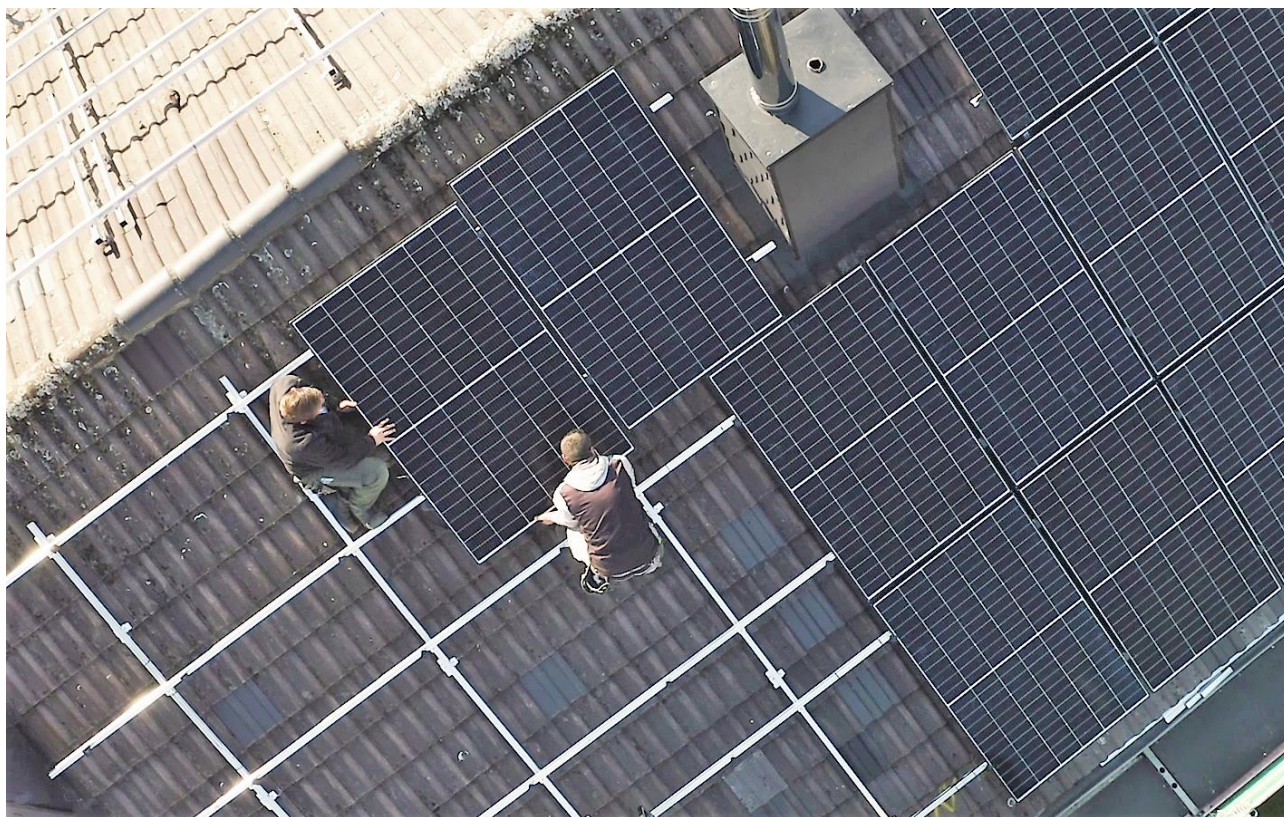


Solar systems from Schweizer

Data sheet PV mounting system MSP-PR

Pitched roof



Read carefully before use and keep in a safe place.

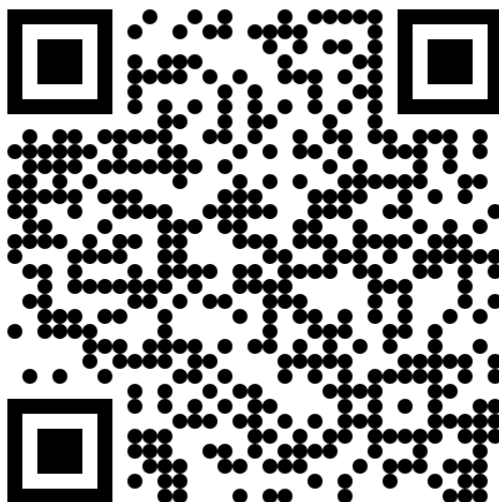


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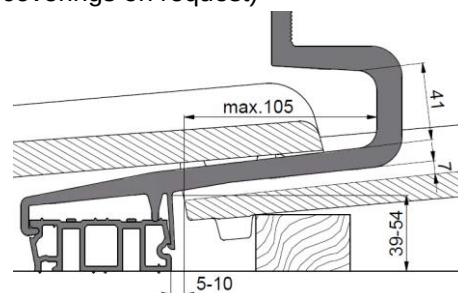
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1 Application and application limits

Roof types: Pitched roof with tile covering (other coverings on request)

Roof pitch: 10° to 75°

Roof structure: Load-bearing rafters/counter battens and roof battens with a thickness from 24 to 40 mm, and
Tile thicknesses up to 36mm.



