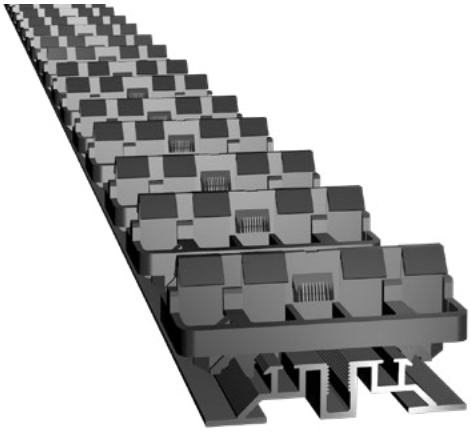
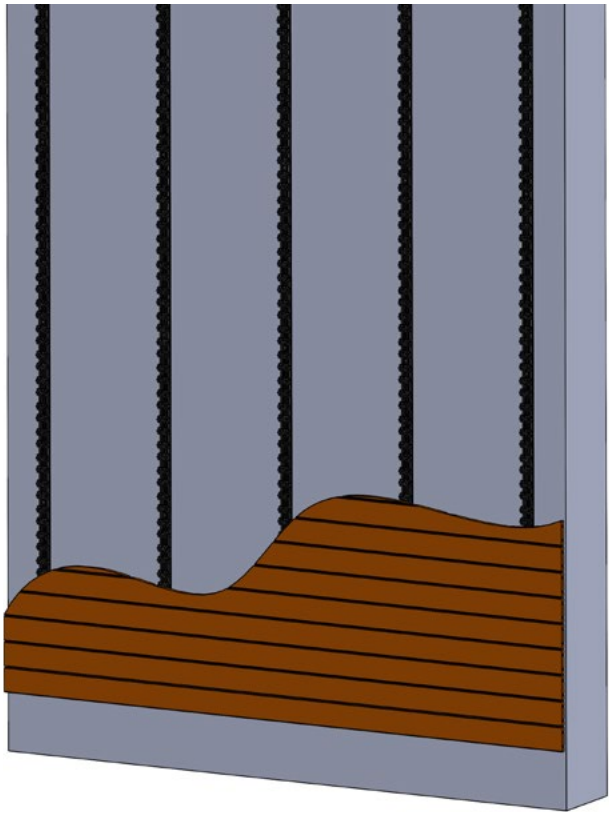
FLAT RAIL - CLADDING

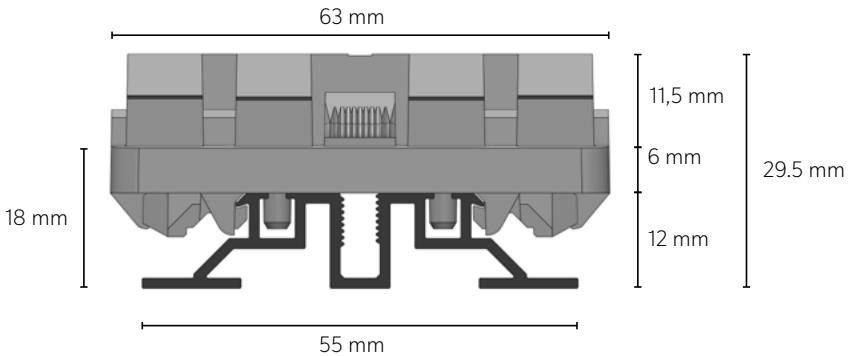
Use: allows for the installation of vertical or horizontal cladding

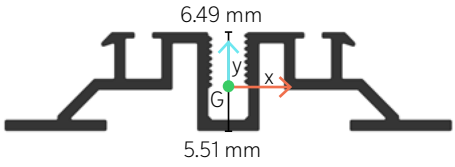


FLAT RAIL



DIMENSIONS OF A FLAT 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

CALCULATION ASSUMPTIONS

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

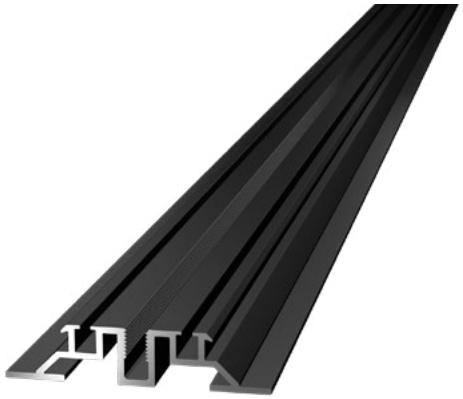
- Maximum pressures on the building envelope (generally depression in the corners of the structure) calculated with the following pressure coefficients:
  - Cpe = -1.4
  - Cpi = 0
- Building heights limited to 10 m and 28 m,
- All wind zones,
- All categories of site roughness (protected, normal and 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.

