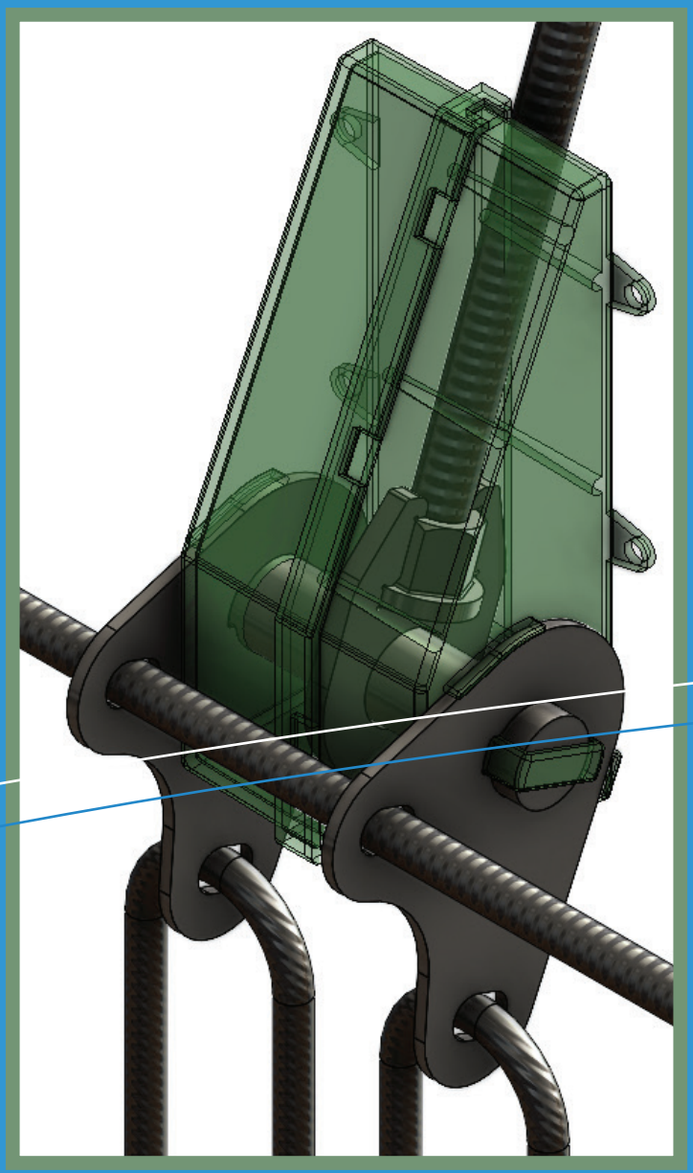
FIXINOX
STAINLESS STEEL CONNECTORS

FIXI3D 2.0
ANCHORS FOR ARCHITECTURAL CONCRETE PANELS



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INTRODUCTION

The ventilated facade clad with large-format precast concrete is durable, high quality and allows for flexible facade design with a wide variety of architectural options.

The precast concrete panels are fastened by punctual anchors to a concrete structure, steel frame or CLT structure.
As the anchors pass through the building insulation, thermal impact of the anchors is taken into account and minimised.
Facade panels thickness depends on the dimensions, surface structure, exposure class and structural design.

What is required for anchors in precast concrete panel facade?
1 - The fixings must withstand the forces involved (dead weight, wind, earthquake)
2 - The system must minimise thermal bridges
3 - The system must comply with fire protection regulations
4 - The system must allow for easy adjustment during installation
5 - The system should minimise maintenance costs by resisting corrosion

For reasons mentioned above, stainless steel is the best solution because it offers :
- 100 years service life
- excellent mechanical performance even at very high temperatures
- low thermal conductivity compared to other metals
- good weldability and deformability
- Optimisation of the number of fixings per m², thus improving the heat balance

What do FIXINOX solutions provide?
- almost 30 years of experience in a specialised activity.
- integration of design, calculation and manufacturing at a unique place.
- a complete study of your project including :
  - engineering of the facade panel anchors
  - verification of compliance with standards
  - the opimisation of installation conditions on site
  - adaptation of the design to the manufacturing conditions
  - preparation of an anchor layout guide
  - in-house production of execution plans
  - assessment of thermal bridges generated by the anchors
  - quality control by the engineering team responsible for the design

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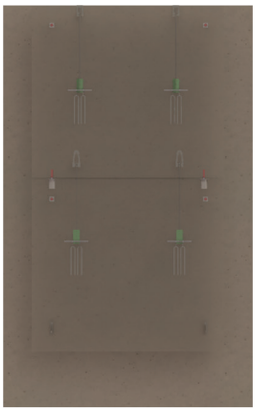
1.DESCRIPTION FIXI3D 2.0

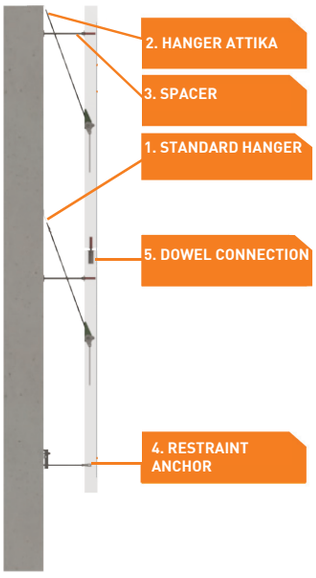
The Fixi3D 2.0 hanger allows concrete panels of different sizes to be suspended from the building structure. The hanger is composed of an insert to be casted into the prefabricated element and a suspension system that allows the whole to be fixed to the load-bearing structure.

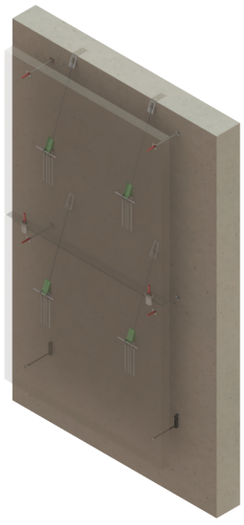
The hangers are adapted to the types of structures encountered.

In addition to the hangers, spacers, anchors, wind pins and/or anti-seismic anchors may be required.

Our design office advises you, guides you and sizes the elements necessary for your project.







FASTENING ELEMENTS

1. Standard hanger : for fixing in the wall

2. Attika hanger : for fixing to a slab or a head of a wall

3. Pressure screw : holds the panel away from the support to ensure alignment

SYSTEM UNDER TECHNICAL APPROVAL

ATG 2630 FROM UBAtc

4. Restraint anchor : anchor preventing the panel from moving due to wind forces

5. Dowel connection : ensures a connection between the superimposed panels and the transmission of transverse loads perpendicular to the facade

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ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

BENEFITS :

UBAtc

- Technical approval by UBATc
- Very short delivery time
- Fast execution when installing the cladding
- **Adjustable in all three dimensions** during installation
- Layout and installation instructions by our design office on request
- All metal components of the architectural panel fixing system are made from stainless steel
- Low contact surfaces combined with large panel sizes drastically reduce thermal bridges. This helps to reduce energy costs and protect the environment

INFORMATION NEEDED FOR THE CALCULATION OF YOUR PROJECT : :

Elevation, floor and section plans

- Panel dimensions (height, width, thickness)
- Size of the cavity (insulation + air space)
- Nature and quality of the structure of the building
- Characteristics of the project with regard to the seismic hazard if applicable

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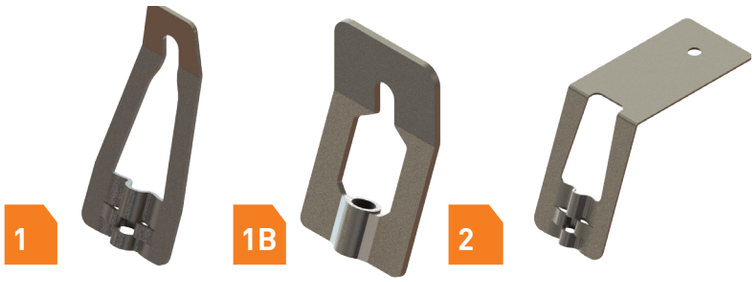
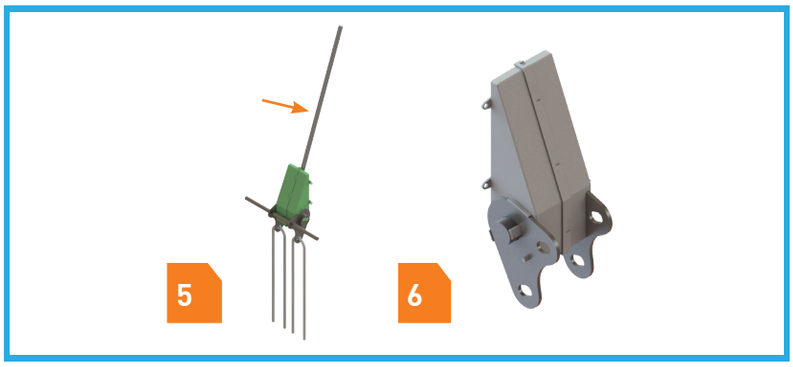
2. HANGERS FIXI3D 2.0

LOAD CLASS (kN)	COLOR CODE
5,0	BLACK
10,0	RED
15,0	GREEN
20,0	WHITE
25,0	YELLOW
35,0	BLUE
45,0	ORANGE
60,0	PINK





DESIGNATION.