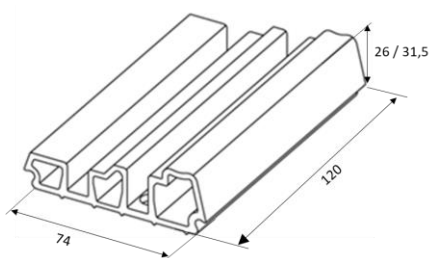
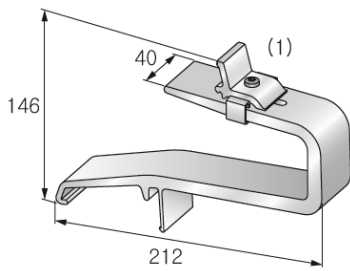
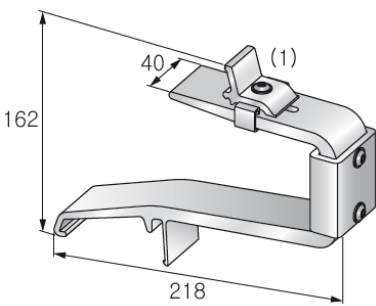
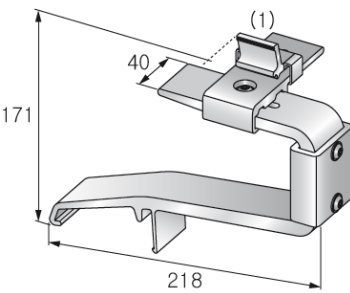
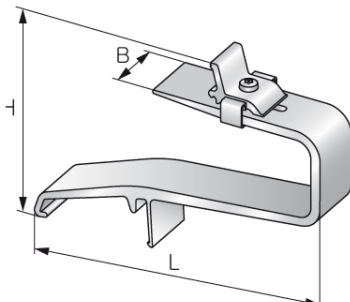
PV module: Frame heights from 28 to 45 mm; length and width without restriction.
Strength assessment by the planner according to actions and support points (calculation in the S.P.T).

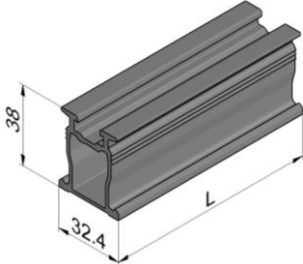
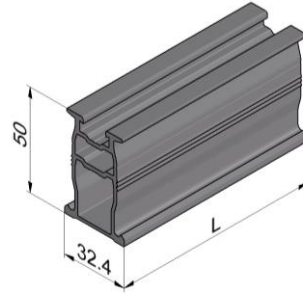
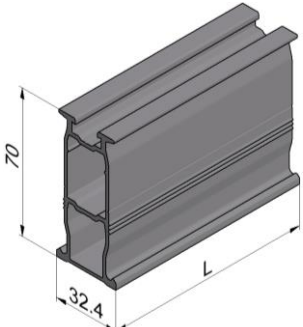
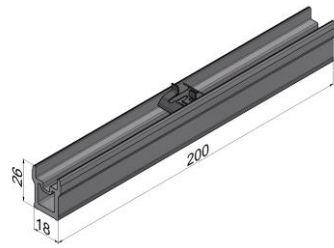
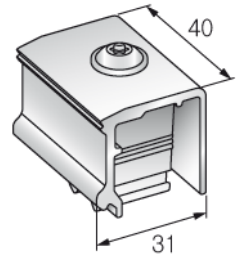
Orientation: Portrait and landscape format

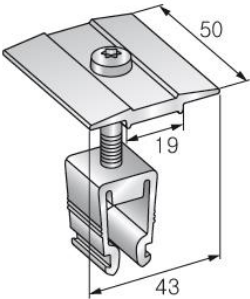
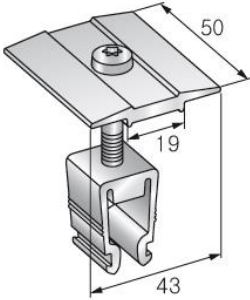
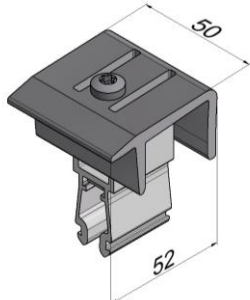
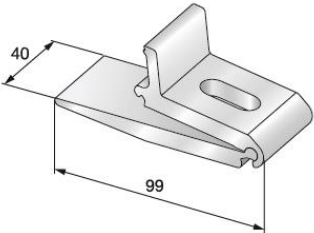
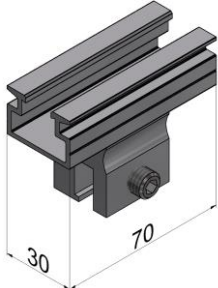
Wind and snow loads Depending on roof parameters and installation system, according to static calculation in the S.P.T.

