Solar systems from Schweizer

Leaflet PV mounting system MSP-PR
On-site fasteners and components in the Solar.Pro.Tool (S.P.T)

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Contents

1 MSP-PR PV mounting system

The MSP-PR PV mounting system is designed for use on pitched roofs. An aluminium roof hook system with a sophisticated click fastening, supplemented by classic stainless steel roof hooks and hanger bolts, which secure the support structure to the roof. The support profiles are fastened with the prefabricated clamps in a single layer or in a cross-bonded configuration.

Combination of MSP-PR with on-site fasteners

Fig.1 : MSP-PR-HBP Hanger bolt plate

The MSP-PR-HBP hanger bolt plate (item no.: 2065896) is available for combining on-site fasteners with the MSP mounting system.
Depending on the fasteners provided on site, the additional fasteners (e.g. screws, nuts) must also be procured on site.

Information on the strength values of fasteners provided by the customer

- Approvals usually specify characteristic values, which are converted to design values using a partial safety factor γ_M.
- If no approvals are available, the design values must be requested from the supplier.
- Information relating to pressure at an angle must be converted into the components pressure and shear force.
- The following catalogue provides tables with load-bearing capacity values and information on how to use the values.
- All information is provided outside the responsibility of Ernst Schweizer AG and without guarantee as to its accuracy, timeliness or compatibility with MSP components. If you have any questions, please contact the supplier of the fasteners.

Interaction with simultaneously acting load directions

1. As standard in S.P.T, calculations are made without interaction, i.e. pressure and shear force may be fully utilised simultaneously.
2. Some fasteners use "linear interaction" between compressive and shear forces, i.e. (compressive utilisation) + (shear utilisation) ≤ 100%.
3. Another variant is quadratic interaction: (utilisation of pressure) ²
   + (utilisation of shear force) ² ≤ 100%.

Note : If interaction is required, please contact our office staff (tec.solar@ernstschweizer.com) for the design.

2 Planning in Solar.Pro.Tool (S.P.T)

1. Select roof covering and substructure according to local conditions.
2. Select fastening system: "Roof hook/fastening element provided by customer – without interaction".*
3. Connection components: "MSP-PR-HBP hanger bolt plate" or "Without connection".
4. Installation system: All options are available. The planner must assess what is technically possible.
5. Enter the design values for pressure, tension and shear force according to the supplier's specifications or table values. The values listed below are taken from data sheets or approvals from the respective manufacturers and are provided without guarantee of accuracy or applicability.

