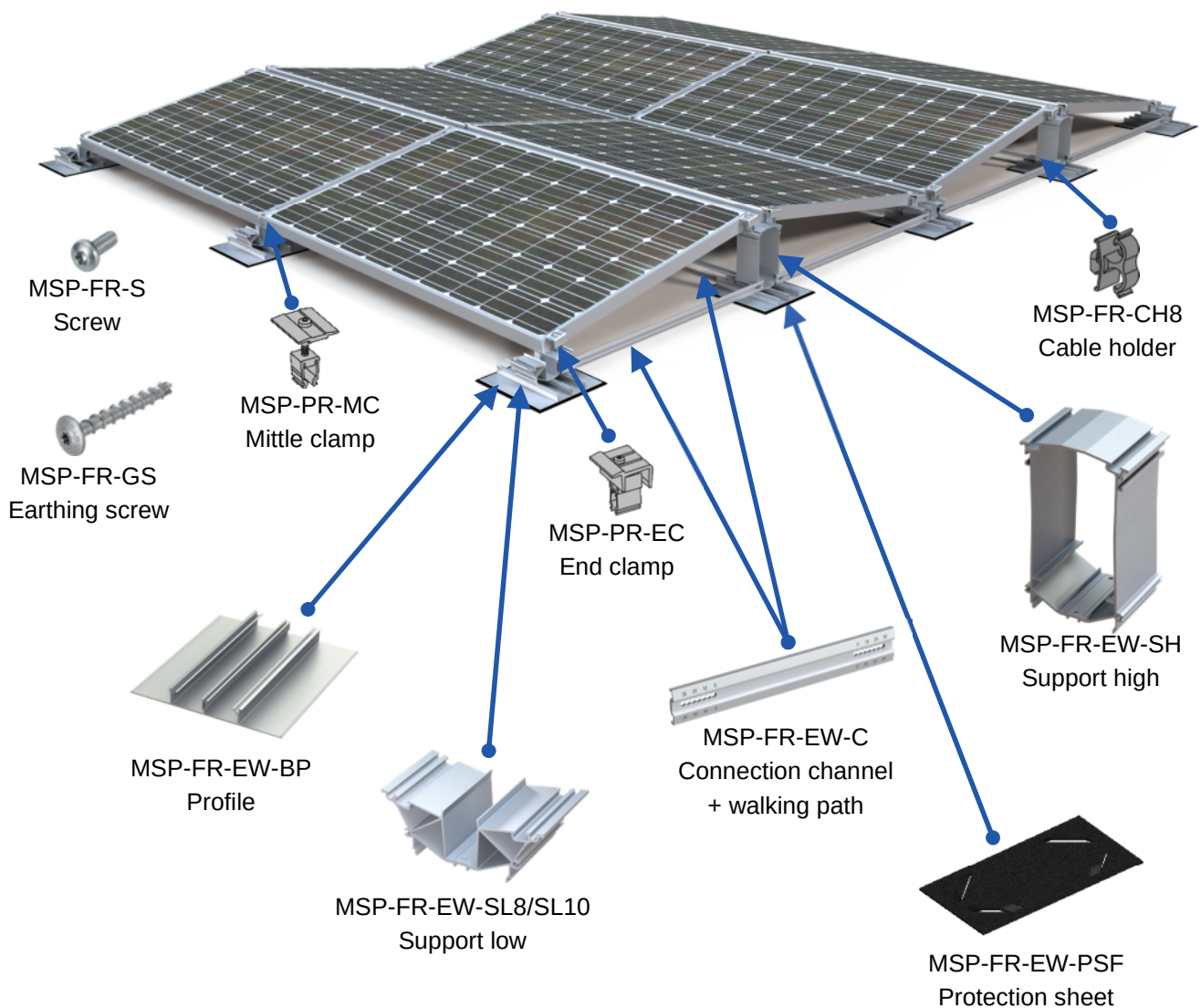


Solar Systems of Schweizer:

Technical Data – MSP-FR-EW

Flat Roof PV Mounting System East-West.



Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

1 Roof requirements

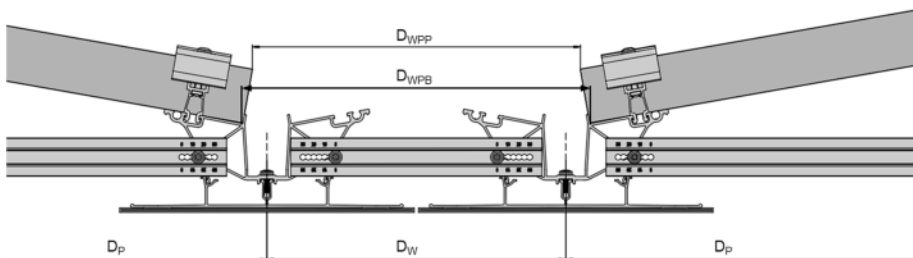
Pitch	≤3.0°
Unevenness	≤+2,5°, ≤-2,5°, ≤±1,25°
Sealing membranes materials	TPO/FPO, PVC, EVA, ASA, PVC-P, ECB, PIB, concrete, bitumen
Friction coefficient	Relevant to the layout, minimum requirement depending on wind load and field geometry
Insulation material	EPS/XPS, Mineral wool, PUR, PIR, foam glass, ...
Long-term pressure resistance	≥ ca. 10 kN/m² (depending on boundary conditions)

2 Systeme properties

Max. block size	14,0 m x 14,0 m
Min. block size, stand alone	3 gables x 1 row / 1 gable x 3 rows
System height	280 – 300 mm
Ground clearance	80 mm
Min. edge distance	150 mm
Inclination angle of the module	8° – 10° (depending on module width)
Panel width	950 mm – 1205 mm
Panel length	1620 mm – 2139 mm
Panel height	30 mm – 50 mm
Ballast stone width	100 mm
Ballast stone length	200 mm
Ballast stone height	40 mm – 80 mm

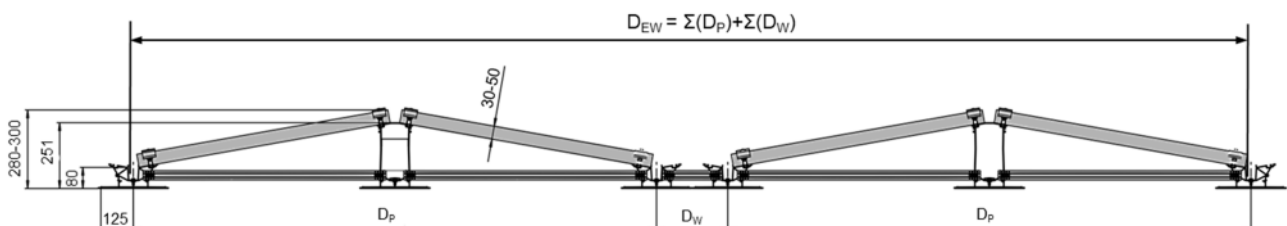
2.1 System geometry, dimensions in east-west direction

Dimension walking path



Article	D_W	D_{WPP} (50mm Module frame)	D_{WPB}	Scaling
Without walking path	0 mm	26 mm	44 mm	
MSP-FR-C 300-360	274 mm	300 mm	318 mm	0
MSP-FR-C 470-530	444 mm	470 mm	488 mm	0
MSP-FR-C 950-1010	978 mm	1005 mm	1023 mm	0
MSP-FR-C 1620-1680	1683 mm	1709 mm	1727 mm	0
MSP-FR-C 1945-2005	2008 mm	2034 mm	2052 mm	0

