Deutsches Institut für Bautechnik

DIBt

National technical approval

Date: 29 October

Company reference number:
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Approval number:
Z-14.4-532

Valid
from: **29 October 2012**
until: **29 October 2017**

Applicant:
EJOT Baubefestigungen GmbH
In der Stockwiese 35
D-57334 Bad Laasphe

Object of approval:
Solar fastener for the fastening of solar installations

The construction product mentioned above is hereby granted the 'national technical approval'. This general technical approval comprises eight pages and four appendices. This national technical approval replaces the general technical approval no. Z-14.4-523 dated 4 April 2007. The product has been granted the national technical approval for the first time on 4 April 2007.

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I   GENERAL PROVISIONS

1   The national technical approval proves the fitness for use or application of the approval object for the purpose of the state building regulations.

2   If the national technical approval includes requirements regarding the expert knowledge and experience of the persons responsible for the production of building products and types according to Sec. 17 Para. 5 of the Model Building Regulations, it has to be noted that this expert knowledge and experience may also be proven with equivalent proof of other EU member states. This also holds true for presented equivalent proofs within the framework of the Agreement on the European Economic Area (EEA) or other bilateral agreements.

3   The national technical approval does not replace any other permits, consents and attestations prescribed by law for the execution of construction projects.

4   The national technical approval is granted without prejudice to any third party rights, in particular to private protected rights.

5   Manufacturers and distributors of the approval object shall make available, notwithstanding any further regulations stipulated in the "Special Conditions", copies of the national technical approval to the user of the approved object and shall point out that the national technical approval must be available wherever the approval object is applied or used. The authorities involved must be provided with copies of the national technical approval on request.

6   The national technical approval must only be reproduced in its entirety. Publication in the form of extracts requires the permission of the Deutsche Institut für Bautechnik (German Institute for Building Technology). Text and drawings used in advertising matter must not contradict the national technical approval. Translations of the national technical approval must contain the statement "Vom Deutschen Institut für Bautechnik nicht geprüfte Übersetzung der deutschen Originalfassung" (translation of the original German language version, not authorised by Deutsches Institut für Bautechnik).

7   The national technical approval can be withdrawn at any time. The provisions of the national technical approval can be supplemented or revised subsequently, particularly if this is justified and required by new technical knowledge.

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II SPECIAL CONDITIONS

1 Definition and intended use of the object of approval

The approval object is thread forming screws with welded-on threaded pins made of corrosion-resistant steel (solar fastener) for the planned force-transferring connection of attachment parts (in particular elevations or support profiles of solar installations) with substructures made of steel or wood. Thereby, the solar fasteners are screwed through the top flanges of profiled sheets or cover caps of moulded sandwich elements made of steel or aluminium.

Please refer to Appendix 1 for the illustration of the individual solar fasteners and examples of use.

This national technical approval regulates the connections made with the solar fasteners for predominantly static loads.

2 Conditions for the building product

2.1.1 Dimensions

2.1.1.1 Solar fasteners

The information given in Appendix 1 apply. Please contact the Deutsche Institut für Bautechnik for further information on dimensions.

2.1.1.2 Profiled sheets

The nominal sheet thickness of the profiled sheets in the fastening area is
$t_I \geq 0.4$ mm for steel and $t_I \geq 0.5$ mm for aluminium.

2.1.1.3 Sandwich elements

The nominal sheet thickness of the outer cover layer in the fastening area is
$t_I \geq 0.4$ mm for steel and $t_I \geq 0.5$ mm for aluminium.

2.1.1.4 Substructure

The nominal sheet thickness of steel substructures in the fastening area is
$t_{II} \geq 1.5$ mm.

2.1.2 Materials

2.1.2.1 Solar fastener

The solar fasteners are made of the stainless steel grade 1.4301, or another stainless steel grade according to the national technical approval Z-30.3-6 that are of equal or higher quality regarding corrosion resistance and mechanical characteristics.

2.1.2.2 Profile sheets and cover layers of sandwich elements

The following requirements apply for the materials of the profiled sheets or the fastening cover layers:

$R_m > 390$ N / mm^2 for profile sheets made of steel and

$R_m \geq 195$ N/mm^2 for profiled sheets made of aluminium.

