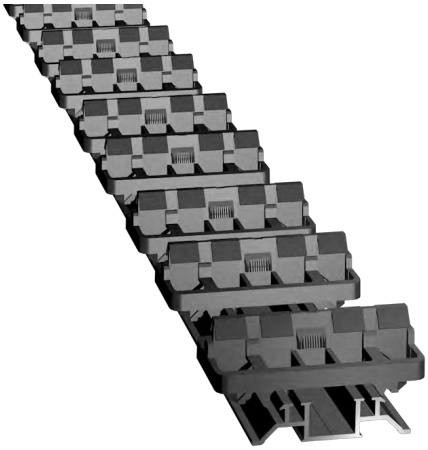
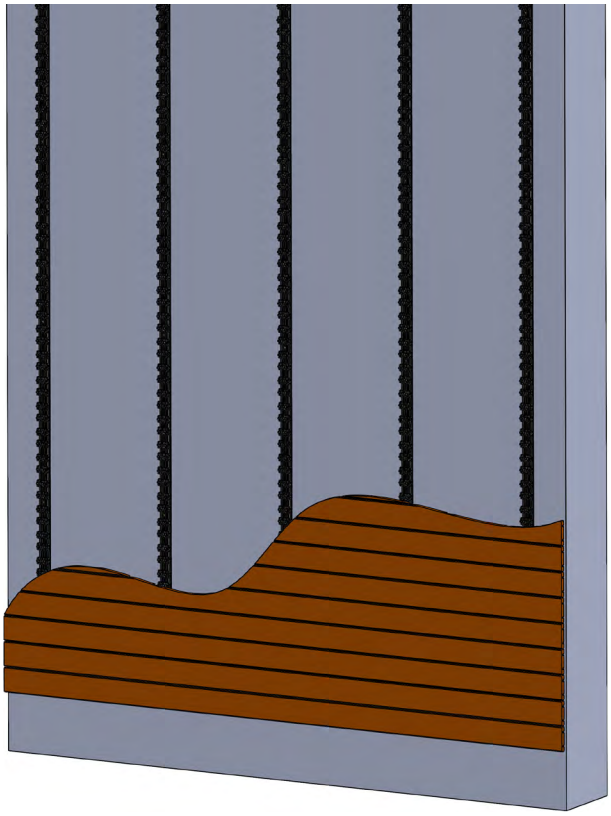
START RAIL - CLADDING

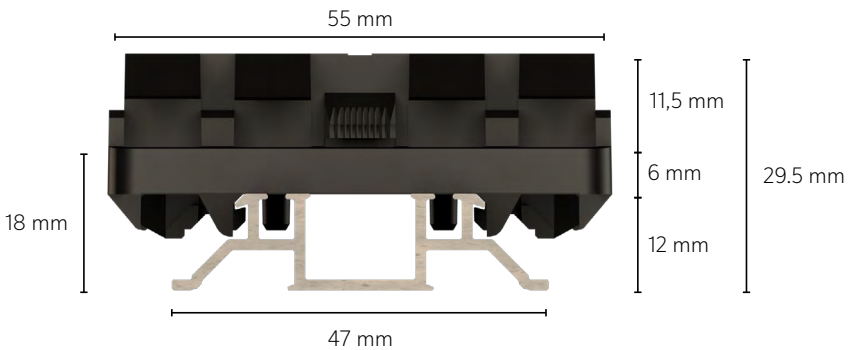
Utilisation : to fasten cladding

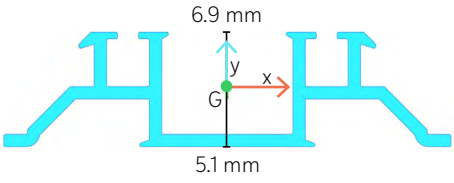


START RAIL



DIMENSIONS OF A START RAIL WITH CLIPS





Position of the centre of gravity (G)

MOMENTS OF INERTIA :
Ixx = 2384,2 mm^4
Iyy = 28960 mm^4
Ixx/v = 367,4 mm^3

Summary

1	Technical characteristics	p 3
2	Wind forces	p 4
3	Pull-out forces	p 6
4	Installing the rails directly to a wall	p 9
5	Fixation spans between rails	p 10
6	Installing the rails on a furring system	p 12

CALCULATION ASSUMPTIONS

The scope of application of the approach used is that defined in NF DTU 41.2 (French norms):

- Maximum pressures on the building envelope (generally depression in the corners of the structure) calculated with the following pressure coefficients:
  - Cpe = -1.4
  - Cpi = 0
- Building heights limited to 10 m and 28 m,
- All wind zones,
- All categories of site roughness (protected, normal and exposed),
- Flat terrain (average slope ≤ 5%, orography coefficient Co = 1).