1. Single panel hanger
1b. Single panel hanger 45 and 60 kN
2. Single panel hanger attika
2b. Single panel hanger attika 45 and 60 kN
3. Panel hanger with double bolt
4. Panel hanger attika with double bolt
5. Threaded rod
6. Insert

The Fixi3D 2.0 hanger is the supporting element of an adjustable system for fixing architectural concrete facing panels.

- Hangers can be sold complete or in individual parts (panel hangers, rods, inserts).
- Each component of the hanger is marked with a colour that corresponds to its load class.
- For each load class, there are 4 different shapes of panel hanger that can be adapted to different situations on site.
- The other components (rods, inserts) remain identical.

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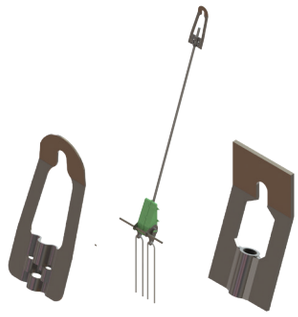
ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

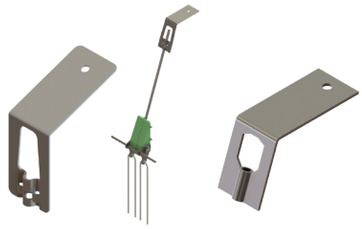
1 FIXI3D STANDARD PANEL HANGER



ARTICLE REFERENCE HANGER COMPLETE	ARTICLE REFERENCE PANEL HANGER ONLY	LOAD CLASS (kN)	CAVITY MIN Ev (mm)	THICKNESS MIN OF THE PANEL Ep (mm)	THICKNESS MIN OF THE CONCRETE SUPPORT Eb (mm)*
04IM-2-001-5,0	**04M-2-010-5,0**	5,0	60	70	100
04IM-2-001-10,0	**04M-2-010-10,0**	10,0	60	70	100
04IM-2-001-15,0	**04M-2-010-15,0**	15,0	60	80	140
04IM-2-001-20,0	**04M-2-010-20,0**	20,0	80	80	140
04IM-2-001-25,0	**04M-2-010-25,0**	25,0	80	100	170
04IM-2-001-35,0	**04M-2-010-35,0**	35,0	80	100	220
04IM-2-001-45,0	**04M-2-010-45,0**	45,0	80	120	220
04IM-2-001-60,0	**04M-2-010-60,0**	60,0	90	120	220

Indicative value, it will depend on the quality of the structure and the type of fixing used

2 FIXI3D SINGLE PANEL HANGER ATTIKA



ARTICLE REFERENCE HANGER COMPLETE	ARTICLE REFERENCE PANEL HANGER ONLY	LOAD CLASS (kN)	CAVITY MIN Ev (mm)	THICKNESS MIN OF THE PANEL Ep (mm)	THICKNESS MIN OF THE CONCRETE SUPPORT Eb (mm)*
04IM-2-002-5,0	**04M-2-015-5,0**	5,0	60	70	100
04IM-2-002-10,0	**04M-2-015-10,0**	10,0	60	70	100
04IM-2-002-15,0	**04M-2-015-15,0**	15,0	60	80	140
04IM-2-002-20,0	**04M-2-015-20,0**	20,0	80	80	140
04IM-2-002-25,0	**04M-2-015-25,0**	25,0	80	100	170
04IM-2-002-35,0	**04M-2-015-35,0**	35,0	80	100	220
04IM-2-002-45,0	**04M-2-015-45,0**	45,0	80	120	220
04IM-2-002-60,0	**04M-2-015-60,0**	60,0	90	120	220

Indicative value, it will depend on the quality of the structure and the type of fixing used

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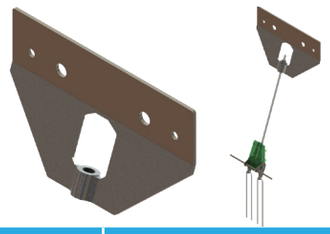
3 FIXI3D PANEL HANGER WITH DOUBLE BOLT ANCHOR



REFERENCE ARTICLE HANGER COMPLETE	ARTICLE REFERENCE PANEL HANGER ONLY	LOAD CLASS (kN)	CAVITY MIN Ev (mm)	MINIMUM THICKNESS OF THE PANEL Ep (mm)	MIN THICKNESS OF THE CONCRETE SUPPORT Eb (mm)*
04IM-2-003-25,0	**04M-2-026-25,0**	25,0	80	100	170
04IM-2-003-35,0	**04M-2-026-35,0**	35,0	80	100	220
04IM-2-003-45,0	**04M-2-026-45,0**	45,0	80	120	220
04IM-2-003-60,0	**04M-2-026-60,0**	60,0	90	120	220

Indicative value, it will depend on the quality of the structure and the type of fixing used

4 FIXI3D PANEL HANGER ATTIKA WITH DOUBLE BOLT ANCHOR

REFERENCE ARTICLE HANGER COMPLETE	ARTICLE REFERENCE PLATINUM ONLY	LOAD CLASS (kN)	CAVITY MIN Ev (mm)	MINIMUM THICKNESS OF THE PANEL Ep (mm)	MIN THICKNESS OF THE CONCRETE SUPPORT Eb (mm)*
04IM-2-005-25,0	**04M-2-027-25,0**	25,0	80	100	170
04IM-2-005-35,0	**04M-2-027-35,0**	35,0	80	100	220
04IM-2-005-45,0	**04M-2-027-45,0**	45,0	80	120	220
04IM-2-005-60,0	**04M-2-027-60,0**	60,0	90	120	220

Indicative value, it will depend on the quality of the structure and the type of fixing used

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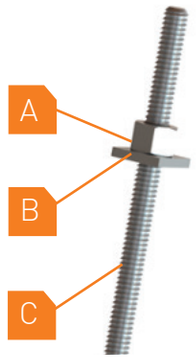
ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

5 THREADED ROD



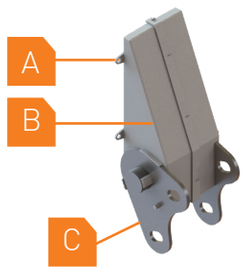
The threaded rod is composed of:

A. a nut
B. a square washer
C. a threaded rod

The length of the rod is determined according to the vacuum, see table page 22.

ARTICLE REFERENCE	LOAD CLASS (kN)	METRIC THREADED ROD	SHAFT DIAMETER (mm)
04M-2-035-5,0	5,0	M8	16
04M-2-035-10,0	10,0	M10	16
04M-2-035-15,0	15,0	M12	20
04M-2-035-20,0	20,0	M12	20
04M-2-035-25,0	25,0	M16	24
04M-2-035-35,0	35,0	M16	24
04M-2-035-45,0	45,0	M20	30
04M-2-035-60,0	60,0	M20	30

6 INSERT



The insert consists of :

A. a recess in recycled and recyclable PVC box
B. a nut fixed on a shaft waiting the threaded rod
C. ears for additional reinforcement

It is casted, in prefabrication, into the architectural panels.

ARTICLE REFERENCE INSERT	LOAD CLASS (kN)	MINIMUM PANEL THICK-NESS (mm)
04I-2-030-5,0	5,0	70
04I-2-030-10,0	10,0	70
04I-2-030-15,0	15,0	80
04I-2-030-20,0	20,0	80
04I-2-030-25,0	25,0	100
04I-2-030-35,0	35,0	100
04I-2-030-45,0	45,0	120
04I-2-030-60,0	60,0	120

Please note: When assembling on site, it is important to grease the threads with a suitable product (such as Molykote) to avoid cold welds. Adjustment should always be done by lowering the panel.

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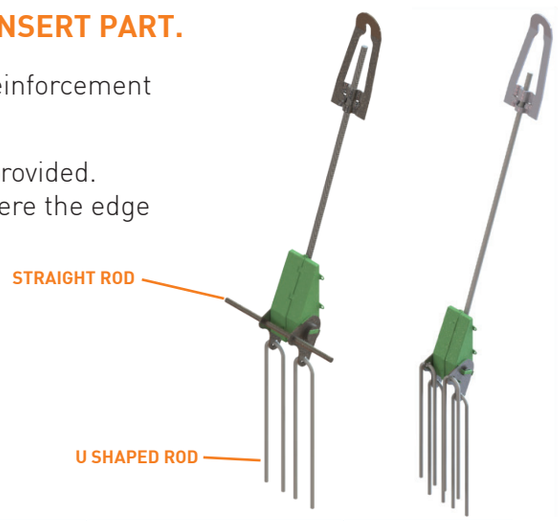
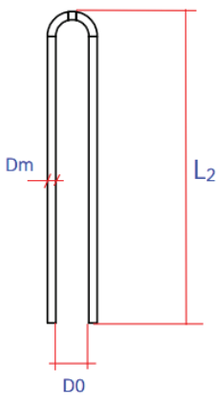
ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

ADDITIONAL REINFORCEMENTS REQUIRED FOR THE INSERT PART.

When placing the insert, it is essential to provide additional reinforcement as shown in the tables below.

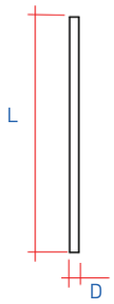
There are two options for the additional reinforcement to be provided. For models from 5 to 20 kN, one straight bar is sufficient. Where the edge distance is too small, 2 or 4 U-bars are required.