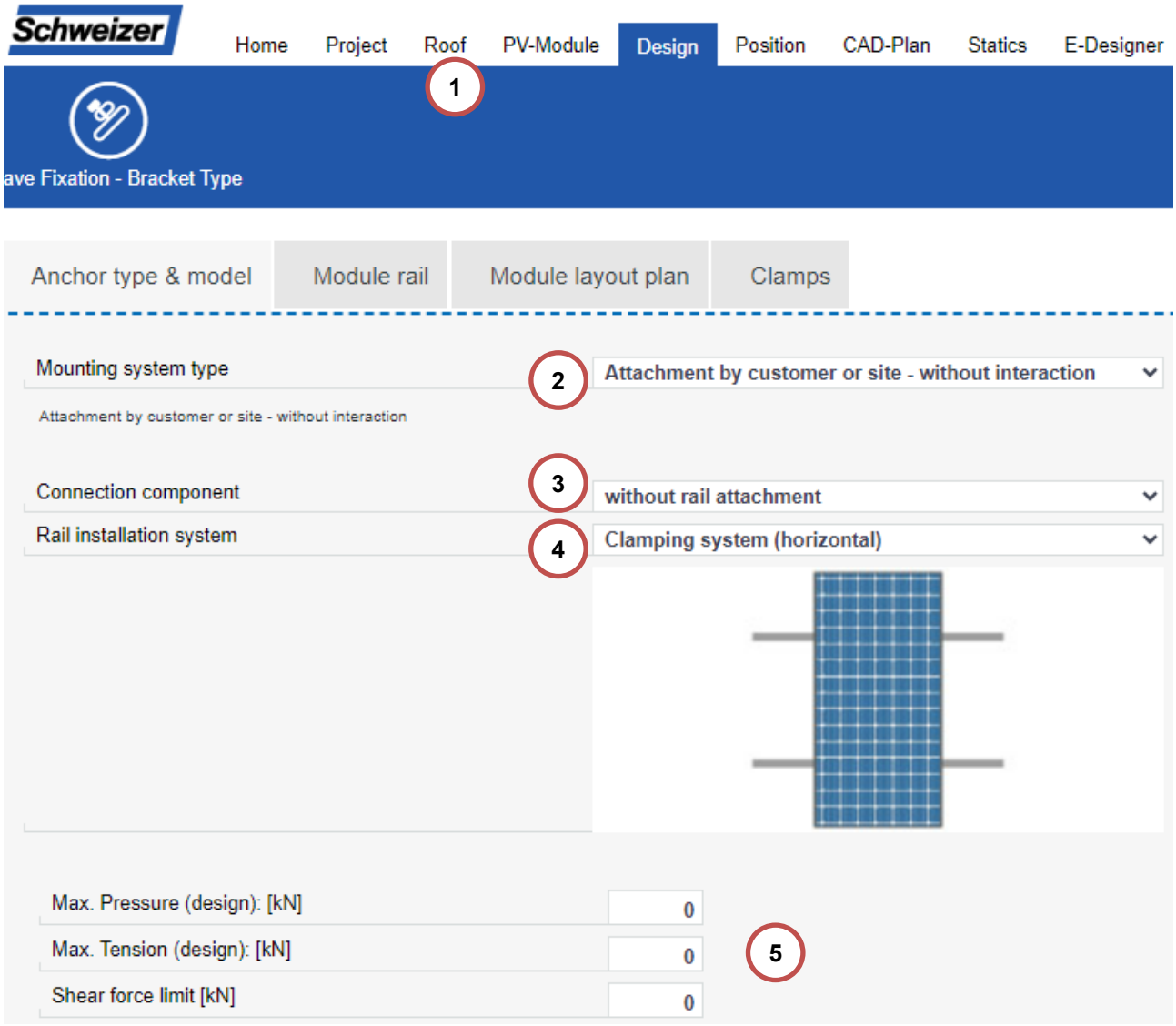


Fig. 2 : Selection of parameters for on-site fasteners

* "Without interaction": For the load-bearing capacity of compression and shear force, limit values must be entered that may take full effect simultaneously.

3 Products

3.1 Manufacturer/supplier : Otto Lehmann GmbH, D-93070 Neutraubling

Product name : Lehmann 7300 rooftop module holder riveted to metal roof panels

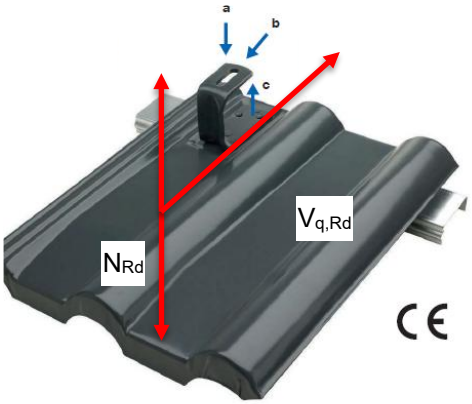


Fig. 3 *:* Lehmann roof-mounted module holder

Application in S.P.T : Select the design values from Table 1 according to the roof pitch.
Interaction condition: "Without interaction".