FCBA study dated 30/05/2023

The fastening methods shown in this document are valid for cladding and soffit applications.

RAIL ALUMINIUM

Material	Aluminium EN AW-6060
Mass per meter of rail without clips	0,423 kg
Colour	Black
Thermal Treatment	T6
Tensile strength (MPa)	190
Tensile stress at yield (MPa)	150
Minimal elongation (%)	6
Tensile modulus (MPa)	70000
Coefficient of linear expansion (10^{-6}/K)	24
Fusion Temperature (°C)	585-655
Thermal conductivity (W/mK)	160

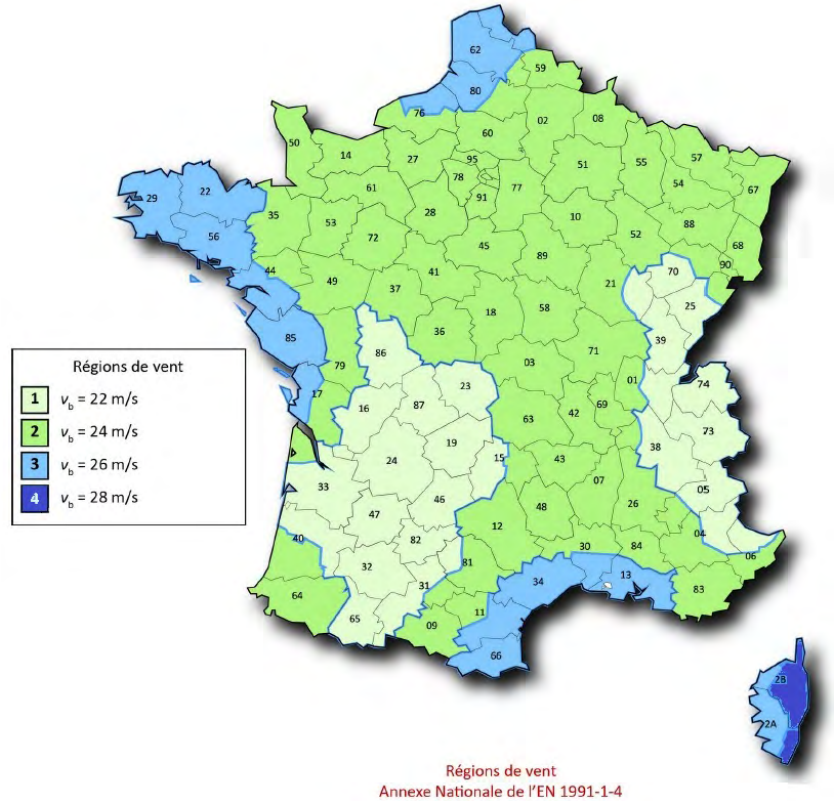
CLIP GRAD

Material	Polyoxymethylene
Density (kg/m³)	1410
Colour	Noir
Tensile stress at yield (MPa)	64
Fusion temperature (°C)	190-220
Tensile modulus (MPa)	2850
Coefficient of linear expansion (10^{-6}/K)	110

WIND ACTION IN FRANCE

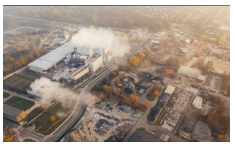
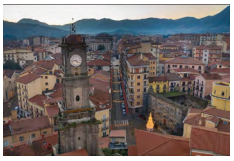
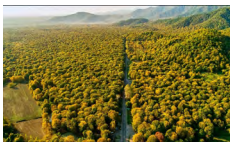
In the Eurocode rules, the average wind speed and the categories of wind roughness must be taken into account.

Here we have provided examples using French wind roughness.
All projects must follow local regulations concerning wind loads.



Régions de vent
Annexe Nationale de l'EN 1991-1-4

WIND ROUGHNESS CATEGORIES

0	II	IIIa	IIIb	IV
Sea or coastal area exposed to the sea.	- Airport - Flat countryside, with or without isolated obstacles (trees, buildings, etc.) separated from each other by more than 40 times their height	Countryside with hedgerows; vineyards, groves, scattered settlements.	Urbanized or industrial areas; dense groves, orchards.	Urban areas, 15% of which are covered with buildings averaging 15 m in height, dense forest.
	 		 	 