U-SHAPED REBARS - NUMBER AND DIMENSIONS					
CLASS (kN)	LENGTH TOTAL L_1 (mm)	D0 (mm)	D_m (mm)	BENDED HEIGHT L_2 (mm)	NUMBER
5,0	460	24	6	220	2*
10,0	520	24	6	250	
15,0	630	32	8	300	
20,0	730	32	8	350	
25,0	835	40	10	400	4
35,0	935	40	10	450	
45,0	1040	48	12	500	
60,0	1140	48	12	550	

*It is recommended to use 4 U-bars for smaller edge distances

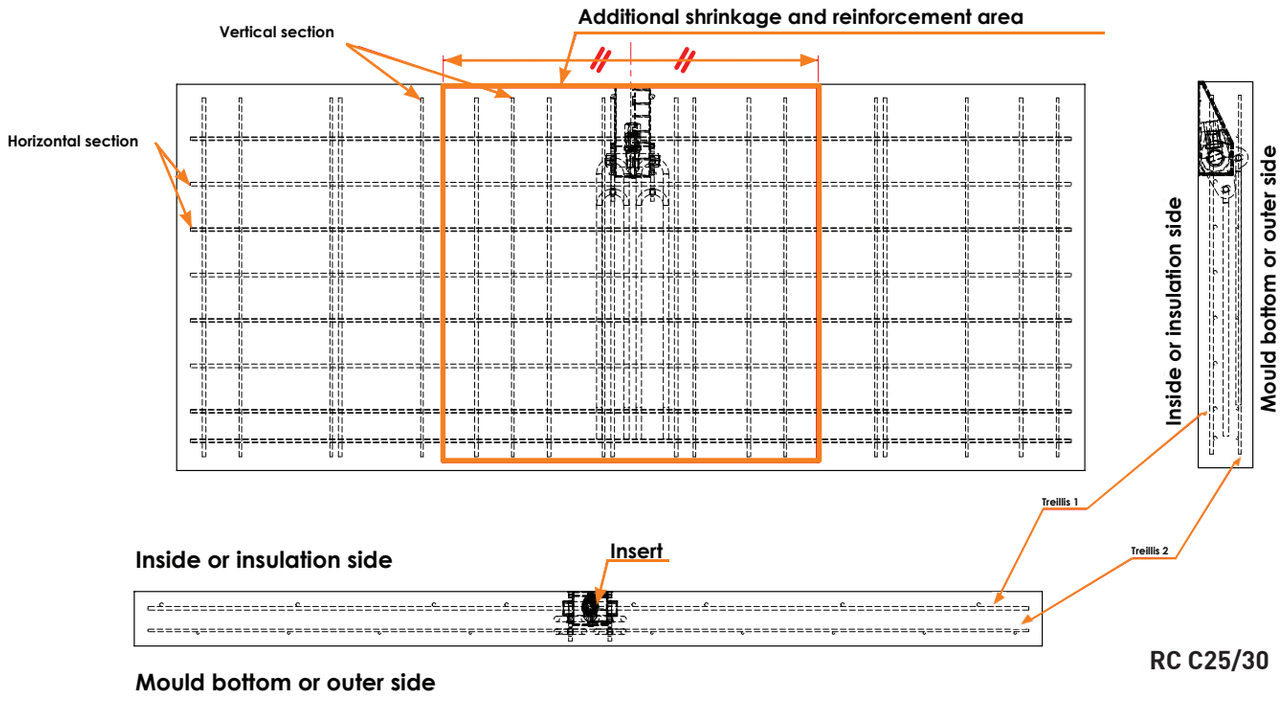


STRAIGHT REBARS - NUMBER AND DIMENSIONS			
CLASS (KN)	TOTAL LENGHT L (mm)	D (mm)	NUMBER
5,0	200	8	1
10,0	250	8	
15,0	250	10	
20,0	300	10	

MINIMUM REINFORCEMENT OF CONCRETE ELEMENTS

CLASS	MESH OVER THE ENTIRE SURFACE OF THE PANEL	DIRECTION OF REINFORCE-MENT	MINIMUM CROSS-SECTION OF MESH (cm²/m)	ARRANGE-MENT OF REINFORCE-MENT MESH 1 AND MESH 2	SURFACE OF THE RE-INFORCE-MENT AREA ONLY ON THE INSIDE	ADDITION-AL REIN-FORCE-MENT SECTION (cm²/m)	TOTAL REIN-FORCEMENT CROSS-SECTION (cm²/m)
5 kN & 10 kN	Mesh 1	Horizontal section	1,42	diam. 6 every 200mm	X	X	1,42
		Vertical section	1,42	diam. 6 every 200mm		X	1,42
	Mesh 2	Horizontal section	X	X	X	X	X
		Vertical section	X	X		X	X
15 kN & 20 kN	Mesh 1	Horizontal section	1,42	diam. every 200mm	X	X	1,42
		Vertical section	1,42	diam. 6 every 200mm		X	1,42
	Mesh 2	Horizontal section	X	X	X	X	X
		Vertical section	X	X		X	X
35 KN & 25 KN	Mesh 1	Horizontal section	2,5	diam. 8 every 200mm	0,85 x 0,85 m	2,5	5
		Vertical section	2,5	diam. 8 every 200mm		0	2,5
	Mesh 2	Horizontal section	X	X	80	X	X
		Vertical section	X	X		X	X
45 KN & 60 KN	Mesh 1	Horizontal section	2,5	diam. 8 every 200mm	1 x 1 m	2,5	5
		Vertical section	2,5	diam. 8 every 200mm		0	2,5
	Mesh 2	Horizontal section	1,42	diam. 6 every 200mm	X	X	1,42
		Vertical section	1,42	diam. 6 every 200mm		X	1,42

ANCHORS FOR ARCHITECTURAL CONCRETE PANELS



4. ADDITIONAL ACCESSORIES

A. PRESSURE SCREW / SPACER

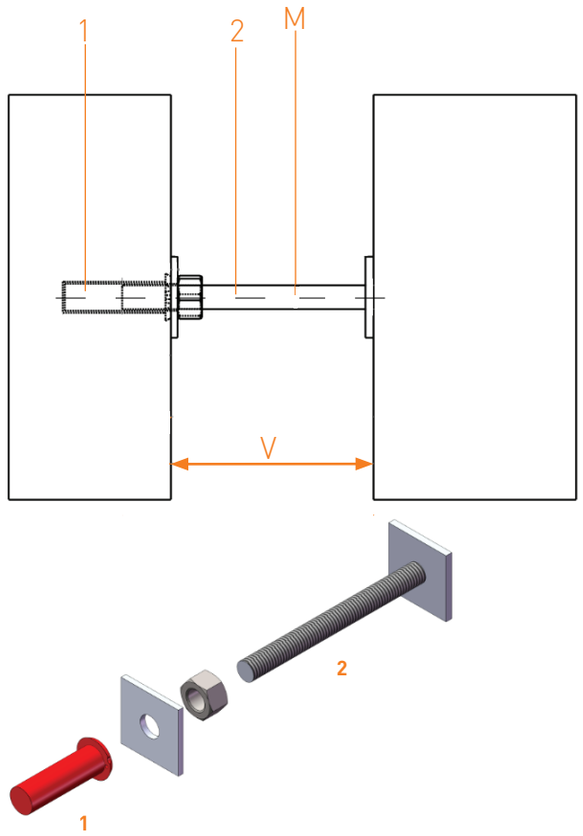
Spacers are used to keep the architectural panel away from the load-bearing structure.

They consist in a threaded rod and a plate welded together, the plate serving to the spread of the stresses into the concrete.

Spacer's choice depends mainly on normal load and cavity (V).

Wind anchors replace spacers when the panel moves away from the support under the action of the wind in succion.

1. Plastic sleeve
2. Spacer



CLASSE (kN)	SPACER METRIC DEPENDING ON HANGER CLASS & CAVITY (mm)																								
	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
60,0	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	M24	M24	M24	M30	M30	M30	M30	M30	M30	M36	M36	M36	M36	M36
45,0	M16	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	M24	M24	M24	M30	M30	M30	M30	M30	M30	M30
35,0	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	M24	M24	M24	M30	M30	M30	M30
25,0	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	M24	M24	M24
20,0	M16	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	M24
15,0	M12	M12	M16	M16	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24	M24
10,0	M12	M12	M12	M12	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20
5,0	M10	M10	M10	M10	M10	M12	M12	M12	M12	M12	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16

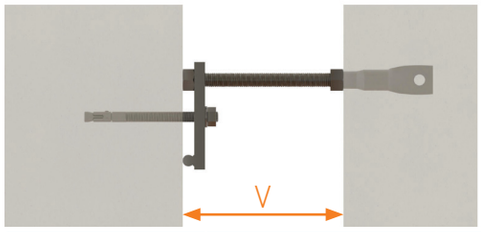
Values given as an indication for a wind pressure of 800 Pa. Our design office will design the necessary elements for you according to your situation (wind pressure, higher cavity, seismic zone,...).

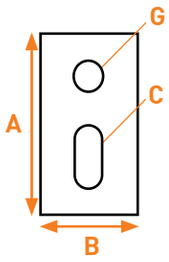
B. RESTRAINT ANCHORS

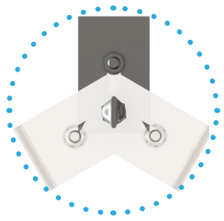
The restraint anchor replaces the spacer in the event that the architectural panel is lifted by the action of the wind in succion. Like the spacer, it serves to keep the architectural panel away from the support but also, it withstands stresses in negative pressure. Choice of the restraint anchor is made according to cavity and load to be taken.

CLASSIC RESTRAINT ANCHOR

The slotted hole, the rotation around the axis of the bolt anchor and the screwing/unscrewing in the fixing dowel ensure adjustment in all three dimensions.