Table 1 : Design values for load-bearing capacity

Force angle	Compression (N_{Rd})	Tension ($-N_{Rd}$)	Shear force ($V_{q,Rd}$)
0°	3.61 kN	2.16 kN	0.00 kN
5°	3.35 kN	2.16 kN	0.29 kN
10°	2.97 kN	2.16 kN	0.52 kN
15°	2.59 kN	2.16 kN	0.70 kN
20°	2.26 kN	2.16 kN	0.82 kN
25°	1.97 kN	2.16 kN	0.92 kN
30°	1.72 kN	2.16 kN	1.00 kN
35°	1.51 kN	2.16 kN	1.05 kN
40°	1.31 kN	2.16 kN	1.10 kN
45°	1.14 kN	2.16 kN	1.14 kN
50°	0.98 kN	2.16 kN	1.17 kN
55°	0.84 kN	2.16 kN	1.20 kN
60°	0.71 kN	2.16 kN	1.22 kN
65°	0.58 kN	2.16 kN	1.24 kN
70°	0.46 kN	2.16 kN	1.26 kN
75°	0.34 kN	2.16 kN	1.27 kN

3.2 Manufacturer/supplier : Jacobi Walter GmbH, D-37434 Bilshausen I

Product name : Aluminium solar support with base tile, available with various roof tiles.

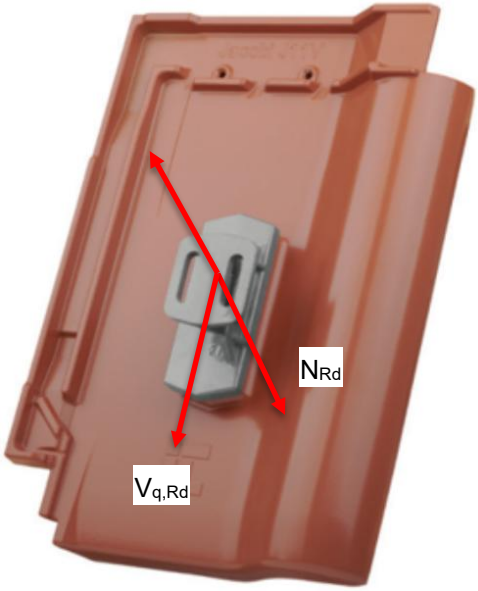


Fig.4 : Jacobi Walther flat roof tile J11v with aluminium solar panel

Application in S.P.T : Select the design values from Table 2 according to the roof tiles used. Interaction condition: "Without interaction". This does not constitute a binding static verification; responsibility lies with the contractors.

Table 2 : Design values for load-bearing capacity

	Compression (N_{Rd})	Tension ($-N_{Rd}$)	Shear force ($V_{q,Rd}$)
Flat roof tile J11v	6.1 kN	3.9 kN	6.3 kN
Flat roof tile J13v	4.4 kN	3.8 kN	5.7 kN
Flat roof tile J160	6.73 kN	3.81 kN	5.75 kN
Flat roof tile W6v	5.9 kN	5.0 kN	5.5 kN
Flat roof tile Z5	7.3 kN	4.8 kN	3.9 kN
Standard interlocking tile Z10	4.9 kN	2.8 kN	3.9 kN