Orography: The orography coefficient takes into account an acceleration in wind speed on the structure due to specific orography. If the terrain has an average slope <5% then Co=1, if the value obtained is >5% then Co=1.15. An orography study is required to validate the coefficient.

- Support spacing: 650 mm (maximum spacing in accordance with NF DTU 41.2 [French Norms]);

Properties of aluminium used for Grad rails grade: EN AW-6060 T6 :
- Modulus of elasticity: E = 70,000 MPa ;
- Strength at 0.2%: f0= 150 MPa ;
- Ultimate tensile strength: fu = 190 MPa ;
- Partial safety factors: γ1= 1.1 ;
- Factor of safety (cladding board on 3 supports): k = 1.25 ;

WIND FORCE : DEPRESSION VALUES IN (KN/M²)

BUILDING HEIGHT: 10 M

Flat Terrain (Co = 1), H = 10 m

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	1,20	1,01	0,75	0,58	0,54
2	1,43	1,21	0,90	0,70	0,64
3	1,67	1,41	1,05	0,82	0,75
4	1,94	1,64	1,22	0,95	0,87
Guadeloupe	3,21	2,71	2,02	1,57	1,44
Guyana	0,72	0,60	0,45	0,35	0,32
Martinique	2,53	2,14	1,60	1,24	1,14
Réunion	2,86	2,42	1,80	1,40	1,28
Mayotte	2,24	1,81	1,42	1,09	1,00

Table 1: Depression forces at 10 m height (kN/m²) flat terrain

Max Orography (Co = 1,15), H = 10 m

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	1,59	1,34	0,99	0,77	0,71
2	1,89	1,60	1,19	0,93	0,85
3	2,21	1,86	1,39	1,08	0,99
4	2,57	2,17	1,61	1,26	1,15
Guadeloupe	4,25	3,58	2,67	2,08	1,90
Guyana	0,95	0,79	0,60	0,46	0,42
Martinique	3,35	2,83	2,12	1,64	1,51
Réunion	3,78	3,20	2,38	1,85	1,69
Mayotte	2,96	2,39	1,88	1,44	1,32

Table 2: Depression forces at 10 m height (kN/m²) Maximum orography

BUILDING HEIGHT: 28 M

Flat Terrain (Co = 1), H = 28 m

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	1,49	1,28	1,07	0,90	0,73
2	1,77	1,53	1,28	1,07	0,86
3	2,08	1,79	1,50	1,25	1,01
4	2,41	2,08	1,74	1,45	1,18
Guadeloupe	3,99	3,43	2,88	2,40	1,94
Guyana	0,89	0,77	0,64	0,54	0,43
Martinique	3,15	2,71	2,27	1,90	1,54
Réunion	3,56	3,06	2,57	2,14	1,73
Mayotte	2,72	2,34	1,96	1,62	1,31

Table 3: Depression forces at 28 m height (kN/m²) flat terrain

Max Orography (Co = 1,15), H = 28 m

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	1,97	1,69	1,42	1,19	0,97
2	2,34	2,02	1,69	1,42	1,14
3	2,75	2,37	1,98	1,65	1,34
4	3,19	2,75	2,30	1,92	1,56
Guadeloupe	5,28	4,54	3,81	3,17	2,57
Guyana	1,18	1,02	0,85	0,71	0,57
Martinique	4,17	3,58	3,00	2,51	2,04
Réunion	4,71	4,05	3,40	2,83	2,29
Mayotte	3,60	3,09	2,59	2,14	1,73

Table 4: Depression forces at 28 m height (kN/m²) Maximum orography

MAXIMUM DESIGN PULL-OUT FORCE PER FASTENER FOR FAÇADE APPLICATION

These values are used to determine the size of the rail fastener.