Grid dimensions, scale setting connection channel short



Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

Tilt angle nominal 10°

	Min. module width	Max. module width	Scale support high	Scale support low	Tilt angle	D _p
950 - 1010 mm	950 mm	951 mm	0	0	10.3 °	1952 mm
	952 mm	956 mm	0	5	10.3 °	1962 mm
	957 mm	961 mm	5	5	10.2 °	1972 mm
	962 mm	966 mm	5	10	10.1 °	1982 mm
	967 mm	971 mm	10	10	10.1 °	1992 mm
	972 mm	976 mm	10	15	10.0 °	2002 mm
	977 mm	981 mm	15	15	10.0 °	2012 mm
	982 mm	986 mm	15	20	9.9 °	2022 mm
	987 mm	990 mm	20	20	9.9 °	2032 mm
	991 mm	995 mm	20	25	9.8 °	2042 mm
	996 mm	1000 mm	25	25	9.7 °	2052 mm
	1001 mm	1005 mm	25	30	9.7 °	2062 mm
	1006 mm	1010 mm	30	30	9.6 °	2072 mm
1011 - 1075 mm	1011 mm	1015 mm	0	0	9.6 °	2083 mm
	1016 mm	1020 mm	0	5	9.5 °	2093 mm
	1021 mm	1025 mm	5	5	9.5 °	2103 mm
	1026 mm	1030 mm	5	10	9.4 °	2113 mm
	1031 mm	1035 mm	10	10	9.4 °	2123 mm
	1036 mm	1040 mm	10	15	9.3 °	2133 mm
	1041 mm	1045 mm	15	15	9.3 °	2143 mm
	1046 mm	1050 mm	15	20	9.2 °	2153 mm
	1051 mm	1055 mm	20	20	9.2 °	2163 mm
	1056 mm	1060 mm	20	25	9.1 °	2173 mm
	1061 mm	1065 mm	25	25	9.1 °	2183 mm
	1066 mm	1069 mm	25	30	9.0 °	2193 mm
	1070 mm	1075 mm	30	30	9.0 °	2203 mm

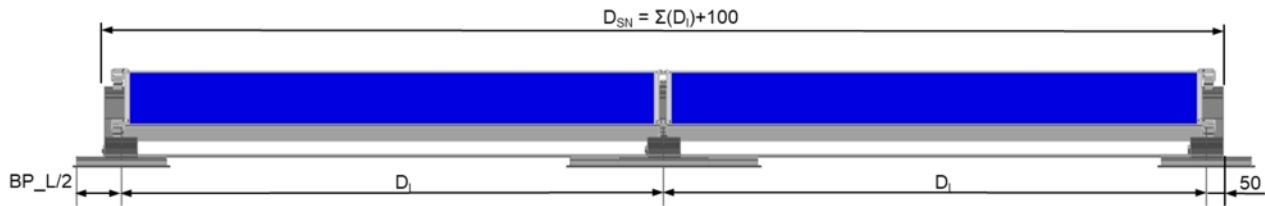
Angle of attack nominal 8°

	Min. module width	Max. module width	Scale support high	Scale support low	Tilt angle	D _p
1076 - 1140 mm	1076 mm	1079 mm	0	0	9.1 °	2213 mm
	1080 mm	1084 mm	0	5	9.0 °	2223 mm
	1085 mm	1089 mm	5	5	9.0 °	2233 mm
	1090 mm	1094 mm	5	10	8.9 °	2243 mm
	1095 mm	1099 mm	10	10	8.9 °	2253 mm
	1100 mm	1104 mm	10	15	8.9 °	2263 mm
	1105 mm	1109 mm	15	15	8.8 °	2273 mm
	1110 mm	1114 mm	15	20	8.8 °	2283 mm
	1115 mm	1119 mm	20	20	8.7 °	2293 mm
	1120 mm	1124 mm	20	25	8.7 °	2303 mm
	1125 mm	1129 mm	25	25	8.6 °	2313 mm
	1130 mm	1134 mm	25	30	8.6 °	2323 mm
	1135 mm	1140 mm	30	30	8.5 °	2333 mm
1141 - 1205 mm	1141 mm	1144 mm	0	0	8.5 °	2345 mm
	1145 mm	1149 mm	0	5	8.5 °	2355 mm
	1150 mm	1154 mm	5	5	8.4 °	2365 mm
	1155 mm	1159 mm	5	10	8.4 °	2375 mm
	1160 mm	1164 mm	10	10	8.3 °	2385 mm
	1165 mm	1169 mm	10	15	8.3 °	2395 mm
	1170 mm	1174 mm	15	15	8.3 °	2405 mm
	1175 mm	1179 mm	15	20	8.2 °	2415 mm
	1180 mm	1184 mm	20	20	8.2 °	2425 mm
	1185 mm	1189 mm	20	25	8.1 °	2435 mm
	1190 mm	1194 mm	25	25	8.1 °	2445 mm
	1195 mm	1199 mm	25	30	8.1 °	2455 mm
	1200 mm	1205 mm	30	30	8.0 °	2465 mm