3.3 Manufacturer/supplier : Fleck GmbH, fleck-dach.de, Industriestr. 12, 45711 Datteln, Germany

Product name : 6.01 SD solar support tile

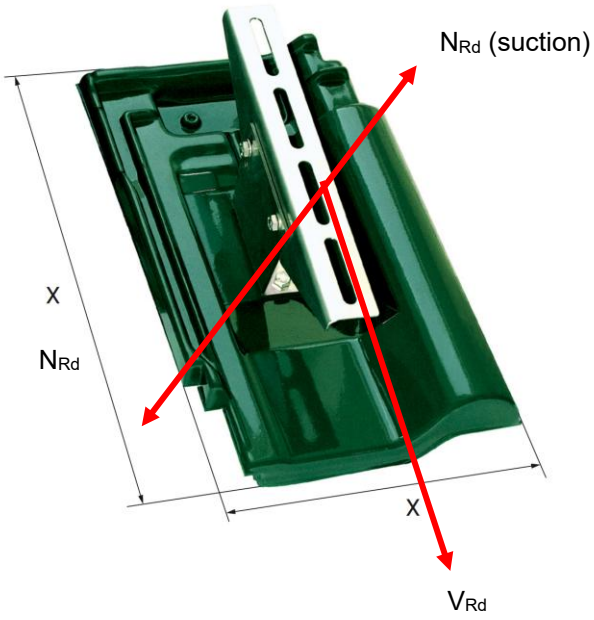


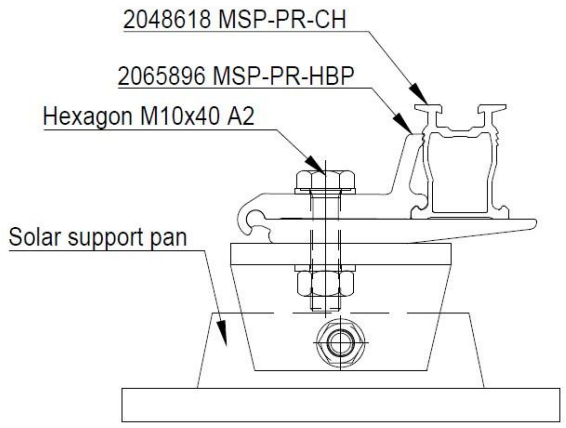
Fig.5 : Fleck GmbH 6.01 SD solar support tile

Application in S.P.T :

Abbreviation	Meaning	Value
NRD	Normal force component (pressure perpendicular to the roof surface)	4.62 kN
NRd (suction)	Normal force component (suction perpendicular to the roof surface)	2.58 kN
VRD	Shear force component (parallel to the roof surface in the direction of the eaves)	1.48 kN
Interaction	Square $F_{Rd} = \left[\left(\frac{\cos\alpha}{N_{Rd}}\right)^2 + \left(\frac{\sin\alpha}{V_{Rd}}\right)^2\right]^{-0,5}$	
FRD	Design value for corresponding roof pitch	Calculated by S.P.T

Suggested fastening of hanger bolt plate to solar support tile

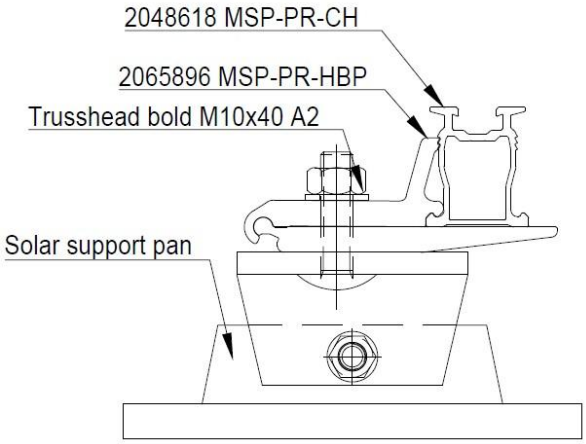
- Variant 1 with M10



Structure consisting of :

- Solar support pan from Jacobi Walther
- 2065896 MSP-PR-HBP Hanger bolt plate
- 2048618 representative of all Support profiles (MSP-PR-CH38/ -CH50 /-CH70)
- Screw DIN933 ISO4017 stainless steel A2 M10x40
- Washer DIN125A ISO7089 stainless steel A2 M10
- Hexagon nut DIN934 ISO4032 stainless steel A2 M10

- Variant 2 with M10



Assembly consisting of :

- Solar support pan from Jacobi Walther
- 2065896 MSP-PR-HBP Hanger bolt plate
- 2048618 representative of all Support profiles (MSP-PR-CH38/ -CH50 /-CH70)
- Screw DIN603 UNI5732 stainless steel A2 M10x40
- Washer DIN125A ISO7089 stainless steel A2 M10
- Hexagon nut DIN6923 EN1661 stainless steel A2 M10