BUILDING HEIGHT: 10 M

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	578	516	423	356	340
2	650	582	477	404	380
3	721	644	529	449	423
4	797	712	585	495	467
Guadeloupe	1033	951	818	692	653
Guyana	411	364	301	254	240
Martinique	913	835	701	591	559
Réunion	976	897	758	641	604
Mayotte	852	761	647	542	512

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	578	516	423	356	340
2	650	582	477	404	380
3	721	644	529	449	423
4	797	712	585	495	467
Guadeloupe	1033	951	818	692	653
Guyana	411	364	301	254	240
Martinique	913	835	701	591	559
Réunion	976	897	758	641	604
Mayotte	852	761	647	542	512

Maximum design pull-out force - Building height 10 m for façade installation only

BUILDING HEIGHT: 28 M

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	578	516	423	356	340
2	650	582	477	404	380
3	721	644	529	449	423
4	797	712	585	495	467
Guadeloupe	1033	951	818	692	653
Guyana	411	364	301	254	240
Martinique	913	835	701	591	559
Réunion	976	897	758	641	604
Mayotte	852	761	647	542	512

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	578	516	423	356	340
2	650	582	477	404	380
3	721	644	529	449	423
4	797	712	585	495	467
Guadeloupe	1033	951	818	692	653
Guyana	411	364	301	254	240
Martinique	913	835	701	591	559
Réunion	976	897	758	641	604
Mayotte	852	761	647	542	512

Max. design pull-out force - Building height 28 m for façade installation only

MAXIMUM DESIGN PULL-OUT FORCE PER FASTENER FOR SOFFIT APPLICATION

These values are used to determine the size of the rail fastener.

BUILDING HEIGHT: 10 M

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	650	591	505	445	430
2	718	653	556	488	467
3	786	712	604	529	505
4	825	777	656	572	546
Guadeloupe	1040	975	834	758	721
Guyana	495	452	396	356	344
Martinique	942	855	766	662	632
Réunion	994	930	821	709	674
Mayotte	891	796	715	616	588

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	763	691	585	511	493
2	846	766	647	564	538
3	903	839	706	615	585
4	954	865	737	638	635
Guadeloupe	1222	1116	934	810	812
Guyana	573	520	451	401	386
Martinique	1116	1014	846	729	740
Réunion	1174	1070	891	771	769
Mayotte	1058	767	802	668	687

Maximum design pull-out force - Building height 10 m for underside installation only

BUILDING HEIGHT: 28 M

MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	735	674	610	556	498
2	780	747	674	610	542
3	833	788	738	665	591
4	901	856	805	724	644
Guadeloupe	1111	1071	1031	976	846
Guyana	552	512	467	430	388
Martinique	1022	946	926	848	749
Réunion	1072	994	983	910	802
Mayotte	949	902	864	772	683

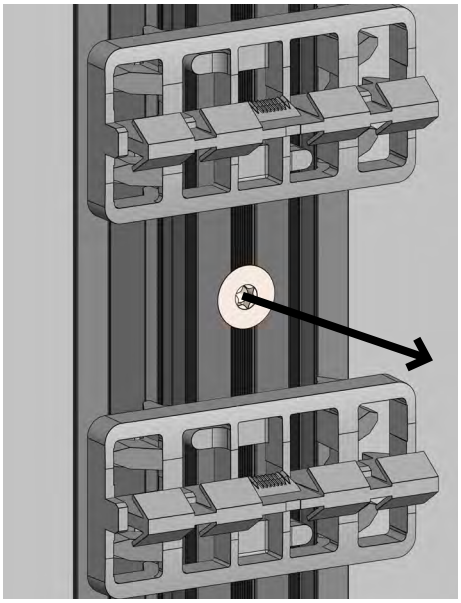
MAX CALCULATED PULL-OUT FORCE (ULS-STR VALUE) IN N

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	815	792	714	647	577
2	902	857	792	714	631
3	988	912	842	781	691
4	1033	988	913	838	755
Guadeloupe	1342	1255	1142	1029	954
Guyana	643	594	538	493	441
Martinique	1200	1116	1008	936	862
Réunion	1252	1168	1061	985	908
Mayotte	1119	1037	963	879	803

Maximum design pull-out force - Building height 28 m for underside installation only

