Deutsches Institut für Bautechnik

Member of EOTA
www.eota.eu

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-21/0800 of 6 December 2021

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	HALFEN HBS-05 threaded coupler system
Product family to which the construction product belongs	Couplers for mechanical splices of reinforcing steel bars
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	Leviat Manufacturing Plants
This European Technical Assessment contains	23 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

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

The HALFEN HBS-05 threaded coupler system 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 HALFEN HBS-05 threaded coupler system not indicated in Annexes A1 to A9 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 HALFEN HBS-05 threaded coupler system 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 HALFEN HBS-05 threaded coupler system 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 – C5
Slip under static or quasi-static load	See Annex C1 – C5
Slip after static or quasi-static load	See Annex C1 – C5
Fatigue strength for $N = 2 \cdot 10^6$ load cycles	See Annex C1, C2, C4, C5
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 C1 – C5
Resistance to low cycle loading (seismic actions)	See Annex C1, C2

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 1090-1:2009 + A1:2011	Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components
– 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 10025–2:2019	Hot rolled products for structural steels – Part 2: Technical delivery conditions for non-alloy structural steels
– EN 10277:2018	Bright steel products – Technical delivery conditions
– EN 17660-1:2006	Welding – Welding of reinforcing steel – Part 1: Load-bearing welded joints (ISO 17660-1:2006)
– EN ISO 4032:2012	Hexagon regular nuts (style 1) – Product grades A and B (ISO 4032:2012)
– EN ISO 4035:2012	Hexagon thin nuts chamfered (style 0) – Product grades A and B (ISO 4035:2012)
– EN ISO 9606-1:2013	Qualification testing of welders – Fusion welding – Part 1: Steels (ISO 9606-1:2012, including Cor 1:2012)
– EN ISO 12944-5:2019	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems (ISO 12944-5:2019)
– EN ISO 15609-1:2019	Specification and qualification of welding procedures for metallic materials – Welding procedure specification– Part 1: Arc welding (ISO 15609-1:2019)

Issued in Berlin on 6. December 2021 by Deutsches Institut für Bautechnik

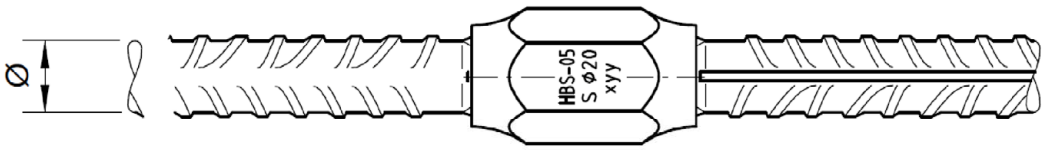
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Kisan

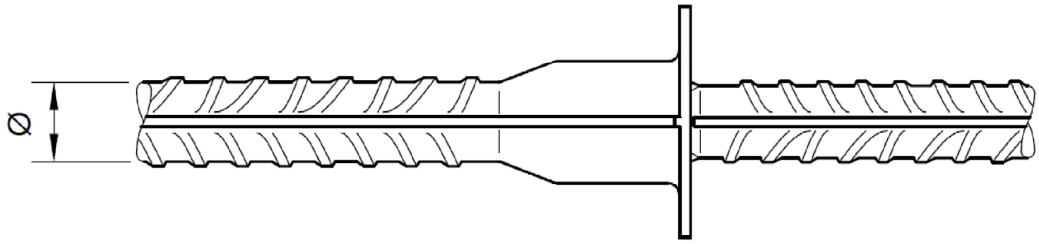
Deutsches Institut für Bautechnik DIBt

A.1 Design variants HBS-05 threaded coupler system

Variant with threaded sleeve



Variant with forged coupler



Variant with weldable coupler

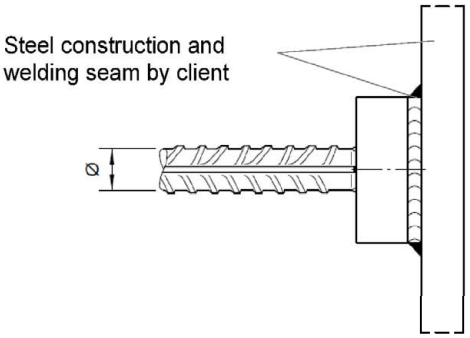


Table A1 Design variants

connections with	annex	∅										
		12	14	16	18	20	22	25	26	28	30	32
standard coupler	A4	B,R,H,J	B,R,H,J	B,R,H,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J
right-left-coupler	A4	B,R,H,J	B,R,H,J	B,R,H,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J
transition coupler	A5		B,H,J	B, H,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J
forged coupler	A6	B	B	B	B	B	B	B	B	B		
positioning coupler	A7, A8	B,H,J	B,H,J	B,H,J	B,J	B, J	B,J	B,J	B,J	B,J	B,J	B,J
weldable coupler	A9	B,H,J	B,H,J	B,H,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J	B,J

B: B500B

R: B500B NR

H: B500B product made of reinforcing steel in coils

J: B500C

permitted welding joint B500: butt joint in accordance with DIN EN ISO 17660-1, welding process 24 – flash butt welding

(under fatigue loading only for ∅ ≤ 25 mm)

Halfen threaded coupler system HBS-05

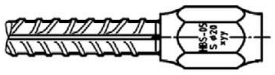
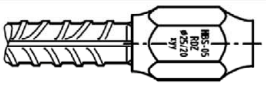
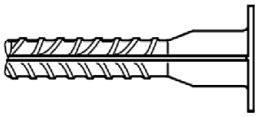
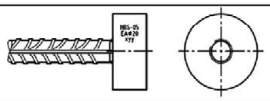
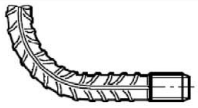
Product description
System overview, design variants

Annex A1

Deutsches Institut für Bautechnik DIBt

A.2 System overview installation elements

Table A2: installation elements of HBS-05 threaded coupler sytem

Designation	Illustration	Type	Material
			Sleeve
Standard coupler		HBS-05-S HBS-05-SG	A
Right-Left-Coupler		HBS-05-RL	A
Transition Coupler		HBS-05-RDZ	A
Forged Coupler		HBS-05-B	B
Positioning coupler consisting of long sleeve, threaded bolt and flat nut		HBS-05-P	Long sleeve: A Threaded bolt: C Nuts: D, A, E
Weldable coupler		HBS-05-EA	A, F, K
Continuation bar straight		HBS-05-A	
Continuation bar, bent		HBS-05-AG	