ALUMINIUM RAIL

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



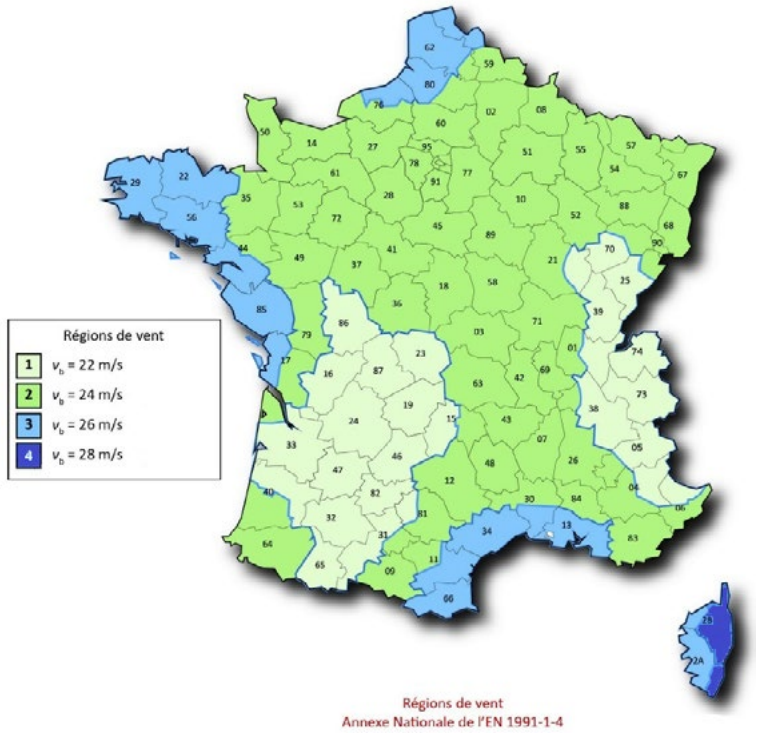
GRAD CLIP

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 20 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 Land (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
Guyane	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

Orography max (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
Guyane	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 Land (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
Guyane	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

Orography max (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
Guyane	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

BUILDING HEIGHT : 10 M

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

Flat Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	672	599	491	414	395
2	756	676	555	469	442
3	838	748	615	521	491
4	926	828	680	575	542
Guadeloupe	1295	1157	951	804	759
Guyane	478	423	350	296	278
Martinique	1105	988	814	687	650
Réunion	1199	1073	881	745	702
Mayotte	1019	884	752	630	595

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

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	810	722	592	499	476
2	910	814	669	565	533
3	1009	902	741	628	592
4	1116	997	819	693	654
Guadeloupe	1561	1394	1146	969	915
Guyane	576	510	421	356	336
Martinique	1332	1191	981	828	783
Réunion	1445	1293	1061	897	845
Mayotte	1228	1065	906	760	717

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

BUILDING HEIGHT : 28 M

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

Flat Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	776	702	623	555	483
2	871	790	702	623	538
3	970	878	780	691	599
4	1070	970	861	763	665
Guadeloupe	1439	1304	1205	1067	926
Guyane	551	500	442	395	339
Martinique	1279	1157	1028	913	794
Réunion	1354	1255	1117	988	858
Mayotte	1160	1049	932	821	713

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

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	936	845	750	669	581
2	1049	952	845	750	649
3	1169	1057	940	832	722
4	1289	1169	1037	919	801
Guadeloupe	1698	1548	1452	1286	1116
Guyane	664	602	533	476	409
Martinique	1503	1394	1239	1100	956
Réunion	1607	1460	1346	1191	1034
Mayotte	1397	1264	1123	989	859

