BUILDING COMMON GROUND

MAX FRANK®

European Technical Assessment

MAX FRANK Coupler

ETA-20/0387 | 2020/09/04 | english

Couplers for mechanical splices of reinforcing steel bars

Tested by: DIBt, Berlin

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Deutsches Institut für Bautechnik

Member of EOTA
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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment ETA-20/0387 of 4 September 2020

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	Max Frank Coupler
Product family to which the construction product belongs	Couplers for mechanical splices of reinforcing steel bars
Manufacturer	Max Frank GmbH & Co KG Mitterweg 1 94339 Leiblfing DEUTSCHLAND
Manufacturing plant	Max Frank GmbH & Co. KG Mittlerweg 1 94339 Leiblfing DEUTSCHLAND
This European Technical Assessment contains	14 pages including 3 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 160129-00-0301, Edition 01/2020

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Specific part

1 Technical description of the product

The Max Frank Coupler is used as a mechanical, screwed system for connecting reinforcing bars in reinforced concrete components and for connecting to steel components under static or quasi-static, fatigue and low cycle loading.

The product description is given in Annex A.

The characteristic material values, dimensions and tolerances of the Max Frank Coupler not indicated in Annexes A1 to A4 shall correspond to the respective values laid down in the technical documentation[1] of this European technical assessment.

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

The performances given in Section 3 are only valid if the Max Frank Coupler is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the Max Frank Coupler of at least 100 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
Resistance to static or quasi-static loading	See Annex C1 – C3
Slip under static or quasi-static load	See Annex C1 – C3
Slip after static or quasi-static load	See Annex C1 – C3
Fatigue strength for $N = 2 \cdot 10^6$ load cycles	No performance assessed
Fatigue strength for S-N curve with k_1 and k_2 according to EN 1992-1-1	No performance assessed
Fatigue strength for S-N curve with specific k_1 and k_2	See Annex C2 and C3
Resistance to low cycle loading (seismic actions)	See Annex C1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

[1] The technical documentation of this European technical assessment is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

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

In accordance with EAD 160129-00-0301 the applicable European legal act is: 2000/606/EC.
The system to be applied is: 1+

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 with Deutsches Institut für Bautechnik.

The following standards are referred to in this European Technical Assessment:

– EN 1992–1–1:2004 + AC:2010 + A1:2014	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
– EN 1998–1:2004 + AC:2009 + A1:2013	Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings
– EN 10083–3:2006	Steels for quenching and tempering – Part 3: Technical delivery conditions for alloy steels
– EN ISO 6789:2003	Assembly tools for screws and nuts - Hand torque tools - Requirements and test methods for design conformance testing, quality conformance testing and recalibration (ISO 6789:2003)
– GB/T 3077:2015	Alloy structure steels

Issued in Berlin on 4 September 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Kisan