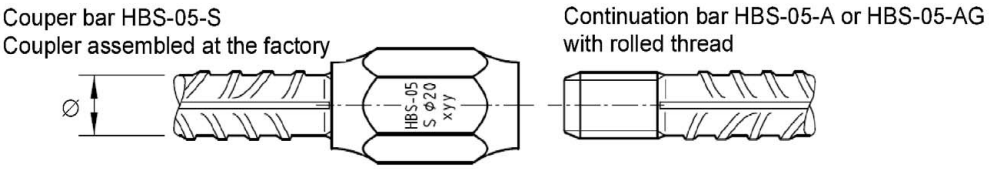
A: 11SMn30+C in accordance with EN 10277 (material no. 1.0715) / equivalent
B: B500B
C: threaded bolt, strength class 10.9
D: Hex nut, thin type, in accordance with DIN EN ISO 4035, strength class ≥ 04
E: Hex nut, thick type, in accordance with DIN EN ISO 4032, strength class 8
F: S235J0-N in accordance with DIN EN 10025-2 (material no. 1.0114+N) / equivalent
K: S235J2 in accordance with DIN EN 10025-2 (material no. 1.0117) / equivalent.

Halfen threaded coupler system HBS-05	Annex A2
Product description System overview: Installation elements	

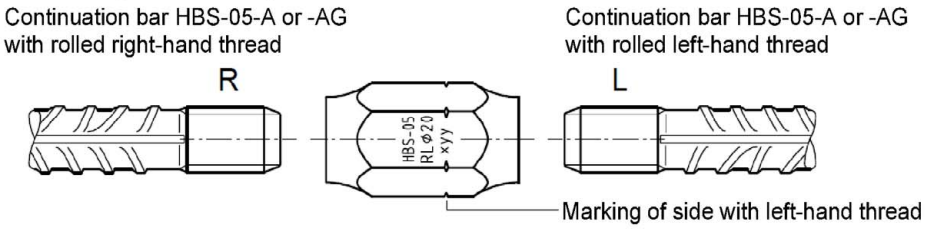
Deutsches Institut für Bautechnik DIBt

A.3 Installation principle

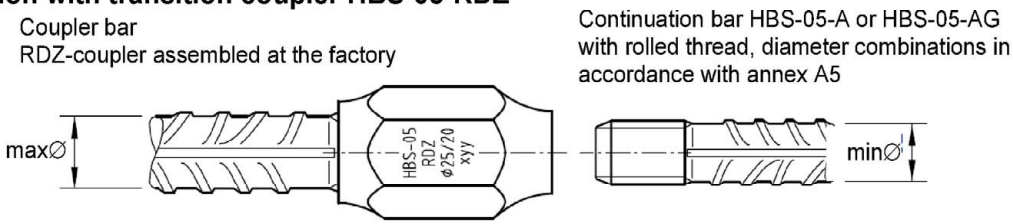
Connection with standard coupler HBS-05-S / -SG



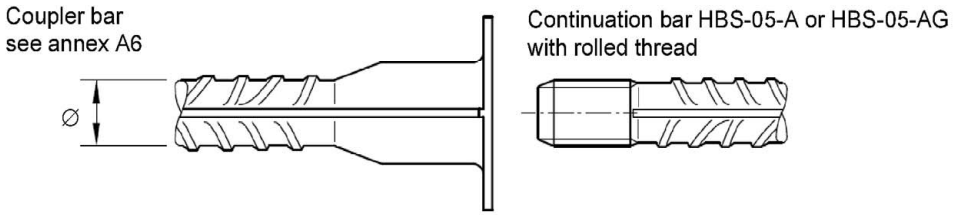
Connection with right-left-coupler HBS-05-RL



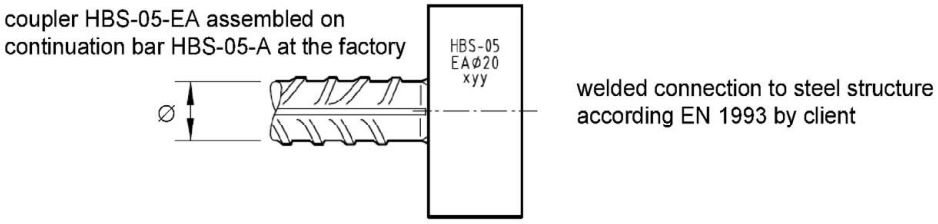
Connection with transition coupler HBS-05-RDZ



Connection with forged coupler HBS-05-B



Connection to steel structure with weldable coupler HBS-05-EA



Connection with positioning coupler HBS-05-P

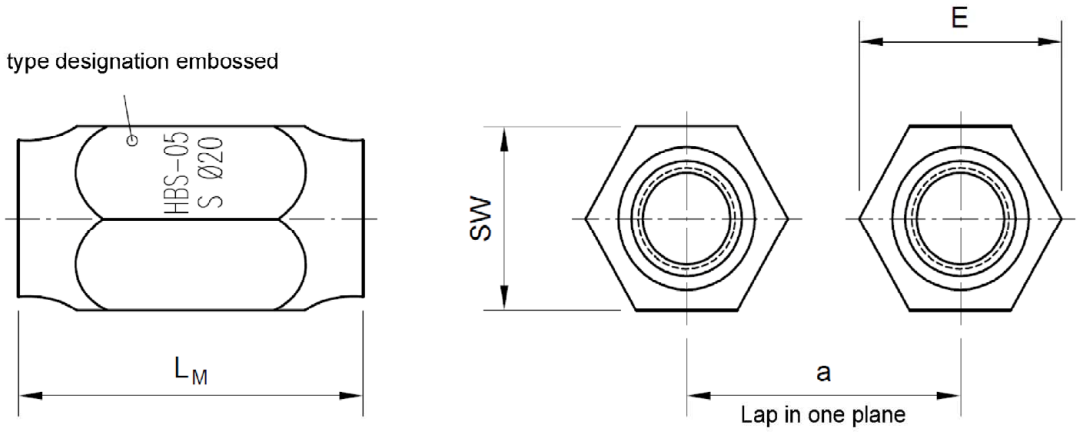
see annex A8

Installation rule: Bar threads shall be screwed into the coupler along their entire length.
A wrench with torque display is not required.

