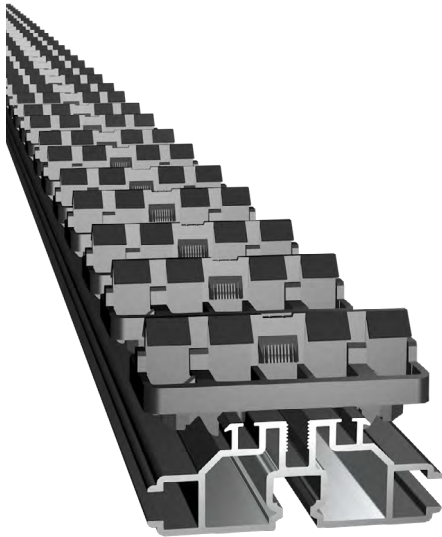


## PR24 - CLADDING

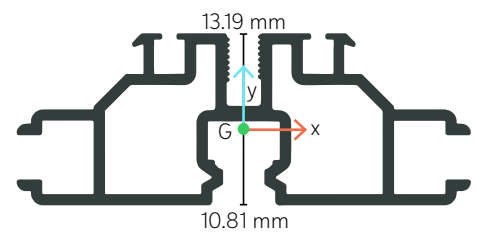
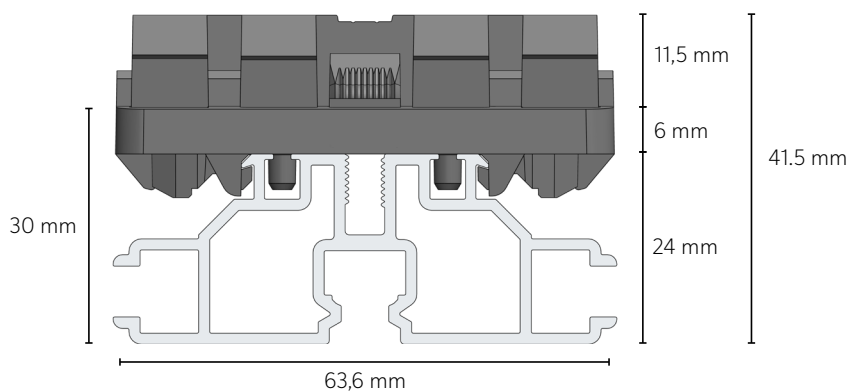
Utilisation : For fastening cladding



**RAIL PR24**



### DIMENSIONS OF PR24 RAIL WITH CLIPS



Position of center of gravity (G)

MOMENTS OF INERTIA:

$$I_{xx} = 19602 \text{ mm}^4$$

$$I_{yy} = 87737 \text{ mm}^4$$

$$I_{xx/v} = 1486 \text{ mm}^3$$

## SUMMARY

1	Technical Characteristics	p 3
2	Wind Forces	p 4
3	Pull-out Forces	p 8
4	Rail Installation Directly on the Wall	p 9
5	Rail Installation on L Brackets	p 11

## 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:
  - $C_{pe} = -1.4$
  - $C_{pi} = 0$
- 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  $\leq 5\%$ , orography coefficient  $C_o = 1$ ).