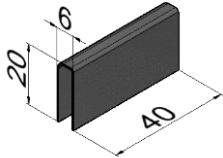
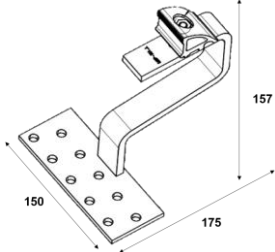
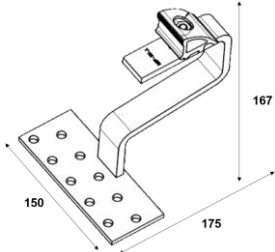
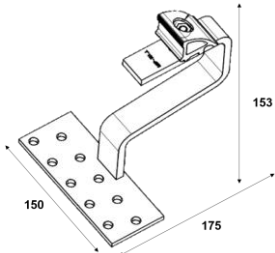
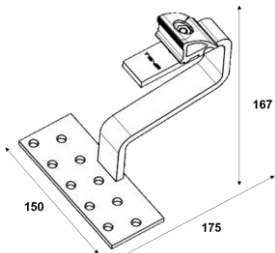
2 Components

Product designation	Material designation	Dimensions (rounded up to full mm)
Spacer plate MSP-PR-SP 10mm	PA66 GF30	
Roof hook MSP-PR-RHM incl. base plate 39/44mm	EN AW-6063 T66 - EN 755-2 Screw A2-70 - DIN 7500 C	
Wood screw DxL MSP-PR-HS 8x100mm MSP-PR-HS 8x120mm Head diameter 18mm	Stainless steel A2	

Product designation	Material designation	Dimensions (rounded up to full mm)
Base plate MSP-PR-BP 39mm MSP-PR-BP 45mm	EN AW-6063 T66 - EN 755-2	
Roof hook MSP-PR-RHF	Clamp (1) EN AW-6060 T66 - EN 755-2 All other aluminium components EN AW-6063 T66 - EN 755-2 Screws and bolts A2-70 - ISO 3506-1 Nuts A4-70 - ISO 3506-2	
Roof hook MSP-PR-RHA	Clamp (1) EN AW-6060 T66 - EN 755-2 All other aluminium components EN AW-6063 T66 - EN 755-2 Screws and bolts A2-70 - ISO 3506-1 Nuts A4-70 - ISO 3506-2	
Roof hook MSP-PR-RHC	Clamp (1) EN AW-6060 T66 - EN 755-2 All other aluminium components EN AW-6063 T66 - EN 755-2 Screws and bolts A2-70 - ISO 3506-1 Nuts A2 - ISO 3506-2	
Roof hook MSP-PR-RHL	Clamp (1) EN AW-6060 T66 - EN 755-2 All other aluminium components EN AW-6063 T66 - EN 755-2 Screws and bolts A2-70 - ISO 3506-1 Nuts	

Product designation	Material designation	Dimensions (rounded up to full mm)
	A2 - ISO 3506-2	
Support profile 38mm MSP-PR-CH 38 6.3 m MSP-PR-CH 38 4.8 m MSP-PR-CH 38 3.55 m	EN AW-6063 T66 - EN 755-2	
Support profile 50mm MSP-PR-CH 50 6.3 m MSP-PR-CH 50 4.8 m MSP-PR-CH 50 3.55 m	EN AW-6063 T66 - EN 755-2	
Support profile 70mm MSP-PR-CH 70 6.3 m MSP-PR-CH 70 4.8 m MSP-PR-CH 70 3.55 m	EN AW-6063 T66 - EN 755-2	
Sleeve MSP-PR-SL	Rail EN AW-6063 T66 - EN 755-2 Spring 1.4404 - EN 10088-2	
Cross connector MSP-PR-CC	Mounting bracket EN AW-6063 T66 - EN 755-2 Screw A2-70 - ISO 3506-1	

Product designation	Material designation	Dimensions (rounded up to full mm)
Middle clamp MSP-PR-MC 28-45mm MSP-PR-MCB 28-45mm	Mounting bracket EN AW-6063 T66 - EN 755-2 Screw A2-70 - ISO 3506-1 Washer PVC	
Middle clamp MSP-PR-MC/MCG 28-45mm grounding MSP-PR-MCB/MCBG 28-45mm grounding	Mounting bracket EN AW-6063 T66 - EN 755-2 Screw A2-70 - ISO 3506-1 Washer PVC Earthing bridge Stainless steel A4	
End clamp MSP-PR-EC 28-45mm MSP-PR-ECG 28-45 mm grounding MSP-PR-ECB 28-45mm MSP-PR-ECBG 28-45mm grounding	Mounting bracket EN AW-6063 T66 - EN 755-2 Screw A2-70 - ISO 3506-1 Washer PVC Nut A2- ISO 3506-2	
Hanger bolt plate MSP-PR-HBP	EN AW-6063 T66 - EN 755-2 Slotted hole 12x27mm	
Sheet metal seam clamp MSP-PR-SC 70	EN AW-6063 T6	