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

MAXIMUM DESIGN PULL-OUT FORCE PER FASTENER FOR SOFFIT APPLICATION

BUILDING HEIGHT : 10 M

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

Flat Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	756	687	587	517	500
2	834	759	646	567	542
3	913	828	702	615	587
4	998	903	763	665	634
Guadeloupe	1356	1222	1022	881	838
Guyane	575	526	460	414	400
Martinique	1171	1058	891	770	734
Réunion	1263	1140	954	824	783
Mayotte	1088	957	831	716	683

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

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	886	803	680	594	573
2	983	891	752	656	625
3	1078	974	821	714	680
4	1181	1067	895	775	738
Guadeloupe	1616	1453	1211	1039	987
Guyane	665	605	524	466	448
Martinique	1392	1255	1051	903	860
Réunion	1503	1354	1128	970	920
Mayotte	1291	1132	979	838	798

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

BUILDING HEIGHT : 28 M

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

Flat Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	854	783	709	646	579
2	945	868	783	709	630
3	1040	951	858	773	687
4	1137	1040	935	841	748
Guadeloupe	1481	1356	1268	1134	998
Guyane	642	595	542	500	451
Martinique	1285	1222	1096	985	871
Réunion	1367	1317	1182	1058	932
Mayotte	1224	1117	1004	897	794

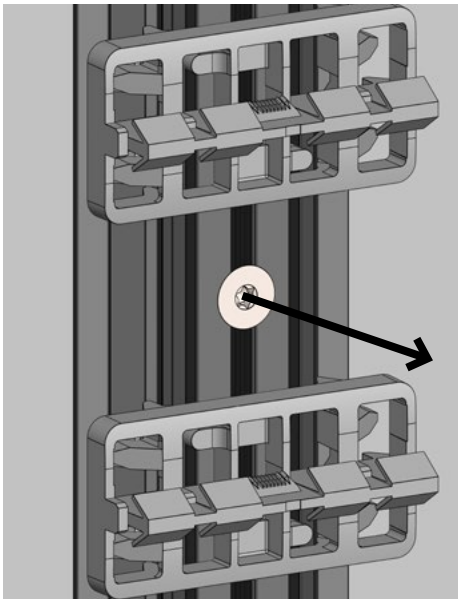
MAX CALCULATED PULL-OUT FORCE (ELU-STR VALUE) IN N

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	1007	920	829	752	670
2	1117	1023	920	829	733
3	1233	1125	1011	908	803
4	1350	1233	1106	991	878
Guadeloupe	1718	1580	1418	1347	1181
Guyane	747	690	625	573	512
Martinique	1500	1453	1301	1166	1027
Réunion	1637	1501	1406	1255	1102
Mayotte	1456	1326	1189	1059	933

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

PULL-OUT FORCE

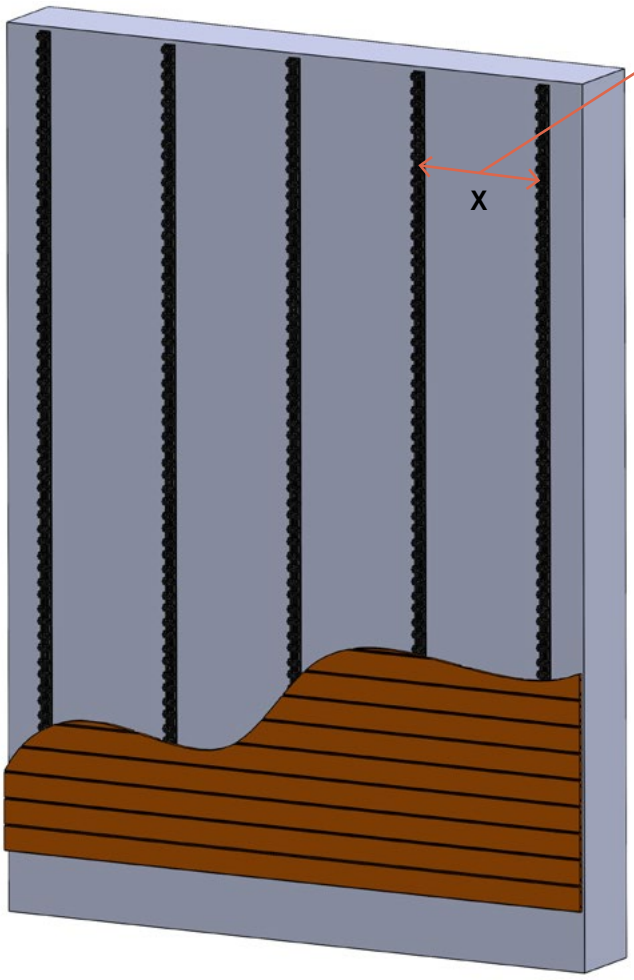


The pull-out force is an essential value for sizing fasteners.

