

Ventilated façade

1 General

These application instructions are specifically intended for the blind mechanical fastening (Tergo®-system) of large-size EURO PANELS OVERSEAS N.V. facade panels as outside wall and/or ceiling cladding on a ventilated and insulated structure in aluminium fixed to a back construction. A number of basic principles are given that must be adhered to. For variations or additional advice one can always contact EURO PANELS OVERSEAS N.V..

2 Cladding material

The following EURO PANELS OVERSEAS N.V. products are treated in this document.

• TEXTURA	12 mm
• NATURA	12 mm
• PICTURA	12 mm
• NATURA PRO	12 mm

Product data and processing information can be found in the product information sheets, available from EURO PANELS OVERSEAS N.V..

For façade or ceiling applications only rectified boards may be used, non-rectified boards should not be used uncut.

When sawing NATURA and NATURA PRO, the sawed edges must be impregnated with LUKO (a transparent impregnating agent) to minimize local colour differences due to moisture absorption. Tergo undercut wholes in NATURA panels should also be treated with LUKO.

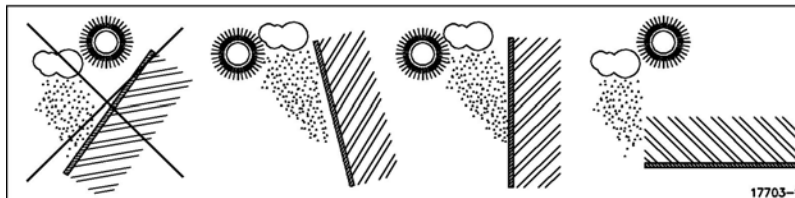
3 Area of application

These instructions apply for buildings up to a certain height and subjected to a maximum actual wind load in a certain wind zone. The maximum intermediate distance of the supporting structure is determined in relation to the occurring wind load taking into account a safety factor. The table below only shows non-binding reference values for the wind loads. The exact values can be found in the standards NBN B 03-002-1; NEN 6702:2001 and NBN-EN 1991-1-4.

Location	Building height	Middle area façade		Edge area façade and single span	
		Max. actual wind load	Max. center-to-center distance supporting laths	Max. actual wind load	Max. center-to-center distance supporting laths
Wind zone	m	N/m <sup>2</sup>	mm	N/m <sup>2</sup>	mm
Land	0-10	650	600	1000	500
Land	10-20	800	600	1200	500
Land Coast	20-50 0-20	1000	500	1500	400

The width of the edge area amounts to at least 1 m from the corner of the building and must be further determined on the basis of prevailing national standards and conditions. If variations of the aforementioned load limits occur (e.g. due to certain location or form factors, etc.), the design must be determined by building services engineers. The fixing of OPERAL to a building height higher than 20 m is not advised.

When the façade panels are exposed to weather conditions (rain, sun) they may only be assembled on a vertical or leaned over supporting structure. For ceiling applications reference is made to the relevant application guidelines.



#### 4 Supporting structure

Restriction has to be made for the use of aluminium supporting structures in aggressive environments, where the aluminium of the supporting structure can be corroded, such as for example in coastal locations (minimum one kilometre from the coastline).

The complete supporting structure of the Tergo system consists of a vertical aluminium supporting structure on which the special horizontal supporting profiles are fixed. The EURO PANELS OVERSEAS N.V. large-size facade panels are hung on the horizontal aluminium supporting profiles with the special panel hangers. The vertical supporting profiles are fixed at a certain distance (depending on the required insulation thickness and air cavity) on the back construction by means of aluminium adjustable brackets.

The supporting structure must be able to resist the wind forces exerted on the building and the load of its own weight.

- maximum buckle under the influence of strain :  $\leq \text{span}/300$
- safety factor calculation of strength : 3