Deutsches Institut für Bautechnik DIBt

A.1 Type overview Max Frank Coupler

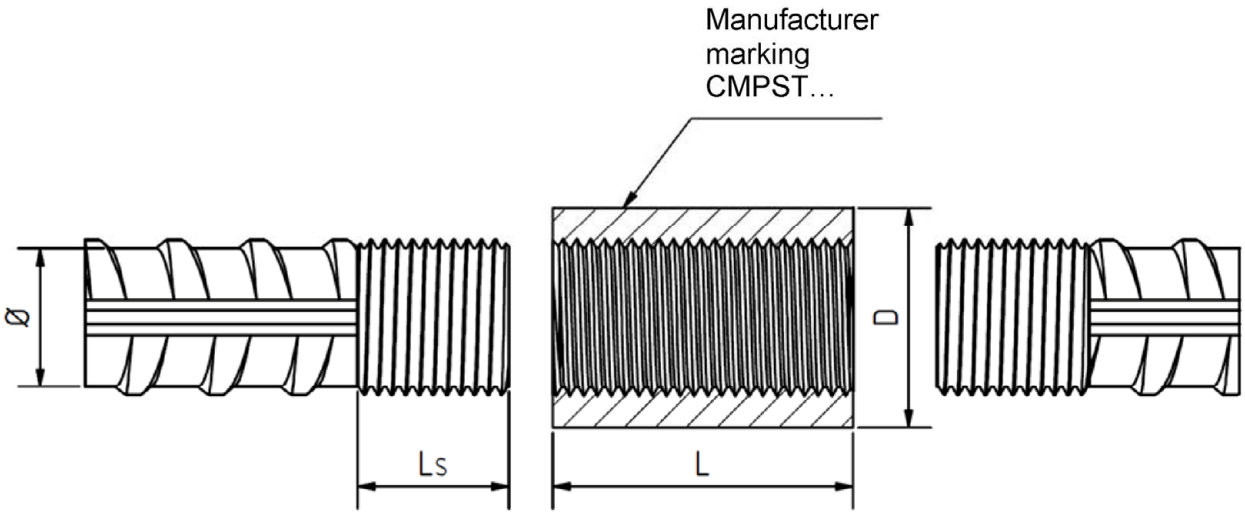

Figure A 1 Standard Coupler

Table A 1 Dimensions Standard Coupler

Rebar nominal diameter Ø [mm]	Coupler external diameter D [mm]	Coupler length L [mm]	Screw-in depth L_S [mm]	Thread dimensions [mm]	Torque [Nm]
12	20	28	14	M14,0 x 2,0	40
14	23	32	16	M16,0 x 2,0	80
16	26	36	18	M18,5 x 2,0	120
18	28,5	40	20	M20,5 x 2,0	150
20	32	44	22	M22,5 x 2,0	180
22	34,5	48	24	M24,5 x 2,0	220
24	38	54	27	M27,5 x 2,5	270
25	38	54	27	M27,5 x 2,5	270
26	38	54	27	M27,5 x 2,5	270
28	42	60	30	M30,5 x 2,5	270
32	48	68	34	M34,5 x 2,5	300
36	56,5	78	39	M39,5 x 3,0	300
40	61	85	42,5	M43,5 x 3,0	350

