Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-15/0351 of 21 June 2019

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	BEMO-Flat-Roof Standing Seam System Aluminium
Product family to which the construction product belongs	Roof and wall systems with hidden fastenings
Manufacturer	BEMO Systems GmbH Max-Eyth-Straße 2 74532 Ilshofen DEUTSCHLAND
Manufacturing plant	BEMO Systems GmbH Max-Eyth-Straße 2 74532 Ilshofen DEUTSCHLAND
This European Technical Assessment contains	31 pages including 27 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 200035-00-0302
This version replaces	ETA-15/0351 issued on 22 December 2016

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Specific Part

1 Technical description of the product

The "BEMO-Flat-Roof Standing Seam Roofing Aluminium" consists of prefabricated wall and roof elements and the appropriate hidden spacer kit (halters), thermal barrier pads and fasteners (e.g. screws). The wall and roof elements are made of stucco-embossed, mill finish, galvanized or plastic-coated aluminium strip, which is roll formed into profiled sheets in cold condition with a trough-shaped cross section of constant height. The halters are made of extruded aluminium. Plastic parts (thermal barrier pads or spacer pads) can be placed under the halters which are fastened to the substructure with fasteners.

The profiled sheeting is connected with each other continuously forming a rainproof standing seam by crimping the lateral edge ribs of adjacent roof elements. The connection to the substructure is made by halters, not visible from above, crimped between the edge ribs, which are fastened to the substructure.

The components and the system setup of the product are given in annexes A 1 to A 7.

2 Specification of the intended use in accordance with the applicable European assessment Document

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the kit of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Profiled sheeting	see annexes B 1 to B 9
Halters (hidden fastenings)	see annexes B 10 to B 13
Fasteners (e.g. screws)	see annexes B 12 to B 14
Walk-on stability	see annex B 15

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
External fire performance of the roof covering	Class B_{ROOF} (t1) Class B_{ROOF} (t2) Class B_{ROOF} (t3)

3.3 Safety in use (BWR 4)

Essential characteristic	Performance
Profiled sheeting: - Dead load g - Effective moment of inertia for uplift and for downward load I_{ef}	see annexes B 1 to B 9
Water permeability	The aluminium profiled sheeting is watertight.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 200035-00-0302, the applicable European legal act is: [1998/214/EC].

The system to be applied is: 2+

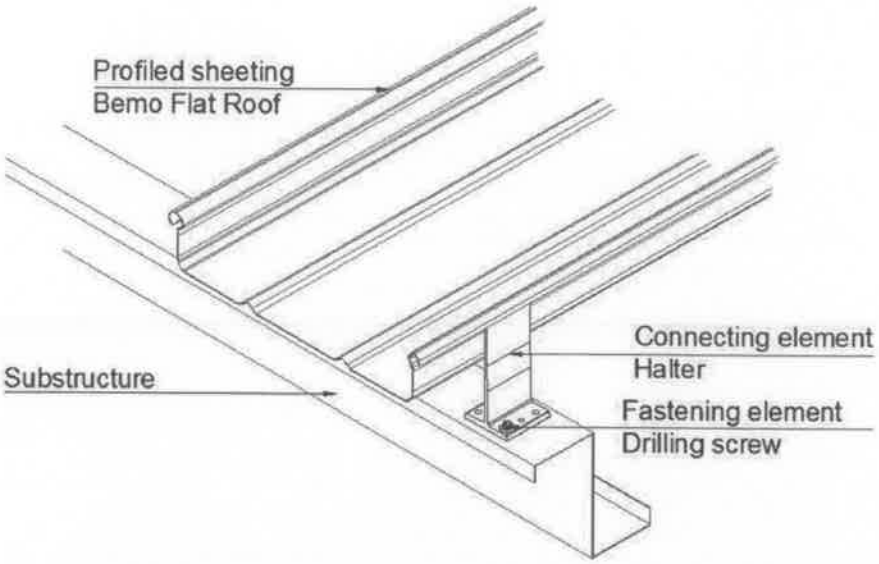
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 21 June 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Böckermann



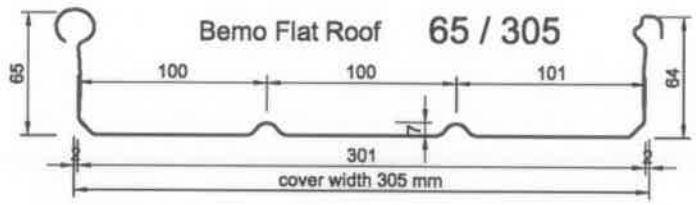
Designation	Material
Profiled sheeting BEMO flat roof standing seam	As material for the manufacture of the profiled sheeting with the sheet thicknesses given in the annexes, the aluminium alloys EN AW-3004 or EN AW 3005 or EN AW 3105 according to EN 573-3 are used. If the aluminium strip is additionally plated, then the plating thickness on each side is at least 4 % of the nominal sheet thickness t. As plating material the aluminium alloy EN AW 7072 according to EN 573-3 is used. The profiled sheeting can be fitted with organic coating of maximum 50 µm on the visible side and with back coating of maximum 25 µm on the back side. Detailed information concerning plastic paint coating of the aluminium strips are contained in the control plan, which is deposited with DIBt. The initial aluminium strip material not yet roll formed (mill finish, stucco-embossed or plastic paint-coated) has at least the following mechanical properties in the longitudinal direction for all sheet thicknesses (resistances and elongation at break determined in accordance with EN 10002-1):

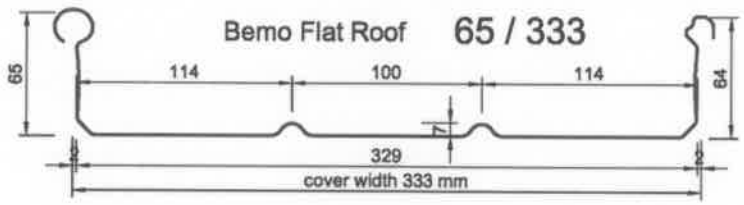
$R_{p0,2}$	R_m	$A_{50\ mm}$
[N/mm²]	[N/mm²]	[%]
185	200	3.0

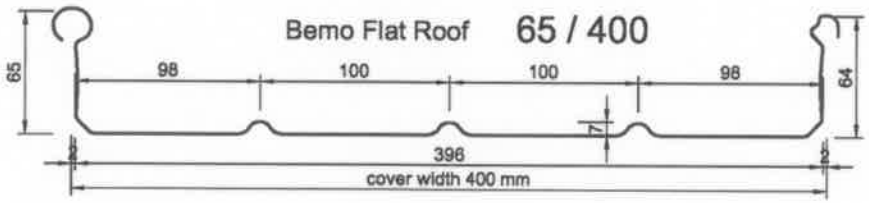
These is also fulfilled by the finished building component in the final state of use.