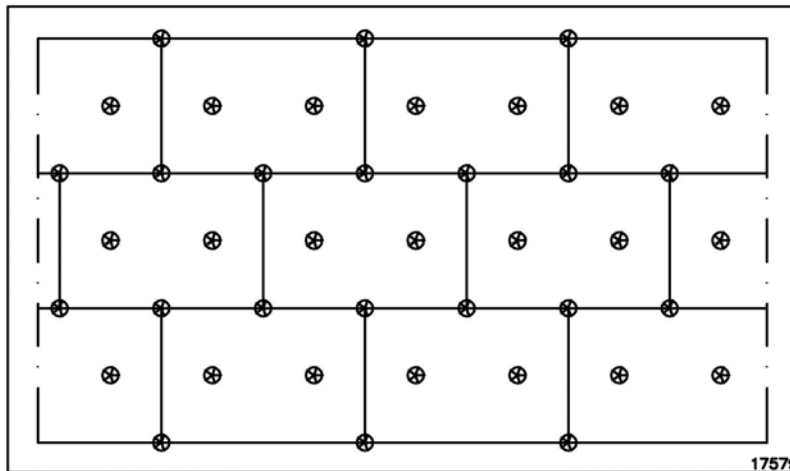
The fastening of EURO PANELS OVERSEAS N.V. facade panels must always take place with a ventilated cavity. The necessary openings are provided on the bottom side, top side and in the details to allow sufficient ventilation.

Badly ventilated façade panels could result physic problems for the construction and differences in colours under influence of humidity for panels with a semi-transparent coating.

- ventilation openings above/below :  $\geq 10 \text{ mm/m}$  or  $100 \text{ cm}^2/\text{m}$

Building height	0-10 m	10-20 m	20-50 m
Minimum cavity width	20 mm	25 mm	30 mm

Mineral wool with a water-repellent black protective coating is recommended for insulation. The insulation is fixed with synthetic insulation fastenings. The insulation is fastened according to the instruction of the producer of the insulation, e.g. with five insulation fasteners per square metre.



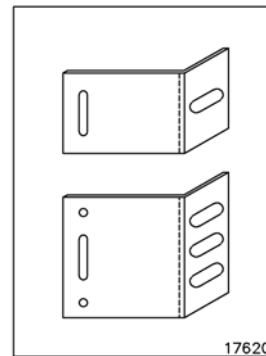
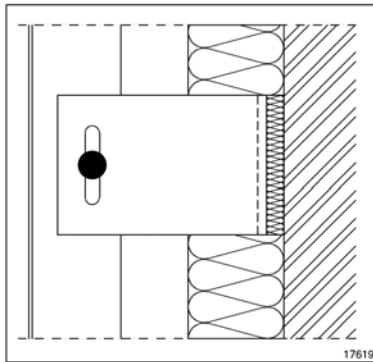
If the supporting profiles are fixed with brackets, the insulation is fastened after the fitting of the brackets and before the fitting of the supporting profiles. A slit is cut in the insulation at the bracket.

It is preferable to isolate the bracket from the supporting wall by using a piece of hard insulation material.

## A. SUPPORTING BRACKET

The aluminium supporting brackets allow the gradual varying of the distance between structural work and rear of the panel. This means an air cavity can be provided, insulation can be placed, and any unevenness of the rear wall can be eliminated.

There are different types of supporting brackets depending on the supplier of the supporting structure. In this document the supporting brackets are diagrammatically represented as follows.



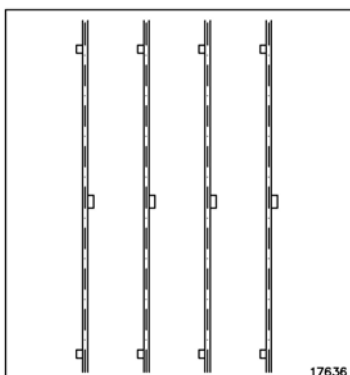
The distance between the brackets is determined by the load exerted (as a result of the wind load and force of gravity) and the strength properties of the aluminium sections (to be indicated by the supplier of the aluminium supporting structure). The calculation of the wind load has to be done according to the national applying standards (NBN B 03-002-1; NEN 6702:2001 ; NBN-EN 1991-1-4).

The fixing of the adjustable brackets to the back construction is individually determined for each project depending on the nature and the state of the wall to be claded.

In general a minimum pull-out value per fixing point of 3 kN (300kg) is recommended. This must however be verified for each project. For concrete and solid brick a stainless steel wood screw (min. 7 mm diameter) with a hexagonal head and associated nylon plug is used. The screws with hexagonal head are, however, not tightened too firmly so thread in the nylon plug is not damaged.

For other surfaces (hollow brick, cellular concrete, system walls, etc.) suitable fastening means must be used to be able to accommodate the tractive force occurring as a result of the wind load and the shearing forces as a result of the own weight. If necessary a pull-test must be conducted on site. An insulation block can be placed between the bracket and the back construction to prevent thermal bridges.