Halfen threaded coupler system HBS-05	Annex A3
Product description Installation principle	

Deutsches Institut für Bautechnik DIBt

Standard coupler HBS-05-S / -SG



Right-Left-Coupler HBS-05-RL

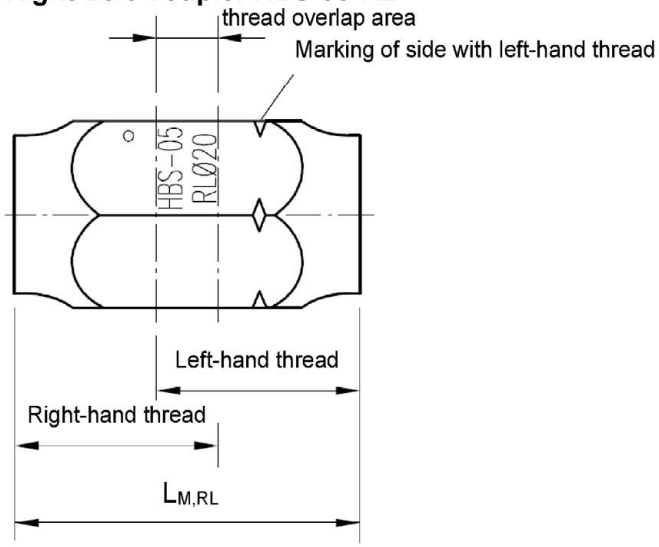


Table A3: dimensions HBS-05-S and HBS-05-RL (material according annex A2, all dimensions in [mm])

Nominal ∅	Thread	L_M	$L_{M,RL}$	a[1)] minimum bar spacing	SW	E
12	M12x1,75	36	38	42	19	21,9
14	M14x2	42	44	46	22	25,4
16	M16x2	48	50	48	24	27,7
18	M18x2,5	56	58	52	27	31,2
20	M20x2,5	60	62	55	30	34,6
22	M22x2,5	68	70	59	32	37,0
25	M25x2,5	75	77	67	36	41,6
26	M26x2,5	75	77	74	41	47,3
28	M28x2,5	84	86	76	41	47,3
30	M30x2,5	90	92	84	46	53,1
32	M32x3	96	98	90	50	57,7

1) The spacing required for installation shall be observed.

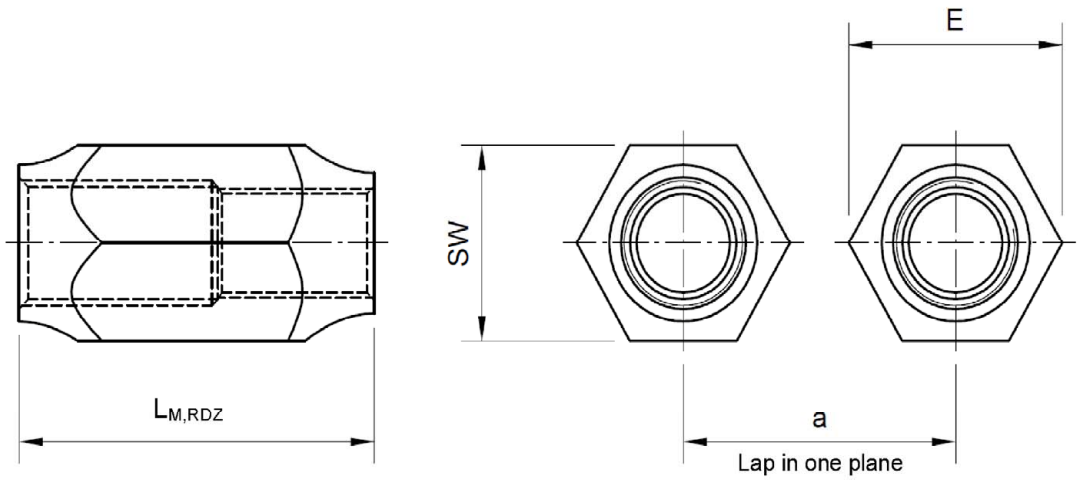
Halfen threaded coupler system HBS-05

Product description
Standard coupler and right-left coupler

Annex A4

Deutsches Institut für Bautechnik DIBt

Transition coupler HBS-05-RDZ



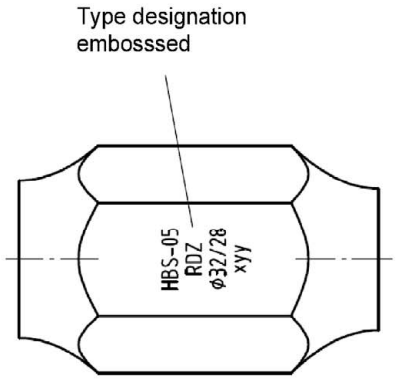


Table A4: dimensions HBS-05-RDZ (material according annex A2, all dimensions in [mm])

Nominal ∅[1)]	Thread	$L_{M,RDZ}$	Minimum bar spacing a[2)]	SW	E
16/14	M16x2,0 / M14x2,0	50	48	24	27,7
20/16	M20x2,5 / M16x2,0	59	55	30	34,6
25/20	M25x2,5 / M20x2,5	72	67	36	41,6
28/25	M28x2,5 / M25x2,5	85	76	41	47,3
32/28	M32x3,0 / M28x2,5	96	90	50	57,7

1) intermediate sizes possible
2) the spacing required for installation shall be observed

