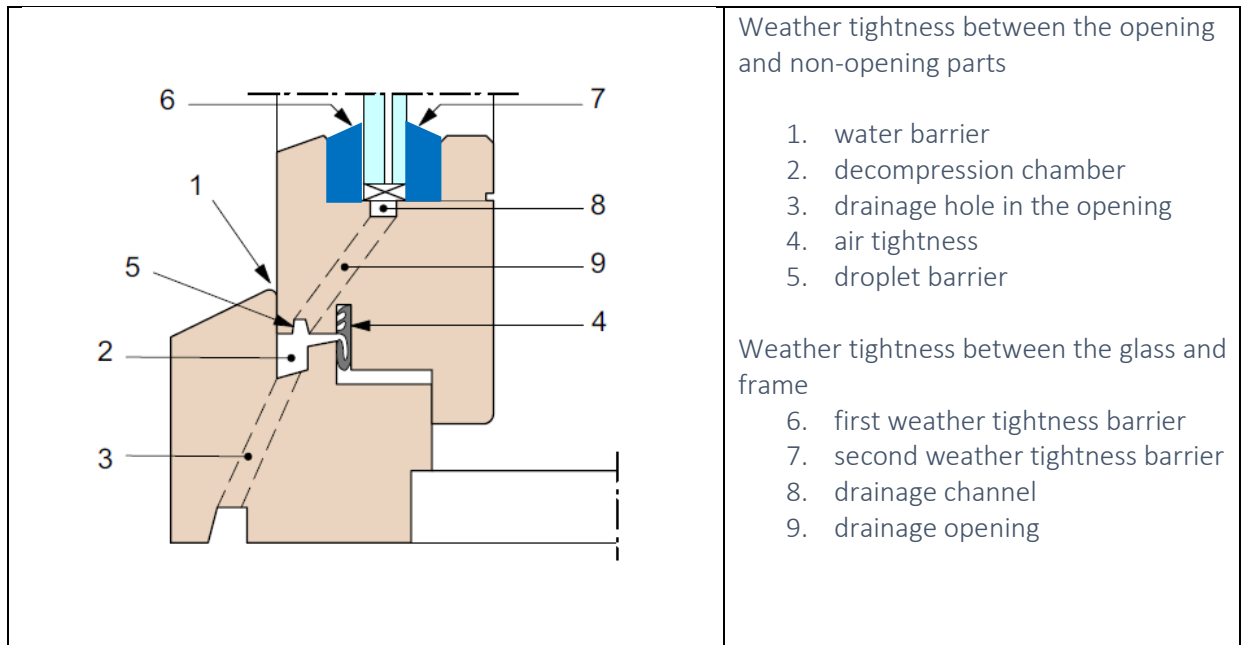


Figure 1 – Drainage and weather tightness of a window frame

2.5. GLAZING BLOCKS: REQUIREMENTS

The glazing must never come into direct contact with the frame or any other hard material. This can be avoided by using suitable setting blocks and location blocks and complying with the edge clearance requirements (see section 2.6).

2.5.1. Definitions

There are two types of glazing blocks (Figure 2):

- **Setting blocks (C1)** transfer the load of the glazing to the frame in order to ensure the frame remains square and to limit the deformation of the gasket. With the exception of U gaskets, setting blocks must be used.
- **Location blocks (C2)** allow the glazing to be positioned and held correctly in relation to the bottom of the rebate and ensure the frame remains square. They are used whenever there is a risk that the glazing could come into contact with the bottom of the rebate, especially at points where the moving parts hang or lock.

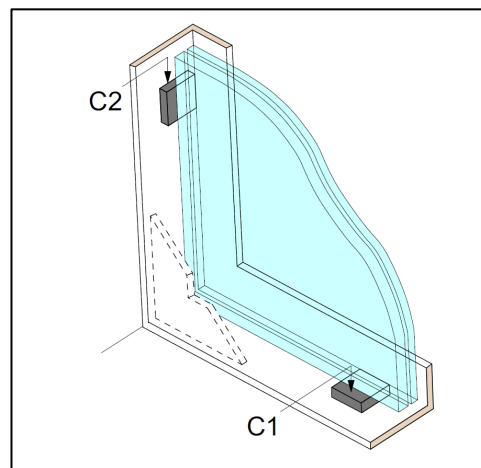


Figure 2 – Types of glazing blocks

2.5.2. Glazing blocks: properties

Setting blocks and location blocks may be made of:

- synthetic materials (e.g. polypropylene or polyamide) that have a hardness of 70 to 95 DIDC (Shore A as per in accordance with ISO 48) and a softening point above 80°C. They must be made of a material that allows the glass to slide across them. Blocks made of EPDM and neoprene are not recommended because they may deform;
- treated, rot-resistant hardwood (density $\geq 650 \text{ kg/m}^3$). The wood fibres must be parallel to the plane of the glazing. Wooden blocks must not be used with coated or laminated glass.