### FCBA study dated 30/05/2023

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

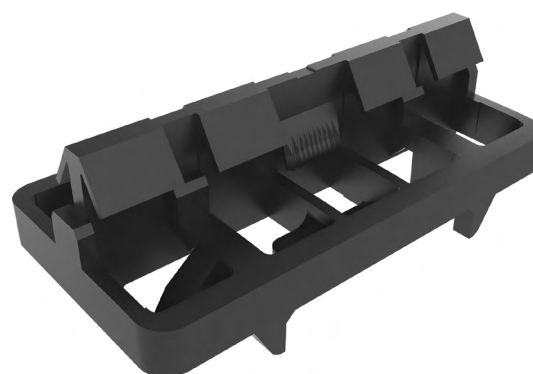
## ALUMINIUM RAIL

<b>Material</b>	Aluminium EN AW-6060
<b>Mass per meter of rail without clips</b>	0,878 kg
<b>Colour</b>	Black
<b>Thermal Treatment</b>	T6
<b>Tensile strength (MPa)</b>	190
<b>Tensile stress at yield (MPa)</b>	150
<b>Minimal elongation (%)</b>	6
<b>Tensile modulus (MPa)</b>	70000
<b>Coefficient of linear expansion (10<sup>-6</sup>/K)</b>	24
<b>Fusion Temperature (°C)</b>	585-655
<b>Thermal conductivity (W/mK)</b>	160



## GRAD CLIP

<b>Material</b>	Polyoxymethylene
<b>Density (kg/m<sup>3</sup>)</b>	1410
<b>Colour</b>	Black
<b>Tensile stress at yield (MPa)</b>	64
<b>Fusion temperature (°C)</b>	190-220
<b>Tensile modulus (MPa)</b>	2850
<b>Coefficient of linear expansion (10<sup>-6</sup>/K)</b>	110

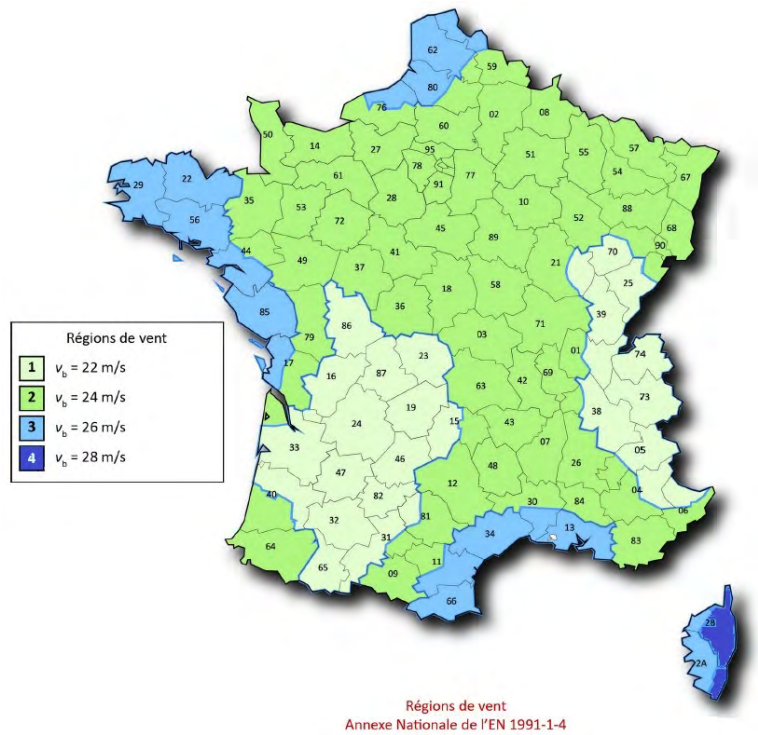


## WIND ACTION IN FRANCE





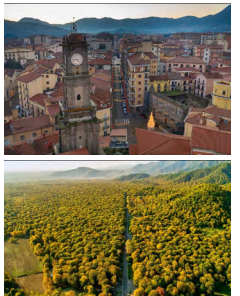
In the Eurocode rules, the average wind speed and the categories of wind roughness must be taken into account.

Here we have provided examples using French wind roughness.

All projects must follow local regulations concerning wind loads.