Halfen threaded coupler system HBS-05

Product description
Transition coupler

Annex A5

Deutsches Institut für Bautechnik DIBt

Forged coupler bar HBS-05-B

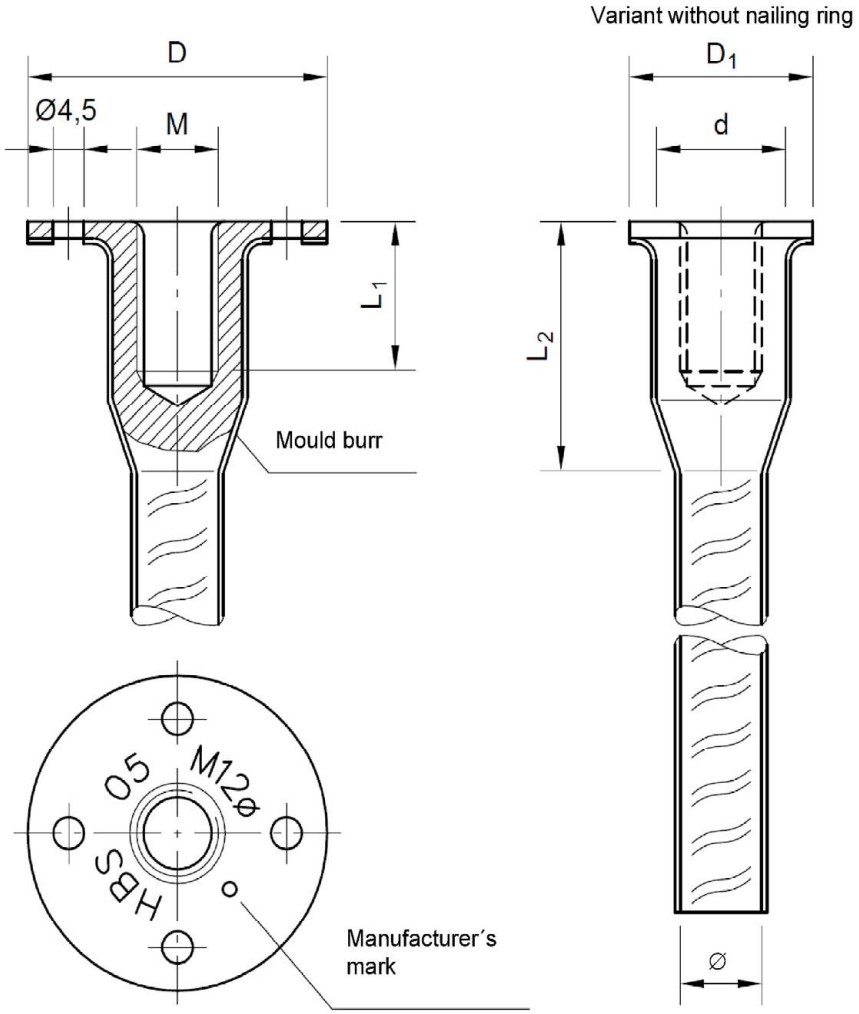


Table A5: dimensions HBS-05-B (material according annex A2, all dimensions in [mm])

nominal ∅[1)]	Thread	Outer coupler ∅	Flange ∅	Flange ∅ without nailing ring	Screw-in depth	Coupler length
∅	M	d	D	D_1	min L_1	L_2
12	M12x1,75	19	45	27	18	35
14	M14X2,00	22	47	30	21	39
16	M16x2,00	25	50	33	24	45
20	M20x2,50	31	58	39	30	51
25	M25x2,50	39	65	48	37,5	71
28	M28x2,50	44	71	53	42	73

1) intermediate sizes possible

Halfen threaded coupler system HBS-05

Product description
Forged coupling bar

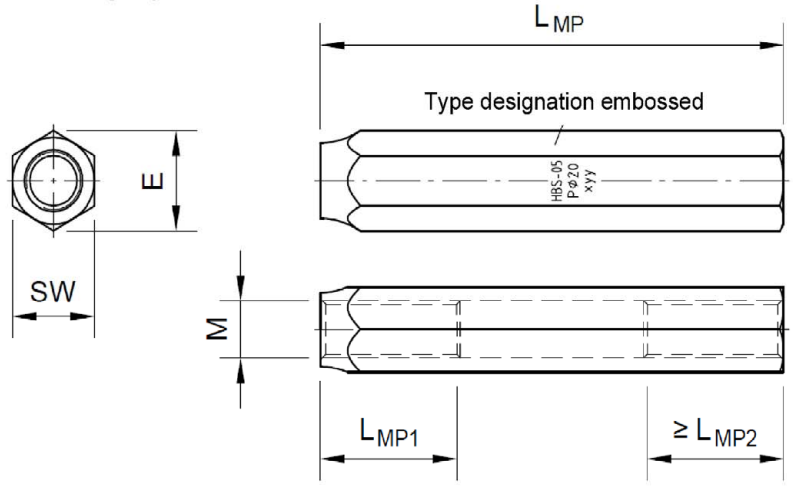
Annex A6

Deutsches Institut für Bautechnik DIBt

Positioning coupler HBS-05-P, components

Long sleeve

Variant with continuous thread L_{MP} or with partial threads L_{MP1}, L_{MP2} and free interior length possible



Threaded bolt with nuts

[1] for compressive or cyclic loading, thick lock nuts shall be used. For tensile loading, thin nuts may be used.

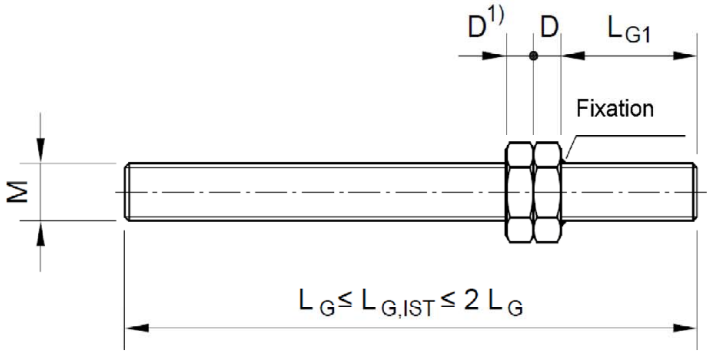


Table A6: dimensions HBS-05-P (material according annex A2, all dimensions [mm])

nominal-Ø[2)]	12	14	16	20	25	28	32
M	12x1,75	14x2,0	16x2,0	20x2.5	25x2.5	28x2,5	32x3,0
L_{MP}	106	117	128	170	200	215	245
L_{MP1}	18	21	24	30	38	42	48
L_{MP2}	18	21	24	25	30	35	40
E	21,9	25,4	27,7	34,6	41,6	47,3	57,7
SW	19	22	24	30	36	41	50
L_G	133	146	159	210	245	263	302
L_{G1}	33	36	39	50	57,5	62	73
D_{Zug} [1)]	6	7	8	10	12,5	14	16
D_{Druck} [1)]	10,8	12,8	14,8	18	22,5	24,5	27,5

2) intermediate sizes possible

Halfen threaded coupler system HBS-05

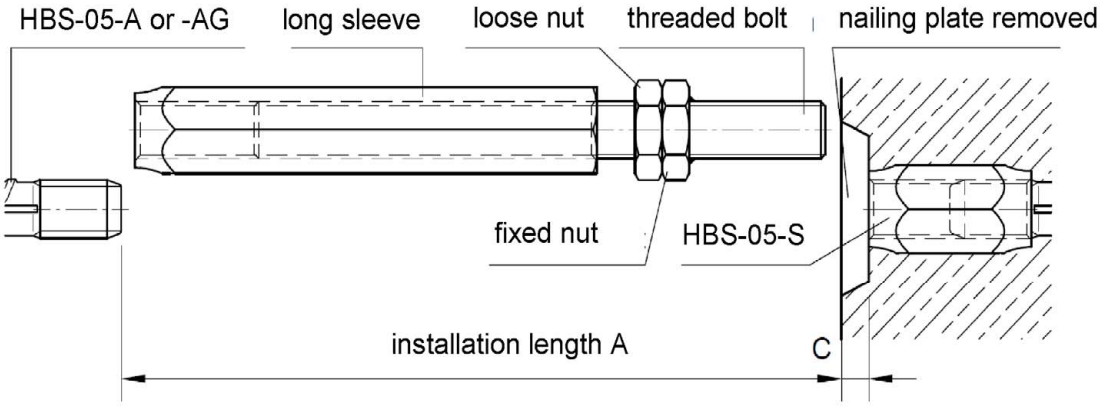
Product description
Positioning coupler, components