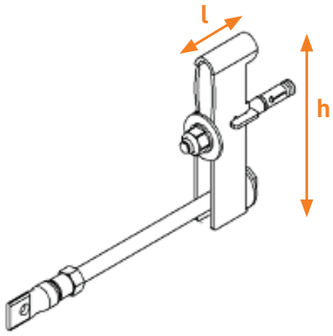


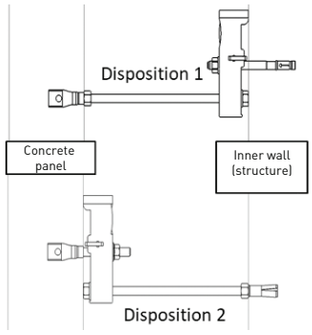


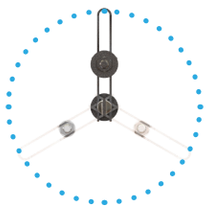
REFERENCE ARTICLE	METRIC THREADED ROD	FASTENER	NRd (kN)	A (mm)	B (mm)	C (mm)	G (mm)
04IM070-04,5	M12	M12	4,5	120	60	13	13
04IM070-06,3	M16	M12	6,3	130	78	17	13
04IM070-09,0	M20	M16	9,0	145	90	21	17
04IM070-12,0	M20	M20	12,0	160	120	21	21
04IM070-12,0	M24	M20	12,0	160	120	25	21

The anchor must be checked according to the structure (type of concrete, distance to the edge, etc.)

OPEN RESTRAINT ANCHOR







REFERENCE ARTICLE	METRIC THREADED ROD	FASTENER	NRd (kN)	Dimensions	
				h (mm)	l (mm)
04IM071-4,4	M10	M10	4,4	138	30
04IM071-5,2	M12	M12	5,2	140	35
04IM071-11,0	M16	M16	11,0	188	45
04IM071-15,6	M20	M20	15,6	228	50

The anchor must be checked according to the structure (type of concrete, distance to the edge, etc.)

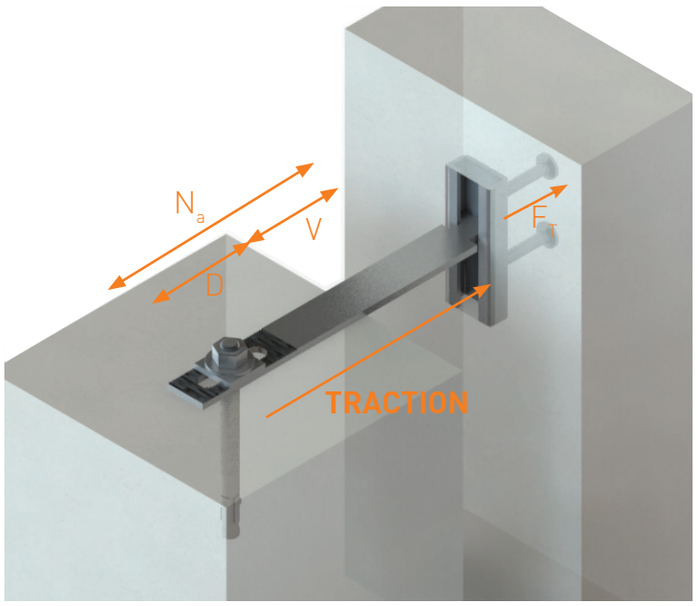
FIXINOX
STAINLESS STEEL CONNECTORS

SERRATED RESTRAINT ANCHOR WITH T-HEAD : HKF TYPE

This anchor allows tensile loads to be absorbed thanks to the serration and the toothed plate.

The channel and dowel can be adjusted in two dimensions.

In order to have an additional dimension of adjustment the dowel can be replaced by a channel.



DIMENSIONS AND LOADS

RAIL MOUNTING BOLT	CHANNEL	F_T (kN)	ELU LOAD F_T (kN)	DISTANCE D* (mm)	DISTANCE V (mm) (TOLERANCE ±20mm)	DISTANCE N_A (mm) (every 25mm)	TIGHTENING TORQUE (Nm)
M10	28/15	3,5	5.0	50	0-200	50-250	15
M12	38/17	7,0	10.0	75	0-225	75-300	25
M12/M16	40/25	7,0	11.1	100	0-250	100-350	25/60
M16	49/30	12,0	17.2	150	0-200	150-350	60

* D can be adapted according to channel or anchor type

NAME

TYPE	DISTANCE $N_a = V + D$	TYPE OF CHANNEL USED	NATURE OF THE MATERIAL
HKF	Na (mm) 50 | 350 (par pas de 25mm)	28/15	Ez (electro-galvanized steel) A2 (Stainless steel 304) A4 (Stainless steel 316)
		38/17	
		40/25	
		49/30	

(FTB bolts, rails and/or dowels to be ordered separately)

Contact us for the design of a wind anchor specific to your project

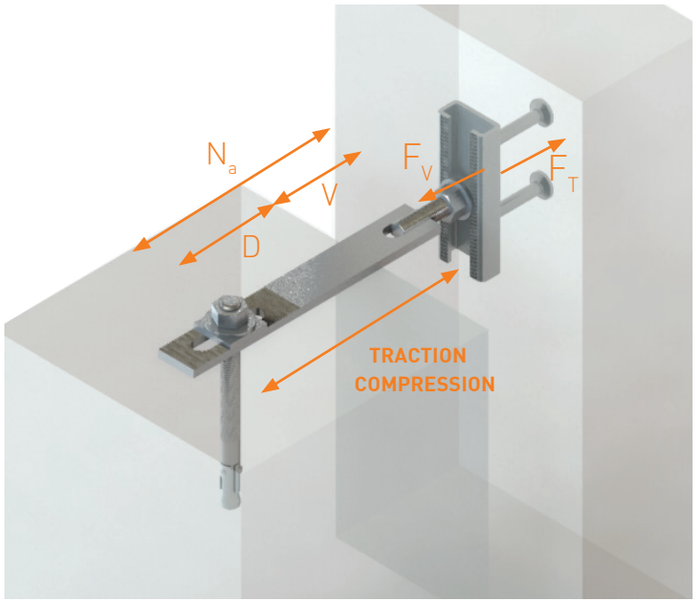
FIXINOX
STAINLESS STEEL CONNECTORS

SERRATED RESTRANT ANCHOR WITH HAMMER HEAD BOLT : HKFP TYPE

This anchor allows tensile and compressive loads to be absorbed thanks to the serration and the toothed plate.

The channel and dowel can be adjusted in two dimensions.

In order to have an additional dimension of adjustment the dowel can be replaced by a channel.



DIMENSIONS AND LOADS

RAIL MOUNTING BOLT	CHANNEL	F_T (kN)	ELU LOAD F_T (kN)	DISTANCE D* (mm)	DISTANCE V (mm) (TOLERANCE ±20mm)	DISTANCE N_A (mm) (every 25mm)	TIGHTENING TORQUE (Nm)
M10	28/15	3,5	5.0	50	25-125	75-175	15
M12	38/17	7,0	10.0	75	25-175	100-250	25
M12/M16	40/25	7,0	11.1	100	25-175	125-275	25/60

* D can be adapted according to channel or anchor type

NAME

TYPE	DISTANCE $N_a = V + D$	TYPE OF RAIL USED	NATURE OF THE MATERIAL
HKFP	Na (mm) 75 | 350 (par pas de 25mm)	28/15 38/17 40/25 49/30	EZ (electro-galvanized steel) A2 (Stainless steel 304) A4 (Stainless steel 316)

(FTB bolts, rails and/or dowels to be ordered separately)

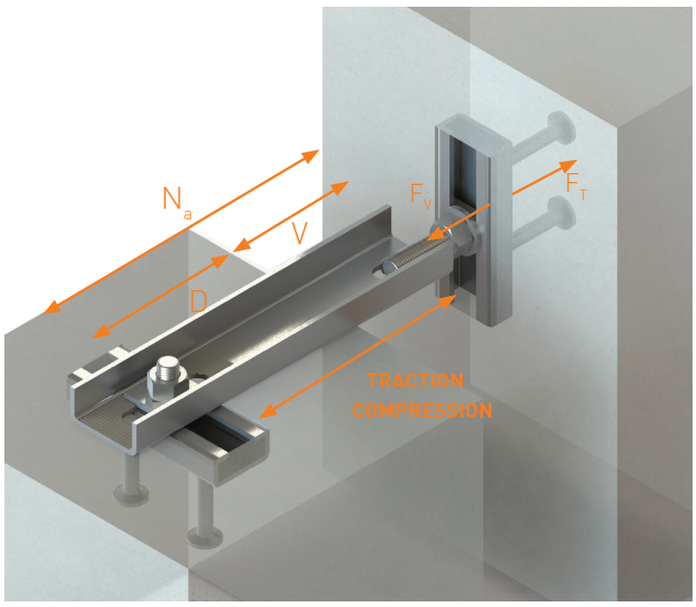
Contact us for the design of a wind anchor specific to your project

FIXINOX
STAINLESS STEEL CONNECTORS

U-SHAPE SERRATED RESTRAINT ANCHOR WITH WELDED HAMMER HEAD BOLT: HKFU TYPE

This anchor allows tensile and compressive loads to be absorbed thanks to the serration and toothed plate.

The channel can be adjusted in all three dimensions. It is possible to replace the channel incorporated in the structure with a dowel (distance D to be adapted and loss of horizontal adjustment).