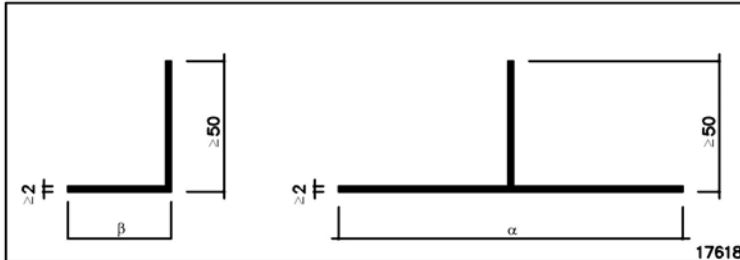
To obtain a stable supporting structure, the supporting brackets can alternately be fitted left and right of the aluminium section. With uneven back constructions the bracket must be bent straight so the aluminium sections are not twisted.



## B. ALUMINIUM SUPPORTING PROFILES

There are different types of aluminium sections depending on the supplier of the supporting structure. In this document the aluminium section are diagrammatically represented as follows.

- T-profile: at the vertical joints between the façade panels
- L-profile: middle support



The vertical aluminium sections and the surface they form must be sufficiently even.

- maximum unevenness :  $\leq L/1000$

The aluminium supporting profiles are placed vertically so that penetrating or condensation water can run down from the back of the panel. The design plan of the façade cladding shows the supporting profiles.

- minimum width T-profile ( $\alpha$ ) : 70 mm
- minimum width L-profile ( $\beta$ ) : 30 mm

Depending on type of aluminium alloy and the spans (to be indicated by the supplier of the aluminium supporting structure) the aluminium sections must be sufficiently thick to stand occurring loads (as a result of the wind load and force of gravity). The aluminium section must also be sufficiently thick to allow the sufficiently strong fastening of the fastening accessories.

- minimum thickness aluminium section : 2.0 mm

The length of the aluminium sections is restricted to avoid too great expansion.

- maximum length aluminium section : 6.0 m
- maximum expansible part of the profile : 3.5 m (from fixed point to section end)

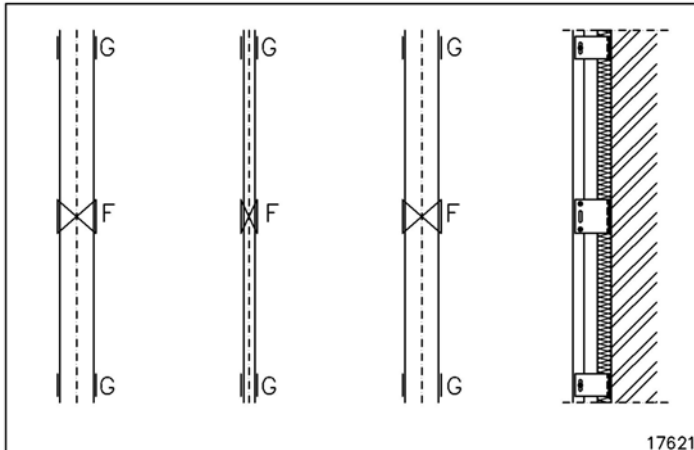
It is recommended to make the fixed points of the aluminium profiles at a horizontal joint between the cladding material. The exact position is to determine by the supplier of the supporting structure.

Point of attention for ceiling applications:

The connection of the ceiling with the façade has to be detailed in a way that rainwater or cavity water cannot infiltrate behind the boards but is evacuated to the outside at all times. The construction also has to be designed in order to avoid water stagnation on the ceiling.

## C. FIXING SYSTEM PROFILE – SUPPORTING BRACKET

In view of the high thermal coefficient of expansion of aluminium, the aluminium sections must be fixed in such a way that free movement is possible. The system for fixing the supporting brackets to the profile must accommodate the expansion of the aluminium sections. This is achieved by fixing the sections with one fixed fastening point (F: fixed point) and at other places free fastening points (G: floating point).



The fixed fastening points are located at the same height so that stress in the sheet is avoided.

The free fastening points must be strong enough to withstand the wind loads. The fixed fastening point must be able to withstand both the wind loads and the dead weight of the façade cladding system.

Fixed and free fastening points can be obtained in different ways depending on the supplier of the supporting structure:

- aluminium clamping blocks
- fixed/free rivets (wire stitcher with/without spacer) in aluminium or stainless steel
- fixed/free stainless steel bolts

The number of fastening points is determined in view of the loads occurring.

Expansion joints must be provided between the vertical aluminium sections (fit a supporting bracket on both sides of the joint).