Annex A7

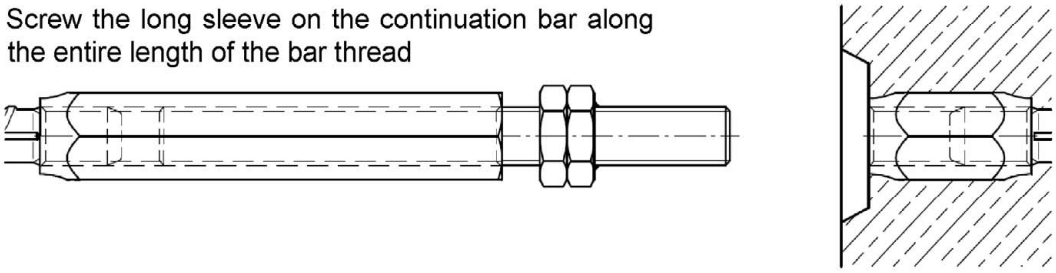
Deutsches Institut für Bautechnik DIBt

Positioning coupler HBS-05-P, Installation

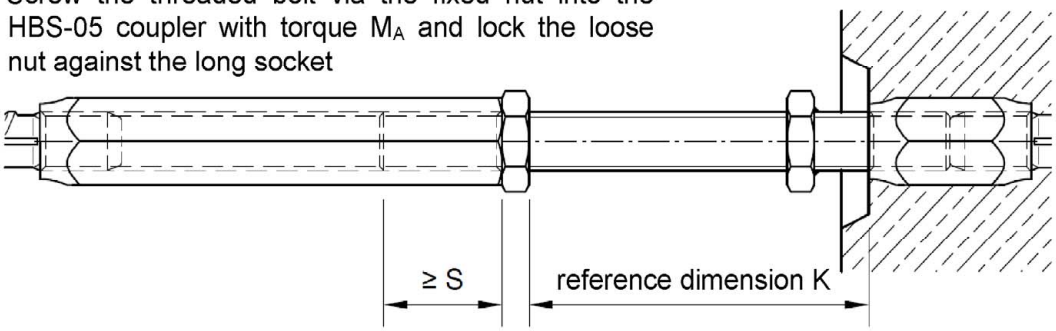
1.) Insert the positioning coupler between two axially unmovable and non-rotatable bars:
- Continuation bar HBS-05-A or -AG
- Bar with HBS-05 coupler (in this example HBS-05-S with nailing plate of thickness C, cast in)



2.) Screw the long sleeve on the continuation bar along the entire length of the bar thread



3.) Screw the threaded bolt via the fixed nut into the HBS-05 coupler with torque M_A and lock the loose nut against the long socket



Installation length A and reference dimension K are calculated as follows, based on the installation situation and acual length ($L_{G,IST}$) of the threaded bolt (symbols in accordance with annexes A7 and A8):

$A_{min} = L_{MP1} + L_{G,IST}$, $A_{max} = L_{MP} - 2 \cdot L_{MP1} + L_{G,IST} - C - S$, $K \leq L_{G,IST} - L_{MP1} - S - D$

Table A7

Nominal ∅[1)]	[mm]	12 ≤ ∅ < 14	14 ≤ ∅ < 16	16 ≤ ∅ < 20	20 ≤ ∅ < 25	25 ≤ ∅ < 28	28 ≤ ∅ < 32	32
S	[mm]	12	14	16	20	25	28	32
M_A	[mm]	30	40	60	80	100	140	190

1)) intermediate sizes possible

Halfen threaded coupler system HBS-05

Product description
Positioning coupler, installation principle

Annex A8

Deutsches Institut für Bautechnik DIBt

Weldable coupler HBS-05-EA

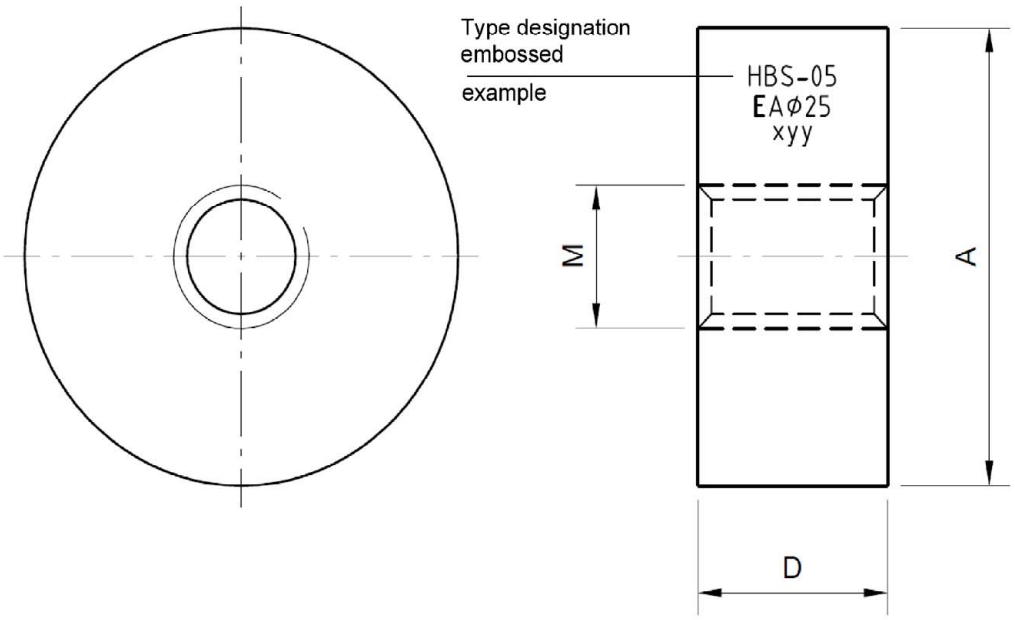


Table A8: dimensions HBS-05-EA (material according A2, all dimensions in [mm])

Nominal ∅[1)]	∅	12	14	16	20	25	28	32
Thread	M	M12x1,75	M14x2,0	M16x2,0	M20x2,5	M25x2,5	M28x2,5	M32x3,0
outer ∅	A	41	46	52	64	80	90	110
Plate thickness	D	18	20	25	30	35	40	45

1)) intermediate sizes possible

Halfen threaded coupler system HBS-05

Product description
Weldable coupler HBS-05-EA

Annex A9

Deutsches Institut für Bautechnik DIBt

B.1 Intended use

Threaded coupler system HBS-05 is used for mechanical splices according EN 1992-1-1 and EN 1998-1 and annex C for:

- transfer of axial tension and/or compression forces of the connected bars according to EN 1992-1-1, clause 8.7 and 8.8 (4)
- limitation of slip according to EN 1992-1-1, clause 7.3
- resistance to high cycle fatigue loading 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)
- Weldable couplers HBS-05-EA are used to connect reinforcing steel bars with steel components. The load transfer from the steel reinforcing bar to the steel component via the welds has to be verified for each case by the responsible engineer.