If blocks are used as distance pieces, they must be made of elastomer materials that have a hardness of 50-70 DIDC (Shore A in accordance with ISO 40 and EN ISO 2039-1) and they must allow the glass to slide.

2.5.3. Glazing blocks: dimensions

The width of the blocks must be at least equal to the width of the glazing.

The thickness of the blocks must be at least equal to the minimum edge clearance between the glazing and the rebate.

The blocks must be at least 50 mm long.

The actual length of the setting blocks is calculated using the following formula (prEN 12488):

$$l = \frac{25 \cdot S}{n \cdot \sigma} \cdot \sin \alpha$$

where

- l is the calculated length of the block (mm)
- 25 is the weight of the glazing expressed in N per m² and mm of thickness
- S is the surface area of the pane (m²)
- n is the number of setting blocks below the lower edge of the glazing ($n = 1$ or 2 depending on the type of frame, Figure 4)
- α is the angle of the glazing in relation to the horizontal
- σ is the permissible resistance of the block (N/mm²), limited to 1.5 N/mm²

Table 1 gives the minimum length of setting blocks depending on the surface of the glazing, the number of setting blocks in the bottom of the rebate (i.e. the type of opening in the frame) for vertical glazing or for glazing that is at an angle of more than 75° from the horizontal.

Table 1 – Length of setting blocks for glazing that is vertical or at an angle greater than 75° from the horizontal (resistance 1.5 N/mm²)

Surface area S of glazing	Opening or tilt and turn sash frame (mm)	Other frames (mm)
≤ 1 m ²	50	50
1 m ² < S ≤ 2 m ²	50	50
2 m ² < S ≤ 4 m ²	67	50
4 m ² < S ≤ 8 m ²		67
8 m ² < S ≤ 12 m ²		100
12 m ² < S ≤ 16 m ²		133
16 m ² < S ≤ 20 m ²		167

Table 2 lists the minimum lengths for setting blocks for roof glazing depending on the angle α of the glazing in relation to the horizontal, glazing surface and material used for the block.

Table 2 – Length of setting blocks for roof glazing (resistance 1.5 N/mm²)

Surface area S of glazing	Angle α of glazing in relation to the horizontal			
	75° < α ≤ 60°	60° < α ≤ 45°	45° < α ≤ 30°	30° < α ≤ 10°
≤ 1 m ²	50	50	50	50
1 m ² < S ≤ 2 m ²	50	50	50	50
2 m ² < S ≤ 4 m ²	54	50	50	50
4 m ² < S ≤ 6 m ²	80	72	59	50

The tolerance over the length of the blocks is ±2 mm.
Setting blocks are generally 50 mm long.

2.5.4. Positioning the glazing blocks

Setting blocks and location blocks must be positioned in accordance with the type of opening in the frame.

The minimum distance between the corners of the frame and the edge closest to the block must be at least equal to the length of one setting block or location block in order to avoid excessive stresses on the corners of the glazing (Figure 3).