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

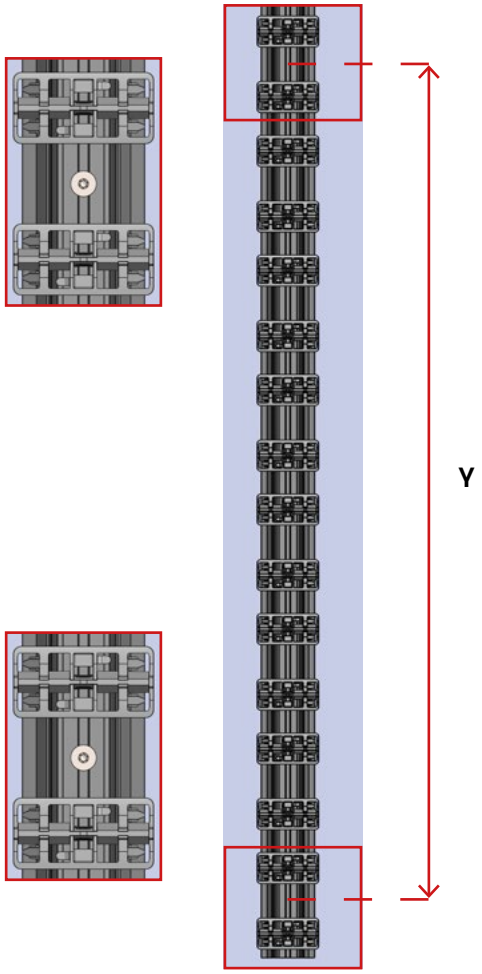
Pull-out force:
Ftens,k

RAIL FASTENING DIRECTLY TO THE WALL



Maximum rail spacing is 650 mm.

Maximum fastener spacing is 890 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 Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,57	0,61	0,67	0,73	0,75
2	0,54	0,57	0,63	0,69	0,71
3	0,51	0,54	0,60	0,65	0,67
4	0,49	0,52	0,57	0,62	0,64
Guadeloupe	0,41	0,44	0,48	0,53	0,54
Guyane	0,68	0,72	0,80	0,87	0,89
Martinique	0,45	0,47	0,52	0,57	0,58
Réunion	0,43	0,45	0,50	0,55	0,56
Mayotte	0,47	0,50	0,54	0,59	0,61

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,52	0,55	0,61	0,67	0,68
2	0,49	0,52	0,58	0,63	0,65
3	0,47	0,50	0,55	0,59	0,61
4	0,45	0,47	0,52	0,57	0,58
Guadeloupe	0,38	0,40	0,44	0,48	0,49
Guyane	0,62	0,66	0,73	0,79	0,81
Martinique	0,41	0,43	0,48	0,52	0,53
Réunion	0,39	0,41	0,46	0,50	0,51
Mayotte	0,43	0,46	0,49	0,54	0,56

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 Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,53	0,56	0,60	0,63	0,68
2	0,50	0,53	0,56	0,60	0,64
3	0,48	0,50	0,53	0,57	0,61
4	0,46	0,48	0,51	0,54	0,58
Guadeloupe	0,37	0,39	0,43	0,46	0,49
Guyane	0,63	0,67	0,71	0,75	0,81
Martinique	0,42	0,44	0,46	0,49	0,53
Réunion	0,39	0,42	0,45	0,47	0,51
Mayotte	0,44	0,46	0,49	0,52	0,56

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,49	0,51	0,54	0,58	0,62
2	0,46	0,48	0,51	0,54	0,58
3	0,44	0,46	0,49	0,52	0,55
4	0,41	0,44	0,46	0,49	0,53
Guadeloupe	0,34	0,35	0,39	0,42	0,45
Guyane	0,58	0,61	0,65	0,68	0,74
Martinique	0,37	0,40	0,42	0,45	0,48
Réunion	0,35	0,37	0,41	0,43	0,46
Mayotte	0,40	0,42	0,44	0,47	0,51