2.1.2.3 Core material of the sandwich elements, that are fastened with the solar fasteners

The use of solar fasteners is approved for sandwich elements with a polyurethane core.

The following minimum requirements apply for the core material:

Tensile strength of the core material with cover layer $f_{Ct} \geq 0.06$ N/mm^2

Shear strength of the core material $f_{Cv} \geq 0.05$ N/mm^2

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A proof of usability admitted for use by the building inspector must be presented for the sandwich elements.

2.1.2.4 Substructure

If the solar fastener JZ3-SB-8.0 x L is used, the substructure must consist of the steel grades S235 according to DIN EN 10025-2:2005-04 or S280GD or S320GD according to DIN EN 10326:2004-09.

The use of the solar fasteners JA3-SB-8.0 x L and JA3-SB-10.0 x L is intended for a substructure made of softwood with minimum strength class C24 according to DIN 1052:2004-08.

2.1.3 Corrosion protection

The solar fasteners are resistant to corrosion and therefore do not require any further corrosion protection.

2.2 Marking

The package of the solar fasteners or the enclosed packing slip must be marked by the manufacturer with the conformity mark Ü (Ü-mark) in accordance with the decrees for conformity marking of the States of the Federal Republic of Germany. Marking is only permitted if the conditions specified in clause 2.3 are satisfied.

Every package shall have an additional label with information about the factory (factory code), the description, the geometry and the material of the solar fastener.

2.3 Verification of conformity

2.3.1 General

Proof of conformity of the construction product manufactured according to this national technical approval shall be delivered by means of a certificate of conformity issued for each manufacturing plant and based on factory production control and continuous external monitoring including initial-type testing of the solar fasteners in accordance with the following provisions.

The manufacturer of the solar fasteners shall involve an accredited certification body and an accredited monitoring body for the granting of the certificate of conformity and for the external monitoring including the related product inspections.

The manufacturer has to mark the building products with the conformity mark (Ü-mark) referring to the intended use to proof that a certificate of conformity has been issued.

The certification body shall submit a copy of the relevant certificate of conformity to the Deutsches Institut für Bautechnik for information.

For the scope, way and frequency of the factory production control and the external monitoring, the approval principles of the Deutsches Institut für Bautechnik for the "verification of conformity for screws in lightweight metal construction" (see issue 6/1999 of "DIBt Mitteilungen") apply accordingly.

2.3.2 In-house production control

Every manufacturing plant shall set-up and implement in-house production control. In-house production control means continuous monitoring of production to be performed by the manufacturer, by means of which the latter ensures that the construction products produced by him are in conformity with this national technical approval.

Additionally to the tests listed under 2.3.1, bending tests on three solar fasteners of each production unit have to be carry out. In doing so, a bending angle of at least 45° without rupture has to be reached with the welded-on threaded pins.

The results of the factory production control must be recorded and evaluated. The records must contain at least the following information:

- designation of the construction product and the initial material and the components
- type of the control or inspection
- date of manufacture and date of testing the construction product or the initial material or the components
- results of the controls and tests and comparison with the requirements deposited at the Deutsches Institut für Bautechnik
- signature of the person responsible for in-house production control.

The records must be kept for at least five years and submitted to the monitoring body involved in the external monitoring process. These must be submitted to the Deutsche Institut für Bautechnik and the responsible supreme building authority on request.

In the event of unsatisfactory test results, the manufacturer must implement the necessary measures to rectify the defect immediately. Construction products that do not fulfil the requirements must be handled in such a way that mix-ups with flawless products are excluded. After rectification of the defect – insofar as technically possible and required as proof that the defect has been rectified – the corresponding test must be repeated immediately.

2.3.3   External monitoring

The in-house production control processes performed in every manufacturing plant must be checked regularly, at least once a year, through external monitoring.

In the course of the external monitoring, an initial-type testing of the solar fasteners and random sampling testing must be performed.

The sampling and testing procedures are the responsibility of the accredited body.