Max Frank Coupler	**Annex A 1**
Product description – Standard Coupler	

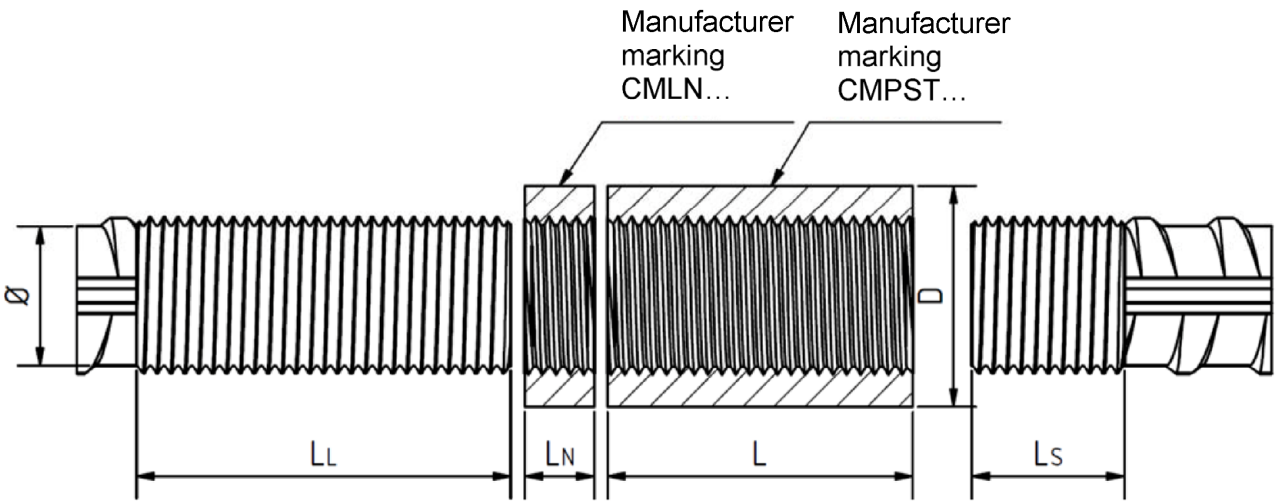

Figure A 2 Positional Coupler

Table A 2 Dimensions Positional Coupler

Rebar nominal diameter Ø [mm]	Coupler external diameter D [mm]	Coupler length L [mm]	Screw-in depth L_S [mm]	Thread length L_L [mm]	Nut length L_N [mm]	Thread dimensions [mm]	Torque [Nm]
12	20	28	14	37	9	M14,0 x 2,0	40
14	23	32	16	41	9	M16,0 x 2,0	80
16	26	36	18	45	9	M18,5 x 2,0	120
18	28,5	40	20	49	9	M20,5 x 2,0	150
20	32	44	22	53	9	M22,5 x 2,0	180
22	34,5	48	24	57	9	M24,5 x 2,0	220
24	38	54	27	67	13	M27,5 x 2,5	270
25	38	54	27	67	13	M27,5 x 2,5	270
26	38	54	27	67	13	M27,5 x 2,5	270
28	42	60	30	73	13	M30,5 x 2,5	270
32	48	68	34	81	13	M34,5 x 2,5	300
36	56,5	78	39	91	13	M39,5 x 3,0	300
40	61	85	42,5	98	13	M43,5 x 3,0	350