PULL-OUT FORCE

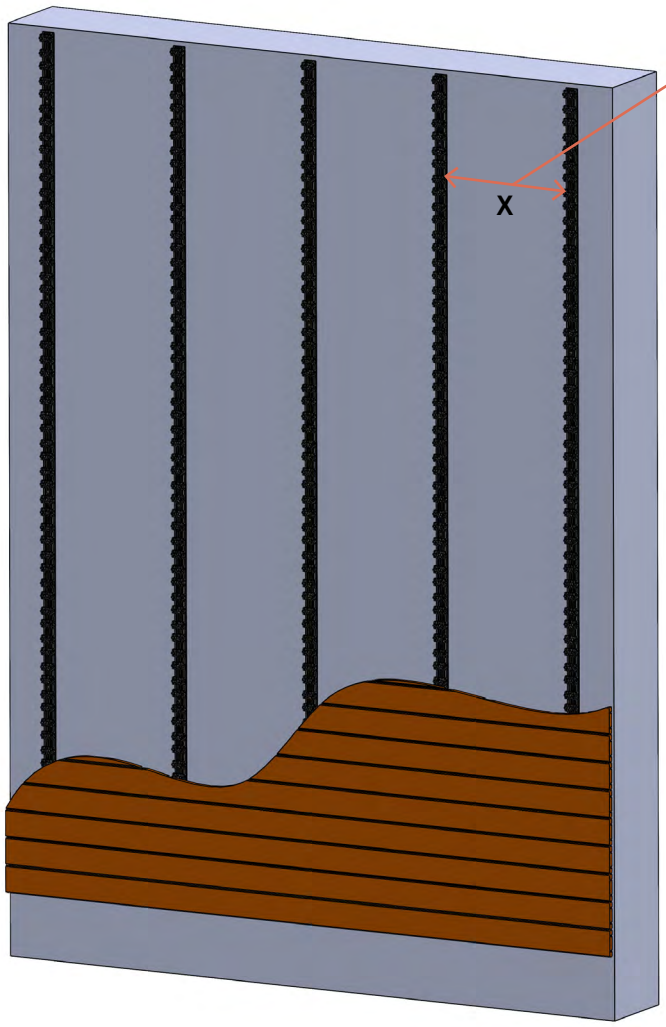


The pull-out force is an essential value for sizing fasteners.

A calculation note is also available to help with fastener sizing.

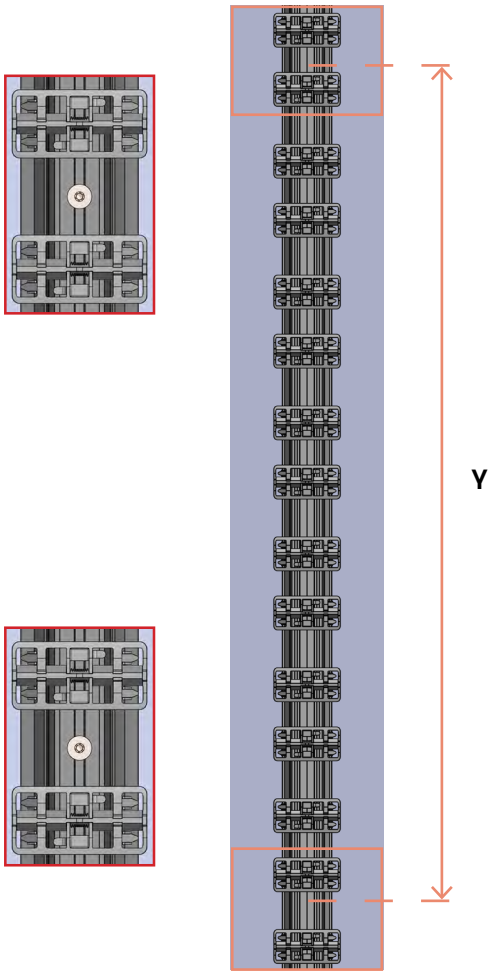
Pull-out force:
Ftens,k

RAIL FASTENING DIRECTLY TO THE WALL



Maximum rail spacing is 650 mm.

Maximum fastener spacing is 770 mm; this value may vary according to geographical area (see table p.10).



MAXIMUM DISTANCE BETWEEN FASTENERS FOR FAÇADE APPLICATIONS

Calculations made by the Serviceability Limit State

BUILDING HEIGHT: 10 M

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,49	0,52	0,58	0,63	0,65
2	0,47	0,49	0,54	0,59	0,61
3	0,44	0,47	0,52	0,56	0,58
4	0,42	0,45	0,49	0,53	0,55
Guadeloupe	0,33	0,36	0,42	0,45	0,47
Guyana	0,59	0,62	0,69	0,75	0,77
Martinique	0,37	0,40	0,45	0,49	0,50
Réunion	0,35	0,38	0,43	0,47	0,48
Mayotte	0,39	0,43	0,47	0,51	0,53