The results of the certification and external monitoring processes must be kept for at least five years. The certification body and/or monitoring body must submit these to the Deutsche Institut für Bautechnik and the responsible supreme building authority on request.

3   Provisions for design and dimensioning

3.1   Design

If the solar fasteners are loaded crosswise to the profiled sheets or the sandwich elements, the profiled sheets or sandwich elements must be fastened to the substructure at the same height in the neighbouring troughs (see Figure 1). Those fastening elements must be designed in such way that the shear forces are transferred from the solar fasteners to the substructure. In the case of shear forces from the solar fasteners in the longitudinal direction of the profiled sheets or sandwich elements, more remote connections of the corresponding profiled sheet with the substructure are also permitted to be included for the load transfer.

The distance from the edge of the solar fasteners in stress direction of the sandwich elements must be at least 250 mm, and the distance of the solar fasteners in stress direction among themselves must be at least 500 mm. A fastening in the ridge ribs is not permitted.
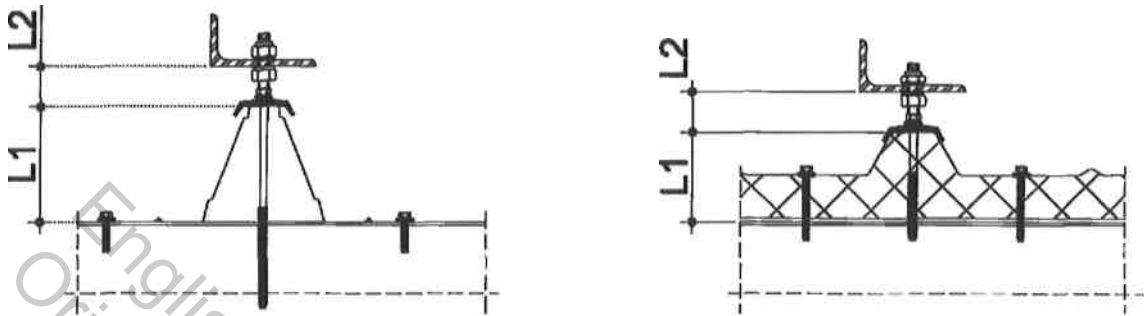
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Figure 1

3.2 Dimensioning

3.2.1 General

The verification concept in connection with the national appendix stated in DIN EN 1990:2012-12 applies.

3.2.2 Characteristic values for load-bearing capacity

3.2.2.1 Characteristic values of the tensile and compressive strength $N_{R,k}$

Solar fastener JZ3-SB-8.0 x L:

Table 1

	Thickness of the substructure [mm]			
	1.5	2.00	3.00	≥ 4
$N_{R,k}$ [kN]	2.20	3.40	5.80	6.80

For intermediate values of the thickness of the substructure, $N_{R,k}$ for the smaller component thickness must be selected.

In case of thin-walled ($t_{\parallel} ≤ 2.00$ mm), non-symmetrical substructures (e.g. B, C or Z profiles), the characteristic load-bearing values $N_{R,k}$ must be reduced by 30%.

Solar fastener JA3-SB-8.Q x L:

$N_{R,k} = 0.0686 \cdot k_{mod} \cdot l_{ef}$ [kN/mm]   mit $l_{ef} ≥ 32$ mm und $l_{ef} ≤ 0.6 \cdot L$
or according to Appendix 2, Table 4

l_{ef} - effective screw-in length in the wood substructure

k_{mod} - modification factor according to DIN 1052:2004-08, Appendix F

L   - length of the screw according to Appendix 1

Solar fastener JA3-SB-10.0 x L:

$N_{R,k} = 0.0858 \cdot k_{mod} \cdot l_{ef}$ [kN/mm]   mit $l_{ef} ≥ 40$ mm und $l_{ef} ≤ 0.6 \cdot L$
or according to Appendix 2, Table 4

In the case of compression load, the solar fasteners must also   be examined for buckling.

Characteristic value of the compressive strength for buckling:

$N_{R,k} = 1.1 \cdot (K \cdot N_{pl,d})$

$κ \cdot N_{pl,d}$ see Appendices 3 and 4, Tables 5 to 7

The smaller value for $N_{R,k}$ is decisive.