Product designation	Material designation	Dimensions (rounded up to full mm)
Stainless steel saddle MSP-PR-SCC 40	Stainless steel X5CrNi18-10 Sheet thickness 0.5mm	
Roof hook MSP-RHC 45/5	Plate and hook: X5CrNi18-10, X2CrNi19-11, X2CrNi18-9 Terminal: EN AW-6063 T66 Spring: X12CrNi17-7, X10CrNi18-8 Truss-head bolt: stainless steel A2-70 Hexagon nut: stainless steel A4-70	
Roof hook MSP-RHC 55/5	Plate and hook: X5CrNi18-10, X2CrNi19-11, X2CrNi18-9 Terminal: EN AW-6063 T66 Spring: X12CrNi17-7, X10CrNi18-8 Truss-head bolt: stainless steel A2-70 Hexagon nut: stainless steel A4-70	
Roof hook MSP-RHC 41/8	Plate and hook: X5CrNi18-10, X2CrNi19-11, X2CrNi18-9 Terminal: EN AW-6063 T66 Spring: X12CrNi17-7, X10CrNi18-8 Truss-head bolt: stainless steel A2-70 Hexagon nut: stainless steel A4-70	
Roof hook MSP-RHC 55/8	Plate and hook: X5CrNi18-10, X2CrNi19-11, X2CrNi18-9 Terminal: EN AW-6063 T66 Spring: X12CrNi17-7, X10CrNi18-8 Truss-head bolt: stainless steel A2-70 Hexagon nut: stainless steel A4-70	

3 Rated resistance of the components

To verify the resistance values of pitched roof systems of type MSP-PR, the values of each component individually:

– Load-bearing capacity and suitability of the roof structure and, if applicable, the specific covering (e.g. for standing seam roofs) – Rated value of the module according to manufacturer's specifications	– From the customer
– Spacer plate MSP-PR-SP, base plate MSP-PR-BP and wood screw MSP-PR-HS – Roof hook MSP-PR-RHM – Roof hook MSP-PR-RHF/RHA/RHC/RHL – Roof hook MSP-RHC – Support profiles MSP-PR-CH – Cross connector MSP-PR-CC – Middle/End clamp MSP-PR-MC/MCB/EC/ECB – Hanger bolts and adapter plate	– According to this data sheet

The component with the lowest resistance values is relevant for the design.

All resistance values are calculated in accordance with the following regulations and standards:

- DIN EN 1990:2010 (EC 0)
- DIN EN 1999-1-1:2010 (EC 9)
- VDI 2230 Sheet 1:2003 (VDI 2230)
- DIN EN 1995-1-1:2012 (EC 5)

The resistance values only apply when using the complete MSP-PR system from Schweizer and installation in accordance with the installation instructions for PV mounting system pitched roof MSP-PR. The entire chapter 3 describes the limit state of the load-bearing capacity, with the exception of the wood screws.

The construction timber used must comply with standards EN 338 and DIN EN 14081-1 and have a strength class of C24 to C40 and a density ρ of at least 350 kg/m³.

3.1 Roof hook MSP-PR-RHM

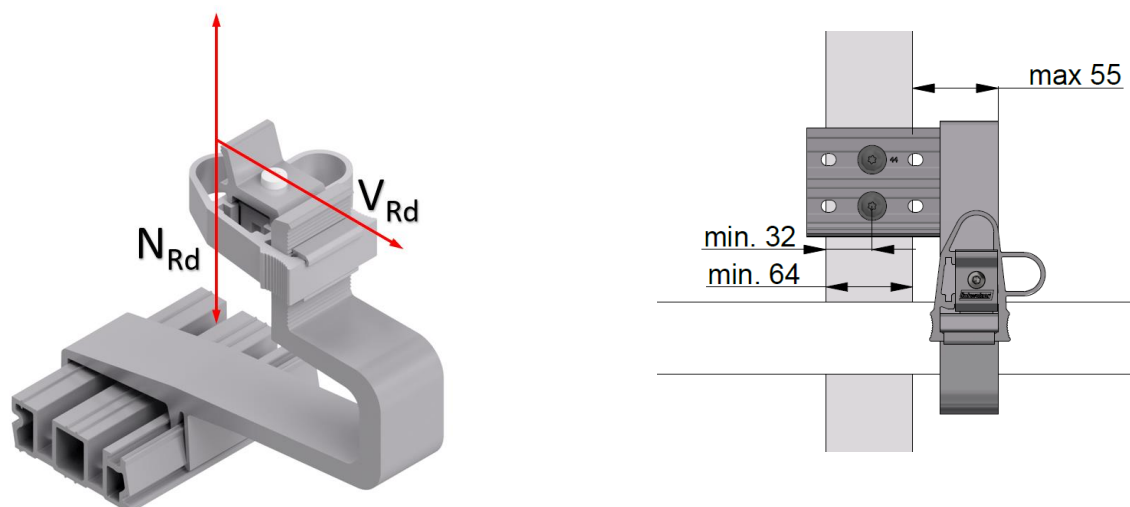


Illustration 1: Dimensioning points of the MSP-PR-RHM roof hook with base plate and position ratios on the rafter