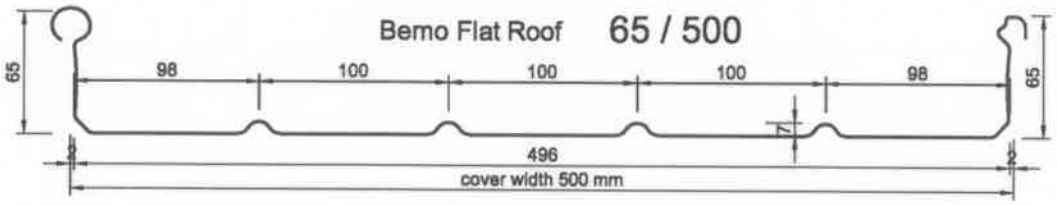
Connecting elements Halter	As material for the manufacture of the halter the aluminium alloy EN AW 6060 T66 according to EN 755-2 is used.
Fastening elements Drilling screw	The drilling screws according to Annex A 6 are made of stainless steel with the material number 1.4567. For the remaining fastening elements according to Annexes B 12 and B 13, the specifications are given in the corresponding ETAs or standards (e.g. EN 1995-1-1).

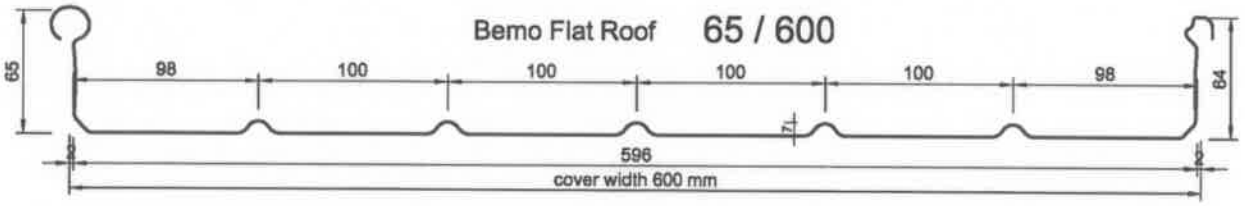
BEMO-Flat-Roof Standing Seam System Aluminium	Annex A 1
System overview	











BEMO-Flat-Roof Standing Seam System Aluminium

Profile Dimensions
Bemo Flat Roof 65/305 65/333 65/400 65/500 65/600

Annex A 2

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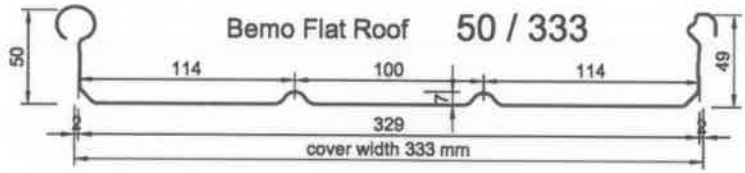

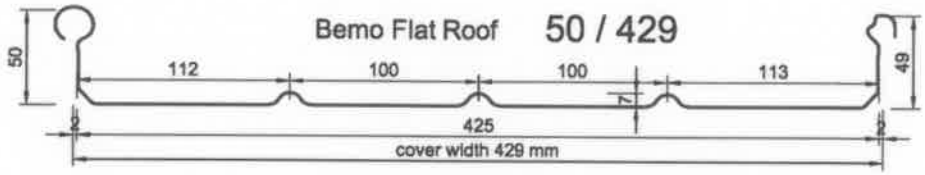

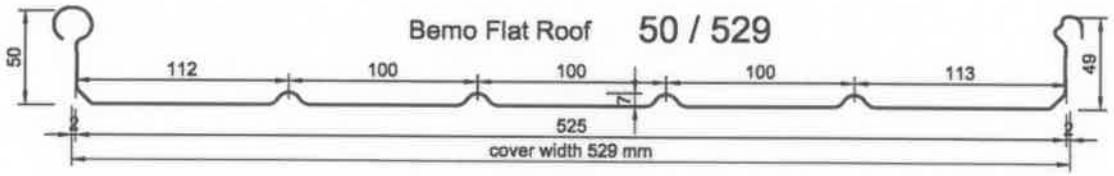

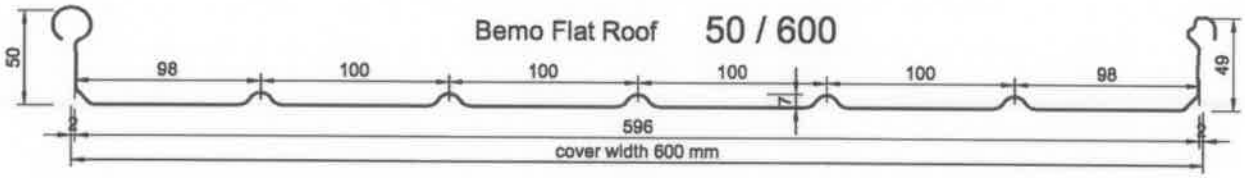

BEMO-Flat-Roof Standing Seam System Aluminium	Annex A 3
Profile Dimensions **Bemo Flat Roof 50/333 50/429 50/500 50/600**	

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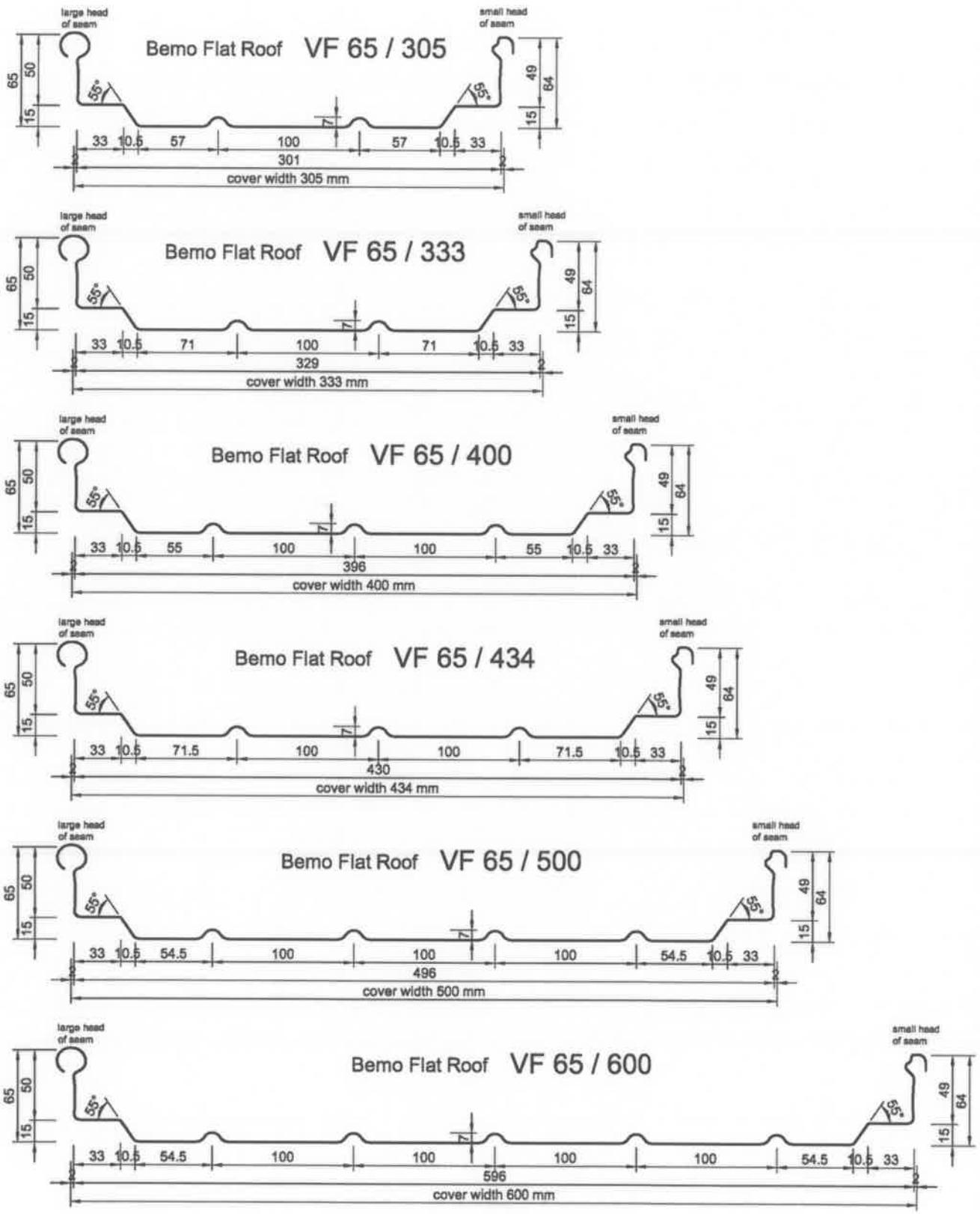