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

2.2 System geometry, dimensions in north-south direction



Dimension base profile

Nominal length base profile	BP_L/2	Area
150 mm	67,5 mm	0,034 m ²
300 mm	140 mm	0,070 m ²
450 mm	215 mm	0,108 m ²
600 mm	290 mm	0,145 m ²
900 mm	440 mm	0,220 m ²
1200 mm	590 mm	0,295 m ²

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

Grid dimensions, scale setting connection channel long

	Module length min.	Module length max.	Scale support left	Scale support right	D _l
1620 - 1684 mm	1620 mm	1623 mm	0	0	1642 mm
	1624 mm	1628 mm	0	5	1647 mm
	1629 mm	1633 mm	5	5	1652 mm
	1634 mm	1638 mm	5	10	1657 mm
	1639 mm	1643 mm	10	10	1662 mm
	1644 mm	1648 mm	10	15	1667 mm
	1649 mm	1653 mm	15	15	1672 mm
	1654 mm	1658 mm	15	20	1677 mm
	1659 mm	1663 mm	20	20	1682 mm
	1664 mm	1668 mm	20	25	1687 mm
	1669 mm	1673 mm	25	25	1692 mm
	1674 mm	1678 mm	25	30	1697 mm
1685 - 1749 mm	1685 mm	1688 mm	0	0	1707 mm
	1689 mm	1693 mm	0	5	1712 mm
	1694 mm	1698 mm	5	5	1717 mm
	1699 mm	1703 mm	5	10	1722 mm
	1704 mm	1708 mm	10	10	1727 mm
	1709 mm	1713 mm	10	15	1732 mm
	1714 mm	1718 mm	15	15	1737 mm
	1719 mm	1723 mm	15	20	1742 mm
	1724 mm	1728 mm	20	20	1747 mm
	1729 mm	1733 mm	20	25	1752 mm
	1734 mm	1738 mm	25	25	1757 mm
	1739 mm	1743 mm	25	30	1762 mm
1750 - 1814 mm	1750 mm	1753 mm	0	0	1772 mm
	1754 mm	1758 mm	0	5	1777 mm
	1759 mm	1763 mm	5	5	1782 mm
	1764 mm	1768 mm	5	10	1787 mm
	1769 mm	1773 mm	10	10	1792 mm
	1774 mm	1778 mm	10	15	1797 mm
	1779 mm	1783 mm	15	15	1802 mm
	1784 mm	1788 mm	15	20	1807 mm
	1789 mm	1793 mm	20	20	1812 mm
	1794 mm	1798 mm	20	25	1817 mm
	1799 mm	1803 mm	25	25	1822 mm
	1804 mm	1808 mm	25	30	1827 mm
1815 - 1879 mm	1815 mm	1818 mm	0	0	1837 mm
	1819 mm	1823 mm	0	5	1842 mm
	1824 mm	1828 mm	5	5	1847 mm
	1829 mm	1833 mm	5	10	1852 mm
	1834 mm	1838 mm	10	10	1857 mm
	1839 mm	1843 mm	10	15	1862 mm
	1844 mm	1848 mm	15	15	1867 mm
	1849 mm	1853 mm	15	20	1872 mm
	1854 mm	1858 mm	20	20	1877 mm
	1859 mm	1863 mm	20	25	1882 mm
	1864 mm	1868 mm	25	25	1887 mm
	1869 mm	1873 mm	25	30	1892 mm
1880 - 1944 mm	1880 mm	1883 mm	30	30	1897 mm

Solar Systems of Schweizer:

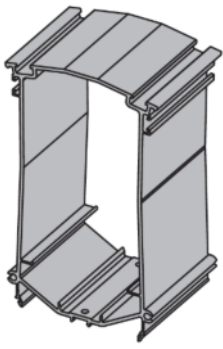
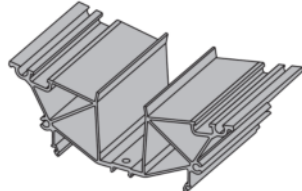
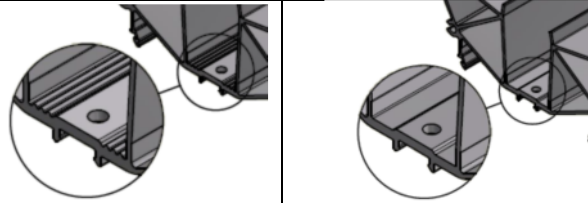
Technical Data – MSP-FR-EW.