Table 1: Rated resistance for MSP-PR-RHM (incl. base plate 39mm / 44mm)

Rated resistance Tension [N _{Rd} in kN]	-2.86	ULS Screw
Rated resistance Pressure [N _{Rd} in kN]	3.89	ULS Hook
Rated resistance Shear force [V _{Rd} in kN]	1.70	SLS* Hook

Pressure-cross-force interaction

A quadratic proof of interaction is required:

$$\left(\frac{N_{Ed}}{N_{Rd}}\right)^2 + \left(\frac{V_{Ed}}{V_{Rd}}\right)^2 \leq 1$$

The minimum thread depth in the load-bearing rafter is 90 mm (ETA11/0024, ETA11/0106)

* Service limit state due to the wooden screw-connection.

The limit values apply to horizontal and vertical support profiles.

For the use of smaller screws for thin rafters, the design values are defined in the data sheet for on-site fasteners in S.P.T.

3.2 Spacer plate MSP-PR-SP, base plate MSP-PR-BP and wood screw MSP-PR-HS

The resistance values in Table 2 apply to roof hooks of type MSP-PR-RHF/RHA/ RHC/RHL, which are fastened in conjunction with all versions of the MSP-PR-SP spacer plate, MSP-PR-BP base plate and MSP-PR-HS wood screw (see chapter 1).

All resistance values listed here are made up of the individual resistances of the components and are transferred to the connection between the MSP-PR-RHF/RHA/RHC/RHL roof hook and the MSP-PR-CH support profile. The corresponding resistance vectors are Illustration 2 can be found in Figure 2. When calculating the resistance values, a fixed connection between the MSP-PR-RHF/RHA/RHC/RHL roof hook and the MSP-PR-CH support profile is assumed.

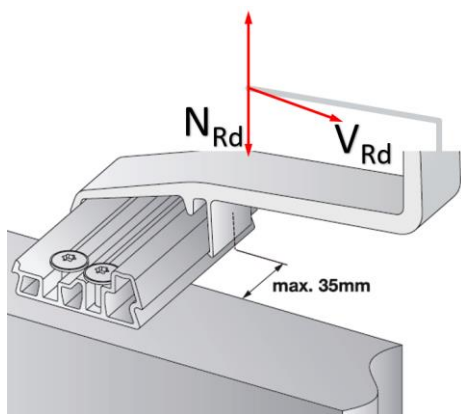


Illustration 2: Resistance vectors of the base plates

Table 2: Rated resistance for MSP-PR-SP, MSP-PR-BP and MSP-PR-HS

Rated resistance Tension [N _{Rd} in kN]	-1.66
Rated resistance Pressure [N _{Rd} in kN]	2.43
Rated resistance Shear force [V _{Rd} in kN]	1.73

3.3 Roof hook MSP-PR-RHF/RHA/RHC/RHL

Table 3: Resistance vectors of the roof hook assembly

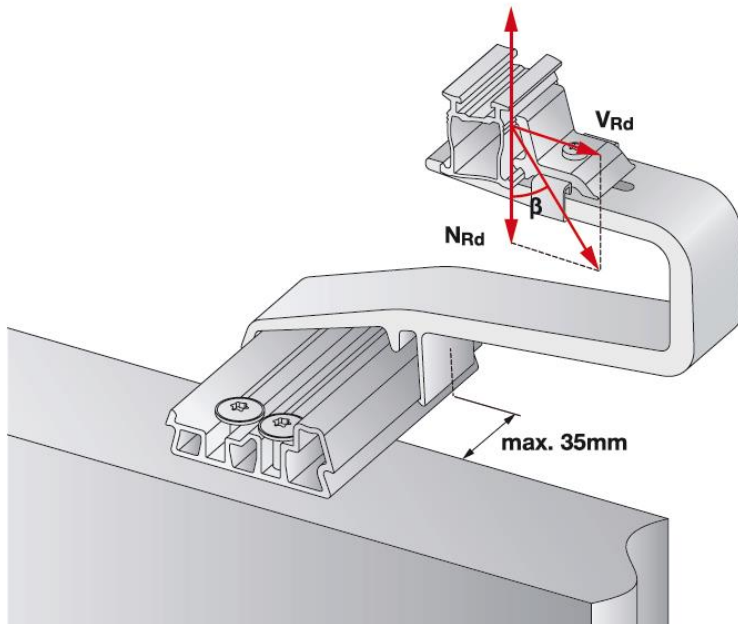


Table 4: Rated resistance for MSP-PR-RHF

Tension	[N_{Rd} in kN]	-2.28
Pressure	[N_{Rd} in kN]	2.28
Shear force	[V_{Rd} in kN]	2.87