## 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  $C_o=1$ , if the value obtained is >5% then  $C_o=1.15$ . 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:  $E = 70,000 \text{ MPa}$  ;
- Strength at 0.2%:  $f_0 = 150 \text{ MPa}$  ;
- Ultimate tensile strength:  $f_u = 190 \text{ MPa}$  ;
- Partial safety factors:  $\gamma_1 = 1.1$  ;
- Factor of safety (cladding board on 3 supports):  $k = 1.25$  ;

## WIND FORCE : DEPRESSION VALUES IN (KN/M<sup>2</sup>)

### BUILDING HEIGHT : 10 M

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

ZONE	WIND ROUGHNESS				
	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/m<sup>2</sup>) flat terrain

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

ZONE	WIND ROUGHNESS				
	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/m<sup>2</sup>) Maximum orography

### BUILDING HEIGHT : 28 M

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

ZONE	WIND ROUGHNESS				
	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/m<sup>2</sup>) flat terrain

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

ZONE	WIND ROUGHNESS				
	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/m<sup>2</sup>) 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	1357	1209	987	763	711
2	1525	1364	1120	921	842
3	1691	1511	1241	1053	987
4	1869	1671	1372	1161	1095
<b>Guadeloupe</b>	2614	2335	1920	1623	1532
<b>Guyana</b>	948	790	592	461	421
<b>Martinique</b>	2231	1995	1643	1387	1311
<b>Réunion</b>	2421	2166	1778	1503	1416
<b>Mayotte</b>	2057	1784	1518	1272	1201

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

##### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1635	1457	1195	1007	940
2	1837	1644	1349	1141	1075
3	2037	1820	1495	1268	1195
4	2252	2013	1653	1399	1319
<b>Guadeloupe</b>	3150	2814	2313	1955	1846
<b>Guyana</b>	1163	1030	783	609	557
<b>Martinique</b>	2688	2404	1980	1671	1580
<b>Réunion</b>	2916	2609	2142	1811	1706
<b>Mayotte</b>	2478	2150	1829	1533	1447

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	1567	1416	1257	1120	961
2	1758	1595	1416	1257	1086
3	1958	1771	1574	1394	1209
4	2160	1958	1738	1539	1342
<b>Guadeloupe</b>	2879	2709	2432	2154	1869
<b>Guyana</b>	1112	1009	842	711	566
<b>Martinique</b>	2582	2335	2075	1843	1602
<b>Réunion</b>	2742	2532	2254	1995	1731
<b>Mayotte</b>	2341	2118	1882	1657	1438

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

##### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1888	1706	1514	1349	1174
2	2118	1922	1706	1514	1309
3	2359	2134	1897	1680	1457
4	2602	2359	2094	1854	1616
<b>Guadeloupe</b>	3396	3184	2930	2595	2252
<b>Guyana</b>	1339	1216	1075	940	749
<b>Martinique</b>	3046	2814	2500	2220	1930
<b>Réunion</b>	3213	2999	2716	2404	2086
<b>Mayotte</b>	2820	2551	2267	1997	1733

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 Terrain (Co = 1)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1525	1387	1185	1044	1009
2	1684	1532	1303	1145	1095
3	1843	1671	1416	1241	1185
4	2014	1824	1539	1342	1280
Guadeloupe	2738	2466	2063	1778	1691
Guyana	1161	1061	895	763	724
Martinique	2364	2136	1797	1553	1482
Réunion	2549	2301	1926	1664	1581
Mayotte	2195	1932	1678	1446	1379

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

##### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1789	1620	1373	1199	1156
2	1983	1798	1518	1323	1262
3	2177	1967	1656	1442	1373
4	2384	2153	1806	1565	1490
Guadeloupe	3263	2933	2444	2097	1992
Guyana	1343	1220	1057	912	860
Martinique	2809	2532	2121	1823	1736
Réunion	3034	2733	2278	1959	1858
Mayotte	2605	2285	1975	1692	1611

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 Terrain (Co = 1)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1725	1581	1431	1303	1169
2	1907	1751	1581	1431	1272
3	2099	1920	1731	1560	1387
4	2295	2099	1888	1698	1511
Guadeloupe	2962	2712	2560	2289	2014
Guyana	1296	1201	1095	1009	869
Martinique	2636	2466	2213	1989	1758
Réunion	2808	2658	2387	2136	1882
Mayotte	2471	2254	2026	1810	1602