DIMENSIONS AND LOADS

MOUNTING BOLT	CHANNEL	F_T (kN)	ELU LOAD F_T (kN)	DISTANCE D* (mm)	DISTANCE V (mm) (TOLERANCE ±20mm)	DISTANCE N_A (mm) (every 25mm)	TIGHTENING TORQUE (Nm)
M10	28/15	3,5	5.0	50	25-125	75-175	15
M12	38/17	7,0	10.0	75	25-175	100-250	25
M12/M16	40/25	7,0	11.1	100	25-175	125-275	25/60
M16	49/30	12,0	17.2	150	50-150	200-300	60

* D can be adapted according to channel or anchor type

NAME

TYPE	DISTANCE N_a = V + D	TYPE OF RAIL USED	NATURE OF THE MATERIAL
HKFU	Na (mm) 25 | 350 (par pas de 25mm)	28/15	EZ (electro-galvanized steel) A2 (Stainless steel 304) A4 (Stainless steel 316)
		38/17	
		40/25	
		49/30	

(FTB bolts, channels and/or dowels to be ordered separately)

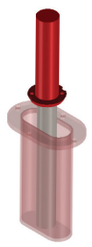
Contact us for the design of a wind anchor specific to your project

DOWEL CONNECTION

The dowel connection system enables the panels to be joined together and horizontal loads to be transmitted from one panel to the other by means of a dowel sealed in the edge of the two panels.

The dowel connection system consists of:

1. A **cylindrical polyethylene sleeve** in the bottom edge of the top panel



ARTICLE	L(mm)	Ø(mm)
04M031-12-80	80	12
04M031-16-80	80	16
04M031-20-80	80	20

2. **A stainless steel pin**

ARTICLE	L(mm)	Ø(mm)	VRD (kN)	THICKNESS EP MIN (mm)
04M051-12-170	170	12	4.68	80
04M051-16-170	170	16	5.22	100
04M051-20-170	170	20	5.42/7.59*	120

*Extra reinforcement to be provided, please contact our engineering office.
Maximum joint : 20 mm

3. An **oval polyethylene sleeve** in the upper edge of the bottom panel

ARTICLE	L(mm)	O(mm)
04M051-12-170	100	22/47
04M051-16-170	100	22/47
04M051-20-170	95	35/60
04M051-24-170	95	35/60

Other diameters or workload on request

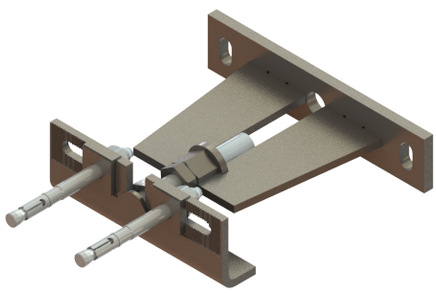
5. ANTI-SEISMIC ANCHORS (AS)

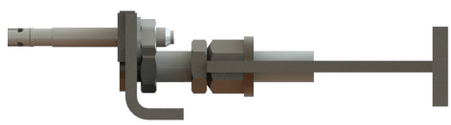
The Fixi3D 2.0 system is adaptable to seismic loads.

Since January 2011, Eurocode 8-1 has been in application in Europe, making it mandatory to take account of seismic risks in the design and construction of buildings, this provision also applies to exterior insulation panels. (non structural elements)

In order to meet seismic requirements, Fixi3D 2.0 must be complemented by a system designed to withstand parallel forces.

These anti-seismic devices ensure stability of architectural panels during an earthquake.
They are designed to take up horizontal seismic forces (normal and parallel to the building's façade).
These fixings are available in 5 different classes depending on the loads.
The system is designed to allow adjustment (tolerance) in all three directions.
Specially developed sockets allow the system to be fixed to architectural elements.
On the load-bearing side, the connection is made with dowels (under ATE) or bolts, in case of a steel structure.





ANTI-SEISMIC ANCHOR (AS) - ANTI-SEISMIC TABLE (AS)

Load table for 300 mm cavity

	V_{Rd} (kN)	M_{Rd} (kN.cm)	SOCKETS METRIC	THICKNESS MIN (mm)	MINIMUM EDGE DISTANCE C (mm)	SOCKET SPACING (mm)
AS1	4,1	123,6	M10	70	120	158,5
AS2	8,2	247,3	M12	75	135	192,5
AS3	12,4	371,1	M16	80	150	210,5
AS4	17,6	529,3	M20	100	175	238,5
AS5	22,9	687,6	M20	120	200	278,5

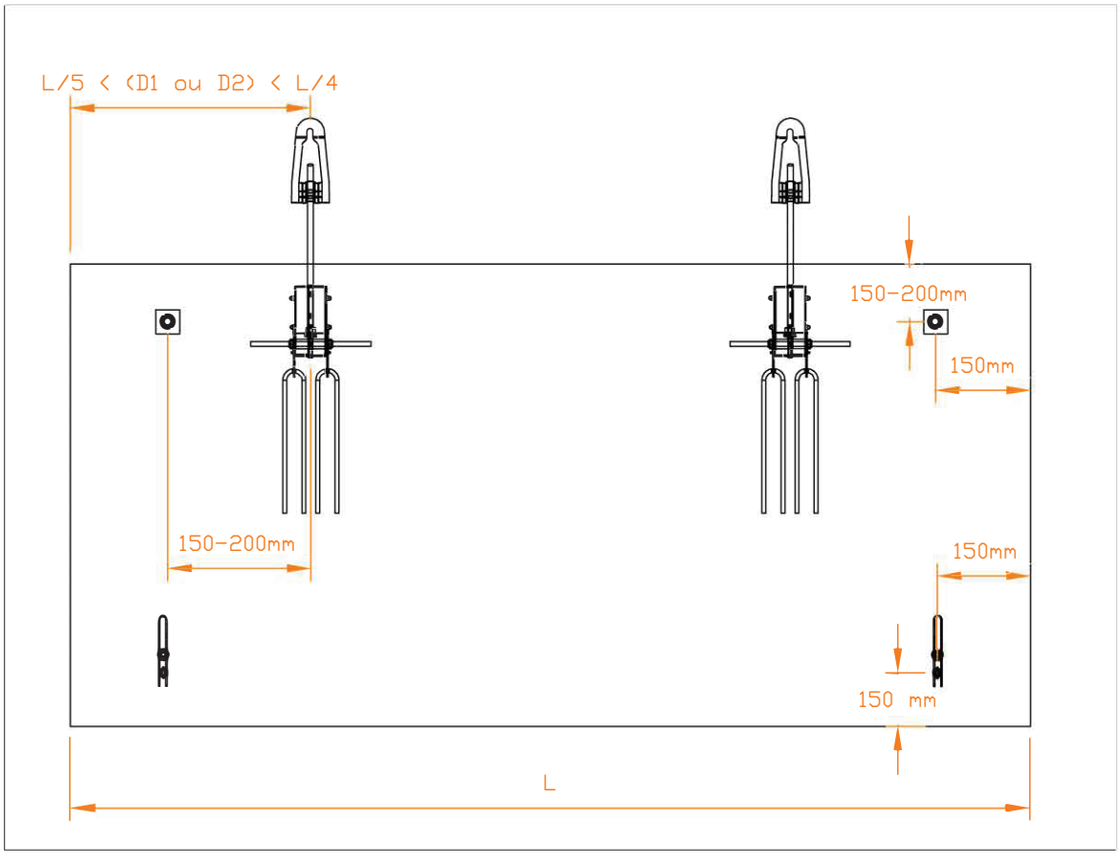
Note: Special reinforcement must be provided for the socket inserted in the precast element (information available on request).

6.ANCHORS LOCATION

IMPLEMENTATION OF ANCHORS

The minimum edge distances to be observed are shown in the tables on page 18

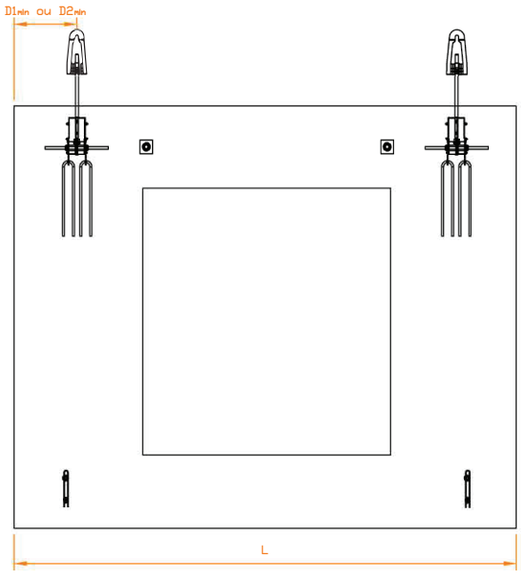
RECOMMENDED EDGE DISTANCES



The spacer is selected according to the hanger class and the compressive stress.
See table on page 12.

On request, can be sent dedicated document.