Halfen threaded coupler system HBS-05	
Intended use Specifications	Annex B1

Deutsches Institut für Bautechnik DIBt

B.2 Installation requirements

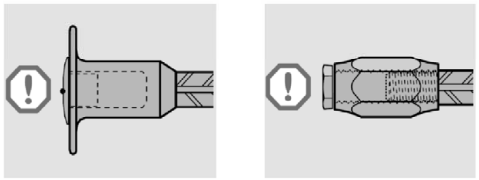
- **General**: EN 1992-1-1 shall apply to the planning and design.
  Mechanical splices with HBS-05 may be loaded up to 100% in the same way as a non-spliced bar under static and quasi-static tensile and compressive load, EN 1992-1-1, 8.7.2 (4) applies.
- **Positioning Coupler**: Splices with positioning couplers HBS-05-P under compressive or cyclic loads shall be executed with a thick lock nut (see Annex 7, table A6). Under tensile load, they may be executed with either a thick or thin lock nut (see Annex 7, table A6).
- **Spacing and edge distances**: The same values for non-spliced bars shall apply to the concrete cover over the outer edge of a coupler and to the clear distances between the outer edges of adjacent couplers in accordance with EN 1992-1-1. The spacing necessary for installation shall remain unaffected.
- **Bent bars**: For bent (pre-bent) bars, the intentional bending shall not begin until a distance of at least 5∅ from the coupler end (∅ = nominal diameter of the bent bar). If coupling bars are bent at the manufacturing plant with special equipment, the distance to the coupler end may be reduced to 2∅.
- **Installation**: The couplers shall only be installed by trained staff under the supervision of the responsible site manager. The installation shall follow the manufacturer‘s written instructions, see assembly instructions, annexes B3 to B5.
- Couplers HBS-05 shall be used as supplied by the manufacturer, without changing or replacing individual parts.
- The threads shall be clean and free from rust. Suitable measures (such as plastic caps) shall be taken to ensure that laitance or other contamination cannot enter the coupler. Foreign materials present in the coupler shall be removed before the connecting bar is screwed in. All threads shall be protected against penetration of concrete, water and oil.
- An appropriate fixing of the coupler and continuing bars to the formwork should prevent shifting of the couplers while laying of the reinforcement or pouring and compacting of the concrete.
- For splices with coupling bars HBS-05-S, HBS-05-SG, HBS-05-RDZ, HBS-05-B the continuing bar shall be able to move along the axis and rotate freely. It shall be screwed in manually up to its tapered thread until hand-tight. The remaining screwing-in process requires suitable tools (e.g. special tongs) and is complete when the last thread turn is no longer visible. To swivel a bent continuing bar into the target plane, an extra, full turn (360°) shall bee available after it has been screwed in completely.
- For splices with right-left-couplers HBS-05-RL one of the bars to be connected shall be free in its axial movement. During the assembly of the coupling, the coupler shall be positioned in such a way that both threads are engaged after one turn. This shall be verified for each coupling by pulling on the bars to be connected. If engaging of both bars failed, the screwing-in process shall be repeated. The threaded coupler shall first be turned by hand, then using suitable tools, until the threads of both bars are screwed in along their entire length.
- When the positioning coupler HBS-05-P is used, the clear distances for installation in accordance with annex A8 shall be taken into account.
- In order to connect the weldable coupler HBS-05-EA to a steel component, a welding procedure specification WPS in accordance with EN ISO 15609-1 shall be available and shall be observed by the welding personnel. The welding manufacturer shall submit a welding certificate in accordance with EN 1090-1, table B.1. The welders must have valid welder’s test certificates in accordance with EN ISO 9606-1. The welding coupler and the steel component shall be protected against corrosion in accordance with the applicable provisions, see EN ISO 12944-5.

Halfen threaded coupler system HBS-05	Annex B2
Intended use Specifications, installation requirements	

Deutsches Institut für Bautechnik DIBt

Installation of coupler bars (1. concreting section)

Sealing plug: the threads of HBS-05 coupler bars are protected with sealing plugs (factory made).

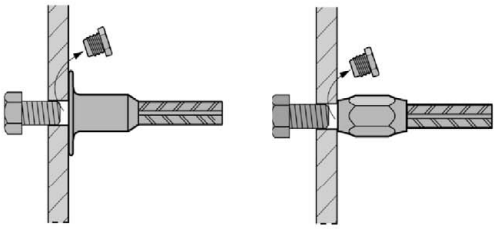


Fixing to formwork

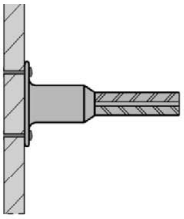
The HBS-05 coupler bar is supplied ready for installation with forged sleeve with nailing flange or threaded sleeve including a thread sealing plug. The coupler bar shall be aligned exactly with the axis of the continuation bar. Any deviations may compromise the necessary concrete cover and bar spacings in the connecting structure. Subsequent bending in the thread area is not permitted.