3.4 Manufacturer/supplier : Zambelli RIB-ROOF GmbH & Co. KG, Hans-Sachs-Straße 3 + 5, D-94569 Stephansposching

Product name : Standard solar bracket RIB-ROOF

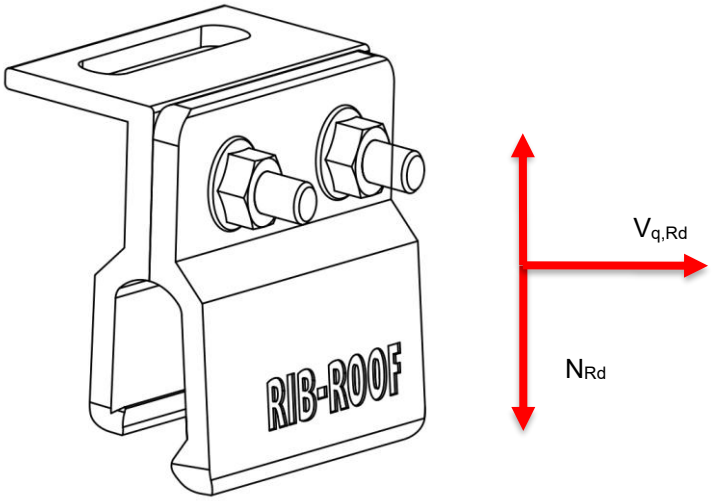


Fig.6 : Standard solar bracket RIB-ROOF

Application in S.P.T : Determination of design values by dividing the characteristic values for pressure, suction and roof-parallel force (shear force) by partial safety factor γ_M= 1.33. Approval Z-14.4-774 contains different characteristic values for various RIB-ROOF systems as well as numerous specifications, boundary conditions and interaction formulas. After rough planning, compliance must be checked and, if necessary, recalculated with new values.
Interaction condition: "No interaction".

Table 3 : Design values for load-bearing capacity when all boundary conditions are met

	Compression (N_{Rd})	Tension ($-N_{Rd}$)	Shear force ($V_{q,Rd}$)
RIB-ROOF 465 steel 0.63 mm	2.68 kN	1.47 kN	1.18 kN
RIB-ROOF 465 Aluminium 0.70 mm	1.86 kN	1.17 kN	1.12 kN
RIB-ROOF Speed 500 steel 0.63 mm	2.50 kN	1.33 kN	1.18 kN
RIB-ROOF Speed 500 aluminium 0.70 mm	1.41 kN	0.89 kN	1.67 kN
RIB-ROOF Evolution steel 0.63 mm	2.93 kN	3.32 kN	0.80 kN
RIB-ROOF Evolution Aluminium 0.70 mm	1.56 kN	2.11 kN	0.80 kN

3.5 Manufacturer/supplier: RoofTech GmbH, Merklinger Straße 30, D-71263 Weil der Stadt

Product name: S-5! E-clamp

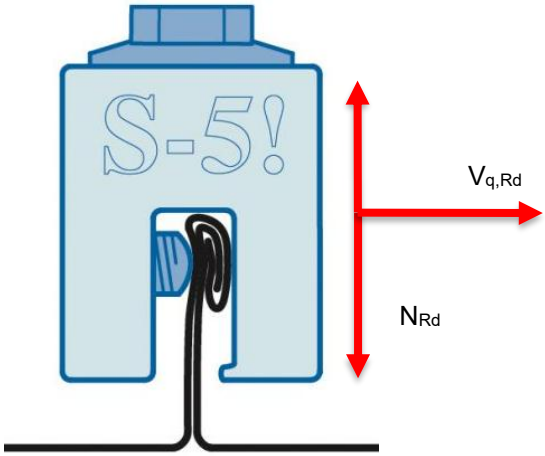


Fig. 7 : S-5! E-terminal

Application in S.P.T : Determination of design values by dividing the characteristic values for pressure, suction and roof-parallel force (shear force) by partial safety factor γ_M = 1.33.
Approval Z-14.4-719 contains different characteristic values for different clamps as well as numerous specifications, boundary conditions and interaction formulas. After rough planning, compliance must be checked and, if necessary, recalculated with new values.
In addition, the standing seam profile must be verified in accordance with the respective approvals.
Interaction condition: "No interaction".