- width of joint between aluminium sections : 20 mm

## 5 Basics of the Tergo®-system

The Tergo system offers the highest technical and aesthetic for designing façades. No fasteners are visible on the surface. The following aspects can be varied as desired:

- Free choice of layout grids
- Use of full panel format in size, without visible fixing points
  - o Textura 3100 x 1500 mm
  - o Natura 3100 x 1250 mm
  - o Pictura 3100 x 1250 mm
- Open joints

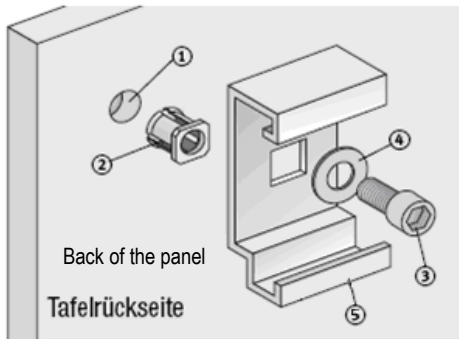
The basis for specifying the size of individual cut panels consists of:

- o The working drawings
- o The measured survey of the building

Secret fixing with Euro Panels Overseas N.V. undercut anchors as part of the Euro Panels Overseas N.V. Tergo system is approved under general building regulations permit N°. Z 21.9-1534.

## 6 Scope of supply

Tergo façade panels are mounted using undercut anchors, screws and washers. The panel hanger or rail for mounting the panel belongs to a particular subconstruction and is not included in the scope of delivery.

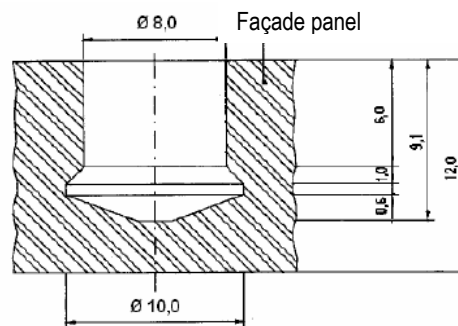


1. individually cut façade panels, pre-drilled at the rear, 12 mm thick: Textura, Natura or Pictura.
2. Euro Panels Overseas N.V. undercut anchor in stainless steel
3. socket cap screw M6 x 12 DIN 912 in stainless steel
4. washer 6.4 DIN 9021 in stainless steel
5. panel hanger (not included within scope of delivery)

## 7 Undercut anchor

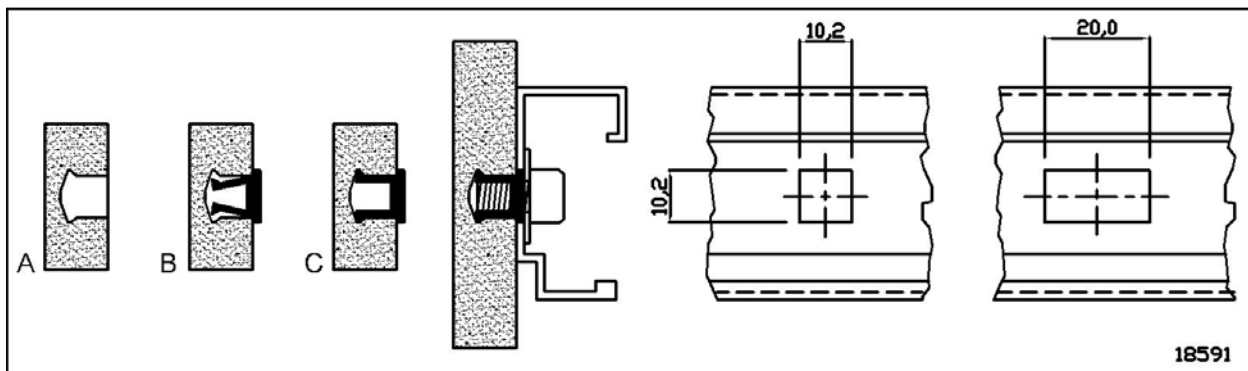
The Euro Panels Overseas N.V. Tergo design solution includes special Euro Panels Overseas N.V. undercut anchors.

Dimensions of the undercut holes.



After the anchor has been inserted into the pre-drilled undercut hole (A + B), its sleeve is splayed into the desired position by insertion of the screw (C).

This creates an interlocking anchorage for the façade panel. The anchor studs have square collars, which enables them to be fixed securely to any subconstruction. Depending on the type of fixing required, holes can be punched in to parts of the subconstruction. The profile to receive the collar, either square for fixed points or rectangular for sliding ones.