Fixing to steel formwork:

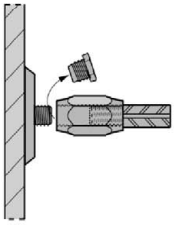
Fixing with hexagonal screw



Fixing with blind rivets



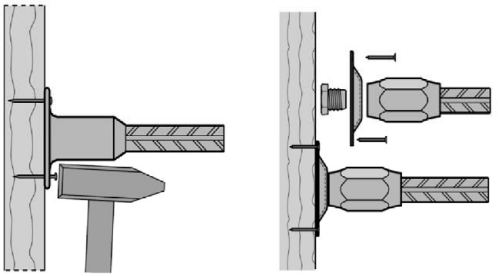
Fixing with adhesive/ magnetic plate



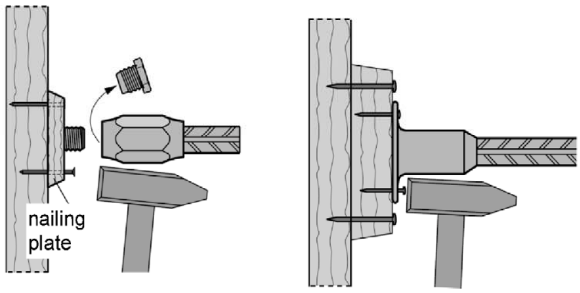
Fixing to timber formwork:

Acessory for coupler bars with threaded sleeve: nailing plate made of plastic / steel

Fixing with nails



Creation of a recess for shear loads



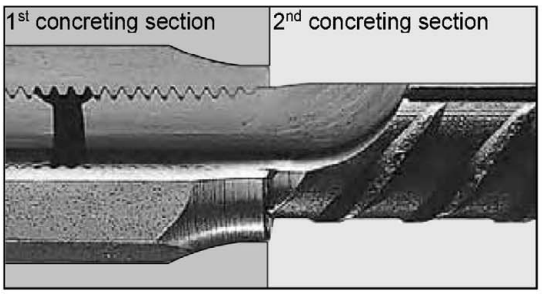
Halfen threaded coupler system HBS-05	
Intended use Installation instructions	Annex B3

Deutsches Institut für Bautechnik DIBt

Installation of continuation bars (2. concreting section)

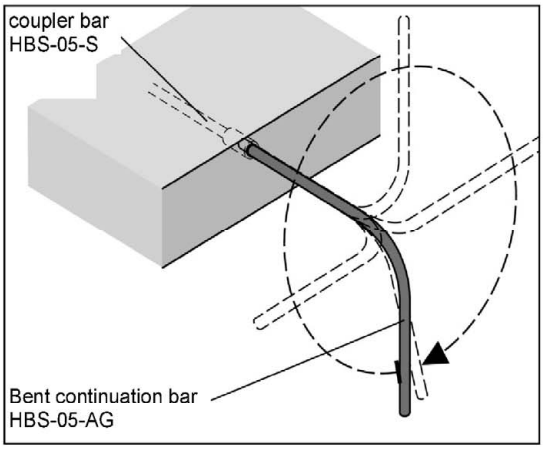
Installation of continuation bars

After removing the thread protection caps the continuation bar HBS-05-A is first screwed in by hand until the conical area of the thread end. Final screwing in and tightening requires an appropriate tool and is finished when the last thread turn is no longer visible. A controlled torque wrench is not required.



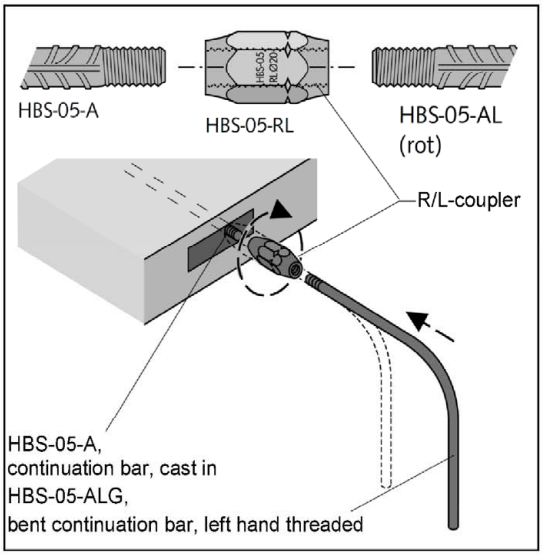
Bent continuation bars

The same assembly procedure applies for bent continuation bars. When a continuation bar is screwed into a coupler bar HBS-05-S with its entire thread length, the continuation bar can be rotated for at least one full turn for adjustment. When turning is continued beyond this point, the two faces of the bars become locked. The bent continuation bar can only be turned if it can be rotated freely and if the rotation is not obstructed by adjacent rebars, formwork parts or other objects.



Right-Left-Coupler / Connection with not freely rotatable bent continuation bars

The right-left-coupler HBS-05-RL shall be placed correctly such that after one turn of the coupler both threads of the continuation bars get griped. Each connection shall be checked manually by pulling to make sure that there is sufficient contact with the bars. The coupler is first turned by hand and then fully tightened using an appropriate tool until the threads of both continuation bars are no longer visible. Plastic trapezoidal recess formers may be used in the first concreting section to ease further assembly.



Halfen threaded coupler system HBS-05

Intended use
Installation instructions

Annex B4

Deutsches Institut für Bautechnik DIBt

Positioning coupler

The positioning coupler is used to connect axially unmovable, non-rotatable rebars. Screw the long sleeve onto the continuating bar and then screw te threaded rod into the coupler bar with the required torque M_A and tighten the locking nut M against the long socket. The maximum reference dimension K_{max} shall not be exceeded.

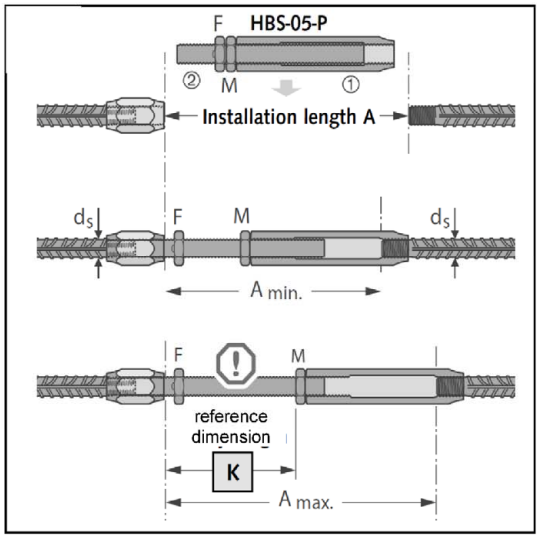
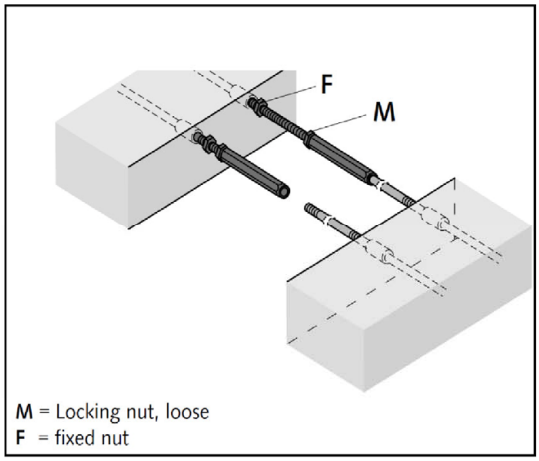