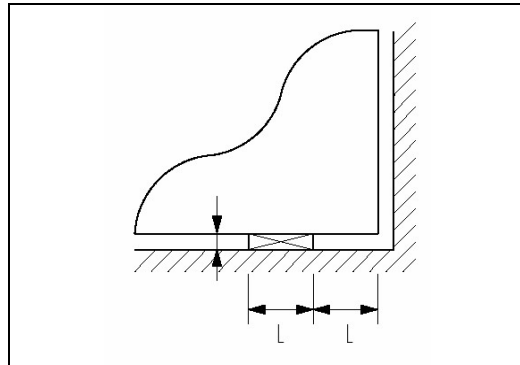
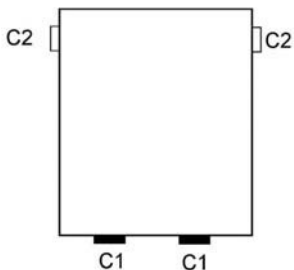
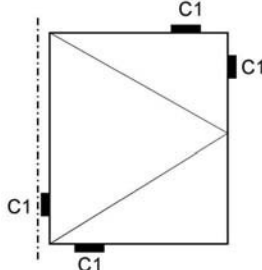
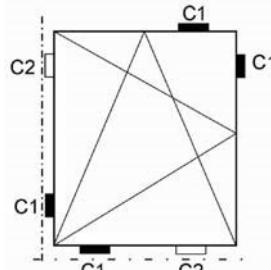
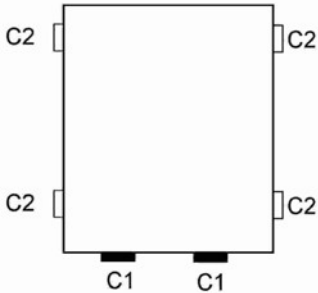
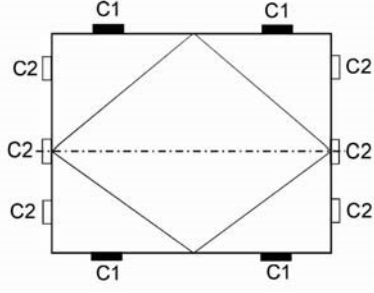
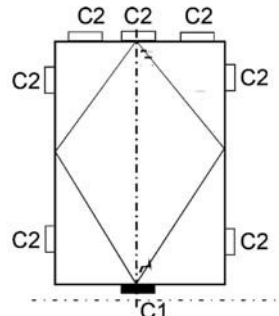
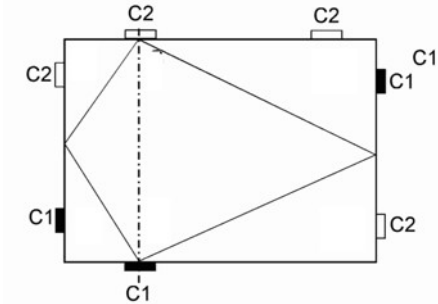
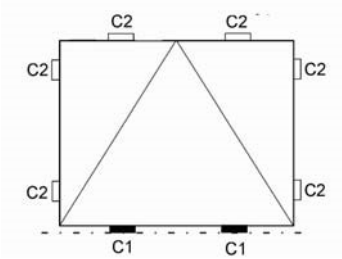
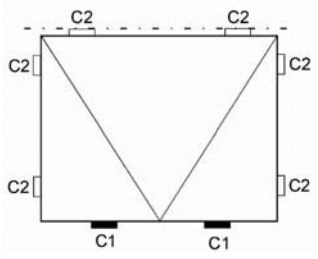
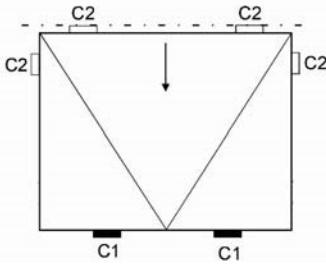
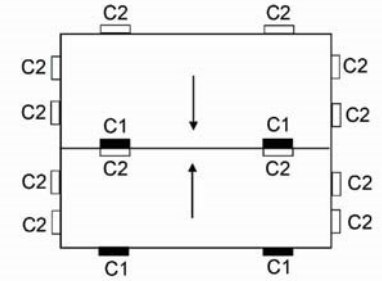


Figure 3 –Position of setting blocks and location blocks in relation to the corners of the glazing

Figure 4 shows the position of the setting blocks and location blocks depending on the type of opening in the frame.

<p style="text-align: center;">Fixed</p>  <p>C2 blocks are only required for frames glazed in a workshop that then need to be transported.</p>	<p style="text-align: center;">Opening (inwards or outwards)</p>  <p>The upper C1 block is adjusted to regulate the squaring of the frame and allow it to open easily.</p>	<p style="text-align: center;">Tilt and turn</p>  <p>The upper C1 block is adjusted to regulate the squaring of the frame and allow it to open easily.</p>
<p style="text-align: center;">Roof glazing</p> 	<p style="text-align: center;">Horizontal pivot casement</p>  <p>The C1 blocks must be placed close to the corners of the frame (at least 50 mm from the corners) to limit bending of the lower crossbar.</p> <p>The C1 blocks on the upper crossbar bear the weight of the glazing when the frame pivots. They must be the same length as the C1 blocks on the lower crossbar.</p> <p>Depending on the design of the frame, one C2 block can be placed along each stile of the frame at the same level as the pivot or else two C2 blocks can be placed at the ends of the stiles.</p>	