## 8 Structural requirements

Each façade panel is to be fixed, by means of at least 4 undercut anchors arranged rectangularly with individual hangers, to a suitable subconstruction in such a way that it is technically free of displacement constraint. The number of separate hangers is to be limited to 9. If more than 9 fixing points are necessary, continuous panel rails, or 'hanger rails' must be specified.

9 Structural design

Façades consisting of Textura, Natura or Pictura fibre cement panels, Euro Panels Overseas N.V. undercut anchors and subconstruction should be dimensioned by a suitably qualified structural engineer.

In each individual case, the number of fasteners is to be calculated with regard to the panel size, the subconstruction, the substrate and the loading (dead load, wind load in accordance with e.g. DIN 1055-4 and in accordance with e.g. DIN 185 16-1 respectively).

The stiffness of the subconstruction profiles is to be taken into account in the calculations. The wall brackets belonging to the subconstruction should be assumed to be immovable at the anchoring points in the substrate.

Table: Nominal values for anchor plugs and panels  
The main parameters for dimensioning are given in the table below

		Nom. value	
Corner distance <sup>2)</sup>	$a_e \geq$ [mm]	50	100
Edge distance	$a_r \geq$ [mm]	50	
Pm. pull-out load per anchor <sup>1)</sup>	$F_{toel} =$ [kN]	0,3	0,4
Pm. lateral load per anchor	$Q_{toel} =$ [kN]	0,8	
Centre spacing of anchors	$a \leq$ [mm]	750	
Punched hole (fixed point)	$a \times b$ [mm <sup>2</sup> ]	10,2 x 10,2	
Punched hole (sliding point)	$a \times b$ [mm <sup>2</sup> ]	10,2 x 14,2	

- 1) for anchor plugs subjected to an oblique tensile force, the permissible pull-out load is calculated according to the following formula.

$$F_{pm} = 0,4 \times 1,5 \sqrt{1 - \left(\frac{Q}{0,8}\right)^{1,5}}$$

Q can be taken as the figure for the lateral load acting on the anchors as a result of the dead load of the panels.

- 2) For corner distances of  $50 \text{ mm} \leq a_e \leq 100 \text{ mm}$ , the permissible pull-out load is to be calculated by interpolation. If the corner distances in both directions are unequal, the small figure is to be taken.

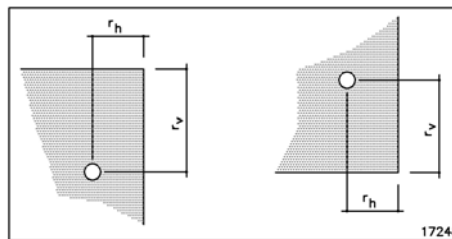
10 Positioning of the fixing holes

The positioning of the fixing holes depends upon:

- the format of the panels
- the type of subconstruction
- the structural stability analysis of the façade
- the edge distances for pre-drilled undercut holes

Recommended edge distances for planning holes positions: 100 mm

Edge distances horizontally (i.e. to vertical edges) must lie between 50 mm min. and 100 mm max. and vertically (i.e. horizontal edges) between 70 mm min. and 100 mm max.



$r_h$	50-100
$r_v$	70-100

Edges distances in excess of 100 mm can have a negative effect on the appearance, especially at cross-joints, because it can no longer be guaranteed that the panel edges will lie evenly in the same plane.

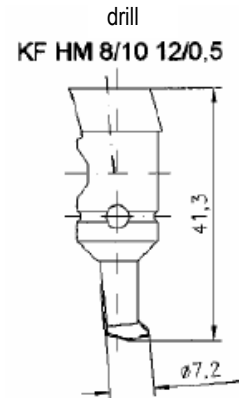
The maximum centre spacings for Euro Panels Overseas N.V. undercut anchors are as follows:

Height of building	Standard zone	Edge zone
$\leq 8 \text{ m}$	750 mm	620 mm
$\leq 20 \text{ m}$	750 mm	500 mm
$\leq 100 \text{ m}$	680 mm	420 mm
ceiling	400 mm	300 mm

- These centre spacings are non-binding. The actual spacing must be ascertained by structural analysis. A joint width of 10 mm is recommended.
- For Tergo façades with open joints, increased wind suction loads do not need to be assumed in the edge zone of the building.