EDGE MINIMUM DISTANCES



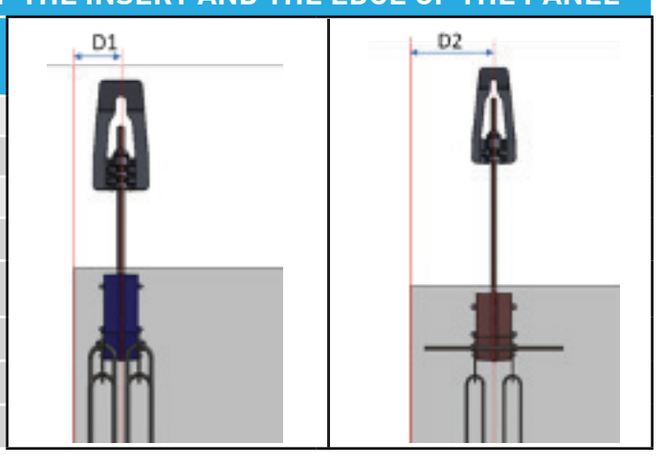
Two types of anchor rebars can be considered depending on the class of the hanger and the distance to the edge of the panel:

- One straight bar and two U-bars
- Four U-bars

In order to ensure a 25 mm concrete cover of the reinforcement bars, the following minimum edge distances must be observed depending on the type of installation:

MINIMUM DISTANCE BETWEEN THE MIDDLE OF THE INSERT AND THE EDGE OF THE PANEL

CLASS	D1 MINI. (mm)	D2 MINI. (mm)
5	76	125
10	76,5	150
15	83,5	150
20	84	175
25	93	-
35	93,5	-
45	103,5	-
60	104,5	-

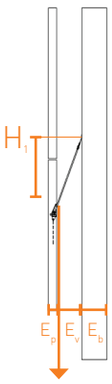


Please note: The following examples show only standard panels, these situations are not representative of all cases.

ASSEMBLY COMPONENT : THREADED ROD

The total length of the threaded rod (L) depends on the class of the hanger, the thickness of the cavity (Ev), the thickness of the panel (Ep) and the type of panel anchor chosen. These values are shown in the table on page 6 and 8 which show the minimum values for these dimensions (Ev and Ep). The lengths H_1 and L of the threaded rod are to be chosen from the tables below:

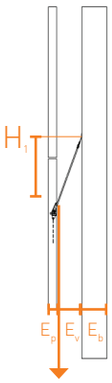
LENGTH OF THE THREADED ROD DEPENDING ON THE CAVITY - PANEL ANCHOR



LENGTH OF THREADED ROD L AS A FUNCTION OF CAVITY - SINGLE PANEL ACHOR- 20° ANGLE (mm)													
HANGER TYPE	CAVITY (mm)												
	60	70	80	90	100	110	120	130	140	150	160	170	180
5 single	192	221	250	280	309	338	367	397	426	455	484	514	543
10 single	175	204	233	262	292	321	350	379	409	438	467	496	526
15 single	176	205	234	264	293	322	351	381	410	439	468	498	527
20 single			220	249	278	307	337	366	395	424	454	483	512
25 single			240	270	299	328	357	387	416	445	474	504	533
35 single			248	278	307	336	365	395	424	453	482	511	541
45 single			281	311	340	369	398	427	457	486	515	544	574
60 single				310	340	369	398	427	456	486	515	544	573

LENGTH OF THREADED ROD L AS A FUNCTION OF CAVITY - SINGLE PANEL ACHOR- 20° ANGLE (mm)												
HANGER TYPE	CAVITY (mm)											
	190	200	210	220	230	240	250	260	270	280	290	300
5 single	572	601	631	660	689	718	748	777	806	835	864	894
10 single	555	584	613	643	672	701	730	759	789	818	847	876
15 single	556	585	614	644	673	702	731	761	790	819	848	878
20 single	541	570	600	629	658	687	717	746	775	804	834	863
25 single	562	591	621	650	679	708	738	767	796	825	854	884
35 single	570	599	628	658	687	716	745	775	804	833	862	892
45 single	603	632	661	691	720	749	778	808	837	866	895	925
60 single	603	632	661	690	720	749	778	807	837	866	895	924

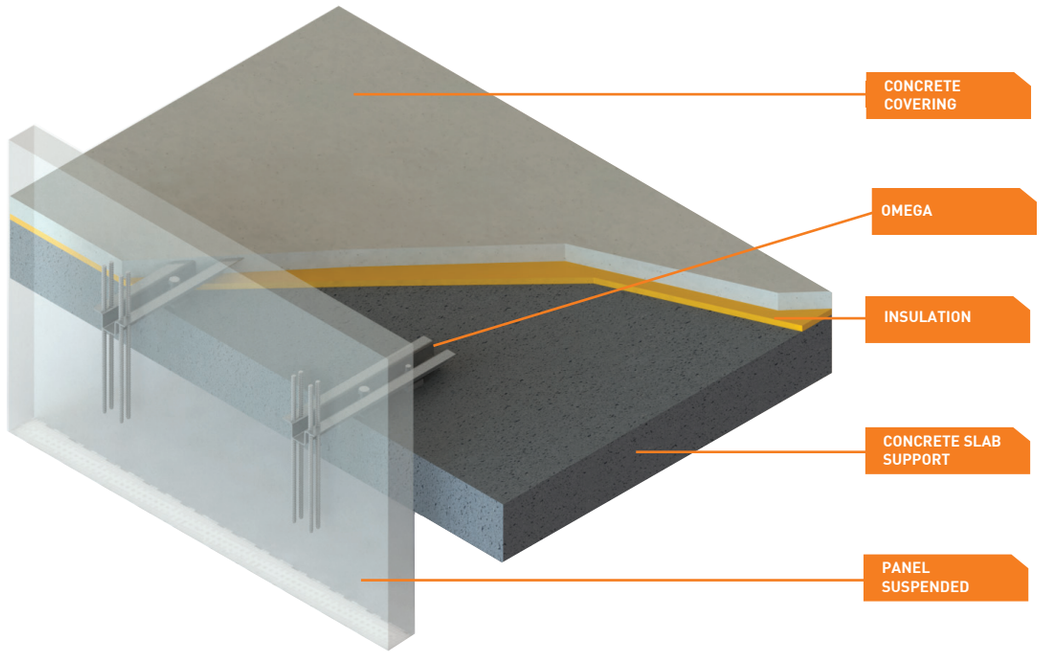
VERTICAL DISTANCE BETWEEN THE TOP OF THE INSERT AND THE FASTENING: H_1



VERTICAL DISTANCE INSERT - FASTENING H_1 DEPENDING ON THE CAVITY - SINGLE PANEL ANCHOR - 20° ANGLE (mm)													
HANGER TYPE	CAVITY (mm)												
	60	70	80	90	100	110	120	130	140	150	160	170	180
5 single	138	165	193	220	248	275	303	330	357	385	412	440	467
10 single	135	163	190	218	245	273	300	328	355	383	410	437	465
15 single	131	158	186	213	241	268	296	323	351	378	406	433	460
20 single			187	214	242	269	297	324	352	379	407	434	461
25 single			161	188	215	243	270	298	325	353	380	408	435
35 single			160	187	215	242	270	297	325	352	380	407	435
45 single			186	214	241	269	296	324	351	378	406	433	461
60 single				213	240	268	295	323	350	377	405	432	460

VERTICAL DISTANCE INSERT - FASTENING H_1 DEPENDING ON THE CAVITY - SINGLE PANEL ANCHOR - 20° ANGLE (mm)													
HANGER TYPE	CAVITY (mm)												
	190	200	210	220	230	240	250	260	270	280	290	300	
5 single	495	522	550	577	605	632	660	687	715	742	770	797	
10 single	492	520	547	575	602	630	657	685	712	740	767	795	
15 single	488	515	543	570	598	625	653	680	708	735	763	790	
20 single	489	516	544	571	599	626	654	681	709	736	764	791	
25 single	463	490	518	545	573	600	628	655	683	710	738	765	
35 single	462	490	517	545	572	600	627	655	682	709	737	764	
45 single	488	516	543	571	598	626	653	681	708	736	763	791	
60 single	487	515	542	570	597	625	652	680	707	735	762	790	

7. OMEGA - PARAPET ANCHORS

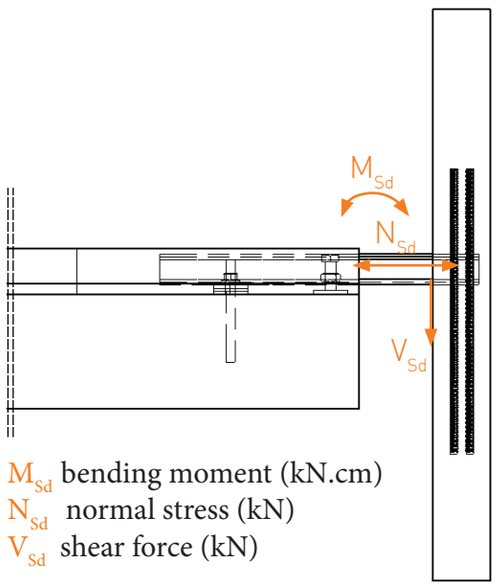


The use of omegas is an effective solution for fixing parapets to slabs.

The omegas take up the forces linked to the weight of the panel and to the wind in a single piece, as opposed to three for the classic FIXI3D system.

This system offers many advantages:

- Non linear thermal bridging
- Low thermal bridging (more significant reduction by using stainless steel)
- Quick and adjustable assembly
- Two fixings per element instead of four to six
- Adjustable in all 3 dimensions



M_{Sd} bending moment (kN.cm)
N_{Sd} normal stress (kN)
V_{Sd} shear force (kN)

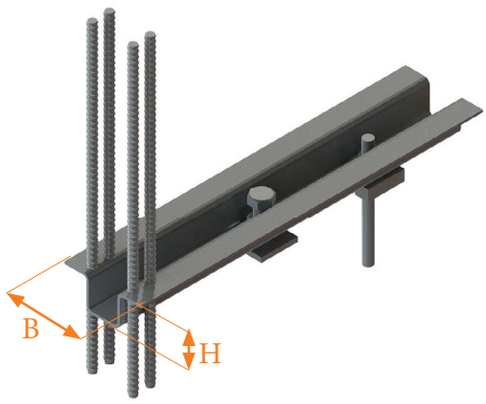
FIXINOX

STAINLESS STEEL CONNECTORS

ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

There should be at least two omega fasteners per panel. The design should be carried out according to the calculation description on pages 26-27.