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

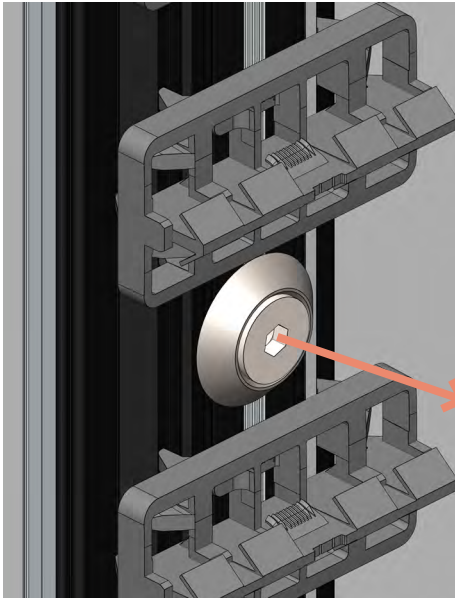
##### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	2033	1858	1674	1518	1353
2	2255	2065	1858	1674	1480
3	2488	2270	2041	1832	1620
4	2726	2488	2231	2000	1771
Guadeloupe	3490	3253	2953	2719	2384
Guyana	1509	1393	1262	1156	1034
Martinique	3129	2901	2626	2354	2073
Réunion	3274	3086	2837	2532	2224
Mayotte	2873	2676	2399	2137	1883

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

## PULL-OUT FORCE



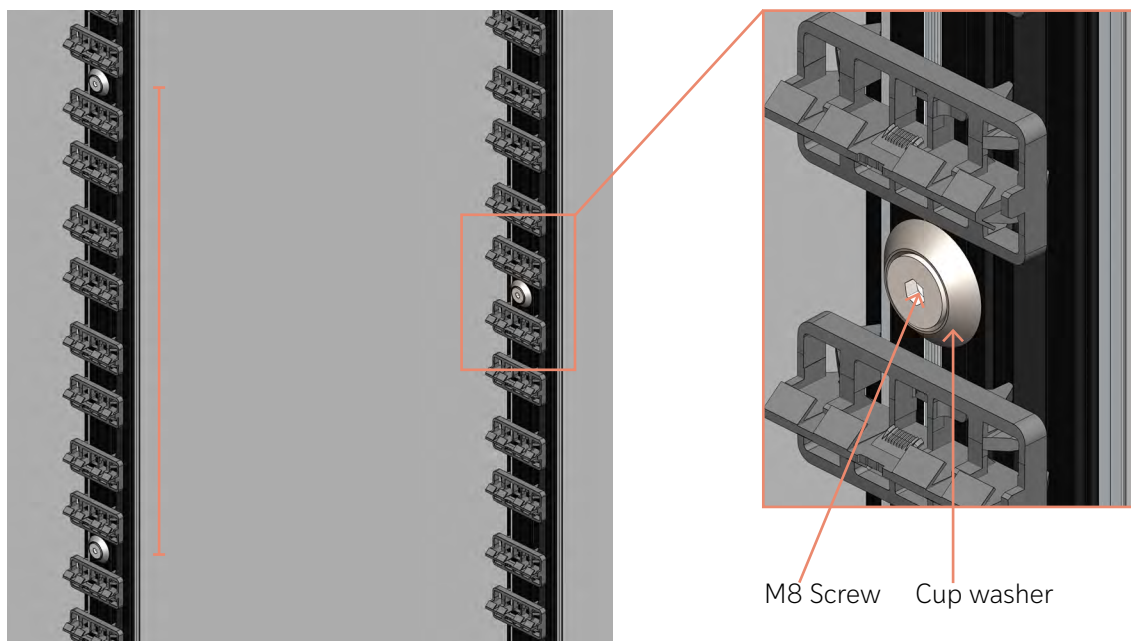
The pull-out force is an essential value for sizing fasteners.