<p style="text-align: center;">Centre vertical pivot casement</p>  <p>Two C1 setting blocks should be placed at a distance of 50 mm on either side of the frame rotation axis. For small volumes, C2 blocks at the bottom of the stiles are optional.</p>	<p style="text-align: center;">Off-centre vertical pivot casement</p>  <p>Two C1 setting blocks should be placed at a distance of 50 mm on either side of the frame rotation axis. For small volumes, C2 blocks at the bottom of the stiles are optional.</p>
<p style="text-align: center;">Bottom hung</p>  <p>The C1 blocks should be placed at the level of the hinges. For small volumes, C2 blocks at the bottom of the stiles are optional.</p>	<p style="text-align: center;">Top hung casement</p>  <p>The C1 blocks must be placed close to the corners of the frame (at a minimum distance of 50 mm) to limit bending of the lower crossbar.</p>
<p style="text-align: center;">Projecting top hung</p>  <p>The C1 blocks must be placed close to the corners of the frame (at a minimum distance of 50 mm) to limit bending of the frame.</p> <p>The C2 blocks along the stiles are placed at the point where the support arms are fixed.</p>	<p style="text-align: center;">Guillotine</p>  <p>A single C2 block along the stiles is sufficient for small panes.</p>

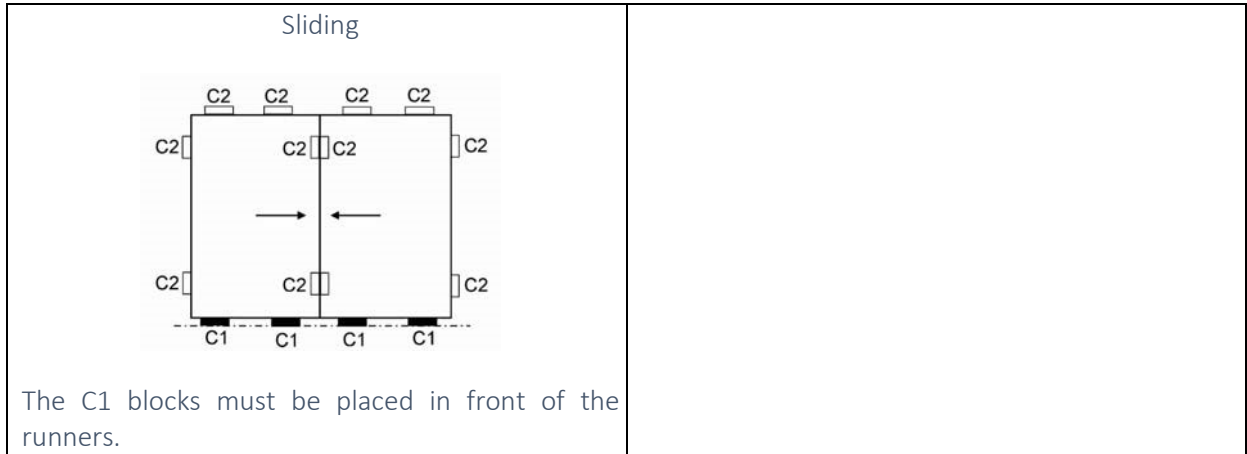


Figure 4 – Position of setting blocks and location blocks depending on the type of frame

2.5.5. Notes

- The glazing blocks must not prevent drainage from the bottom of the rebate or obstruct the drainage openings. Several options are available that will ensure good drainage.
- Metal and synthetic frames generally have different grooves in the bottom of the rebate and therefore require one or more additional support blocks to ensure a flat surface on which the setting block can rest.

2.6. GLAZING CLEARANCE REQUIREMENTS

The FINEO must never come into direct contact with the frame or any other hard material. This can be avoided by using a suitable setting block and complying with the edge clearance requirements (see section 2.5).

Figure 5 shows a rebate and the various key dimensions for installing glazing:

- height and width of the rebate
- bite , i.e. the height at which the glazing is effectively held by the frame
- edge clearance (or bottom of the rebate), i.e. the space between the glazing and the bottom of the rebate
- lateral clearance, i.e. the space between the glazing and the bottom of the rebate on the one hand and the glazing bead on the other.