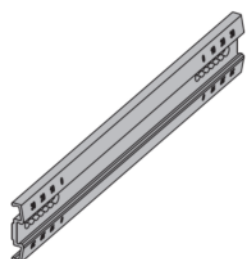
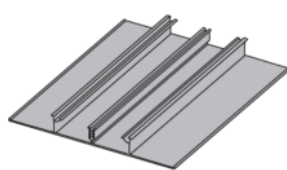
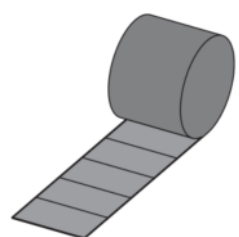
	Module length min.	Module length max.	Scale support left	Scale support right	D ₁
1880 - 1944 mm	1880 mm	1883 mm	0	0	1902 mm
	1884 mm	1888 mm	0	5	1907 mm
	1889 mm	1893 mm	5	5	1912 mm
	1894 mm	1898 mm	5	10	1917 mm
	1899 mm	1903 mm	10	10	1922 mm
	1904 mm	1908 mm	10	15	1927 mm
	1909 mm	1913 mm	15	15	1932 mm
	1914 mm	1918 mm	15	20	1937 mm
	1919 mm	1923 mm	20	20	1942 mm
	1924 mm	1928 mm	20	25	1947 mm
	1929 mm	1933 mm	25	25	1952 mm
	1934 mm	1938 mm	25	30	1957 mm
	1939 mm	1944 mm	30	30	1962 mm
	1945 mm	1948 mm	0	0	1967 mm
1945 - 2009 mm	1949 mm	1953 mm	0	5	1972 mm
	1954 mm	1958 mm	5	5	1977 mm
	1959 mm	1963 mm	5	10	1982 mm
	1964 mm	1968 mm	10	10	1987 mm
	1969 mm	1973 mm	10	15	1992 mm
	1974 mm	1978 mm	15	15	1997 mm
	1979 mm	1983 mm	15	20	2002 mm
	1984 mm	1988 mm	20	20	2007 mm
	1989 mm	1993 mm	20	25	2012 mm
	1994 mm	1998 mm	25	25	2017 mm
	1999 mm	2003 mm	25	30	2022 mm
	2004 mm	2009 mm	30	30	2027 mm
	2010 mm	2013 mm	0	0	2032 mm
	2014 mm	2018 mm	0	5	2037 mm
2010 - 2074 mm	2019 mm	2023 mm	5	5	2042 mm
	2024 mm	2028 mm	5	10	2047 mm
	2029 mm	2033 mm	10	10	2052 mm
	2034 mm	2038 mm	10	15	2057 mm
	2039 mm	2043 mm	15	15	2062 mm
	2044 mm	2048 mm	15	20	2067 mm
	2049 mm	2053 mm	20	20	2072 mm
	2054 mm	2058 mm	20	25	2077 mm
	2059 mm	2063 mm	25	25	2082 mm
	2064 mm	2068 mm	25	30	2087 mm
	2069 mm	2074 mm	30	30	2092 mm
	2075 mm	2078 mm	0	0	2097 mm
	2079 mm	2083 mm	0	5	2102 mm
	2084 mm	2088 mm	5	5	2107 mm
2075 - 2139 mm	2089 mm	2093 mm	5	10	2112 mm
	2094 mm	2098 mm	10	10	2117 mm
	2099 mm	2103 mm	10	15	2122 mm
	2104 mm	2108 mm	15	15	2127 mm
	2109 mm	2113 mm	15	20	2132 mm
	2114 mm	2118 mm	20	20	2137 mm
	2119 mm	2123 mm	20	25	2142 mm
	2124 mm	2128 mm	25	25	2147 mm
	2129 mm	2133 mm	25	30	2152 mm
	2134 mm	2139 mm	30	30	2157 mm