BEMO-Flat-Roof Standing Seam System Aluminium

Profile Dimensions
Bemo Flat Roof VF65/305 VF65/333 VF65/400 VF65/434 VF65/500 VF65/600

Annex A 4

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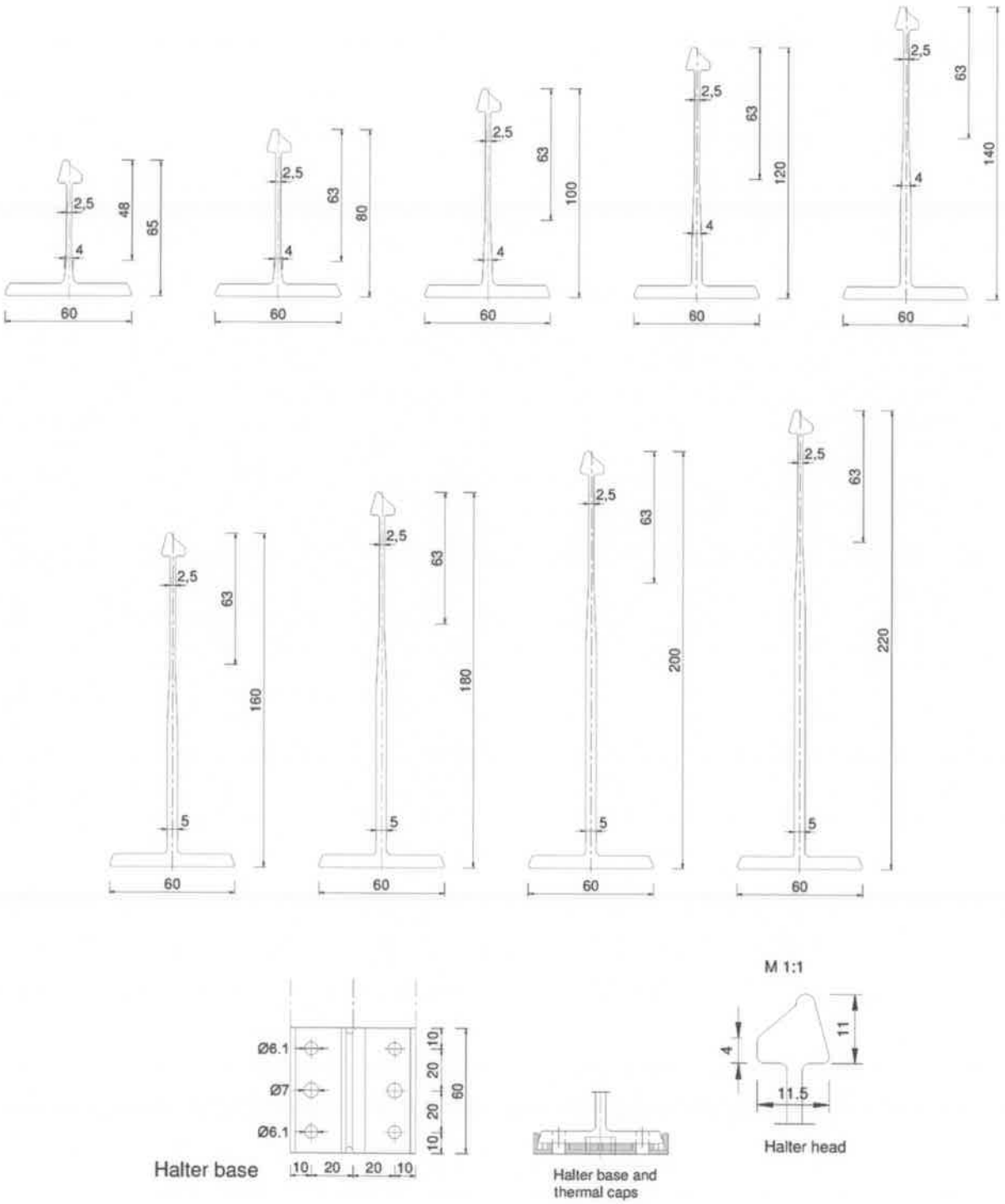
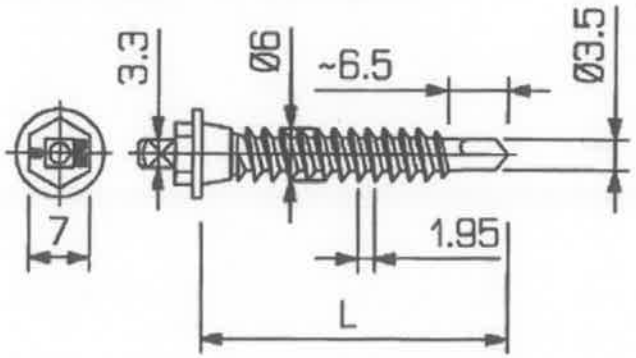
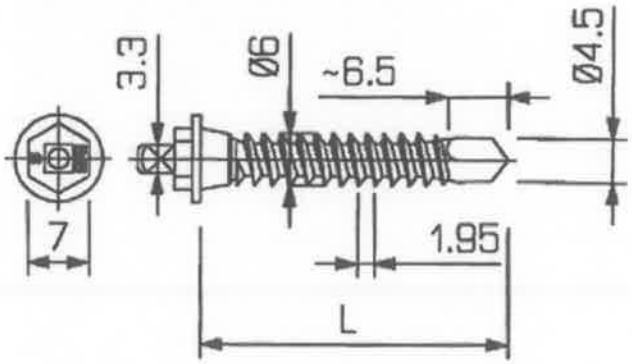