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3.2.2.2 Characteristic values of the shear resistance $V_{R,k}$

$$V_{R,k} = \min\left\{\frac{F_{L,k}\cdot L1}{(L1+L2)}; \frac{M_{lp,k}}{L2}\right\}$$

L1 and L2 see Appendix 1

Table 2 values for $F_{L,k}$ in kN

Profiled sheets or cover caps made of steel with $R_m \leq 390$ N/mm^2			Profiled sheets or cover caps made of aluminium with $R_m \leq 195$ N/mm^2		
$t_N = 0.40$ mm	$t_N = 0.55$ mm	$t_N \geq 0.63$ mm	$t_N = 0.50$ mm	$t_N = 0.60$ mm	$t_N \geq 0.70$ mm
0.64	1.63	1.86	0.53	0.82	1.11

t_N – nominal sheet thickness of the profiled sheets or cover caps of the sandwich elements

$M_{pl,k} = 33.35$ Nm   for solar fastener JZ3-SB-8.0 x L
$M_{pl,k} = 40.66$ Nm   for solar fastener JA3-SB-8.0 x L and JA3-SB-10,0 x L

3.2.3   Design values of load-bearing capacity

The following applies for the calculation of the load-bearing capacity design values from the characteristic values:

$$N_{R,d} = \frac{N_{R,k}}{\gamma_M}$$

$$V_{R,d} = \frac{N_{V,k}}{\gamma_M}$$

With $\gamma_M = 1.33$

3.2.4   Combined load of tensile or compression forces and shear forces

In the case of combined load due to the design values of the acting tensile forces N and shear forces V, no reduction is required. In the case of simultaneous compression and shear forces, the following simplified buckling resistance equation must also be made:

$$\frac{N}{\kappa \bullet N_{pl,d}} + \frac{V+L2}{M_{pl,d}} \leq 1,0$$

$\kappa \bullet N_{pl,d}$ see Appendix 3 and 4, Tables 5 to 7

$M_{pl,d} = M_{pl,k} / \gamma_M$ $\gamma_M = 1.1$

$M_{pl,d} = 30.3$ Nm   for solar fastener JZ3-SB-8.0xL
$M_{pl,d} = 37.0$ Nm   for solar fastener JA3-SB-8.0 x L and JA3-SB-10.0 x L

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4 Provisions for execution

The solar fasteners shall be mounted exclusively in accordance with the manufacturer information. The manufacturer gives the installation instructions to the company performing the work.

Connections with solar fasteners according to clause 1 must only be made by companies who have the necessary experience for this unless there is instruction of the installation personnel by specialists experienced in this field.

It must be ensured during the installation that no contact corrosion can occur and that no compressive and tensile forces are fed into the profiled sheets and sandwich elements.

The profiled sheets or sandwich elements and the substructure must be predrilled according to the information in Table 3.

The use of impact screwdrivers for the installation of the solar fasteners is not permitted.

The solar fasteners must be installed at right angles to the component surface in order to ensure correct load bearing and, if necessary, rain-proof connection.

When mounting the solar fasteners with sandwich elements, mind that the cover caps are not excessively deformed.

Table 3 Predrilling diameter in mm

Solar fastener	Thickness of the substructure made of:					[mm]
	Steel				Wood	
	1.5 ...< 5.0	5.0 ...< 7.5	7.5 ...< 10	≥ 10	≥ 32	≥ 40
JZ3-SB-8.0 x L	6.8	7.0	7.2	7.4	-	-
JA3-SB-8.0 x L	-	-	-	-	5.5	5.5
JA3-SB-10.0xL	-	-	-	-	-	7.0

Andreas Schult
Head of division

Certified

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**JA3-SB-8.0 x L und JA3-SB-10.0 x L
for wood substructures**