Max Frank Coupler

Product description – Positional Coupler

Annex A 2

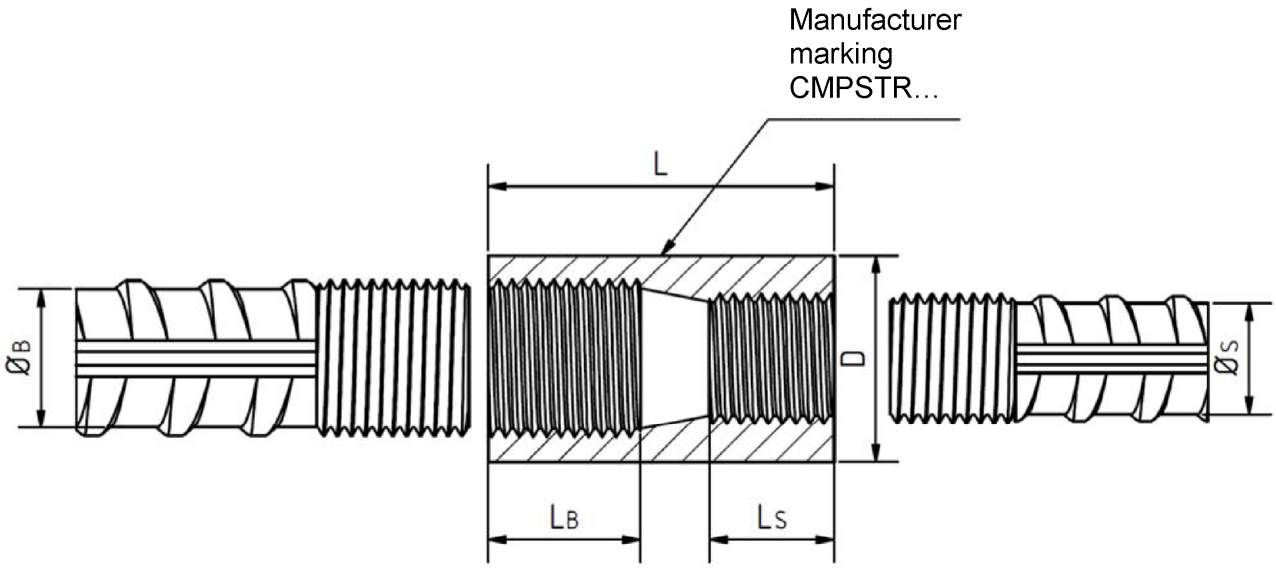

Figure A 3 Transition Couplers

Table A 3 Dimensions Transition Couplers

Rebar nominal diameter $Ø_B$ bar B [mm]	Rebar nominal diameter $Ø_S$ bar S [mm]	Coupler external diameter D [mm]	Coupler length L [mm]	Screw-in depth L_B [mm]	Screw-in depth L_S [mm]	Thread dimensions bar B [mm]	Thread dimensions bar S [mm]	Torque bar B [Nm]	Torque bar S [Nm]
14	12	23	35	16	14	M16,0 x 2,0	M14,0 x 2,0	80	40
16	14	26	39	18	16	M18,5 x 2,0	M16,0 x 2,0	120	80
18	16	28,5	43	20	18	M20,5 x 2,0	M18,5 x 2,0	150	120
20	16	32	45	22	18	M22,5 x 2,0	M18,5 x 2,0	180	120
20	18	32	47	22	20	M22,5 x 2,0	M20,5 x 2,0	180	150
22	20	34,5	51	24	22	M24,5 x 2,0	M22,5 x 2,0	220	180
22	18	34,5	49	24	20	M24,5 x 2,0	M20,5 x 2,0	220	150
25	22	38	56	27	24	M27,5 x 2,5	M24,5 x 2,0	270	220
25	20	38	54	27	22	M27,5 x 2,5	M22,5 x 2,0	270	180
28	25	42	64	30	27	M30,5 x 2,5	M27,5 x 2,5	270	270
28	22	42	61	30	24	M30,5 x 2,5	M24,5 x 2,0	270	220
28	20	42	59	30	22	M30,5 x 2,5	M22,5 x 2,0	270	180
32	28	48	71	34	30	M34,5 x 2,5	M30,5 x 2,5	300	270
32	25	48	68	34	27	M34,5 x 2,5	M27,5 x 2,5	300	270
36	32	56,5	80	39	34	M39,5 x 3,0	M34,5 x 2,5	300	300
36	28	56,5	76	39	30	M39,5 x 3,0	M30,5 x 2,5	300	270
40	36	61	88,5	42,5	39	M43,5 x 3,0	M39,5 x 3,0	350	300
40	32	61	83,5	42,5	34	M43,5 x 3,0	M34,5 x 2,5	350	300
40	28	61	79,5	42,5	30	M43,5 x 3,0	M30,5 x 2,5	350	270

Max Frank Coupler

Annex A 3

Product description – Transition Coupler

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A.2 Materials

Sleeve steel:	40Cr according to GB/T 3077,
	1.7035, 1.7039, 1.7225 or 1.7227 according to EN 10083-3
	and according to deposited technical specification
Reinforcing steel:	B450C, B500B or B500C

Max Frank Coupler	**Annex A 4**
Product description – Materials	

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B.1 Intended use

Max Frank Couplers are used as mechanical coupling in accordance with EN 1992-1-1 and EN 1998-1 and annex C for reinforcing steel bars B450C, B500B and B500C with a nominal diameter of 12 to 40 mm in accordance with EN 1992-1-1, clause C.1 for:

- Transmission of static or quasi static tension and compression loads according to EN 1992-1-1, clauses 8.7 and 8.8 (4),
- Limitation of slip according to EN 1992-1-1, clause 7.3,
- Transmission of high-cycle fatigue loads with fatigue resistance according to EN 1992-1-1, clause 6.8.4,
- Resistance to low-cycle seismic loading according to EN 1998-1, clause 5.6.3 (2).

The rebar connection is primarily used for force transmission in construction joints.

The “Max Frank Coupler” system allows the following rebar coupling variants:

- Standard coupler where the connecting rebar can move along the axis and rotate freely,
- Positional coupler where the movement of the connecting bar is restricted (e.g. cannot be rotated because bent or offset and/or cannot move along the axis),
- Transition coupler for connecting rebars with different nominal diameters.

The screw couplers have metric internal threads. The bar ends to be connected are provided with metric external threads.

The bar ends are screwed into the internal threads of the couplers and locked in the coupling threads to a specified torque to reduce the slip.