BEMO-FLAT-ROOF Standing Seam System Aluminium	Annex A 5
Dimensions Aluminium-Halter	

SFS SDK2-S-377-6,0 x L

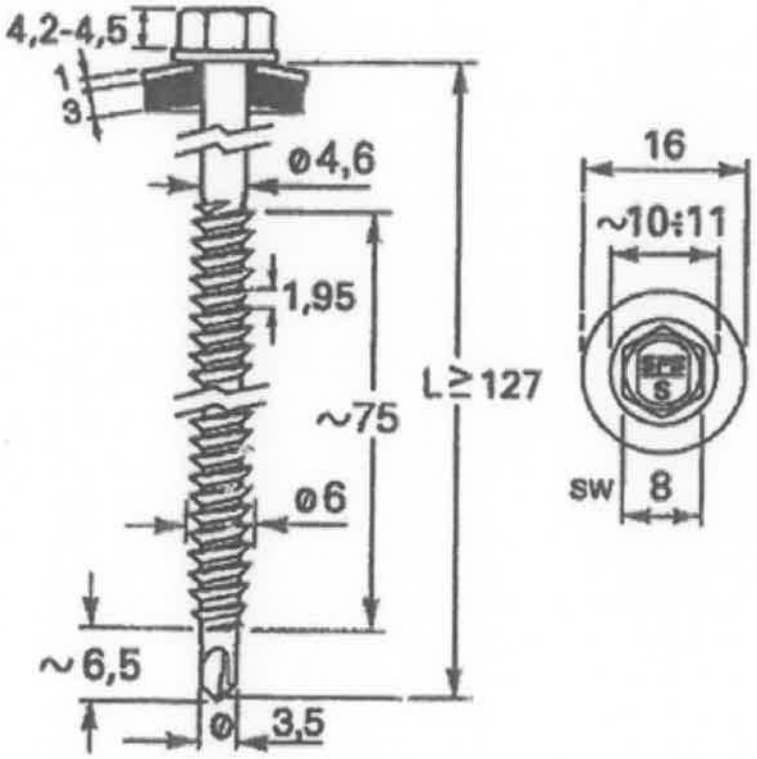


SFS SDK3-S-377-6,0 x L



Available screw length		
Screw	L in mm	
SDK2	35	45
SDK3	30	45

BEMO-Flat-Roof Standing Seam System Aluminium	Annex A 6
Drilling screws **SFS SDK2-S-377-6,0xL** **SFS SDK3-S-377-6,0xL**	



BEMO-Flat-Roof Standing Seam System Aluminium	Annex A 7
Drilling screw SFS SD2-S-6,0xL	

Bemo Flat Roof 65/305

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + [F_{Ed}/(R^0_{Rk,B}/\gamma_M)]^2 \le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,031	48,7	1,16	12,3	1,31	50,5	1,31	12,4
0,8	0,035	55,6	1,51	16,1	1,72	65,3	1,72	15,8
0,9	0,040	62,6	1,94	20,2	2,12	57,9	2,09	19,0
1,0	0,044	69,5	2,37	24,3	2,52	58,6	2,46	21,7
1,2	0,053	76,5	2,60	26,7	2,78	64,1	2,71	23,9
		recommended: $\gamma_M = 1,0$	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 65/305

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \le 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	1,20	4,96	1,80	10,3	1,22	6,66
0,8	1,56	6,48	2,36	13,8	1,59	8,70
0,9	1,80	8,65	2,61	23,8	1,97	12,5
1,0	2,04	10,8	2,87	37,0	2,35	16,2
1,2	2,24	11,9	3,16	40,7	2,59	17,8
	recommended: $\gamma_M = 1,1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M
Bemo Flat Roof 65/305

Annex B 1

Bemo Flat Roof 65/333

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + [F_{Ed}/(R^0_{Rk,B}/\gamma_M)]^2 \le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,029	48,7	1,16	12,3	1,31	50,5	1,31	12,4
0,8	0,033	55,6	1,51	16,1	1,72	65,3	1,72	15,8
0,9	0,037	62,6	1,94	20,2	2,12	57,9	2,09	19,0
1,0	0,041	69,5	2,37	24,3	2,52	58,6	2,46	21,7
1,2	0,045	76,5	2,60	26,7	2,78	64,1	2,71	23,9
		recommended: $\gamma_M = 1{,}0$	recommended: $\gamma_M = 1{,}1$					

Bemo Flat Roof 65/333

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \le 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	1,20	4,96	1,80	10,3	1,22	6,66
0,8	1,56	6,48	2,36	13,8	1,59	8,70
0,9	1,80	8,65	2,61	23,8	1,97	12,5
1,0	2,04	10,8	2,87	37,0	2,35	16,2
1,2	2,24	11,9	3,16	40,7	2,59	17,8
	recommended: $\gamma_M = 1{,}1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M Bemo Flat Roof 65/333

Annex B 2

Bemo Flat Roof 65/400

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + [F_{Ed}/(R^0_{Rk,B}/\gamma_M)]^2 \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,029	41,9	1,05	6,55	1,76	14,0	1,29	9,52
0,8	0,034	47,9	1,32	8,30	2,19	18,1	1,66	12,2
0,9	0,038	53,9	1,69	10,3	2,37	28,5	2,01	16,2
1,0	0,042	59,9	2,07	12,3	2,64	46,3	2,36	20,2
1,2	0,050	71,8	2,48	14,7	3,17	55,5	2,83	24,2
		recommended: $\gamma_M = 1,0$	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 65/400

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	1,16	1,91	2,65	5,97	1,01	5,05
0,8	1,36	2,46	2,81	8,94	1,31	7,12
0,9	1,69	3,40	3,56	11,3	1,67	9,0
1,0	2,02	4,34	4,30	13,7	2,01	10,9
1,2	2,42	5,21	5,16	16,4	2,41	13,1
	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 65/500

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0258	33,6	0,731	3,29	1,16	22,6	0,991	6,59
0,8	0,0295	40,3	0,954	4,30	1,51	29,5	1,29	8,60
0,9	0,0331	45,3	1,13	5,03	1,59	57,9	1,43	10,1
1,0	0,0368	50,4	1,31	5,76	1,66	86,3	1,57	11,5
1,2	0,0442	60,4	1,71	7,93	2,57	69,1	2,35	15,9
		recommended: $\gamma_M = 1,0$	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 65/500