## 11 Additional holes

- The undercut holes in the rear of the panels are pre-drilled at the factory.
- Additional holes may be drilled in workshop conditions on site using a mobile drill (type KS-HV) and a special bit (type KF HM 8/10 12/0,5) manufactured by KEIL, Im Auel 42, D-51766 Engelskirchen-Loope, Germany, tel +49 22 63 80 70, fax +49 22 63 80 73 33.
- The geometry of the additionally drilled holes is to be checked with a gauge of 8/0,5.
- The drill dust must be removed completely from the hole.
- If a hole is badly drilled, the distance between it and any new hole must be at least twice the depth of the badly drilled hole.

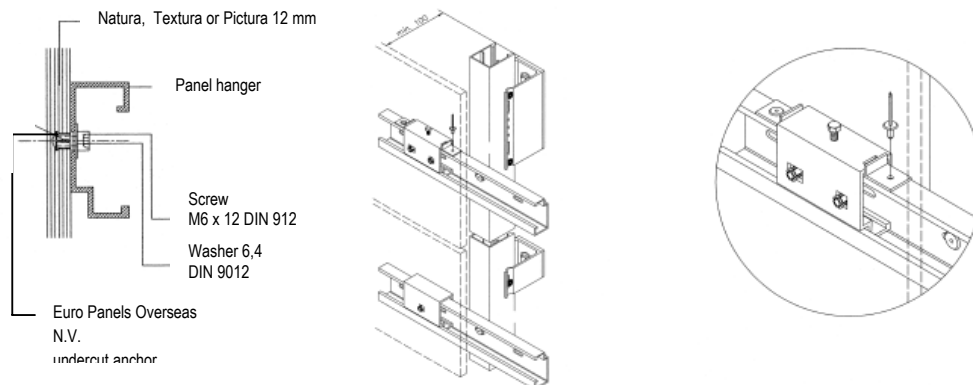


## 12 Subconstruction

### 12.1. Subconstruction with panel hangers

Panel hangers suitable for the system are fixed to the rear of the panels with undercut anchors. Each panel is provided with 2 adjustable hangers on the same horizontal level. After this has been done, the panels are hung on the horizontal supporting profiles of the subconstruction, adjusted and secured firmly and permanently against sideways slippage with screws and special angles. The horizontal profiles should be interrupted approximately every 4 m in order to avoid unwanted differences in the width of joints between the panels being caused by expansion of the aluminium. The dead load is transferred via the two adjustable fixings in all cases.

The minimum thickness of the construction, measured from the face of the façade panel (12 mm thick) to the surface of the supporting wall, is 100 mm.



### 12.2. Subconstruction with panel rails

If more than 9 fixing points are necessary, continuous panel rails, or 'hanger rails' must be specified. Hanger rails are fixed to the rear of the panel without constraint, using Euro Panels Overseas N.V. undercut anchors. Each rail is fixed with one fix point, the other fixing points are sliding points.

The panels are hung on the horizontal supporting profiles of the subconstruction, aligned by means of 2 screws. After this has been done, the panels are secured firmly and permanently against sideways slippage with screws and special angles.

The horizontal profiles should be interrupted approximately every 4 m in order to avoid unwanted differences in the width of joints between the panels being caused by expansion of the aluminium. The dead load is transferred via the two adjustable fixings in all cases.

For subconstructions with hanger rails, a lock washer (6 DIN 7980-A2) must be inserted between the undercut anchor and the washer at sliding points. The washers are included in the scope of delivery by the subconstruction suppliers.



### 12.3. Suppliers of subconstruction systems

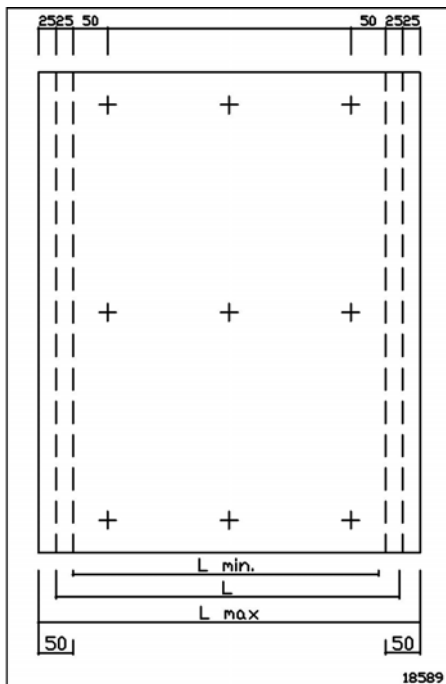
Panel hanger systems are supplied by the following companies:

- Etanco Benelux nv/sa, Wommelgem ([www.etanco.be](http://www.etanco.be) en [www.etanco.nl](http://www.etanco.nl))
- Justimax BV, Venlo, Nederland ([www.justimax.nl](http://www.justimax.nl))

The design and dimensions of the supporting structure in relation to the load fall under the guarantee conditions of the supplier of the supporting structure. This document only explains a number of general principles.