Max Frank Coupler	**Annex B 1**
Intended use – design	

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B.1 Installation requirements

- All rebars may be coupled in one cross section (full joint).
- The same values as for non-lapped bars shall apply to the concrete cover over the outer edge of a coupler as well as to the clear distances between the outer edges of adjacent couplers in accordance with EN 1992-1-1, clauses 4.4.1 and 8.2. The spacing necessary for installation shall remain unaffected.
- In case of bent (pre-bent) bars, the planned bending shall not begin until a distance of at least 5 Ø from the end of the coupler (Ø = nominal diameter of the bent bar). If coupling bars are bent at the manufacturing plant using a special equipment, the distance may be reduced to 2 Ø.
- The couplers shall only be installed by appropriately trained personnel in accordance with the manufacturer's instructions. These installation instructions are part of the accompanying documents.
- Only coupling elements that are marked in accordance with annex A shall be used.
- The required displacement and rotation of the bars shall be given.
- The threads of the bars and coupling elements shall be free of rust and contamination.
- Only torque tools whose functionality and precision have been tested in accordance with EN ISO 6789-1 shall be used for tightening the screw coupler connections. The torque to be applied is given in annexes A. The torque wrench shall be checked before and during use to ensure compliance with the requirements.

Max Frank Coupler	**Annex B 2**
Intended use – installation requirements	

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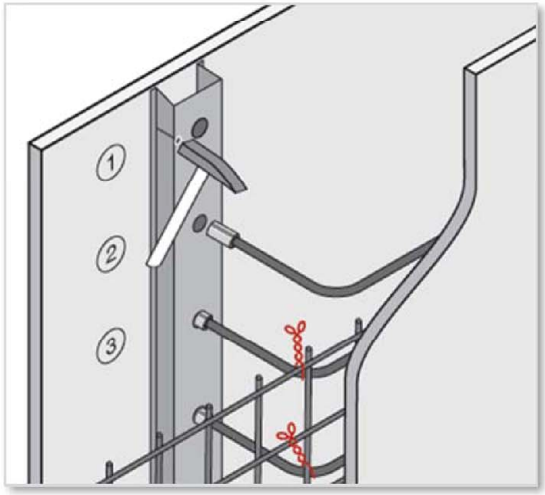
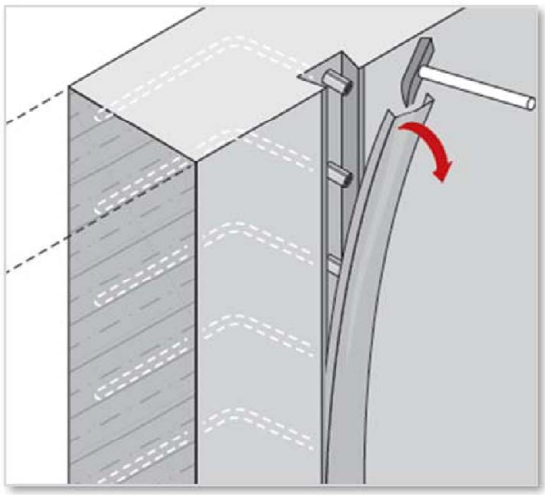
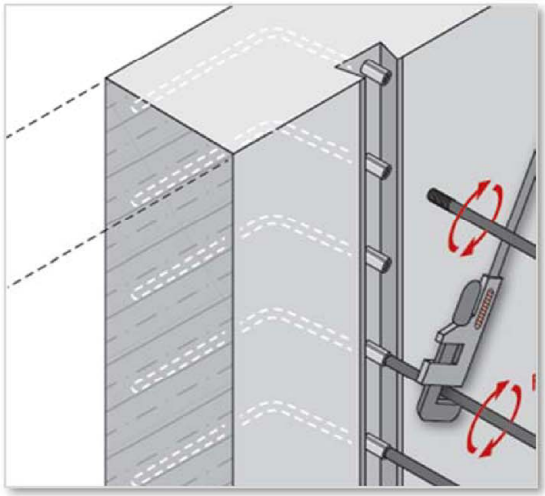
Installation manual



Fixing of Coupler bars in the first construction stage, e.g. as shown with mounting box on the formwork.