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,600	1,42	1,11	4,63	0,618	2,85
0,8	0,784	1,86	1,45	6,04	0,807	3,72
0,9	0,994	2,58	1,60	12,8	1,10	5,16
1,0	1,20	3,30	1,75	19,5	1,39	6,60
1,2	1,76	4,29	2,25	36,1	1,95	8,58
	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 65/600

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0246	28,8	0,537	2,54	0,675	83,5	0,657	5,09
0,8	0,0282	33,6	0,701	3,32	0,881	109	0,858	6,64
0,9	0,0317	37,8	0,895	4,39	1,20	106	1,16	8,8
1,0	0,0352	42,0	1,09	5,45	1,52	103	1,46	10,9
1,2	0,0422	50,4	1,33	7,63	2,20	112	2,10	15,3
		recommended: $\gamma_M = 1{,}0$	recommended: $\gamma_M = 1{,}1$					

Bemo Flat Roof 65/600

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,596	1,32	0,807	5,14	0,531	2,63
0,8	0,776	1,72	1,05	6,72	0,694	3,44
0,9	0,977	2,30	1,47	9,51	1,00	4,59
1,0	1,17	2,87	1,88	12,3	1,31	5,74
1,2	1,41	3,36	2,39	15,3	1,73	6,72
	recommended: $\gamma_M = 1{,}1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M Bemo Flat Roof 65/600

Annex B 5

Bemo Flat Roof 50/333

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0276	21,8	0,91	5,54			0,830	11,1
0,8	0,0315	28,4	1,21	7,23			1,08	14,50
0,9	0,0355	32,5	1,44	9,27			1,37	18,5
1,0	0,0394	36,6	1,68	11,3			1,7	22,6
1,2	0,0473	41,8	2,30	14,5			2,12	28,9
		recommended: $\gamma_M = 1{,}0$	recommended: $\gamma_M = 1{,}1$					

Bemo Flat Roof 50/333

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,708	2,19	3,210	5,51	1,09	4,38
0,8	0,924	2,86	4,19	7,19	1,43	5,72
0,9	1,090	3,95	3,26	17,7	1,66	7,90
1,0	1,26	5,04	2,33	28,5	1,89	10,1
1,2	2,09	7,80	-	-	2,20	15,6
	recommended: $\gamma_M = 1{,}1$					

BEMO-Flat-Roof Standing Seam System Aluminium

**Cross section properties, characteristic resistance values and partial safety factors γ_M
Bemo Flat Roof 50/333**

Annex B 6

Bemo Flat Roof 50/429

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^{0}_{Rk,B}/\gamma_M) + F_{Ed}/(R^{0}_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^{0}_{Rk,B}$	$R^{0}_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0256	17,5	0,772	4,73			0,887	9,46
0,8	0,0293	22,9	1,01	6,18			1,16	12,40
0,9	0,0330	26,0	1,20	7,25			1,31	14,5
1,0	0,0366	29,0	1,40	8,32			1,46	16,6
1,2	0,0440	34,0	1,73	11,2			1,69	22,4
		recommended: $\gamma_M = 1{,}0$	recommended: $\gamma_M = 1{,}1$					

Bemo Flat Roof 50/429

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^{0}_{Rk,B}/\gamma_M) + F_{Ed}/(R^{0}_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^{0}_{Rk,B}$	$R^{0}_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,529	1,69	1,78	5,36	0,742	3,37
0,8	0,691	2,20	2,32	7,00	0,969	4,40
0,9	0,850	2,93	2,29	11,8	1,22	5,86
1,0	1,01	3,66	2,25	16,6	1,48	7,3
1,2	1,44	5,54	-	-	1,74	11,1
	recommended: $\gamma_M = 1{,}1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M Bemo Flat Roof 50/429

Annex B 7

Bemo Flat Roof 50/529

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0244	14,7	0,675	4,20	0,955	67,8	0,904	8,39
0,8	0,0278	19,2	0,881	5,48	1,25	88,4	1,18	11,0
0,9	0,0313	21,6	1,05	5,92	-	-	1,24	11,8
1,0	0,0348	24,0	1,21	6,37	-	-	1,30	12,7
1,2	0,0418	28,9	1,30	9,06	-	-	1,41	18,1
		recommended: $\gamma_M = 1,0$	recommended: $\gamma_M = 1,1$					

Bemo Flat Roof 50/529

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,411	1,35	0,84	5,26	0,511	2,71
0,8	0,537	1,77	1,09	6,87	0,668	3,54
0,9	0,690	2,26	1,65	7,84	0,94	4,52
1,0	0,84	2,76	2,20	8,8	1,20	5,51
1,2	1,01	4,06	2,67	29,7	1,44	8,11
	recommended: $\gamma_M = 1,1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M
Bemo Flat Roof 50/529

Annex B 8

Bemo Flat Roof 50/600

Characteristic values for downward load

sheet thickness	dead-load	moment of inertia	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,0237	13,0	0,642	3,29			0,588	6,57
0,8	0,0271	16,9	0,838	4,29			0,768	8,58
0,9	0,3050	19,1	0,988	4,62			0,906	9,24
1,0	0,0339	21,2	1,14	4,95			1,04	9,89
1,2	0,0407	25,4	1,33	7,78			1,12	15,6
		recommended: $\gamma_M = 1{,}0$	recommended: $\gamma_M = 1{,}1$					

Bemo Flat Roof 50/600

Characteristic values for uplift load

sheet thickness	field moment	end support reaction	moment and reaction at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M) + F_{Ed}/(R^0_{Rk,B}/\gamma_M) \leq 1$			
t	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0,7	0,381	1,11	2,73	2,53	0,515	2,22
0,8	0,498	1,45	3,57	3,31	0,673	2,90
0,9	0,676	2,23	2,35	16,7	0,84	4,46
1,0	0,855	3,01	1,13	30,1	1,00	6,02
1,2	1,14	3,07	1,60	14,5	1,22	6,14
	recommended: $\gamma_M = 1{,}1$					

BEMO-Flat-Roof Standing Seam System Aluminium

Cross section properties, characteristic resistance values and partial safety factors γ_M Bemo Flat Roof 50/600

Annex B 9

Characteristic resistance values for aluminium-halter under pressure load in kN/halter	
halter heights in mm	end or intermediate support
65	10,85
80	10,85
100	10,85
120	8,21
140	4,71
160	4,50
180	4,23
200	3,05
220	2,00
recommended: $\gamma_M = 1{,}1$	

Characteristic pull out resistance for halter in head of seam in kN/halter		
Blechdicke mm	end or intermediate support	
	Bemo Flat Roof 50	Bemo Flat Roof 65
0,7	1,44	3,45
0,8	1,88	4,48
0,9	2,56	5,73
1,0	3,25	6,99
1,2	3,85	8,63
recommended: $\gamma_M = 1{,}33$		

BEMO-FLAT-ROOF Standing Seam System Aluminium	
Characteristic resistance values of aluminium-halter and partial safety factors γ_M	Annex B 10