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 Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,54	0,57	0,61	0,65	0, 67
2	0,52	0, 54	0,59	0,63	0,64
3	0,49	0,52	0,56	0,60	0,61
4	0,47	0,50	0,54	0,58	0,59
Guadeloupe	0,40	0,43	0,47	0,50	0,51
Guyane	0,62	0,65	0,69	0,73	0,75
Martinique	0,44	0,46	0,50	0,54	0,55
Réunion	0,42	0,44	0,48	0,52	0,53
Mayotte	0,45	0,48	0,52	0,56	0,57

MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

All Orography (Co = 1,15)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,50	0,53	0,57	0,61	0,62
2	0,48	0,50	0,54	0,58	0,60
3	0,45	0,48	0,52	0,56	0,57
4	0,43	0,46	0,50	0,53	0,55
Guadeloupe	0,37	0,39	0,43	0,46	0,47
Guyane	0,58	0,61	0,65	0,69	0,70
Martinique	0,40	0,42	0,46	0,50	0,51
Réunion	0,38	0,40	0,44	0,48	0,49
Mayotte	0,41	0,44	0,48	0,51	0,53

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 Land (Co = 1)

	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,51	0,53	0,56	0,59	0,62
2	0,48	0,51	0,53	0,56	0,59
3	0,46	0,48	0,51	0,54	0,57
4	0,44	0,46	0,49	0,51	0,54
Guadeloupe	0,36	0,38	0,42	0,44	0,47
Guyane	0,59	0,61	0,64	0,67	0,70
Martinique	0,39	0,43	0,45	0,47	0,50
Réunion	0,37	0,41	0,43	0,46	0,49
Mayotte	0,43	0,45	0,47	0,50	0,53

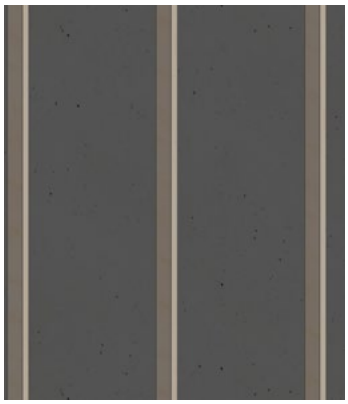
MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

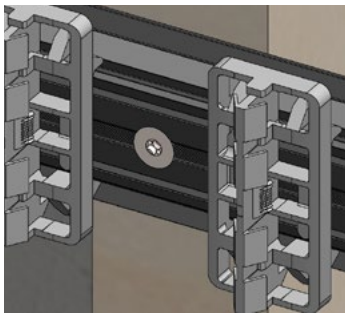
All Orography (Co = 1,15)

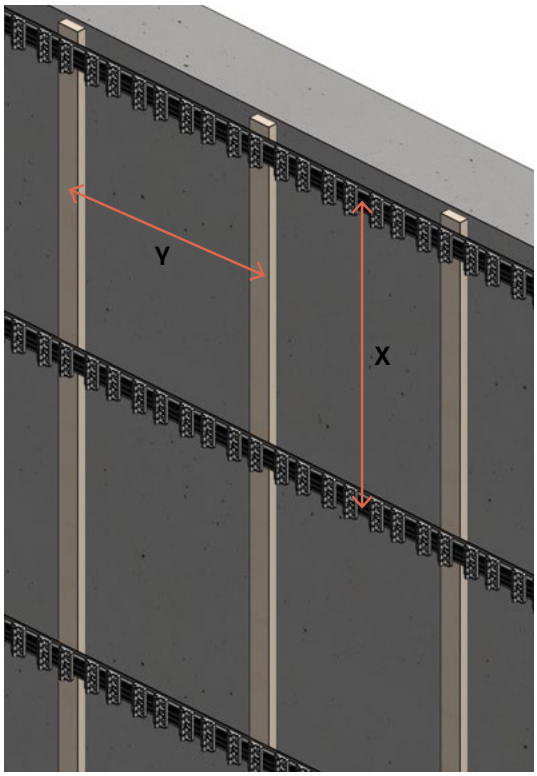
	WIND ROUGHNESS				
ZONE	**0**	**II**	**IIIa**	**IIIb**	**IV**
1	0,47	0,49	0,52	0,54	0,58
2	0,45	0,47	0,49	0,52	0,55
3	0,42	0,44	0,47	0,49	0,53
4	0,41	0,42	0,45	0,47	0,50
Guadeloupe	0,32	0,34	0,36	0,41	0,43
Guyane	0,54	0,57	0,60	0,62	0,66
Martinique	0,35	0,39	0,41	0,44	0,46
Réunion	0,34	0,36	0,40	0,42	0,45
Mayotte	0,39	0,41	0,43	0,46	0,49