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,45	0,48	0,53	0,57	0,59
2	0,42	0,45	0,50	0,54	0,56
3	0,40	0,43	0,47	0,51	0,53
4	0,37	0,41	0,45	0,49	0,50
Guadeloupe	0,29	0,32	0,34	0,38	0,42
Guyana	0,53	0,57	0,62	0,68	0,70
Martinique	0,33	0,36	0,39	0,42	0,46
Réunion	0,31	0,33	0,36	0,40	0,44
Mayotte	0,35	0,38	0,42	0,46	0,48

Max. fixing distance to justify L/167 minimum - Building height 10 m for façade installation only

BUILDING HEIGHT: 28 M

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,46	0,48	0,51	0,54	0,58
2	0,42	0,46	0,48	0,51	0,55
3	0,39	0,43	0,46	0,49	0,52
4	0,37	0,4	0,44	0,46	0,5
Guadeloupe	0,28	0,31	0,36	0,39	0,42
Guyana	0,55	0,57	0,61	0,65	0,70
Martinique	0,32	0,35	0,40	0,42	0,45
Réunion	0,30	0,33	0,38	0,41	0,44
Mayotte	0,34	0,38	0,42	0,45	0,48

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,42	0,44	0,47	0,50	0,53
2	0,38	0,42	0,44	0,47	0,5
3	0,35	0,38	0,42	0,44	0,48
4	0,33	0,35	0,39	0,42	0,45
Guadeloupe	0,25	0,27	0,30	0,33	0,37
Guyana	0,50	0,52	0,56	0,59	0,63
Martinique	0,29	0,31	0,34	0,37	0,41
Réunion	0,27	0,29	0,32	0,35	0,39
Mayotte	0,31	0,33	0,36	0,40	0,44

Max. fixing distance to justify L/167 minimum - Building height 28 m for façade installation only

MAXIMUM DISTANCE BETWEEN FASTENERS FOR SOFFIT APPLICATION

Calculations made by the Serviceability Limit State

BUILDING HEIGHT: 10 M

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,47	0,49	0,53	0,56	0,57
2	0,44	0,47	0,50	0,54	0,55
3	0,42	0,45	0,48	0,52	0,53
4	0,39	0,43	0,46	0,50	0,51
Guadeloupe	0,31	0,34	0,38	0,43	0,44
Guyana	0,53	0,56	0,60	0,63	0,64
Martinique	0,35	0,37	0,43	0,46	0,47
Réunion	0,33	0,36	0,41	0,45	0,46
Mayotte	0,37	0,40	0,44	0,48	0,49

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,43	0,45	0,49	0,53	0,54
2	0,41	0,43	0,47	0,50	0,51
3	0,38	0,41	0,45	0,48	0,49
4	0,35	0,37	0,41	0,44	0,47
Guadeloupe	0,28	0,30	0,33	0,36	0,39
Guyana	0,50	0,52	0,56	0,59	0,61
Martinique	0,32	0,34	0,37	0,40	0,44
Réunion	0,30	0,32	0,35	0,38	0,41
Mayotte	0,34	0,30	0,39	0,42	0,45

Max. fixing centre distance to justify L/167 minimum - Building height 10 m for soffit installation only

BUILDING HEIGHT: 28 M

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

Flat Terrain (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,44	0,46	0,48	0,50	0,53
2	0,40	0,44	0,46	0,48	0,51
3	0,37	0,40	0,44	0,46	0,49
4	0,35	0,38	0,42	0,44	0,47
Guadeloupe	0,27	0,30	0,34	0,38	0,40
Guyana	0,51	0,53	0,55	0,57	0,60
Martinique	0,31	0,33	0,38	0,41	0,43
Réunion	0,29	0,31	0,36	0,39	0,42
Mayotte	0,33	0,36	0,40	0,43	0,45

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,38	0,42	0,45	0,47	0,49
2	0,36	0,39	0,42	0,45	0,47
3	0,34	0,36	0,39	0,43	0,45
4	0,31	0,34	0,37	0,40	0,43
Guadeloupe	0,25	0,27	0,29	0,31	0,35
Guyana	0,47	0,49	0,51	0,54	0,57
Martinique	0,28	0,30	0,32	0,35	0,39
Réunion	0,26	0,28	0,30	0,33	0,37
Mayotte	0,30	0,32	0,35	0,38	0,42