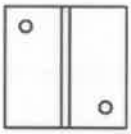
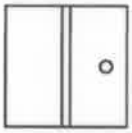
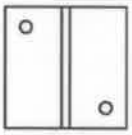
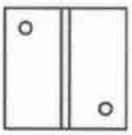
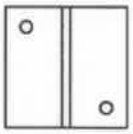
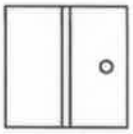
Characteristic pull out resistance for halter in head of seam in kN/halter	
sheet thickness mm	end or intermediate support
	BEMO Flat Roof VF 65
0,7	1,82
0,8	2,38
0,9	3,23
1,0	4,08
1,2	5,16
recommended: $\gamma_M = 1{,}33$	

Regardless of the verification of pull-out resistance the maximum distance of halter L_{max} is:

$L_{max} = f/(w_{S,d}\, b_R)^{0,5}$

with
- L_{max} maximum distance of halter in mm
- f factor according table below in $(kNm)^{0,5}$
- $w_{S,d}$ design value of uplift load (distributed load) in kN/m²
- b_R cover width of profiled sheeting in mm

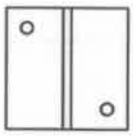
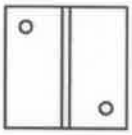
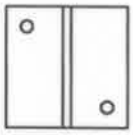
Faktors f in $(kNm)^{0,5}$ for determination of maximum distance of halter				
sheet thickness mm	Bemo Flat Roof VF 65/333, VF 65/400 and VF 65/434		Bemo Flat Roof VF 65/500 and VF 65/600	
	for single and two-span beams	for multi-span beams (≥ 3 spans)	for single and two-span beams	for multi-span beams (≥ 3 spans)
0,7	0,96	1,07	1,08	1,20
0,8	1,28	1,43	1,23	1,38
0,9	1,28	1,43	1,58	1,76
1,0	1,38	1,55	1,77	1,98
1,2	1,52	1,70	2,10	2,35

Row	Substructure	Flange thick-ness mm	Connection layout	Fastener	Drill hole Ø mm	F_k kN/Halter
1	aluminium $R_{p0,2} > 200$ N/mm²	0,7 0,8 1,0 2,0		bulb-tite rivet Ø 5 mm	5,5	1,81 2,37 2,44 2,44
2	aluminium EN AW-6060 T6	1,5		self-tapping screw Ø 6.3 mm	5,0	1,89
3		2,0		self-drilling screw SFS SDK2-S-377-6.0xL acc. to annex A 6	-	3,66
4	steel trapezoidal sheeting acc. to EN 1993-1-3	0,75 0,88 1,00		bulb-tite rivet Ø 5 mm	5,5	2,22 2,62 2,97
5	steel trapezoidal sheeting acc. to EN 1993-1-3	0,75 0,88 1,00 1,25		self-drilling screw SFS SDK2-S-377-6.0xL acc. to annex A 6	-	2,10 2,90 3,75 5,00
6	steel S235	1,3 1,5 ≥ 2.00 (max 3.2)		self-drilling screw SFS SDK3-S-377-6.0xL acc. to annex A 6		2,79 4,27 7,23
7	steel S235	1,5 2,5		self-tapping screw Ø 6.3 mm	5,0 5,3	3,14 3,83
recommended: $\gamma_M = 1,33$						

BEMO-Flat-Roof Standing Seam System Aluminium

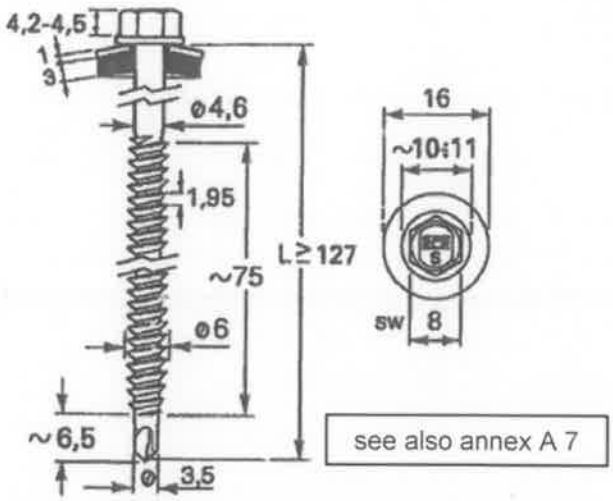
Characteristic resistance values for connecting aluminium-halter to substructure and partial safety factor γ_M Metal substructure

Annex B 12

Row	Substructure	Connection layout	Fastener	Effective penetration length mm	F_k kN/Halter
1	coniferous wood strength class ≥ C24		self-drilling screw SFS SDK2-S-377-6.0xL acc. to annex A 6	23 mm (30 mm incl. drill bit)	3,44
2				33 mm (40 mm incl. drill bit)	4,98
3	particle board nominal thickness 19 mm (≥ P5 acc. to EN 312)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to annex A 6	The thread must cover the entire board width.	2,25
4	OSB-board nominal thickness 18 mm (OSB/3 or OSB/4 acc. to EN 300)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to annex A 6		2,64
5	timber	1)			
recommended: $\gamma_M = 1{,}33$					

1) For fasteners not listed the characteristic values of the resistances can be taken from corresponding ETAs or standards (e. g. EN 1995-1-1).

BEMO-Flat-Roof Standing Seam System Aluminium	
Characteristic resistance values for connecting aluminium-halter to substructure and partial safety factor γ_M Wooden substructure	Annex B 13



see also annex A 7

Row	Characteristic pull-out resistance from steel substructure in kN/screw			
	t_{II} in mm	steel S280 ($R_{m,min}$ = 360 N/mm²)	steel S320 ($R_{m,min}$ = 390 N/mm²)	steel S350 ($R_{m,min}$ = 420 N/mm²)
1	0,88	1,47	1,59	1,66
2	1,00	1,88	2,04	2,08
3	1,13	2,19	2,37	2,50
4	1,25	2,50	2,71	2,92
γ_M = 1,33				

Row	Characteristic pull-out resistance from wooden substructure in kN/screw		
	Substructure	effective penetration length	F_k kN/screw
1	coniferous wood strength class ≥ C24	23 mm (30 mm incl. drill bit)	1,72
2	coniferous wood strength class ≥ C24	68 mm (75 mm incl. drill bit)	5,20
3	particle board nominal thickness 19 mm (≥ P5 acc. EN 312)	The thread must cover the entire board width.	1,13
4	OSB-board nominal thickness 18 mm (OSB/3 or OSB/4 acc. to EN 300)		1,32
5	timber	see annex B 13, 1)	
γ_M = 1,33			

BEMO-Flat-Roof Standing Seam System Aluminium

Characteristic resistance values for connecting aluminium-halter to substructure and partial safety factor γ_M
Drilling screw SFS SD2-S-6,0xL