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

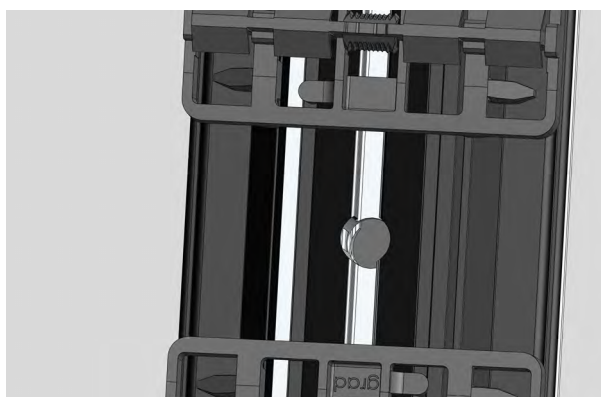
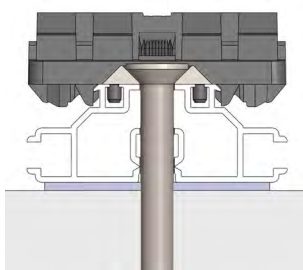
Pull-out force:  
 $F_{tens,k}$



## RAIL FASTENING DIRECTLY TO THE WALL USING THROUGH-BOLTS HORIZONTAL CLADDING



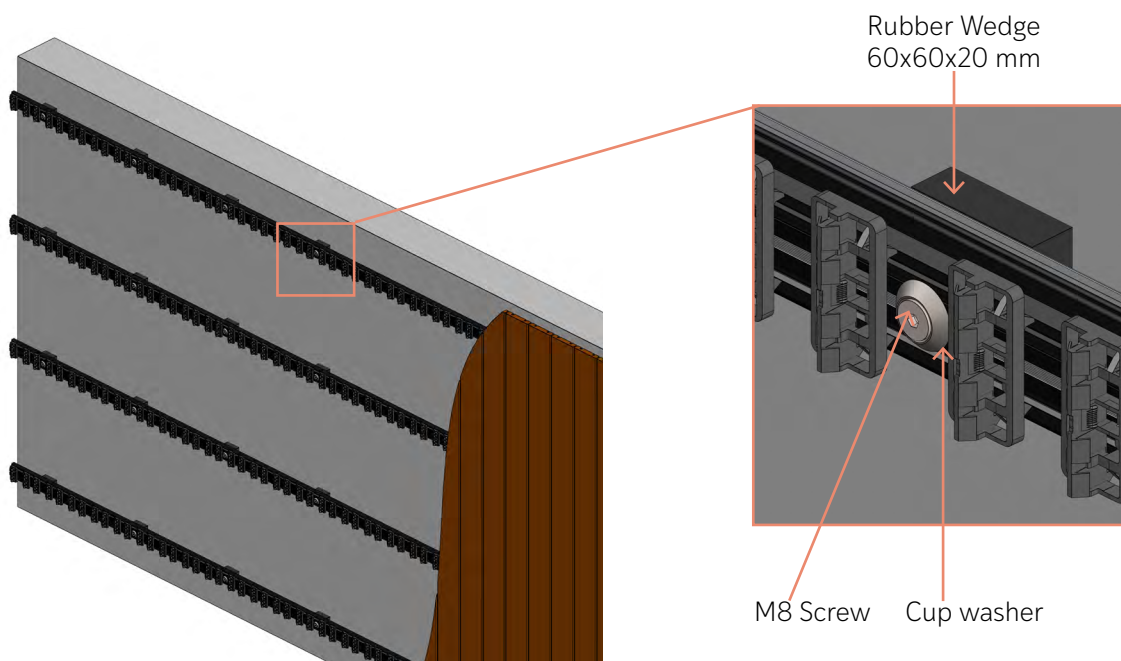
Max. distance between fasteners: **1350 mm**  
(depending on geographical area - refer to tables on  
pages 9 and 10)