Table 5: Rated resistance for MSP-PR-RHA and MSP-PR-RHC

Tension	[N_{Rd} in kN]	-2.28
Pressure	[N_{Rd} in kN]	2.28
Shear force	[V_{Rd} in kN]	2.52

Table 6: Rated resistance for MSP-PR-RHL

Tension	[N_{Rd} in kN]	-1.36
Pressure	[N_{Rd} in kN]	1.36
Shear force	[V_{Rd} in kN]	1.67

3.4 Roof hook MSP-RHC

Table 7: Rated resistances without support

	MSP-RHC 45/5	MSP-RHC 55/5	MSP-RHC 41/8	MSP-RHC 55/8
Tension $[N_{Rd} \text{ in kN}]$	-0.60	-0.60	-1.49	-1.49
Pressure $[N_{Rd} \text{ in kN}]$	0.39	0.39	1.03	1.03
Shear force $[V_{Rd} \text{ in kN}]$	0.27	0.25	0.71	0.63

Pressure-cross-force interaction

A linear proof of interaction is required:

$$\frac{N_{Ed}}{N_{Rd}} + \frac{V_{Ed}}{V_{Rd}} \leq 1$$

Table 8: Design resistances with support on a load-bearing metal tile

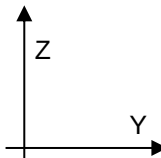
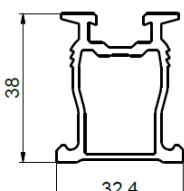
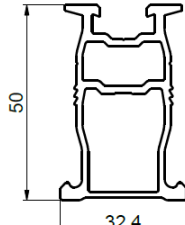
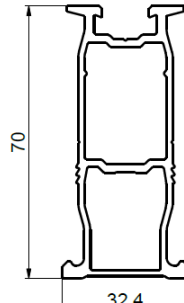
	MSP-RHC 45/5	MSP-RHC 55/5	MSP-RHC 41/8	MSP-RHC 55/8
Tension $[N_{Rd} \text{ in kN}]$	-0.60	-0.60	-1.49	-1.49
Pressure $[N_{Rd} \text{ in kN}]$	0.59	0.59	1.55	1.55
Shear force $[V_{Rd} \text{ in kN}]$	0.80	0.80	1.99	1.99

Pressure-cross-force interaction

No proof of interaction is required.

3.5 Carrier profile MSP-PR-CH

Table 9: Cross-sectional values for MSP-PR-CH

				
Profiles	Unit	MSP-PR-CH 38	MSP-PR-CH 50	MSP-PR-CH 70
Yield strength f_o	MPa	200	200	200
E-modulus E	MPa	70'000	70'000	70'000
Weight per metre	kg/m	0.77	0.97	1.15
Cross-sectional area A	mm ²	286	360	425
Moment of inertia I_y	mm ⁴	52'300	103'054	241'481
Moment of inertia I_z	mm ⁴	28'100	33'898	42'222
Moment of resistance W_y	mm ³	2'710	4'031	6'833
Moment of resistance W_z	mm ³	1'740	2'092	2'606
Maximum cantilever arm length*	mm	660	770	900

* Service limit state with 20 mm deflection.

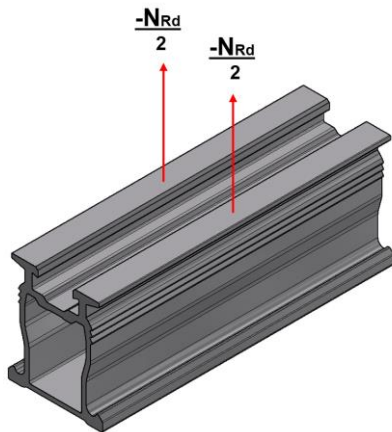


Fig. 1: Rated resistance vectors of the MSP-PR-CH support profile; interface to centre/end clamp or cross connector

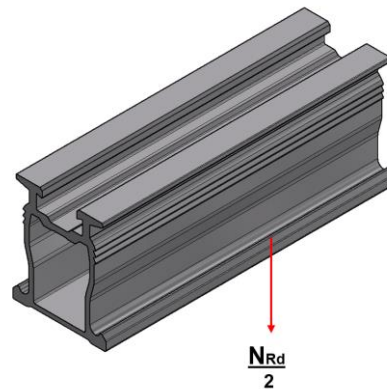


Fig. 2: Rated resistance vectors of the MSP-PR-CH support profile; interface to the clamp for roof hooks or to the cross connector

Table 10: Rated resistance of carrier profile MSP-PR-CH; interface to centre/end terminal or cross connector

Tension	[N_{Rd} in kN]	-4.35
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Table 11: Rated resistance of the MSP-PR-CH support profile; interface to the clamp for roof hooks or to the cross connector

Tension	[N_{Rd} in kN]	5.88
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3.6 Cross connector MSP-PR-CC