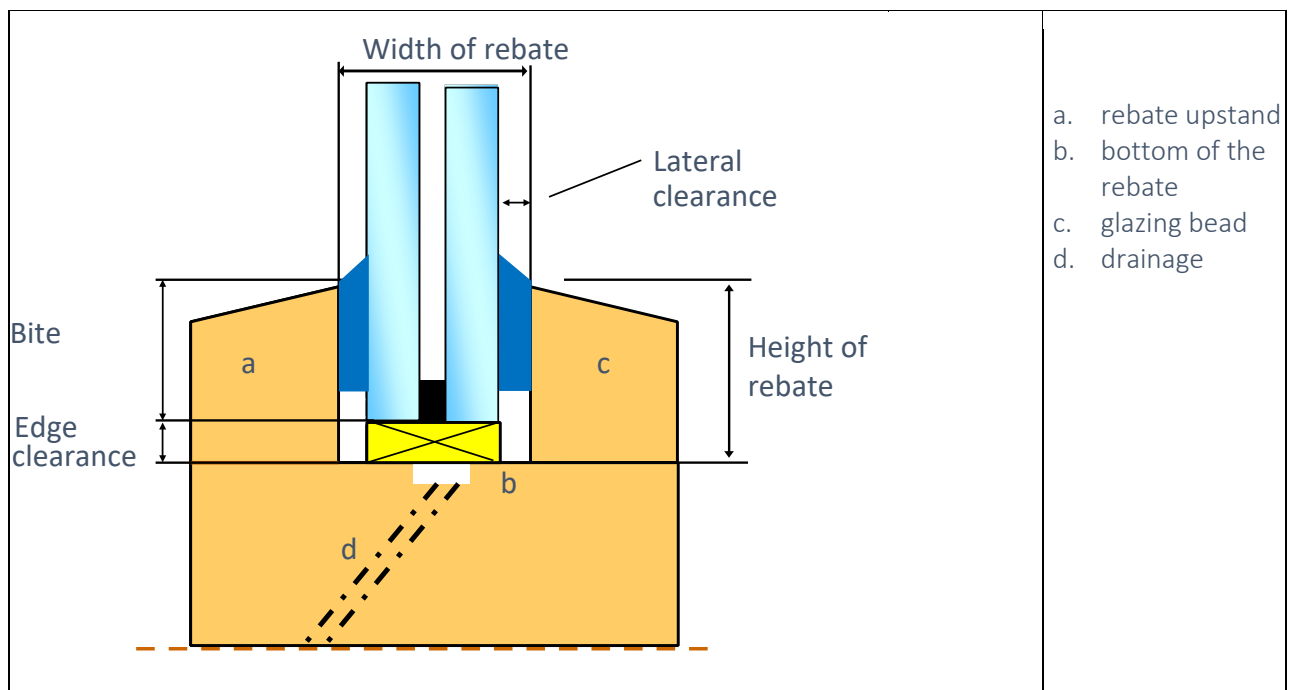


Figure 5 – Clearance

For frames with grooves in the rebate (metal, synthetic materials), the height and width of the rebate are measured from the top of the grooves.

The minimum clearance measurements are listed below.

Edge clearance

The minimum edge clearance is 2mm to 3mm, which is needed to ensure there is no contact between the frame and the glazing or any other hard element.

Glass Bite

Taking into account the edge clearances, dimensional tolerances for the glazing and frame, and the minimum bites required to install the glazing correctly, the minimum glass bite is 13mm, 15mm being optimal.

Lateral clearance

The width of the rebate is measured between the rebate upstand and the glazing bead. The minimum width must be such that, taking into account the thickness tolerances of the glazing, the lateral clearances required by the seals, i.e. 4mm for waterproof seals and putties, are respected.

Rebate width

The width of the rebate is equal to the thickness of the glazing (taking into account the tolerance) plus the lateral clearance on either side.

2.7. SEALS

2.7.1. Putty seals

When installing Fineo with a soft seal, such as silicone for instance, this seal must have a modulus of elasticity of no more than 0.5 MPa at 100% elongation and compression and must be at least 4 mm wide.