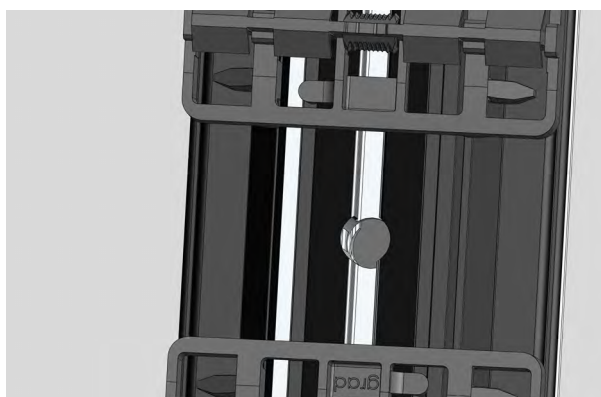
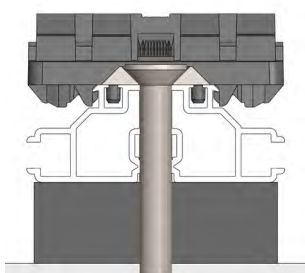
PR24 rails can be fastened using M8 countersunk screws. A cup washer must be fitted between the screw head and the rail.

## RAIL FASTENING DIRECTLY TO THE WALL USING THROUGH-BOLTS

### VERTICAL CLADDING



Max. distance between fasteners: **1350 mm**  
 (depending on geographical area - refer to tables on pages 12 and 13)



PR24 rails can be fastened using M8 countersunk screws. A cup washer must be fitted between the screw head and the rail.

## FASTENING RAILS WITH AN L BRACKET SYSTEM



Max distance between brackets  
**1350 mm**

*(depending on geographical zone -  
refer to the tables on pages 12 and 13)*



# 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	1,16	1,23	1,35	1,35	1,35
2	1,09	1,16	1,28	1,35	1,35
3	1,04	1,10	1,21	1,32	1,35
4	0,99	1,04	1,15	1,25	1,29
Guadeloupe	0,84	0,88	0,97	1,06	1,09
Guyana	1,35	1,35	1,35	1,35	1,35
Martinique	0,90	0,96	1,05	1,15	1,18
Réunion	0,87	0,92	1,01	1,10	1,13
Mayotte	0,94	1,01	1,10	1,20	1,23

### MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

#### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1,06	1,12	1,24	1,35	1,35
2	1,00	1,05	1,16	1,26	1,30
3	0,95	1,00	1,10	1,20	1,24
4	0,90	0,95	1,05	1,14	1,18
Guadeloupe	0,76	0,81	0,89	0,97	0,99
Guyana	1,25	1,33	1,35	1,35	1,35
Martinique	0,82	0,87	0,96	1,04	1,07
Réunion	0,79	0,84	0,92	1,00	1,03
Mayotte	0,86	0,92	1,00	1,09	1,12

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	1,08	1,13	1,20	1,28	1,35
2	1,02	1,07	1,13	1,20	1,30
3	0,97	1,01	1,08	1,14	1,23
4	0,92	0,97	1,02	1,09	1,17
Guadeloupe	0,74	0,81	0,87	0,92	0,99
Guyana	1,28	1,34	1,35	1,35	1,35
Martinique	0,84	0,88	0,94	0,99	1,07
Réunion	0,79	0,85	0,90	0,96	1,03
Mayotte	0,88	0,93	0,98	1,05	1,13

### MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

#### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	0,98	1,03	1,10	1,16	1,25
2	0,93	0,97	1,03	1,10	1,18
3	0,88	0,92	0,98	1,04	1,12
4	0,84	0,88	0,93	0,99	1,06
Guadeloupe	0,66	0,72	0,79	0,84	0,90
Guyana	1,17	1,22	1,30	1,35	1,35
Martinique	0,75	0,81	0,85	0,91	0,97
Réunion	0,70	0,75	0,82	0,87	0,94
Mayotte	0,80	0,85	0,90	0,96	1,03