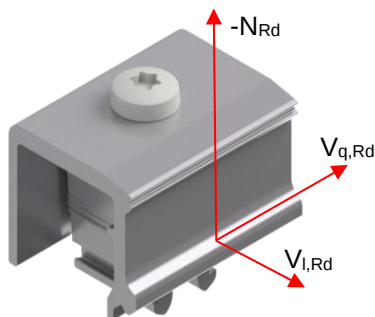


Fig. 3: Resistance vectors of the MSP-PR-CC cross connector

Table 12: Rated resistances of the cross connector MSP-PR-CC

Tension	[N_{Rd} in kN]	-1.87
Transverse shear force in kN]	[$V_{q,Rd}$ in kN]	0.78
Longitudinal shear force in kN]	[$V_{l,Rd}$ in kN]	1.48

3.7 Middle clamp MSP-PR-MC /G & MSP-PR-MCB/G

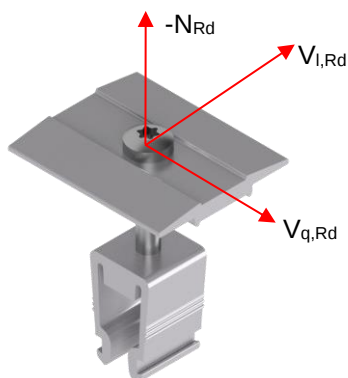


Fig. 4: Resistance vectors of the middle clamp MSP-PR-MC/G & MSP-PR-MCB/G

Table 13: Rated resistances of the middle clamp MSP-PR-MC/G & MSP-PR-MCB/G

Tension	$[N_{Rd} \text{ in kN}]$	-6.14
Transverse shear force in kN]	$[V_{q,Rd}$	2.20
Longitudinal shear force in kN]	$[V_{l,Rd}$	2.04

3.8 End clamp MSP-PR-EC/G & MSP-PR-ECB/G

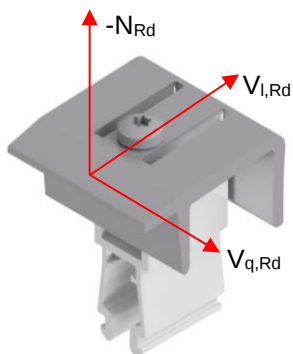


Fig. 5: Resistance vectors of the end clamp MSP-PR-EC/G & MSP-PR-ECB/G

Table 14: Rated resistances of the end clamp MSP-PR-EC/G & MSP-PR-ECB/G

Tension	$[N_{Rd} \text{ in kN}]$	-3.76
Transverse shear force in kN]	$[V_{q,Rd}$	1.33
Longitudinal shear force in kN]	$[V_{l,Rd}$	1.93

3.9 Hanger bolt plate MSP-PR-HBP (without hanger bolt)

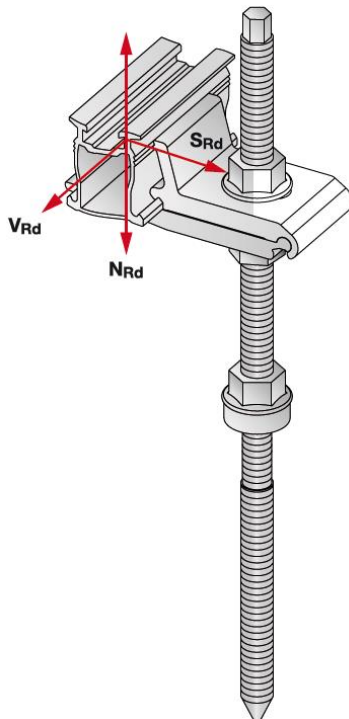


Fig. 6: Resistance vectors of the MSP-PR-HBP hanger bolt plate

Table 15: Resistance values of the hanger bolt plate MSP-PR-HBP

Tension	$[N_{Rd} \text{ in kN}]$	-3.00
Pressure	$[N_{Rd} \text{ in kN}]$	2.93
Shear force	$[V_{Rd} \text{ in kN}]$	± 0.79
Shear force	$[S_{Rd} \text{ in kN}]$	± 2.17

4 Deflection of the roof hook MSP-RHF/RHA/RHC/RHL

(Service limit state)

When installed in accordance with the MSP-PR operating instructions, the minimum distance on the underside of the roof hook is at least 7 mm in a load-free state (see Fig. 7). The deflection of the MSP-PR-RHF/RHA/RHC/RHL roof hook can be up to 5 mm. This leaves a safety dimension of 2 mm. The deflection of the MSP-PR-BP base plate and the deformation of the MSP-PR-SP spacer plate and the structural timber are not taken into account.

The actual values of the deflection at the serviceability limit state for roof hooks of the type MSP-PR-RHF/RHA/RHC/RHL are shown in Table 16, Table 17 and Table 18 are listed. The deflection values are calculated according to the design resistance limit and divided by the overall safety factor 1.4.