Table 4 : Design values for load-bearing capacity under optimal conditions

	Compression (N_{Rd})	Tension ($-N_{Rd}$)	Shear force ($V_{q,Rd}$)
S-5-E, S-5-E Mini and S-5-E Mini FL	1.17 kN	1.42 kN	0.95 kN
S-5-Z, S-5-Z Mini and S-5-Z Mini FL	1.02 kN	0.86 kN	1.28 kN

3.6 Manufacturer/supplier : Kalzip GmbH, August-Horch-Straße 20–22, D-56070 Koblenz

Product name : Kalzip fastening clamp type FA and type FS

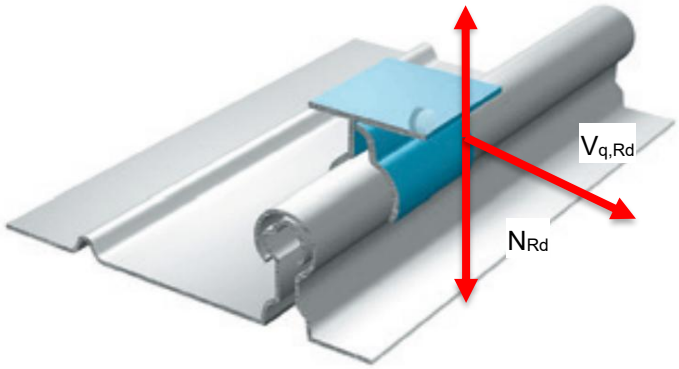


Fig.8 : Kalzip fastening clamp type FA

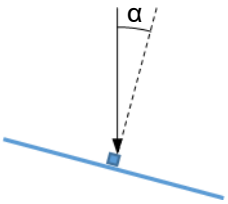
Application in S.P.T : Determination of design values by dividing the characteristic value of the load-bearing capacity by the partial safety factor γ_M= 1.1. The same value applies in all directions (compression, suction, shear force); a linear interaction verification is required between simultaneously acting forces.
Approval Z-14.4-560 contains further characteristic values for various clamps as well as numerous specifications, boundary conditions and interaction formulas.

Table 4 shows the load-bearing capacity depending on sheet thickness t and clip spacing (fastening points of the sheet metal clips). This load-bearing capacity value can then be used to calculate the input values depending on the force angle α. The interaction condition "No interaction" applies to the calculated input values.

Table 5 : Design values R_d of the load-bearing capacity according to the Kalzip data sheet

Sheet thickness t	Clip spacing Lk [m]										
[mm]	1.0	1.1	1.2	1.3	1.4	1.50	1.60	1.70	1.80	1.90	2.00
0.80	1.12	1.06	1.02	0.96	0.92	0.86	0.81	0.76	0.71	0.66	0.61
0.90	1.25	1.21	1.16	1.11	1.06	1.02	0.97	0.92	0.87	0.83	0.78
1.00	1.40	1.35	1.29	1.24	1.18	1.13	1.07	1.03	0.97	0.92	0.86
1.20	1.67	1.61	1.55	1.48	1.42	1.35	1.29	1.23	1.16	1.10	1.02

Design values (input values S.P.T)
Pressure = R_d * cos(α)
Suction = R_d
Shear force = R_d * sin(α)