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	1,09	1,15	1,24	1,32	1,34
2	1,04	1,09	1,18	1,26	1,29
3	0,99	1,04	1,13	1,21	1,24
4	0,95	1,00	1,09	1,17	1,19
Guadeloupe	0,82	0,86	0,94	1,01	1,04
Guyana	1,25	1,31	1,35	1,35	1,35
Martinique	0,88	0,92	1,01	1,08	1,11
Réunion	0,85	0,89	0,97	1,05	1,07
Mayotte	0,91	0,97	1,04	1,12	1,15

### MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

#### All Orography (Co = 1,15)

##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	1,01	1,06	1,15	1,23	1,26
2	0,96	1,01	1,10	1,17	1,20
3	0,92	0,96	1,05	1,12	1,15
4	0,87	0,92	1,00	1,08	1,11
Guadeloupe	0,75	0,79	0,86	0,93	0,96
Guyana	1,17	1,22	1,31	1,35	1,35
Martinique	0,81	0,85	0,93	1,00	1,02
Réunion	0,78	0,82	0,89	0,97	0,99
Mayotte	0,84	0,89	0,96	1,04	1,06

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	1,03	1,07	1,13	1,18	1,25
2	0,98	1,02	1,07	1,13	1,20
3	0,93	0,97	1,03	1,08	1,15
4	0,89	0,93	0,98	1,04	1,10
Guadeloupe	0,72	0,78	0,84	0,89	0,95
Guyana	1,19	1,23	1,29	1,34	1,35
Martinique	0,80	0,86	0,91	0,96	1,02
Réunion	0,76	0,83	0,87	0,92	0,98
Mayotte	0,86	0,90	0,95	1,00	1,07

### MAX DISTANCE BETWEEN FASTENERS TO JUSTIFY L/167 IN M

#### All Orography (Co = 1,15)

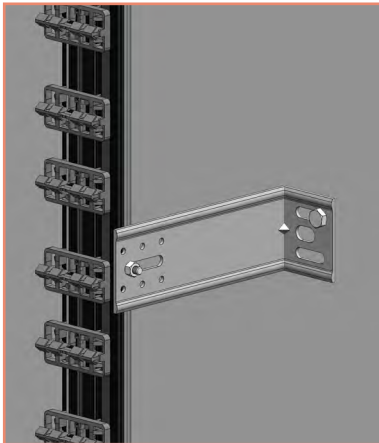
##### WIND ROUGHNESS

ZONE	0	II	IIIa	IIIb	IV
1	0,95	0,99	1,04	1,10	1,16
2	0,90	0,94	0,99	1,04	1,11
3	0,86	0,90	0,95	1,00	1,06
4	0,82	0,86	0,90	0,96	1,01
Guadeloupe	0,65	0,70	0,75	0,82	0,87
Guyana	1,10	1,14	1,20	1,26	1,33
Martinique	0,73	0,78	0,83	0,88	0,94
Réunion	0,68	0,74	0,80	0,85	0,91
Mayotte	0,78	0,83	0,87	0,92	0,98