## 13 Cut-to-fit panels for adjusting

Deviations from the planned dimensions of the structural shell can be allowed for by using oversize panels cut to fit. If such deviations are expected, cut-to-fit panels should be ordered before beginning work. This helps to avoid delays in construction work and extra costs.



Each panel can cope with a horizontal tolerance of -50 mm to +50 mm in the building. Cut-to-fit panels should be ordered with a width 50 mm greater than the desired width. The distance of the undercut holes to the vertical panel edges normally measures 100 mm, but can lie between 50 en 100 mm.

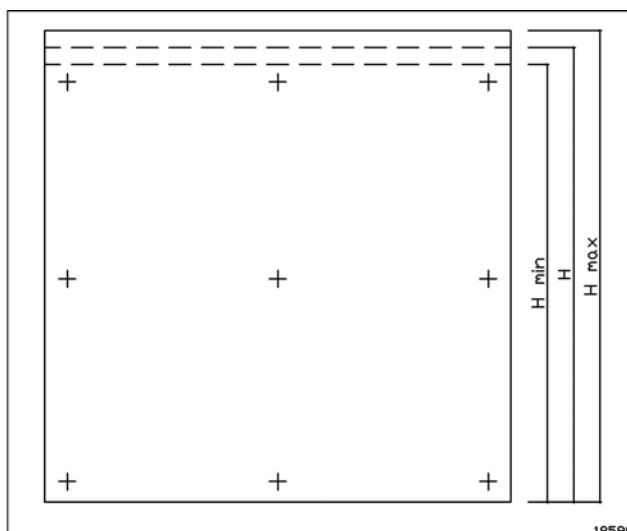
Cut-to-fit panels should be selected with an edge distance of 100 mm on both sides. Cutting the sides back by up to 50 mm each allows the width of a panel to be varied by up to 100 mm.

L min = minimum panel width

L = desired panel width

L max = ordered panel width

+ = undercut holes



Each panel can cope with a vertical tolerance of -15 mm to +15 mm in the building. Cut-to-fit panels should be ordered with a height 15 mm greater than the desired height. The edge distance of the undercut holes from the top edge of the panel normally measures 100 mm, but can lie between 70 and 100 mm.

Cut-to-fit panels should be selected with an edge distance of 100 mm at one of the two horizontal edges. When fitting at copings this is the upper edge, when fitting at plinths it is the bottom edge. The height of a panel can be varied by up to 30 mm simply by cutting the edge concerned back up to 30 mm.

H min = minimum panel height

H = desired panel height

H max = ordered panel height

+ = undercut holes

## 14 Notes on installation

1. When using panels, lift them completely from the stack – do not slide them. Please note: panels should be protected from moisture and direct sunlight.
2. Insert the Euro Panels Overseas N.V. undercut anchor in the pre-drilled blind hole.
3. Fix panel hangers to the rear of the panel with screws and washers (recommended tightening torque 2,5-4,0 Nm) or:
4. Fix panel rail to the rear of the panel using screws with washers and lock washers. A lock washer 6 (in accordance with e.g. DIN 7980-A2) must be inserted between the undercut anchor and the washer at gliding points
5. The panels are usually mounted from the bottom upwards. Please note: once the panel hangers or panel rails are attached to them, panels should be stored in a vertical position with ample protection for the decorated face.
6. When mounting with panel hangers: align the panels, then secure them firmly and permanently against sideways slippage or creep, as specified in the instructions of the subconstruction manufacturer.
7. Attention: For ceiling applications panels have to be secured against falling down of the panel rail.

## 15 Joints

The facade panels are fixed with open joints to allow the free movement of the panel.

- joint width (horizontal/vertical) : 10 mm

## 16 Accessories<sup>1</sup>

The following accessories can be obtained from EURO PANELS OVERSEAS N.V..