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

FASTENING RAILS TO A FURRING SYSTEM



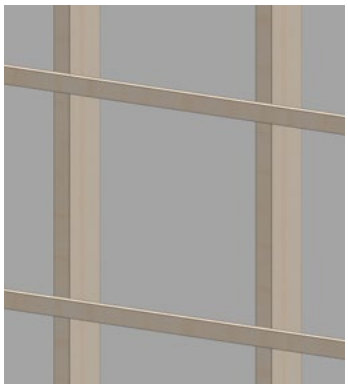


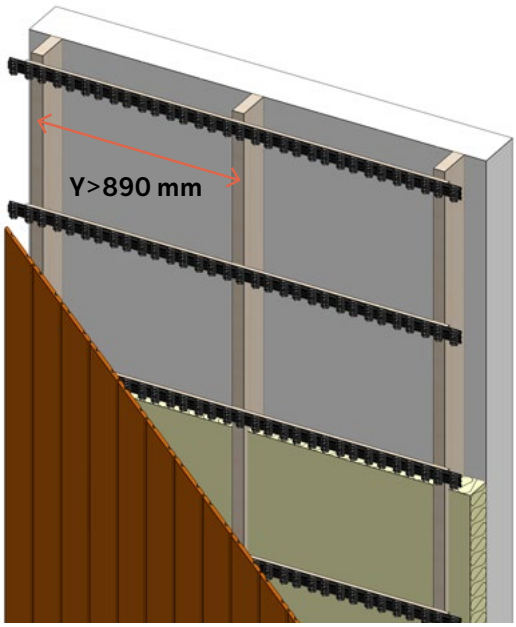


If the rails are fastened to a timber structure with existing furring system, it is important to ensure that the furring spacing is **similar to or less than the maximum rail fastening spacing of 890 mm.**

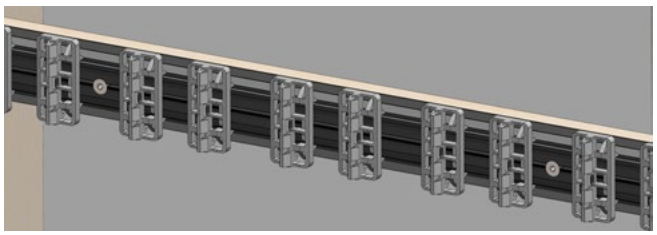
Rails should also be fastened with fasteners suitable for this type of structure.

When the center-to-center distance of the existing wood structure is greater than the maximum rail fastening center-to-center distance (890 mm), the structure must be adapted with a double furring system.





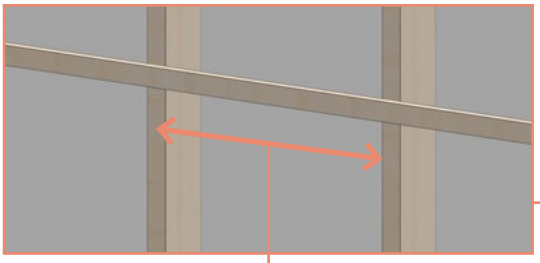
The horizontal furring strips are fastened to the existing furring using countersunk screws, so that the screw head can be flush and does not interfere with the installation of the rail on the furring strip.