Max. fixing centre distance to justify L/167 minimum - Building height 28 m for soffit installation only

FASTENING RAILS TO A FURRING SYSTEM

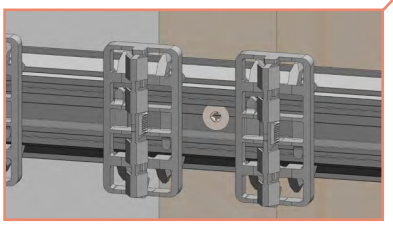
VERTICAL CLADDING

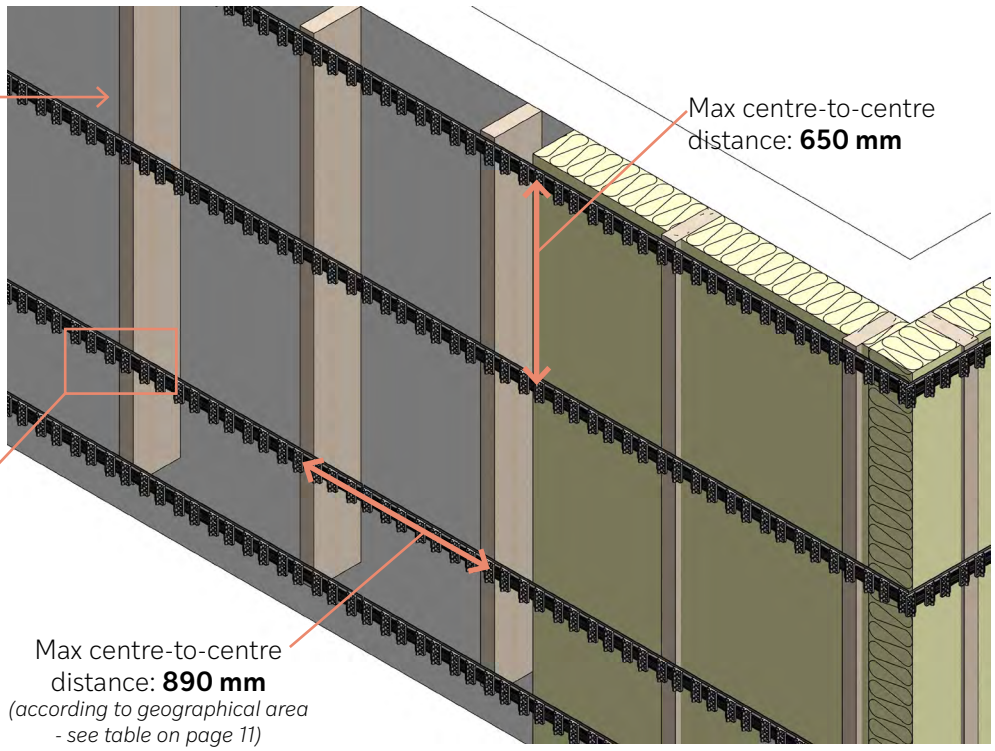
Horizontal cladding uses the same fastening principle, only the structure undergoes a few modifications

The structure can be built with vertical furring strips fixed to the wall.

The rails are fastened to the vertical furring with a screw suitable for this type of structure.

Note that the center-to-center distance between the cleats is similar to or less than the center-to-center distance between the rails.

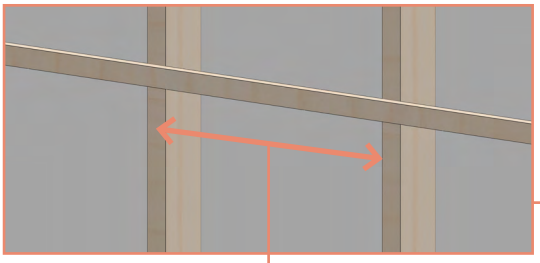




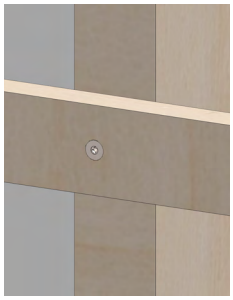
RAIL FASTENING ON A DOUBLE FURRING SYSTEM