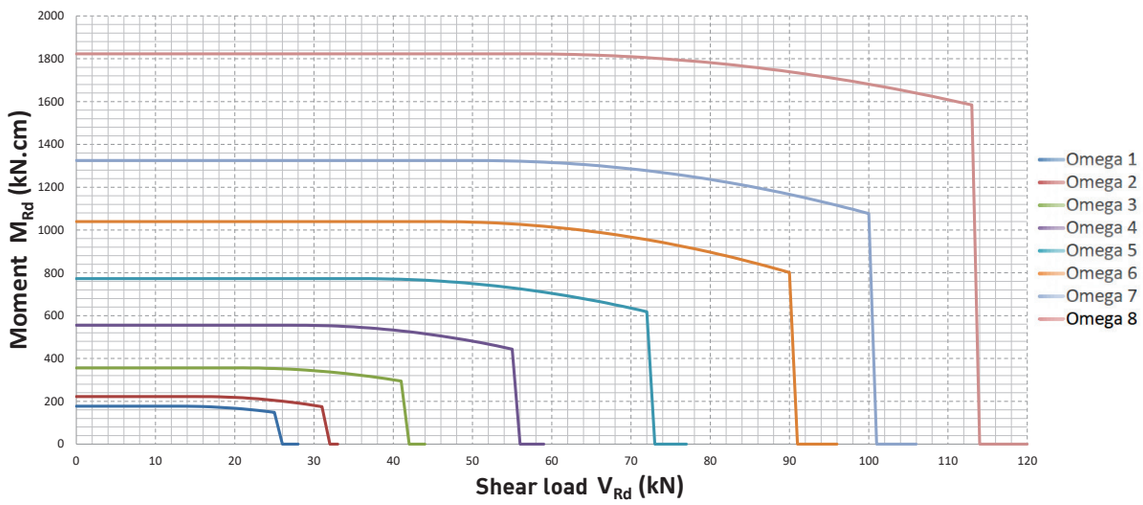
Variations in length due to thermal expansion are taken into account, an expansion joint (5 mm polystyrene) must be placed when the omega is installed. This expansion joint is not necessary if the omega is not cast in concrete.

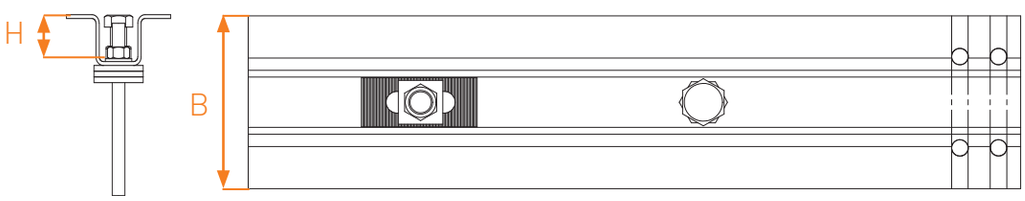


A. RANGE OF OMEGA FASTENERS

DESIGNATION		omega 1	omega 2	omega 3	omega 4	omega 5	omega 6	omega 7	omega 8
Height (H)	(mm)	44	50	54	66	70	83	84	85
Width (B)	(mm)	74	79	92	117	125	135	148	159
Thickness of element with embedding of reinforcement (Emin)	(mm)	100	100	110	120	130	135	150	150
M_{Rd}	(kN.cm)	177	222	355	555	773	1039	1324	1823

B. INTERACTION GRAPH M_{Rd} & V_{Rd}





C. CHOICE OF FASTENING SYSTEM

Depending on the intensity of the loads to be taken up and the method of assembly on site, the choice is made among three types of fixings:

1. Fixing with an anchor channel

Characteristics of the channels are :

- High loads
- Quick to install as they are already integrated into the slab. Their positioning requires the collaboration with the structural engineering department in order to fit them into the load-bearing structure

2. Fixing with a mechanical bolt

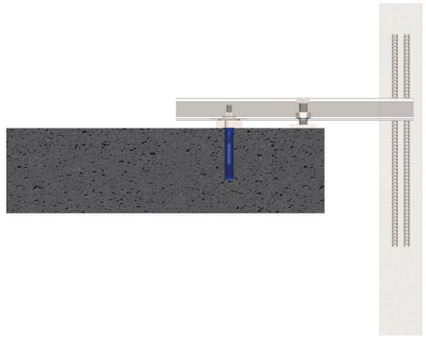
The characteristics of the mechanical bolts are :

- High stresses on the bolts
- Bolts to be drilled on site (no risk of misplacement)

3. Fixing with a chemical anchor

The characteristics of the chemical anchors are :

- Very high loads on the chemical anchor
- Holes to be drilled on site (no risk of misplacement)



D. CALCULATION DESCRIPTION

The omegas for parapet are designed according to the Eurocode standards.

Standards :

- Eurocode 1 (EN 1991)
- Eurocode 2 (EN 1992)
- Eurocode 3 (EN 1993)

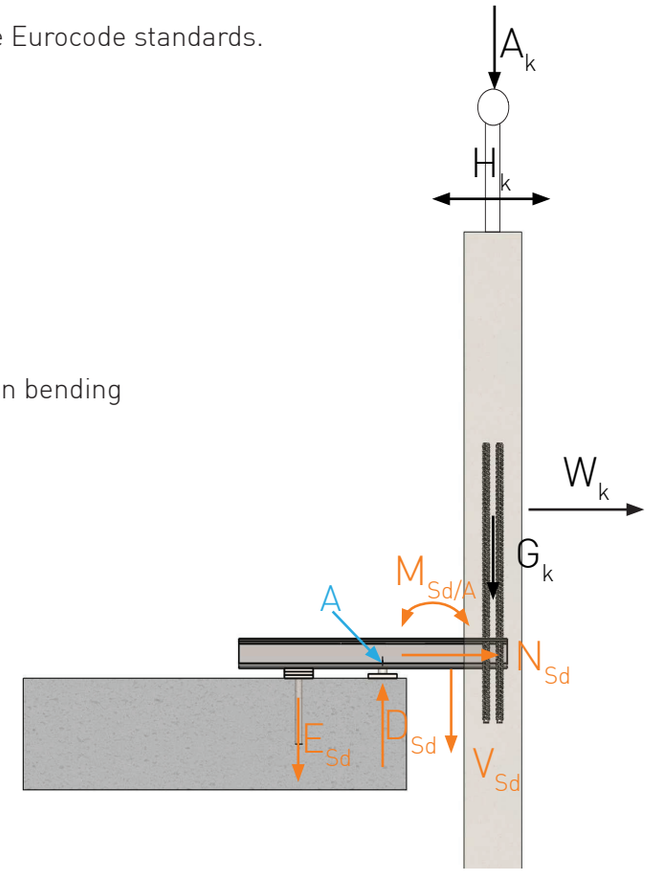
Partial safety factors :

γ_G = 1.35 (permanent loads)
γ_Q = 1.50 (operating or climatic loads)
The choice of the appropriate omega is made by design bending moment ($M_{Sd/A}$) and shear (V_{Sd}) at the loading point A.

Additional verification :

In-Service Verification
Additional checks may be required:

- Deformations
- Vibration hazards
- Seismic-related instabilities



APPLIED LOADS		
G_K	kN.m^{-1}	Dead weight of the parapet
A_K	kN.m^{-1}	Vertical overload
H_K	kN.m^{-1}	Load on the guardrail
W_K	kN.m^{-1}	Wind load
DIMENSIONAL LOADS		
M_{Sd}	kNm	Bending moment
V_{Sd}	kN	Shear force
N_{Sd}	kN	Normal force
E_{Sd}	kN	Support reaction in tension
D_{Sd}	kN	Compression reaction of the support

FIXINOX
STAINLESS STEEL CONNECTORS

ANCHORS FOR ARCHITECTURAL CONCRETE PANELS

APPLICATION

Shear loads :

$V_d = \gamma_G . G_k + \gamma_Q . A_k$

Normal effort :

$N_d = \gamma_Q . H_k + \gamma_w . W_k$

Normal effort :

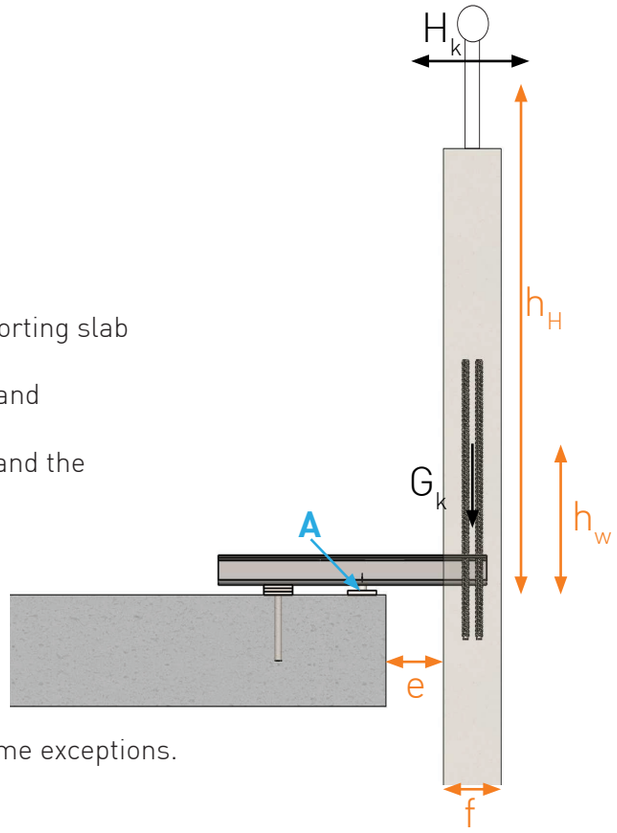
w = e + 0,5f + 50mm

e = distance between the panel and the edge of the supporting slab

f = thickness of the panel

h_w = distance between the centre of gravity of the panel and the top of the slab

h_H = distance between the location of the punctual load and the top of the slab



Bending moment :

The maximum is reached at point A:

$M_d = \gamma_G . (A_k + G_k) . w + \gamma_Q . h_H + \gamma_w . W_k . h_w$

$M_{d.adm} = \frac{M_d}{n}$

with n = the number of omegas per parapet, n=2 with some exceptions.