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

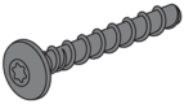
3 Components

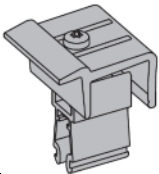
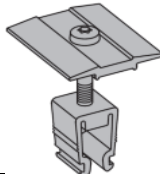
Description	Support	Support	
Designation	MSP-FR-EW-SH	MSP-FR-EW-SL8	MSP-FR-EW-SL10
Figure		 	
Material Coating	EN AW-6063 T66 - EN 755-2	EN AW-6063 T66 - EN 755-2	

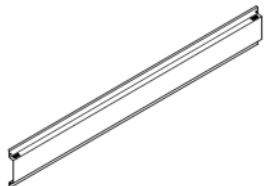
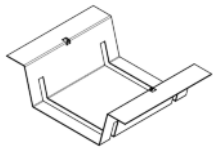
Description	Connection channel	Profile	Protective sheet (role)
Designation	MSP-FR-EW-C 300-360 MSP-FR-EW-C 950-1010 MSP-FR-EW-C 1011-1075 MSP-FR-EW-C 1076-1140 MSP-FR-EW-C 1141-1205 MSP-FR-EW-C 1230-1290 MSP-FR-EW-C 1495-1559 MSP-FR-EW-C 1620-1684 MSP-FR-EW-C 1685-1749 MSP-FR-EW-C 1750-1814 MSP-FR-EW-C 1815-1879 MSP-FR-EW-C 1880-1944 MSP-FR-EW-C 1945-2005 MSP-FR-EW-C 2010-2074 MSP-FR-EW-C 2075-2139	MSP-FR-EW-BP 150 MSP-FR-EW-BP 300 MSP-FR-EW-BP 450 MSP-FR-EW-BP 600 MSP-FR-EW-BP 900 MSP-FR-EW-BP 1200	MSP-FR-EW-PSF
Figure			
Material Coating	EN AW-6063 T66 - EN 755-2	EN AW-6060 T66 - EN 755-2	PES-Vlies 450 g/m ² 3-4mm thickness with adhesive strips

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

Description	Protective layer (plugged)	Screw	Screw
Designation	MSP-FR-PSF 150 MSP-FR-PSF 300	MSP-FR-S M6x16	MSP-FR-GS 6x60
Figure			
Material / Coating	PES-Vlies 450 g/m ² 3-4mm thickness, slotted	Carbon steel / ZnNi galvanised >10 µm	Carbon steel / ZnNi galvanised >10 µm

Description	End clamp	middle clamp	Cable holder
Designation	MSP-PR-EC 30-50 mm MSP-PR-ECB 30-50mm	MSP-PR-MC 30-50mm MSP-PR-MCG 30-50mm MSP-PR-MCB 30-50mm MSP-PR-MCGB 30-50mm	MSP-FR-CH8
Figure			
Material / Coating	<u>Clamp</u> EN AW-6063 T66 - EN 755-2 <u>Screw</u> A2-70 - ISO 3506-1 <u>Securing washer</u> PE-HD oder PVC <u>Nut</u> A4-70 - ISO 3506-2	<u>Clamp</u> EN AW-6063 T66 - EN 755-2 <u>Screw</u> A2-70 - ISO 3506-1 <u>Securing washer</u> PE-HD oder PVC	PA6

Description	Ballast tray	Ballast tray holder	
Designation	MSP-FR-S-WD 1620-1684 MSP-FR-S-WD 1685-1749 MSP-FR-S-WD 1750-1814	MSP-FR-S-SB	
Figure			
Material / Coating	Sheet steel ZM-coated	Sheet steel SVZ/ZM-coated	

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

4 Design Resistances of Components and Connections

For the resistance verification of MSP-FR-EW applications, the following component design resistances have to be considered individually:

– Resistance of the roof structure – Compressive strength of the thermal insulation – Friction coefficient between the roof membrane and the protective layer – Rated value of the module according to manufacturer's specifications	– by the costumer
– Support low MSP-FR-EW-SL8/SL10 – Support high MSP-FR-EW-SH – Connection channel MSP-FR-EW-C – Ballast tray MSP-FR-S-WD – Middle and end clamps MSP-PR-MC/MCB/EC/ECB	– According to this factsheet

The component with lowest resistance limits the application.