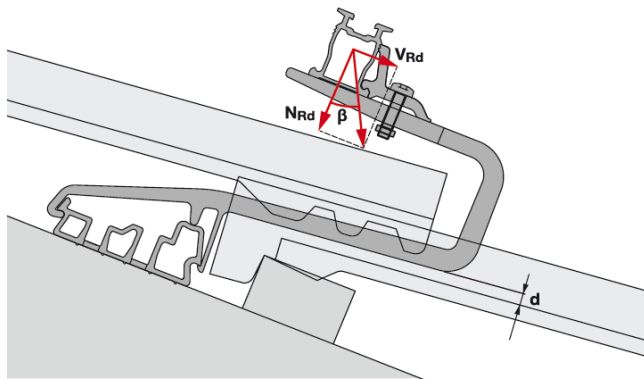


Fig. 7: Roof hook MSP-PR-RHF/RHA/RHC/RHL in unloaded condition

Table 16

Deflection (GZG) for MSP-PR-RHF roof hook under the effect of compressive and shear forces

Resulting Angle of action [β in °]	0	10	20	30	40	50	60	70	80	90
Deflection [d in mm]	3.3	3.3	3.3	3.3	3.2	3.2	3.2	3.0	2.6	2.2

Table 17

Deflection (GZG) for roof hook MSP-PR-RHA/RHC under the effect of compressive and shear forces

Resulting Angle of action [β in °]	0	10	20	30	40	50	60	70	80	90
Deflection [d in mm]	3.3	3.4	3.4	3.4	3.4	3.4	3.5	3.5	3.6	3.6

Table 18

Deflection (GZG) for MSP-PRL roof hook under the effect of compressive and shear forces

Resulting Angle of action [β in °]	0	10	20	30	40	50	60	70	80	90
Deflection [d in mm]	3.3	3.5	3.5	3.5	3.5	3.3	3.1	2.9	2.5	2.2

5 Information on the MSP-PR-SC 70 sheet metal seam clamp

5.1 Covering

The "MSP-PR-SC 70" standing sheet metal seam clamp has building authority approval for the Rheinzink standing seam system (DIBt Z-14.1-773). Similarly, it is also suitable for double standing seam roofing with the following materials:

1. Titanium zinc (0.7 mm to 1 mm)
2. Aluminium (0.7 mm to 1 mm)
3. Stainless steel (0.7 mm to 1 mm)
4. Coated steel (0.7 mm to 1 mm)
5. Copper (0.7 mm), in conjunction with stainless steel saddle

Minimum total thickness of double standing seam (s) = 3.5 mm

Maximum total thickness of double standing seam (s) = 5 mm

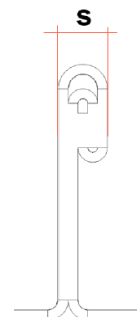


Fig. 8: Double standing seam

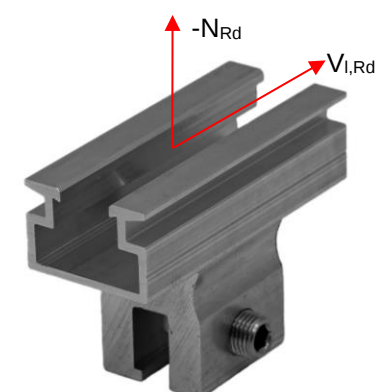
5.2 Laying method and field size

1. Horizontal system installation: recommended max. field length = 3.55 m or as specified by the roof covering manufacturer
2. Cross bond system installation: recommended max. field length = 3.55 m or as specified by the roof covering manufacturer

Direct mounting of the modules on the "MSP-PR-SC 70" sheet metal seam clamp is not permitted. The "MSP-PR-SC 70" sheet metal seam clamp may only be installed in conjunction with the "MSP-PR-CH*" support profile. The "vertical" and "insertion system" installation types are not permitted with the "MSP-PR-SC 70" sheet metal seam clamp.

5.3 Rated values

The following design values in accordance with approval DIBt Z-14.4-912 apply when correctly installed on a Rheinzink standing seam system in accordance with approval DIBt Z-14.1-773. The properties of the standing seam roofing are largely decisive for the load-bearing capacity; i.e. when installed on other standing seam systems, a specific assessment or test of the load-bearing capacity may be required.



Horizontal support profile

Tension	[N _{Rd} in kN]	-1.21
Longitudinal shear force in kN]	[V _{l,Rd}	2.16

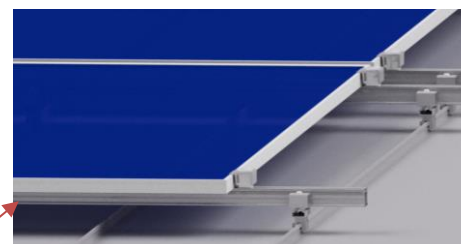


Fig. 9: Horizontal system installation

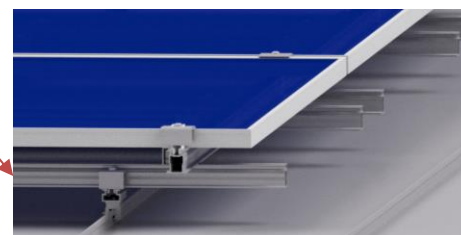


Fig. 10: Cross bond system installation