Recommendation for positioning:

Distribution of omegas

The omegas should be positioned on either side of the centre of gravity to ensure even load distribution.

Horizontal load :

A serration coupled with toothed plates allow the horizontal force to be taken up.

Installation of the omega :

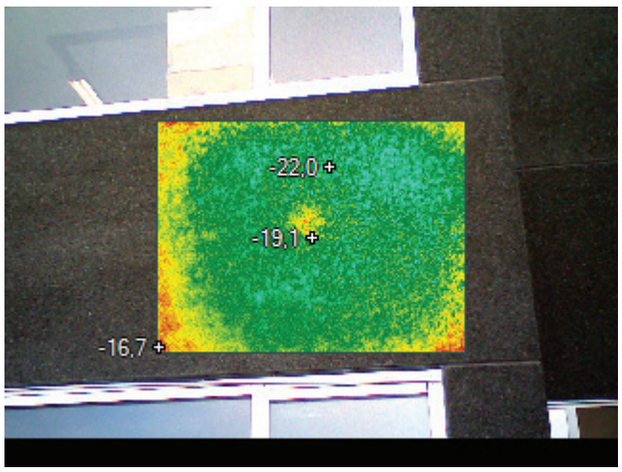
The height is adjusted by means of wedges.

In the last step, the remaining cavity can be filled with anti-shrinkage mortar.

8. THERMAL BRIDGES

Since 2012, Fixinox has been a pioneer in the accurate assessment of thermal bridges caused by anchor passing through insulation. Based on simple observations, we claim to have some of the best solutions on the market in terms of thermal bridges due to the presence of fixings.

Without even going into the details of the calculations by digital simulation, three common sense recommendations should be followed:



- have the lowest number of thermal bridges and and therefore the number of fixings passing through the insulation

- reduce anchors sections, for example, by choosing materials with the best mechanical characteristics

- finally, look for materials with the lowest possible thermal conductivity

Stainless steel successfully fulfils all three of these requirements. Even though there are less conductive materials such as wood or fibreglass/resin composites, stainless steel offers the best possible fire resistance of the various materials used today as a facade anchoring system as well as greater durability.

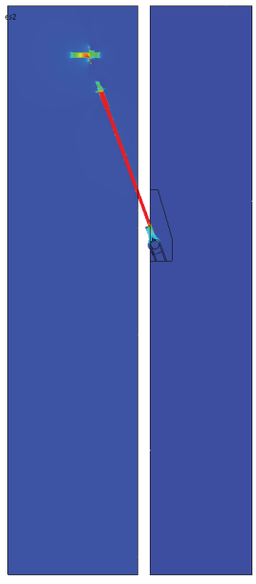
MATERIAL	CURRENT THERMAL CONDUCTIVITY AT 23°C
Aluminium	**200 W m^{-1} K^{-1}**
Steel	**50 W m^{-1} K^{-1}**
Stainless steel	**15 W m^{-1} K^{-1}**

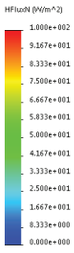
9. REFERENCES :

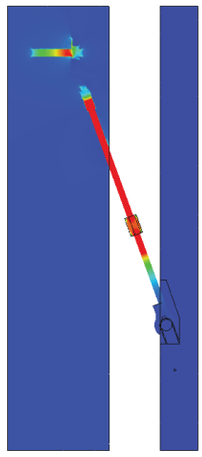
Applied to concrete fixings, Fixinox has already collaborated on leading projects for which a precise study and calculation note were requested by the site's EPB manager, who was responsible for the building's K coefficient and the future consumption of the finished building:

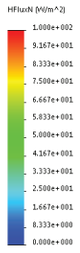
KU LEUVEN CAMPUS, BRUGES (BELGIUM)

Architect: ABCIS Architects



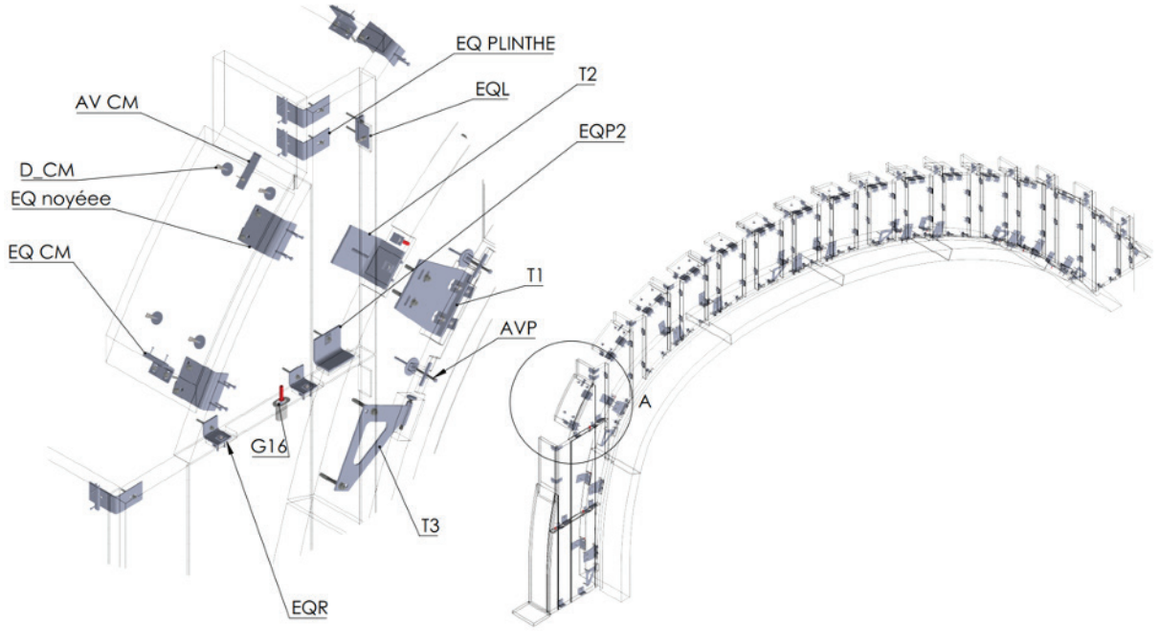






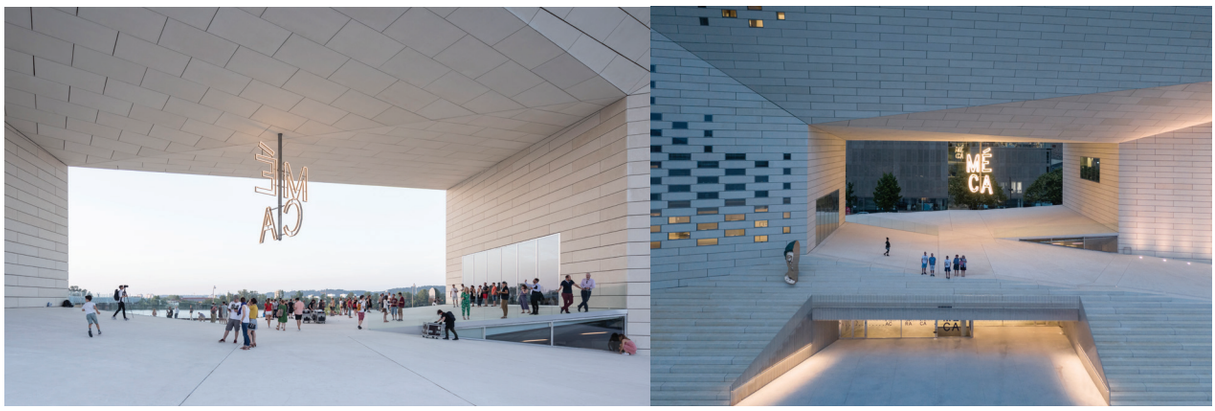
MONTAGNE DU PARC, HEAD QUARTERS BNPPF, BRUSSELS (BELGIUM)

Architects : Baumshlager Eberle & Jaspers-Eyers
Certificate obtained: BREEAM Excellent



For this project, a special solution was designed and developed by our design office. We offer our technical creativity for all non-standard projects.

MECA : THE HOUSE OF THE CREATIVE AND CULTURAL ECONOMY IN NOUVELLE-AQUITAINE



Architect : Bjarke Ingels
Seismic zone 2 :category 3
Experimental technical approvals from the CSTB (French certification)

FIXINOX

STAINLESS STEEL CONNECTORS

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MG Tower
Gand, BE

Gallerie Foksal
Varsovie, PL

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