VERTICAL CLADDING

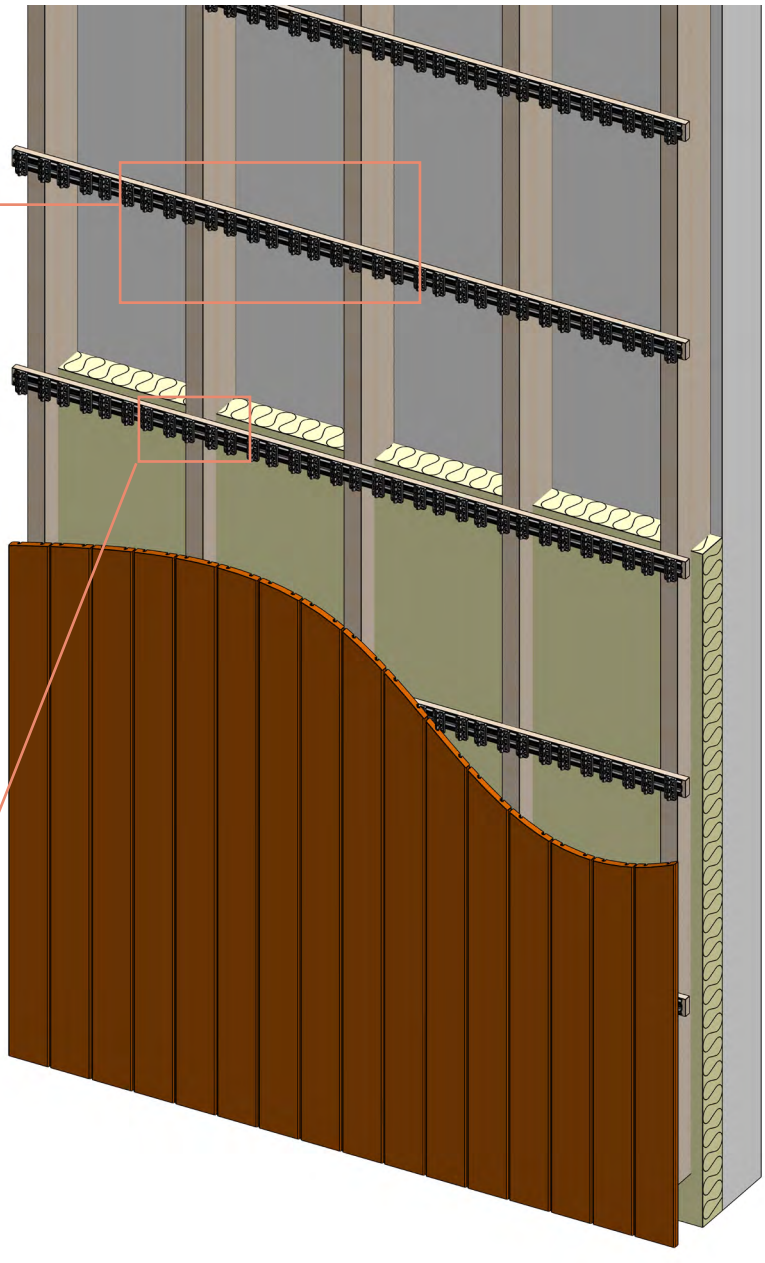
Horizontal cladding uses the same fastening principle, only the structure undergoes a few modifications



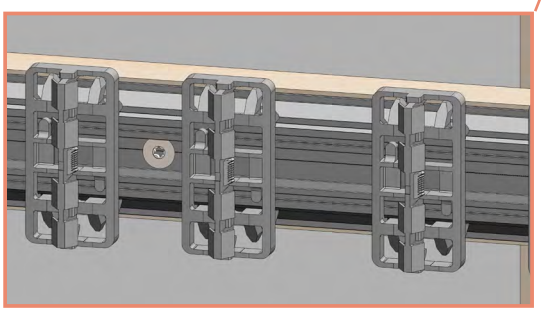
In cases where the spacing of the furring is greater than the maximum spacing for fastening the Start Rail, a double-furring structure must be created and the rails fastened to these furring strips.

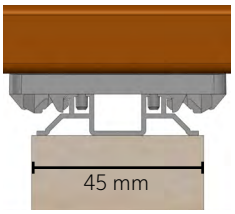


The horizontal furring is fastened to the existing furring using countersunk screws, so that the screw head can be embedded in the furring strip without interfering with the installation of the Start Rail on the furring strip.



The rails are fastened to the horizontal furring with a screw suitable for this type of structure.





Minimum furring strip width is 45 mm