3.7 Manufacturer/supplier : PREFA Aluminiumprodukte GmbH, Werkstrasse 1, A-3182 Marktl/Lilienfeld

Product name : PREFA, Prefalz Vario solar bracket

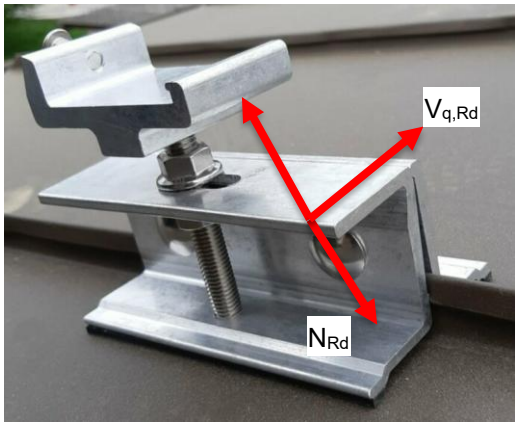


Fig. 9: PREFA, Prefalz Vario solar bracket

Important to know : A linear interaction verification is required between simultaneously acting forces. The permissible load varies depending on the seam spacing and load direction. The values specified only apply to pre-folded roofs installed with Prefa fasteners. The formwork must have a minimum thickness of T ≥ 24 mm, C24, and the fasteners must be secured with PREFA Niro grooved nails 28-30 or 28/25.
The value for "roof normal" acts normally on the roof and "roof parallel" in the direction of the eaves or ridge.
The distance between the start of the load-bearing wood material (upper edge of the formwork) and the load transfer point (lower edge of the solar panel) of the horizontal force is a maximum of 150 mm.

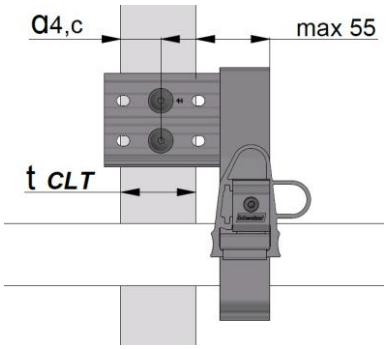
Note : For entry in S.P.T., if the distribution of fixed and sliding fasteners is not known, the values marked with an asterisk (*) must be used.

Table 6 : Design values for load-bearing capacity under optimal conditions

	Compression (N_{Rd})	Tension ($-N_{Rd}$)	Shear force ($V_{q,Rd}$)
Prefa fixed fastening area, distance between two seam clamps on the same seam ≥ 600 mm	5 kN*	1.1 kN*	1.35 kN*
Prefa fixed clamping range, distance between two seam clamps on the same seam ≥ 400 mm	5 kN*	0.725 kN*	1.3 kN*
Prefa sliding clamping range, distance between two seam clamps on the same seam ≥ 600 mm	5 kN	1.37 kN	1.38 kN
Prefa sliding clamp area, distance between two seam clamps on the same seam ≥ 400 mm	5 kN	0.915 kN	1.3 kN
Prefa long sliding clamp area, distance between two seam clamps on the same seam ≥ 600 mm	5 kN	1.5 kN	1.8 kN
Prefa long sliding fastener area, distance between two seam clamps on the same seam ≥ 400 mm	5 kN	1 kN	1.75 kN

3.8 Swiss MSP-PR-RHM with Ø6 wood screws

Recommended use with smaller wood screws in accordance with ETA11/0024 or ETA11/0106.

1 		Screw dimensions	
		HS6 Ø6 	**HS Ø8** 
t_{CLT}	Minimum rafter width	35	65
$a_{4,c}$	Distance to rafter edge	17	32
Lg	Minimum thread depth in load-bearing rafter	70	90

In the S.P.T planning software, select the on-site fasteners with square interaction.
When using Ø6 screws and mounting on a 40 mm wide rafter, the following design values apply.

Table 7 : Design resistance for MSP-PR-RHM

Design resistance Tension [N_{Rd} in kN]	-1.05
Design resistance Compression [N_{Rd} in kN]	1.21
Design resistance Shear force [V_{Rd} in kN]	0.72