Annex B 14

Walk-on stability during assembly

Profiled sheetings in the assembly area which are zipped on at least one side may be walked on without any load-distributing measure up to the following spans:

sheet thickness	Bemo Flat Roof				
	65/305	65/333	65/400	65/500	65/600
t mm	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m
0,7	1,17				
0,8	1,56				
0,9	1,90				
1,0	2,24				
1,2	2,53				

Walk-on stability after assembly

Zipped profiled sheetings may be walked on without any load-destributing measure up to the following spans:

sheet thickness	Bemo Flat Roof								
	65/305	65/333	65/400	65/500	65/600	50/333	50/429	50/529	50/600
t mm	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m
0,7	2,24	-	1,85	2,07	2,07	1,76	1,72	1,74	1,74
0,8	2,78	2,68	2,48	2,70	2,70	2,30	2,24	2,27	2,28
0,9	3,21	3,12	2,87	3,15	3,05	2,54	2,47	2,55	2,59
1,0	3,70	3,60	3,41	3,60	3,40	2,78	2,70	2,83	2,90
1,2	4,19	-	3,41	4,50	4,50	4,05	3,90	3,97	4,00

Individual, unzipped aluminium profiled sheetings are not accessible.

Supplementary information for design, installation, execution and maintenance

The performance and serviceability of the construction product can be provided according the following provisions:

C 1 General

The verification of the load-bearing capacity and serviceability is provided in each individual case according to EN 1990 and EN 1999-1-4 in consideration of the information in this ETA. In general, it is verified that the design value of the effect of the action E_d does not exceed the design values of the related load-bearing capacity R_d e.g., $E_d \leq R_d$.

The design values of the load-bearing capacities are the result of dividing the characteristic values by the partial safety factor γ_M.

Following verifications shall be provided generally:

- Verification of profiled sheeting
- Verification of halters
  - Pull-out resistance of halters in head of seam of profiled sheeting
  - Pressure load resistance of halters
  - Fastening of brackets to the substructure
- Verification of walkability during assembly (where required)
- Verification of walkability after assembly (where required)

If there is the possibility of the formation of a water pocket (Generally applies to roof slopes less than 2 % and to unfavourable position concerning drainage engineering of the roof outlets.), this load case is verified with the following loads: permanent load and water load as a result of the total deflection of the profiled sheeting from the loads to be applied.

The profiled sheeting are supported in a single span configuration or continuously across several spans. The center-to-center distance of the halters is assumed as span. Continuous beams with spans of less than 1.0 m are verified with an effective span of at least 1.0 m.

Fundamentally, the effects of actions acting normal to the installed profiled sheets will be calculated using the theory of elasticity.

The stresses are static or quasi-static.

A diaphragm action of the profiled sheeting for stiffening the total works or a shear or torsional stiffness for stabilizing the substructure against lateral torsional buckling will not be taken into account by way of calculation.

The verification of the ultimate limit state is performed by a structural engineer experienced in the field of lightweight metal construction.

The aluminum strip is protected against corrosion at normal weathering conditions of sea, country, city or industry surroundings by formation of a natural oxide layer.

In cases of an increased corrosion risk, e.g. in the immediate vicinity of plants which emit larger amounts of aggressive substances (e.g. copper smelters), the performance of the profile sheets is given by a suitable plastic coating protection with a nominal thickness of 25 microns minimum. The suitability of the plastic coating shall be attested by evidence of corresponding bodies.

With respect to the corrosion protection for components made of aluminium the information given in EN 1999-1-4 and EN 1090-3 and for the components made of stainless steel, the information given in EN 1993-1-4 and EN 1090-2 applies in addition.

BEMO-Flat-Roof Standing Seam System Aluminium	Annex C 1
Supplementary information for design, installation, execution and maintenance	

C 2 Design loads (actions)

C 2.1 General

Unless otherwise stated EN 1990 shall apply.

C 2.2 Dead load of profiled sheeting

The dead loads of profiled sheeting according to annexes A 2 to A 4 are shown in annexes B 1 to B 9.

C 2.3 Point load, walk-on stability

The verification of the ultimate limit state for a point load action of 1 kN on the profiled sheeting shown in annexes A 2 to A 4 can be assumed as proofed if the provisions in this European Technical Assessment have been observed.

C 3 Verifications for action of loads acting normal to the installed profiled sheets

C 3.1 Calculation of stress

Unless otherwise stated EN 1999-1-4 shall apply.

Fundamentally, the effects of actions acting normal to the installed profiled sheets will be calculated using the theory of elasticity.

C 3.2 Calculation of load bearing capacity on base of characteristic resistance values

EN 1999-1-4 and annexes B 1 to B 15 shall apply.

The verification of the interaction of moment and shear force of the profiled sheeting at the intermediate support is given in deviation from equation (6.22), clause 6.1.11 of EN 1999-1-4 according to the interaction equation given in annexes B 1 to B 9. If $M^0_{Rk,B}$ and $R^0_{Rk,B}$ are not given in tables of annexes B 6 to B 9, verification of interaction is not necessary.

The characteristic values of profiled sheets shown in annexes A 2 and A 4 can be interpolated linearly for those profiled sheets with heights of 65 mm and 50 mm in case of construction widths in between.

Proof of load-bearing capacity for the profiled sheeting shown in annexes A 2 to A 4 is given if the distances of the halters comply with the information according to annex B 11.

In terms of pull-out performance between halters and head of seams as well as the performance under pressure load of halters annex B 10 applies. The design values are the result of dividing the characteristic values by the partial safety factor γ_M

The characteristic values of the resistances are stated in annexes B 12 or B 13 or can be gathered from the corresponding ETAs or standards (e. g. EN 1995-1-1). The design values are the result of dividing the characteristic values by the partial safety factor γ_M.

C 3.3 Verification of strain

The characteristic values of moment of inertia of profiled sheeting according to annexes A 2 to A 4 are shown in annexes B 1 to B 9.

C 3.4 Forces acting in plane of the roof

A transmission of shear and direct forces acting in the plane of the roof due to a roof pitch by the profiled sheeting must not be considered by way of calculation without special requirements concerning the execution - e. g. formation of fixed points according to annex C 5. The forces from fixed points shall be further followed up in the substructure.

C 4 Information for execution

C 4.1 General

The profiled sheeting is connected with each other continuously forming a rainproof standing seam by crimping the lateral edge ribs of adjacent roof elements. The connection to the substructure is made by halters, not visible from above, crimped between the edge ribs, which are fastened to the substructure.

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C 4.2 Profiled sheeting

The profiled sheeting is connected to the substructure at each edge rib by halters. For fixing the profiled sheeting during thermal movement and for transmitting the shear in case of sloped roofs or wall coverings, fixed points are provided according to annex A 6. Transverse joints are permitted only if even under full load complete water run-off is still possible.

Transverse joints may only be installed directly over a support if the joint is at a fixed point. Otherwise the profiled sheeting is overlapped just above a support. For roof pitches of up to 17° (30 %) the mutual overlap of the profiled sheeting amounts to at least 20 cm, for larger roof pitches at least 15 cm.