All resistances are calculated according to the following codes and guidelines:

- DIN EN 1990 (EC1)
- DIN EN 1993-1-1 (EC3)
- DIN EN 1999-1-1 (EC9)
- VDI 2230 Blatt 1

The resistances are valid as long as the full Schweizer MSP-FR-S flat roof system is used and the installation is built according to the mounting instructions MSP-FR-EW Flat Roof PV Mounting System East-West..

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

4.1 Design resistances of support low MSP-FR-EW-SL8/SL10

Pressure design resistance	N_{Rd} in kN	3,75
Suction design resistance	N_{Rd} in kN	-5,20
Shear design resistance	V_{Rd} in kN	$\pm 1,95$
Shear design resistance	S_{Rd} in kN	+1,95 -0,24

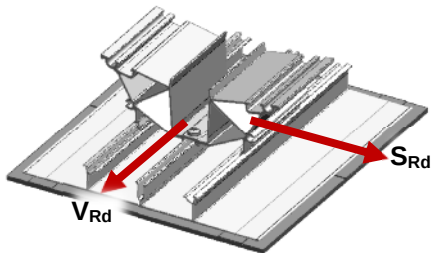


Abb. 1: Vectors of design resistance of MSP-FR-EW-SL8/SL10

4.2 Design resistances of support high MSP-FR-EW-SH

Pressure design resistance	N_{Rd} in kN	7,50
Suction design resistance	N_{Rd} in kN	-10,40
Shear design resistance	S_{Rd} in kN	1,95

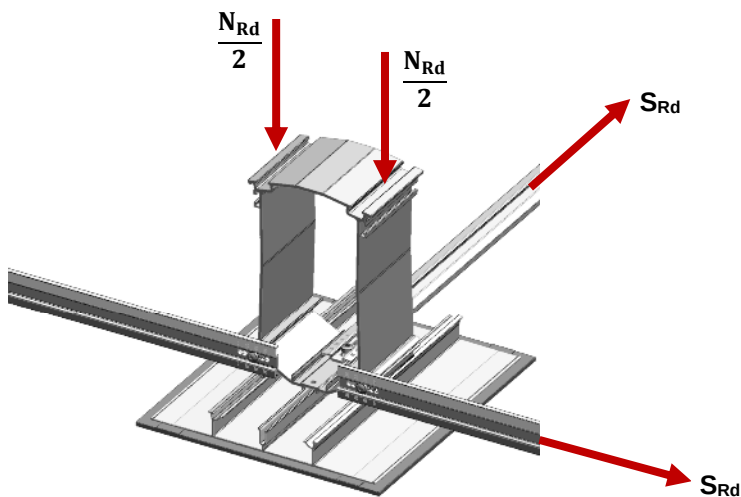


Abb. 2: Vectors of design resistance of MSP-FR-EW-SH

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

4.3 Design resistance of connection channels MSP-FR-EW-C

Pressure design resistance (stones)	N_{Rd} in kN	0,34
Pressure design resistance stiffened (with ballast tray)	N_{Rd} in kN	1,08

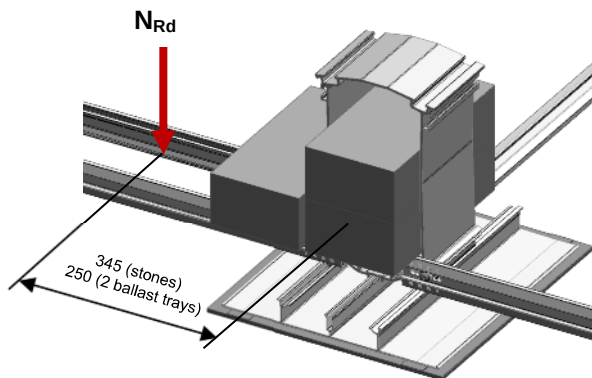


Abb. 3: Vectors of design resistance of MSP-FR-EW-C

4.4 Permissible design resistance for wind deflector MSP-FR-S-WD (with even load distribution)

		MSP-FR-S-WD 1620-1684	MSP-FR-S-WD 1695-1749	MSP-FR-S-WD 1750-1814
Pressure design resistance	N_{Rd} in kN	0,49	0,49	0,39
Suction design resistance	N_{Rd} in kN	-0,49	-0,49	-0,39