Four rules to follow:

- a) **Chemical Compatibility:** The FINEO Certified Installer must check the compatibility and adherence of putties with other window and glazing components (such as frames, glazing beads, interlayer materials if laminated glazing). The sealant manufacturer's instructions must be followed (e.g. with regard to working temperature and properties). Attention: use only putty compatible with EVA interlayer (and PVB) for FINEO Acoustic, Heritage and Safety.
- b) **Cleanliness:** The putty's adhesion to both the rebate and the glass depends on the condition of the surface. The rebate must be dry, clean and treated appropriately (e.g. with a primer for treated or exotic wood, plastic). If necessary, any grease/oil must be removed from the surface of the glass. It is vital to ensure cleanliness and tidiness while installing the gasket, since certain putties can sometimes leave traces that are difficult to remove once they have polymerised
- c) **Weather tightness and adherence:** The weather tightness and adherence of the putties must be checked over time to determine whether it is sufficient. If not, remove the defective non-conform putty and re-install FINEO with newly applied putty.
- d) **Cleaning and maintenance:** Putties must be cleaned and maintained in accordance with the manufacturer's instructions. We advise an inspection one year after installation,

followed by an annual inspection of a representative part of the building in order to determine if a detailed inspection or maintenance is necessary.

Putties must conform ruling EN standards and be approved by a Notified Certification Body . This information must be provided along with the putty's instructions for use.

2.7.1.1. Examples of installation with putty

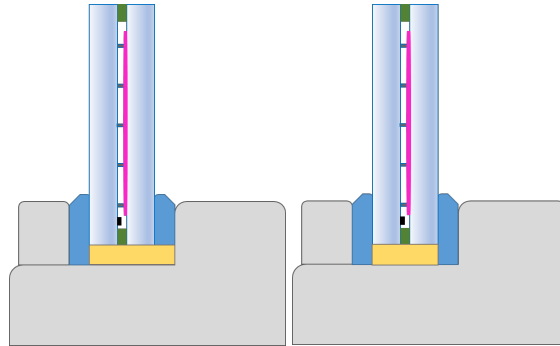


Figure 6 – Installations with putty

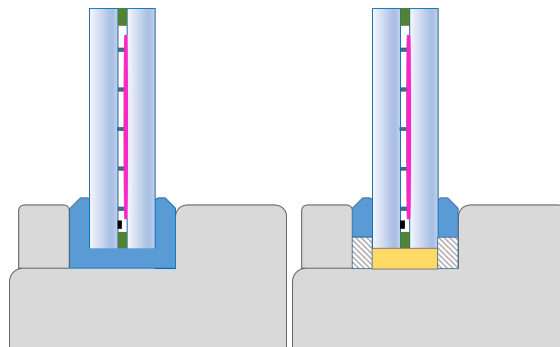


Figure 7 – Installation in a full putty bed and use of joint sealing foam

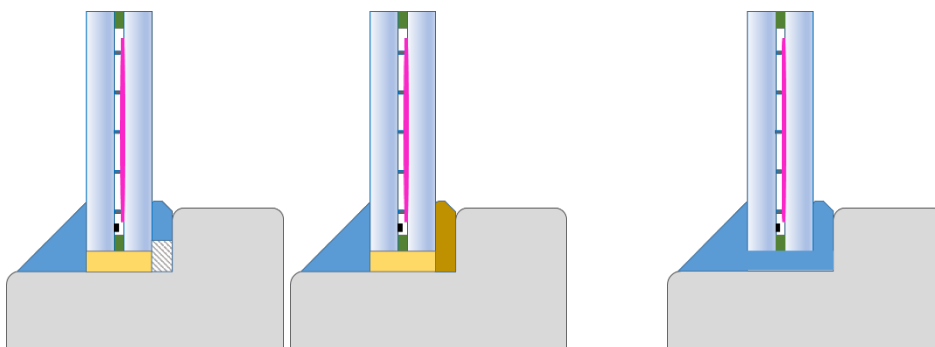


Figure 8 – Installations with flashing putty

2.8. ROOF GLAZING

In addition to the requirements listed in Section 2, particular attention must be paid to the following points for FINEO used in roofs.

If the thermal stresses are deemed to be too high, the glass must be **tempered or toughened** (depending on whether or not an additional safety function to provide protection from injury is required).

2.8.1. Laminated safety glazing

For roof applications, laminated glass is required. The inner pane of FINEO must be laminated to prevent glass debris from falling onto occupants if the glass breaks.

2.8.2. Angle

The angle of the FINEO must not be less than 10° in order to ensure weather tightness and easy draining of water.

2.8.3. UV resistant

FINEO is resistant to UV radiation.