Screw

M10

ø8 JA3-SB-8,0
ø10 JA3-SB-10,0

L

Threaded pin
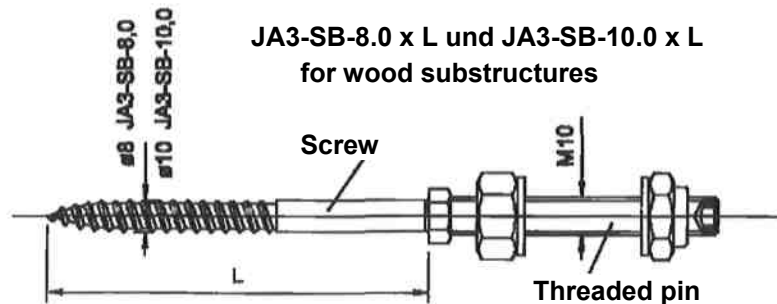
JZ3-SB-8.0 x L for substructures made of steel

Screw

M10

ø8

L

Threaded pin
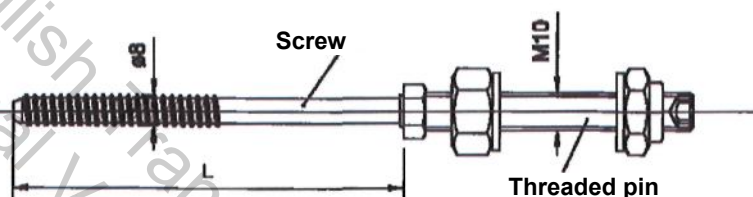
**Example for the use of the solar fastener JZ3-SB-8.0 for trapezoidal profiled sheets
and sandwich elements on a substructure made of steel**

Screw nut M10

disc M10

Angle 100x50x3

screw nut M10 seal

disc E1678

EJOT Orkan Kalotte

**Solar
fastener for
the
fastening of
solar
installations**

L2

L1

L2

L1
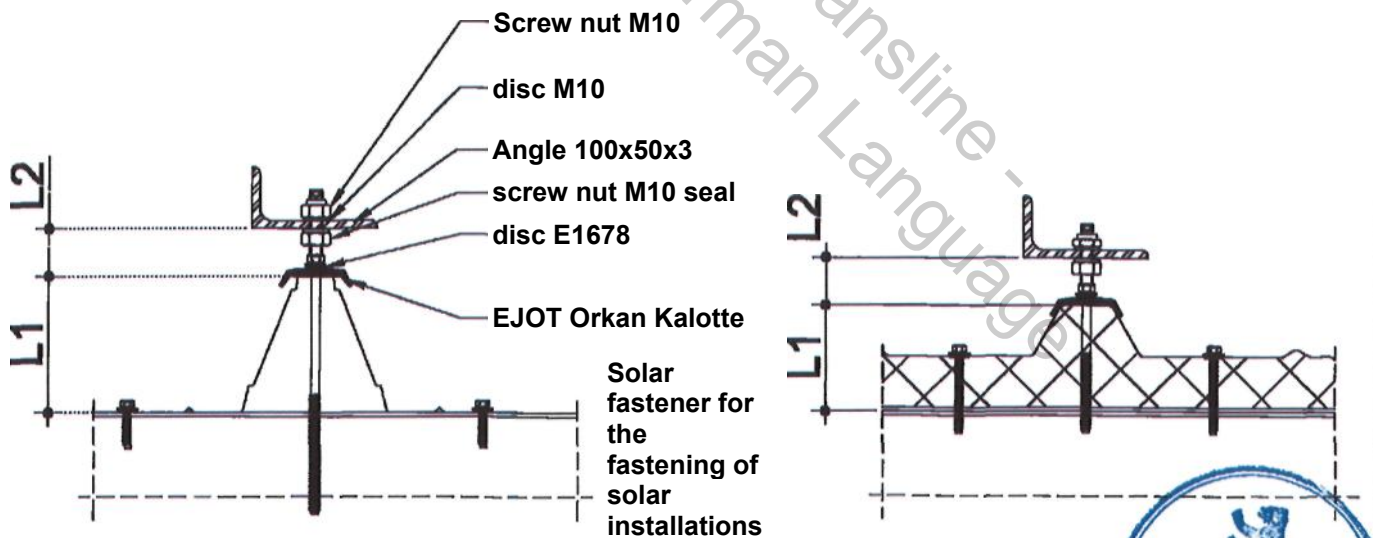
**L1 – Distance between the top edge of the substructure which the
solar fastener is screwed into (this does not have to be the
substructure for the profiled sheets and can be deeper) and
profiled sheet top edge**