Stripping the formwork and opening the mounting box



Screwing in the bars of the second construction stage and applying the necessary torque.

Max Frank Coupler	**Annex B 3**
Intended use – installation requirements	

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C.1 Performance parameters

C.1.1 Connection with reinforcing steel B450C

Nominal diameter Ø [mm]	Resistance to static or quasi-static loading (tension and compression) [1] $f_{u,min,bar,outside}$ [N/mm²]	Slip under static or quasi-static loading [2] s_1 [mm]	Slip after static or quasi-static loading [3] s_2 [mm]	Resistance to low-cycle loading (seismic actions) [4]	
				u_{20} [mm]	$F_{u,min}$ [kN]
12	518	0,1	0,1	0,3	58,6
14					79,7
16					104,2
18					131,8
20					162,7
22					196,9
24					234,3
25					254,3
26					275,0
28					319,0
32					416,6
36					470,3
40					650,9

[1] $f_{u,min,bar,outside} = f_{yk} \cdot 1{,}15$ with $f_{yk} = 450$ N/mm²

[2] Slip within the connection under loading measured at $0{,}6 \cdot f_{yk}$

[3] Slip within the connection after loading measured at $0{,}02 \cdot f_{yk}$

[4] $F_{u,min} = \left(\frac{\pi \cdot Ø^2}{4}\right) \cdot f_{u,min}$

Max Frank Coupler	**Annex C 1**
Performance parameters for connections with B450C	

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C.1.2 Connection with reinforcing steel B500B

Nominal diameter Ø [mm]	Resistance to static or quasi-static loading (tension and compression)[1] $f_{u,min,bar,outside}$ [N/mm²]	Slip under static or quasi-static loading[2] s_1 [mm]	Slip after static or quasi-static loading[3] s_2 [mm]	Fatigue strength for S-N curve with specific k_1 und k_2 with $N^*=10^7$		
				$\Delta\sigma_{Rsk}$ [N/mm²]	k_1 [-]	k_2 [-]
12	540	0,1	0,1	78 ($N = 2 \cdot 10^6$)	3	5
14						
16						
18						
20						
22						
24						
25						
26						
28						
32				68 ($N = 2 \cdot 10^6$)	2	3
36						
40						

[1] $f_{u,min,bar,outside} = f_{yk} \cdot 1{,}08$ with $f_{yk} = 500$ N/mm²

[2] Slip within the connection under loading measured at $0{,}6 \cdot f_{yk}$

[3] Slip within the connection after loading measured at $0{,}02 \cdot f_{yk}$

Max Frank Coupler

Performance parameters for connections with B500B

Annex C 2

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C.1.3 Connection with reinforcing steel B500C

Nominal diameter Ø [mm]	Resistance to static or quasi-static loading (tension and compression)[1] $f_{u,min,bar,outside}$ [N/mm²]	Slip under static or quasi-static loading[2] s_1 [mm]	Slip after static or quasi-static loading[3] s_2 [mm]	Fatigue strength for S-N curve with specific k_1 und k_2 with $N^*=10^7$		
				$\Delta\sigma_{Rsk}$ [N/mm²]	k_1 [-]	k_2 [-]
12	575	0,1	0,1	78 ($N = 2 \cdot 10^6$)	3	5
14						
16						
18						
20						
22						
24						
25						
26						
28						
32				68 ($N = 2 \cdot 10^6$)	2	3
36						
40						

[1] $f_{u,min,bar,outside} = f_{yk} \cdot 1{,}15$ with $f_{yk} = 500$ N/mm²

[2] Slip within the connection under loading measured at $0{,}6 \cdot f_{yk}$

[3] Slip within the connection after loading measured at $0{,}02 \cdot f_{yk}$

Max Frank Coupler

Performance parameters for connections with B500C

Annex C 3