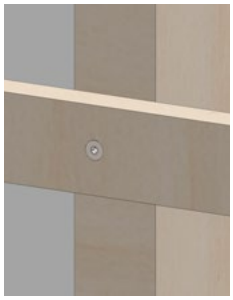
RAIL FASTENING ON DOUBLE FURRING SYSTEM

VERTICAL CLADDING

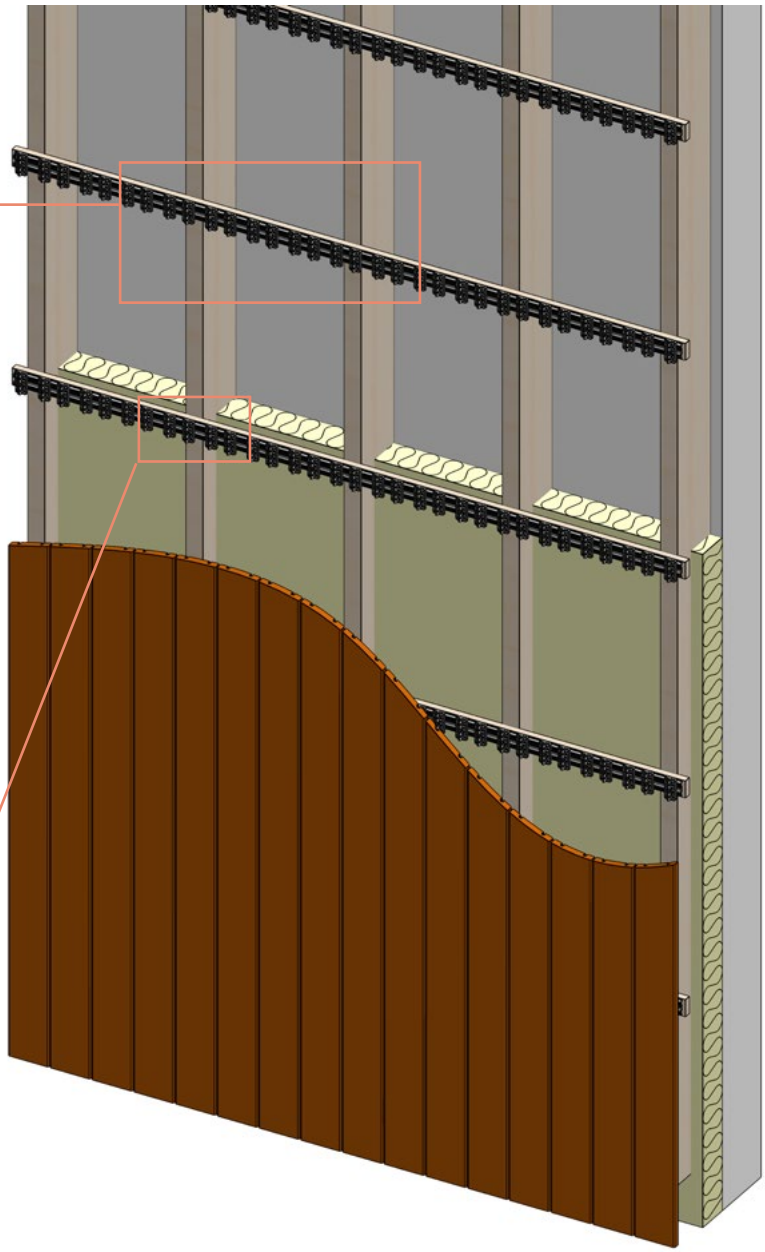
Horizontal cladding uses the same fastening principle, only the structure undergoes a few modifications



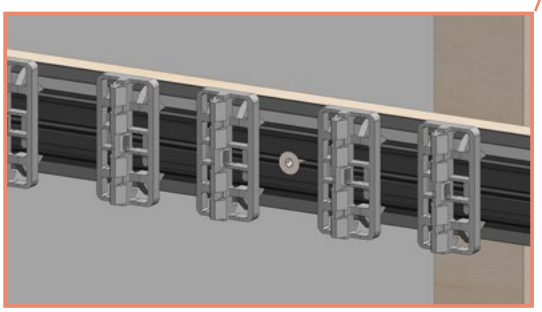
In cases where the spacing of the furring strips is greater than the maximum spacing for fastening the Flat Rail, a double-furring structure must be created and the rails fastened to these furring strips.

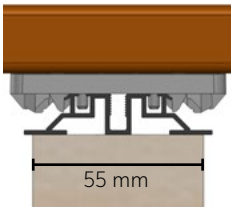


The horizontal furring strips are fastened to the existing furring strips using countersunk screws, so that the screw head can be embedded in the furring strip without interfering with the installation of the Flat Rail on the furring strip.



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





Minimum furring strip width is 55 mm