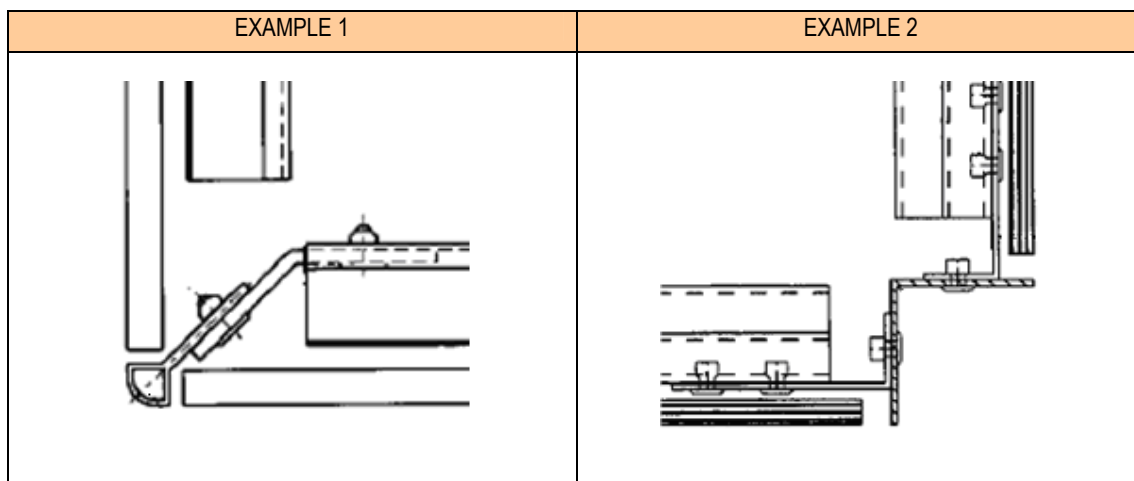
Perforated sealing profile	Blank aluminium	50 x 30 x 2500 mm
Perforated sealing profile	Blank aluminium	70 x 30 x 2500 mm
Perforated sealing profile	Blank aluminium	100 x 30 x 2500 mm
Undercut anchor	Stainless steel	L = 9 mm
Bolt for undercut anchor	Stainless steel	M6 x 12 mm
Washer for bolt	Stainless steel	17 x 6,4 mm

## 17 Other construction details

*Movements in the metal sections (corner section, bottom section, etc.) must always be detached from the panels. If necessary, the aluminium sections must be pre-drilled, and are fixed according to the principle of fixed and free fastening points. Joints between the metal sections must coincide with joints between the panels.*

Finishing sections in metals that can leach (such as zinc, copper, lead, etc.) are advised against because of possible soiling.

**OUTER CORNER:** Corner finishing can be provided by means of a finishing profile of aluminium or PVC.



<sup>1</sup> Use Euro Panels Overseas N.V. accessories; not using standard Euro Panels Overseas N.V. accessories may lead to cancellation of the Euro Panels Overseas N.V. guarantee.



**TOP FINISHING:** Sufficient ventilation openings must be provided.

**BOTTOM FINISHING:** The open cavity between the back of the panel and the insulation or the back construction must be sealed at the bottom by a perforated aluminium sealing profile. This profile prevents the entry of birds and vermin. The raised leg of the sealing profile is clamped between the aluminium supporting profile and the panel and is not thicker than 0,8 mm.

**WINDOW FINISHING WITH RETURN:** Sufficient ventilation openings must be provided at the top and bottom of the window.

**WINDOW FINISHING WITHOUT RETURN:** Sufficient ventilation openings must be provided at the top and bottom of the window.

**EXPANSION JOINT:** The settlement joints in the building must also be included in the cladding.

**CEILING APPLICATION:** The connection of the ceiling with the façade has to be detailed in such a way that ventilation is not blocked.

## 18 Health and safety aspects

During the mechanical machining of panels, dust can be released which can irritate the airways and eyes. Apart from this, the inhalation of fine (respirable size) quartz containing dust, particularly when in high concentrations or over prolonged periods of time can lead to lung disease and an increased risk of lung cancer. Depending on the working conditions, adequate machinery with dust extraction and/or ventilation should be foreseen. For more ample information, please check the Safety Data Sheet according to 91/155/EEC.

## 19 More information

Information about the various cladding panels can be found in the EURO PANELS OVERSEAS N.V. product information sheets. They can be found on the website or can be obtained on demand by phone. Information about external suppliers can also be downloaded from the website.

These application instructions replace any previous editions. EURO PANELS OVERSEAS N.V. reserves the right to amend these instructions without prior notice. Readers should always satisfy themselves that they are referring to the most recent version of this document. No part of this text can be changed without permission of EURO PANELS OVERSEAS N.V..

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