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

## FASTENING RAILS WITH AN L BRACKET SYSTEM

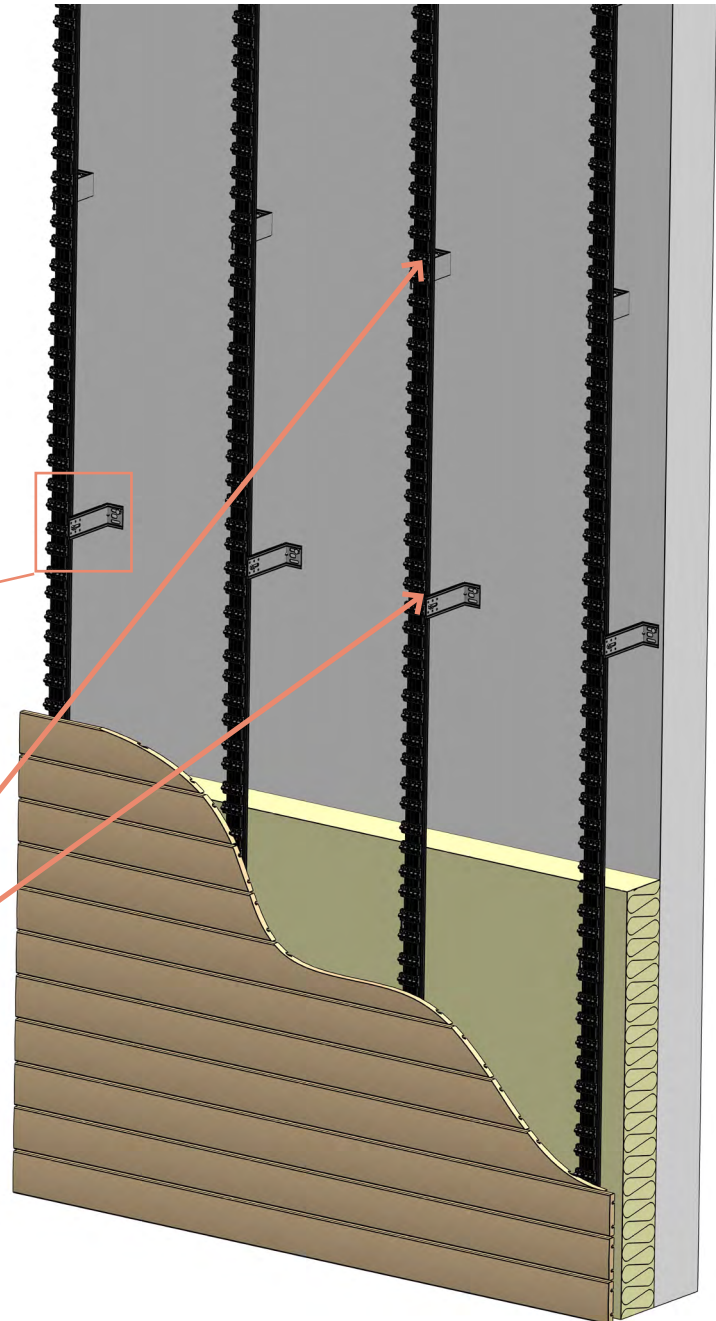
### HORIZONTAL CLADDING



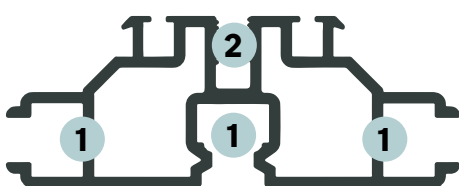
The rails are fastened to the bracket with an M6 bolt.

The cladding brackets can be fixed to the wall using suitable lag bolts.

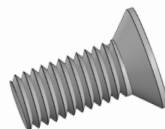
The brackets must be fastened alternately on both sides of the rail.



#### COMPATIBLE SCREWS FOR ANCHORING VIA RAIL GROOVES



**1** M6 hex head screw or nut

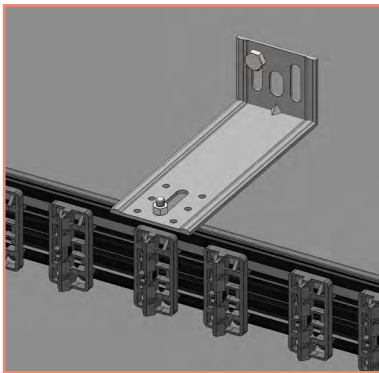


**2** M5 countersunk screw

## FASTENING RAILS WITH AN L BRACKET SYSTEM

### VERTICAL CLADDING

Vertical cladding uses the same holding and fastening principles as horizontal cladding.



The rails are fastened to the bracket with an M6 bolt.

The cladding brackets can be fixed to the wall using suitable lag bolts.