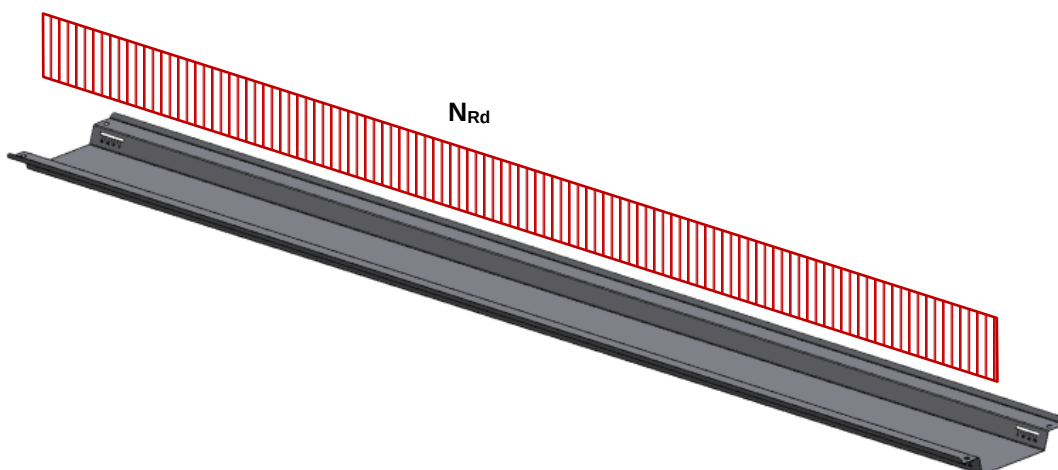


Abb. 4: MSP-FR-S-WD illustration of the load effect

Solar Systems of Schweizer:

Technical Data – MSP-FR-EW.

4.5 Design resistances of the MSP-PR-MC middle clamp

Suction design resistance	N_{Rd} in kN	-5,17
Shear design resistance	V_{Rd} in kN	1,29
Shear design resistance	S_{Rd} in kN	1,29

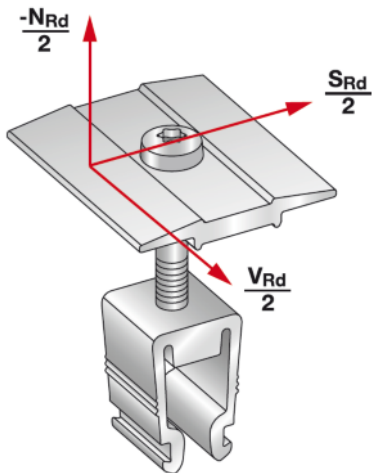


Abb. 5: Vectors of design resistance of MSP-PR-MC middle clamp

4.6 Design resistances of the MSP-PR-EC end clamp

Suction design resistance	N_{Rd} in kN	-1,90
Shear design resistance	V_{Rd} in kN	0,51
Shear design resistance	S_{Rd} in kN	0,51

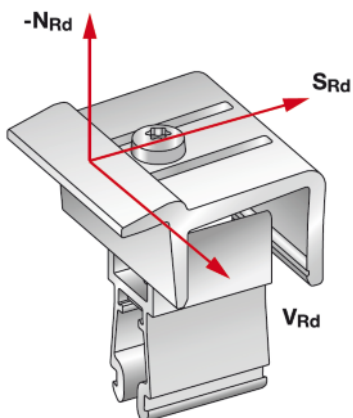


Abb. 6: Vectors of design resistance of MSP-PR-EC end clamp