2.8.4. Cleaning

The cleaning system must be designed to ensure the FINEO is not walked on. In case FINEO might be accessible for temporary cleaning of maintenance purpose: please contact the FINEO technical advisory service department for advice.

3. INSTALLATION IN EXISTING REBATES USING PUTTY

These instructions do not cover the following items, nor do they replace any applicable national standards, building codes, etc. concerning these items:

- the state of the window frame and the correct functioning thereof;
- the putty manufacturer's instructions for use;
- the connection of the window frame to the wall;
- the inclusion of ventilation devices in the window;
- painting (on the window frame and/or putty).

3.1. PREPARING THE WINDOW FRAME

- 3.1.1. Remove old putty, tape and any other glazing material and then remove the original glass pane from the window frame.
- 3.1.2. Make sure that the rebate is flat, smooth and even. Use a suitable brush to remove any loose particles from the surface.
- 3.1.3. Make sure that there are no hard and/or sharp objects in the rebate area. Any necessary surface work can be performed with a router.
- 3.1.4. If necessary, rout out the rebate in accordance with the minimum required distances for FINEO.
- 3.1.5. If necessary, degrease the surface properly.
- 3.1.6. Pre-treat highly porous surfaces with an appropriate primer.
- 3.1.7. Non-porous surfaces should also be treated when required with the appropriate primer to ensure good adhesion. Use the primer recommended by the putty manufacturer.
- 3.1.8. Apply an foam strip (eventually adhesive) or putty to the inner side of the rebate, first making sure that it is clean, uncontaminated, grease-free and dust-free.

3.2. INSTALLATION

- 3.2.1. Check that the surfaces are clean and dry, as well as free of dew, frost, grease and loose particles or material.
- 3.2.2. Position the setting blocks in the bottom of the rebate. Place the FINEO unit on the setting blocks (if necessary, adjust the thickness of the setting blocks to ensure the FINEO is level) and position it so it is centred within the window opening and there is a uniform clearance around the perimeter.
 - 3.2.2.1. Make sure that the glass bite is greater than the sum of the height of the setting blocks and the width of the FINEO cutting trim-off in order to ensure that the coating trim-off zone and marking are not visible.
 - 3.2.2.2. Exception: Setting blocks can be omitted for sizes smaller than 0.4m x 0.4m.
- 3.2.3. Use a temporary measure to hold the FINEO in place while the putty is curing. Make sure there is no direct contact between the FINEO and any hard material (e.g. metal) that can cause the glass to chip or crack.
- 3.2.4. Remove the temporary measure and apply the putty to a stable, compatible, clean, uncontaminated, grease-free and dust-free surface.
- 3.2.5. There are two ways of applying putty:

- 3.2.5.1. The minimum dimensions of the putty bead seal (triangular shape with a right angle): minimum of 10mm x 10 mm (base x height). See section 3.2.2.1. for the height required to hide the coating trim-off and marking.
- 3.2.5.2. Full putty bed: triangular bead of putty of minimum width at base of 10mm.
- 3.2.6. Refer to the putty manufacturer's instructions for application instructions and curing times.
- 3.2.7. Apply a silicone finish if a foam strip is used.

3.3. WHICH PUTTY TO USE

- 3.3.1. Non-laminated FINEO: the FINEO seal is chemically compatible with a wide range of commercial putties, as silicones.
- 3.3.2. Laminated FINEO: IMPORTANT: Use **only** a sealant compatible with laminated glass products and in particular intermediate materials EVA (and PVB).

3.4. WATER DRAINAGE

- 3.4.1. Refer to national building codes and/or best practices to determine if water drainage is required and, if so, how it should be executed.
- 3.4.2. The installation of FINEO in an undrained and non-ventilated rebate is feasible, within the limits of usual rules.
 - 3.4.2.1. FINEO is not negatively impacted by stagnant water in permanent contact with the edge of the glass.

4. WHICH SIDE OF FINEO TO PLACE TO THE INSIDE ?

Please refer to the FINEO coating position document. There are two ways to verify which side of FINEO to be placed to the inside of the building.

4.1. STICKER

All FINEO volumes leave the production facility with a sticker which is placed almost systematically on the inside of the glazing.

4.2. UNIQUE CODE MARKING

All FINEO volumes leave the production facility with a unique number marking for sake of trace ability.

The FINEO is well installed when the marking number can be read from the inside of the building. The position of the marking (on top, bottom, left or right) does not matter.