**Solar fastener JZ3-SB-8.0 x L JA3-SB-8.0 x L JA3-SB-10.0 x L
Examples for the use**

Appendix
1

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Table 4   Characteristic load-bearing values $N_{R|k}$ in kN in relation to extract for JA3-SB-8.0 x L and JA3-SB-10 x L made of softwood in the strength class C24, usage class 2

screw-in depth l_{ef} in mm	permanently $k_{mod} = 0.6$ longer than 10 years (usually		long $k_{mod} = 0.7$ 6 months to 10 years		medium $k_{mod} = 0.8$ 1 week to 6 months (usually snow)		short $k_{mod} = 0.9$ less than 1 week (usually wind)		very short $k_{mod} = 1.1$ less than 1 minute	
	d = 8.0	d = 10	d = 8.0	d = 10	d = 8.0	d = 10	d = 8.0	d = 10	d = 8.0	d = 10
32	1.32	-	1.54	-	1.76	-	1.98	-	2.42	-
40	1.65	2.06	1.92	2.40	2.20	2.74	2.47	3.09	3.02	3.77
45	1.85	2.32	2.16	2.70	2.47	3.09	2.78	3.47	3.40	4.25
48	1.98	2.47	2.31	2.88	2.63	3.29	2.96	3.70	3.62	4.53
50	2.06	2.57	2.40	3.00	2.74	3.43	3.09	3.86	3.77	4.72
56	2.31	2.88	2.69	3.36	3.07	3.84	3.46	4.32	4.23	5.28
60	2.47	3.09	2.88	3.60	3.29	4.12	3.70	4.63	4.53	5.66
64	2.63	3.29	3.07	3.84	3.51	4.39	3.95	4.94	4.83	6.04
70	2.88	3.60	3.36	4.20	3.84	4.80	4.32	5.40	5.28	6.60
72	2.96	3.70	3.46	4.32	3.95	4.94	4.45	5.56	5.43	6.79
80	3.29	4.12	3.84	4.80	4.39	5.49	4.94	6.17	6.04	7.55
85	3.50	4.37	4.08	5.10	4.67	5.83	5.25	6.56	6.41	8.02
88	3.62	4.53	4.23	5.28	4.83	6.04	5.43	6.79	6.64	8.30
90	3.70	4.63	4.32	5.40	4.94	6.17	5.56	6.95	6.79	8.49
96	3.95	4.94	4.61	5.76	5.27	6.59	5.93	7.41	7.24	9.06
100	4.12	5.15	4.80	6.00	5.49	6.86	6.17	7.72	7.55	9.43
104	4.28	5.35	4.99	6.24	5.71	7.13	6.42	8.03	7.85	9.81
110	4.53	5.66	5.28	6.60	6.04	7.55	6.79	8.49	8.30	10.38
112	4.61	5.76	5.38	6.72	6.15	7.68	6.92	8.64	8.45	10.57
120	4.94	6.17	5.76	7.20	6.59	8.23	7.41	9.26	9.06	11.32

Characteristic load-bearing values $N_{R,k}$ for the solar fastener JA3-SB-8.0 x L (d = 8) and JA3-SB-10.0xl_(d = 10) depending on the accumulated load duration and the screw-in depth l_{ef}

Solar fastener for the fastening of solar installations

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Table 4
Characteristic load-bearing values $N_{R,k}$ for the JA3-SB-8.0 x L and JA3-SB-10 x L

Appendix 2

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Table 5   κ • $N_{pl,d}$ in kN   for the solar fastener **JA3-SB-8.0 x L**