When using the profiled sheeting as the weathering outer skin of roofs, the minimum roof pitch for roofs without transverse joints or with welded transverse joints is 1.5° (2.6 %). The required minimum roof pitch increases to 2.9° (5 %) for roofs with sealed transverse joints and/or openings (e.g. domed roof-lights).

The required increase of the minimum roof slope for roof penetrations - e.g. for domed roof lights - may not be required, if completely welded flashings are used and the aluminium flashings are welded with the upper shell of the roof such that a completely watertight joint is achieved.

The requirement of the minimum roof slope does not apply to the ridge area, if the roof elements in the area with pitches ≤ 2.9° (5 %) are arranged continuously over the ridge.

The profiled sheeting may only be installed by specialists of the manufacturing plant or by companies having received appropriate training and authorization by the manufacturer. The manufacturer or the person laying the profiled sheeting shall prepare implementation instructions for the laying of the elements to be handed over to the assemblers.

Damaged profiled sheeting including plastic deformations must not be installed.

When using profiled sheeting of different sheet thicknesses in a roof, these shall be marked according to sheet thicknesses, in order to avoid mix-ups.

The individual elements are connected immediately after laying by crimping the lateral edge ribs. In doing so, attention shall be paid to a faultless connection to the halters. If the laying of the profiled sheeting is interrupted before completion of the full roof or wall extents, then the last laid profiled sheeting shall always be secured to provide adequate restraint against detachment from the halters due to wind loads.

An additional securing against sheet detachment from the halters is also required if the construction, during installation, is exposed to larger stresses from wind loads than at the final state.

During the installation, profiled sheeting shown in annexes A 2 and A 3 still unsecured at an edge may be walked on up to limited spans l_{gr} according to annex B 15 without load-distributing measures. In case of larger spans, they may only be walked on by placing planks.

Single, uncrimped profiled sheeting as well as plastic light tracks must not be walked on.

After completion of a roof installation, all foreign objects shall be cleaned from the roof.

After completion of the roof the profiled sheeting may be walked on for cleaning and maintenance work without load-distributing measures up to spans according to annex B 15.

Load-distributing measures, e. g. wooden planks of strength class C24 according to EN 14081-1 with a cross section of 4 x 24 cm and a length of > 3.0 m shall be applied if the effective span exceeds the aforementioned maximum values.

The planks may be laid on the ribs in the direction of the span of the profiled sheeting or transverse to the direction of the span.

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C 4.3 Halters

For the connection of the profiled sheeting to the substructure halters according to annex A 5 are used, whose upper end is crimped with the lateral edge ribs of adjacent profiled sheeting. The halters are attached directly to substructures made of steel, aluminium or wood.

Attachment of the halters to the substructure is carried out with the appropriate screws or rivets indicated in annexes B 12 to B 14 and/or in the ETAs or standards (e. g. EN 1995-1-1).

For connections of the profiled sheeting with a concrete substructure, sufficiently anchored continuous steel parts (e.g. HTU rails or 8 mm thick flat steels) or timber battens (minimum thickness 40 mm) with a width that corresponds to at least the width of the clip base are interposed.

C 4.4 End and intermediate supports

A minimum purlin width of 50 mm is required at end and intermediate supports. To ensure the load-bearing capacity at the end supports a profiled sheeting overhang of at least 100 mm is required.

C 4.5 Verge

Exposed edges in the direction of span of the profiled sheeting are stiffened by suitable edge stiffening (verge profile).

C 4.6 Indications to the person installing the profiled sheeting

- Packaging, transport and storage

The manufacturer's instructions of BEMO Systems relating to Packaging, transport and storage shall be followed.

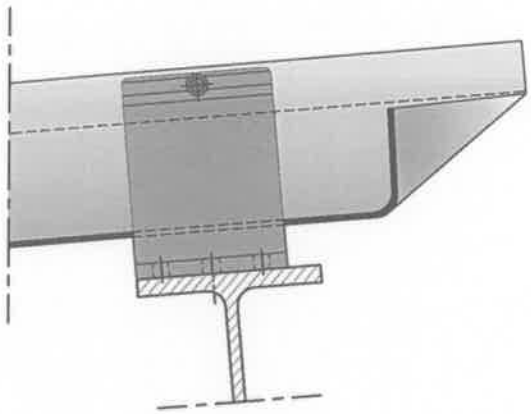
In particular in order to avoid damage to the product a suitable weather protection shall be ensured.

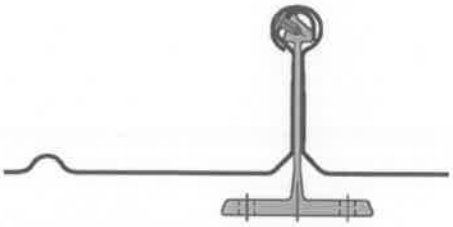
- Use and maintenance

Each delivery of Bemo standing seam system an installation instruction is enclosed. The components of the system must comply with the regulations and must be audited and maintained.

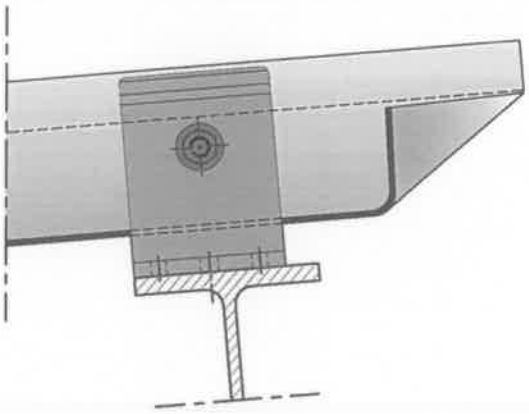
After completion of the roof the profiled sheeting may be walked on for cleaning and maintenance work without load-distributing measures up to spans according to annex B 15. In case of other spans load-distributing measures are necessary (see clause C 4.2).

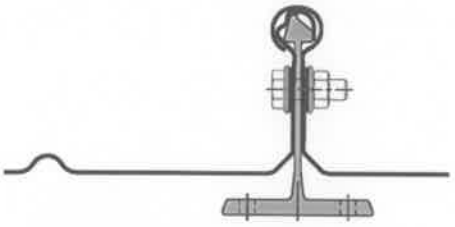
BEMO-Flat-Roof Standing Seam System Aluminium	Annex C 4
Supplementary information for design, installation, execution and maintenance	





Blind rivet Ø 4,8 x 11,0 mm
Blind rivet Ø 5,0 x 12,0 mm
with head diameter 8,0 to 10,0 mm





Bolt M6 x 25 mm with nut and washer
with vulcanised sealant

Material:
stainless steel or
galvanised steel (covered construction)

BEMO-Flat-Roof Standing Seam System Aluminium	Annex C 5
Supplementary information for design, installation, execution and maintenance Fixed point formation	