L_1 in mm	L_2 in mm							
	30	40	50	60	70	80	90	100
70	6.14	5.22	4.52	3.96	3.52	3.16	2.86	2.60
80	5.28	4.52	3.93	3.46	3.08	2.77	2.52	2.30
90	4.59	3.95	3.45	3.05	2.73	2.46	2.24	2.05
100	4.02	3.48	3.06	2.72	2.44	2.21	2.01	1.84
110	3.55	3.09	2.73	2.44	2.19	1.99	1.82	1.67
120	3.15	2.77	2.45	2.20	1.98	1.81	1.65	1.52
130	2.82	2.49	2.22	1.99	1.81	1.65	1.51	1.40
140	2.54	2.25	2.02	1.82	1.65	1.51	1.39	1.29
150	2.29	2.05	1.84	1.67	1.52	1.39	1.28	1.19
160	2.08	1.87	1.69	1.53	1.40	1.29	1.19	1.10
170	1.90	1.71	1.55	1.41	1.30	1.19	1.11	1.03
180	1.74	1.57	1.43	1.31	1.20	1.11	1.03	0.96
190	1.60	1.45	1.33	1.22	1.12	1.04	0.96	0.90
200	1.47	1.34	1.23	1.13	1.05	0.97	0.90	0.84

Table 6   κ • $N_{pl,d}$ in kN   for the solar fastener **JA3-SB-10.0 x L**

L_1 in mm	L_2 in mm							
	30	40	50	60	70	80	90	100
70	14.30	12.04	10.29	8.90	7.79	6.89	6.14	5.51
80	12.40	10.52	9.04	7.87	6.92	6.14	5.50	4.96
90	10.83	9.26	8.01	7.01	6.20	5.52	4.96	4.49
100	9.53	8.21	7.15	6.29	5.58	5.00	4.51	4.09
110	8.44	7.32	6.42	5.67	5.06	4.55	4.12	3.75
120	7.53	6.57	5.79	5.15	4.61	4.16	3.78	3.45
130	6.75	5.93	5.26	4.69	4.22	3.82	3.48	3.18
140	6.08	5.38	4.79	4.30	3.88	3.52	3.22	2.95
150	5.51	4.90	4.38	3.95	3.58	3.26	2.98	2.74
160	5.01	4.48	4.03	3.64	3.31	3.02	2.78	2.56
170	4.57	4.11	3.71	3.37	3.07	2.81	2.59	2.39
180	4.17	3.78	3.43	3.13	2.86	2.63	2.42	2.24
190	3.86	3.50	3.18	2.91	2.67	2.46	2.27	2.11
200	3.56	3.24	2.96	2.71	2.49	2.30	2.13	1.98

Solar fastener for the fastening of solar installations

Table 5   κ • $N_{pl,d}$ for the solar fastener JA3-SB-8.0 x L **Table 6**   κ • $N_{pl,d}$ for the solar fastener JA3-SB-10,0 x L

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Appendix 3

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Table 7 $\kappa \cdot N_{pl,d}$ in kN for the solar fastener **JZ3-SB-8.0 x L**

L_1 in mm	L_2 in mm							
	30	40	50	60	70	80	90	100
70	8.32	7.15	6.22	5.47	4.86	4.36	3.94	3.58
80	7.27	6.27	5.47	4.83	4.30	3.87	3.50	3.19
90	6.39	5.53	4.85	4.30	3.84	3.46	3.14	2.87
100	5.65	4.92	4.33	3.85	3.45	3.12	2.84	2.60
110	5.02	4.37	3.87	3.47	3.12	2.83	2.58	2.37
120	4.49	3.95	3.51	3.14	2.84	2.58	2.36	2.17
130	4.03	3.57	3.19	2.86	2.59	2.36	2.17	2.00
140	3.64	3.24	2.90	2.62	2.38	2.18	2.00	1.85
150	3.30	2.95	2.66	2.41	2.19	2.01	1.85	1.71
160	3.01	2.70	2.44	2.22	2.03	1.86	1.72	1.59
170	2.75	2.48	2.25	2.05	1.88	1.73	1.60	1.49
180	2.53	2.27	2.08	1.90	1.75	1.61	1.50	1.39
190	2.33	2.12	1.93	1.77	1.63	1.51	1.40	1.31
200	2.15	1.96	1.80	1.65	1.53	1.41	1.32	1.23

Solar fastener fort he fatsening of solar installations
Table 7 $\kappa \cdot N_{pl,d}$ for the solar fatsener JZ3-SB

Appendix 4