Table B1: reference dimension K_{max}

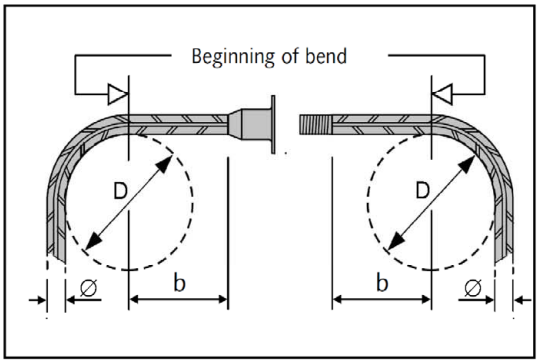
∅ [mm]	A_{min} [mm]	A_{max} [mm]	K_{max} [mm]	M_A [mm]
12	151	191	97	30
14	167	207	104	40
16	183	223	111	60
20	240	300	150	80
25	283	344	170	100
28	305	366	179	140
32	350	419	206	190



Bending on site or at manufacturing plant

Bending of coupler and continuating bars on site or in the precast plant is only permissible if the spacing *b* between the end of the thread or the sleeve and the beginning of the bend is ≥ 5∅.

Bending within 2∅ ≤ b ≤ 5∅ is only permissible if it is done at the manufacturing plant.



Welding

Welding in the bending area is not permitted. Welding outside bending area has to be be carried out according applicable welding regulations is the sole responsibility of the welding-contractor.
Flash-butt welding according EN ISO 17660-1 may be carried out at the manufacturing plant.

Halfen threaded coupler system HBS-05

Intended use
Installation instructions

Annex B5

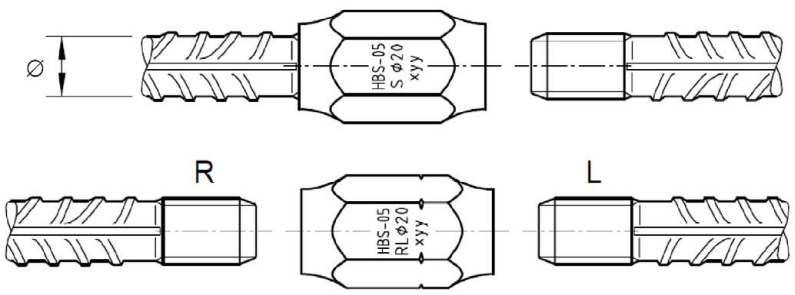
Deutsches Institut für Bautechnik DIBt

C.1 Essential characteristics HBS-05-S, -SG, -RL

Table C1: Essential characteristics of HBS-05-S, -SG, -RL according annex A4

		∅	[mm]	12	14	16	18	20	22	25	26	28	30	32
Resistance to static or quasi-static loading	failure of rebar	$f_{u,min,\ outside}$ [1]	[N/mm²]	540 / 575										
	failure inside splice length	$f_{u,min,\ inside}$ [2]	[N/mm²]	540 / 575										
		$f_{u,min,\ coupler}$ [3]	[N/mm²]	650										
		min $A_{gt,act}$	[%]	3,0										
Slip	under static or quasi-static load	max s_1 [4]	[mm]	0,1										
	after static or quasi-static loading	max s_2 [5]	[mm]	0,1										
Fatigue strength [6]	characteristic fatigue strength for $N = 2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk}$ $N = 2 \cdot 10^6$	[N/mm²]	80					70				60	
	stress exponents of S-N-curve for N load cycles	k_1 $N < 2 \cdot 10^6$	[-]	3,5					3,5				--	
		k_1 $2 \cdot 10^6 \leq N \leq 10^7$	[-]	3,0					3,0				--	
		k_2 $N > 10^7$	[-]	5,0					5,0				--	
Resistance to low-cycle fatigue loading (seismic actions) [9]	residual deformation	max u_{20}	[mm]	0,2										
	ultimate load	min $F_{u,B500B}$ [7]	[kN]	61,1	83,1	108,6	137,4	169,6	205,3	265,1	286,7	332,5	381,7	434,3
		min $F_{u,B500C}$ [8]	[kN]	65,0	88,5	115,6	146,3	180,6	218,6	282,3	305,3	354,1	406,4	462,4

1) $f_{u,min,\ outside} = 1{,}08 \cdot R_{e,nom}$ for B500B / $1{,}15 \cdot R_{e,nom}$ for B500C (in case of bar failure outside splice length)
2) $f_{u,min,\ inside} = 1{,}08 \cdot R_{e,nom}$ (in case of bar failure inside splice length)
3) $f_{u,min,\ coupler} = 1{,}3 \cdot R_{e,nom}$ (in case of coupler failure)
4) slip under load $0{,}6 \cdot R_{e,nom}$
5) slip after unloading from $0{,}6 \cdot R_{e,nom}$ to $0{,}02 \cdot R_{e,nom}$
6) fatigue strength $\Delta\sigma_{Rsk}$ for S-N-curve with specific k_1 and k_2, not valid for B500B NR
7) $F_{u,B500B} = 1{,}08 \cdot A_{s,nom,bar} \cdot R_{e,nom,bar}$
8) $F_{u,B500C} = 1{,}15 \cdot A_{s,nom,bar} \cdot R_{e,nom,bar}$
9) not valid for B500B NR



Halfen threaded coupler system HBS-05

Performance
Essential characteristics: HBS-05-S, -SG, - RL

Annex C1

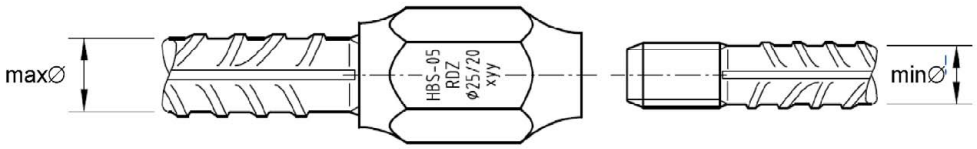
Deutsches Institut für Bautechnik DIBt

C.2 Essential characteristics HBS-05-RDZ

Table C2: Essential characteristics of BS-05-RDZ according annex A5

		∅	[mm]	16/14	20/16	25/20	28/25	32/28
		min∅	[mm]	14	16	20	25	28
		max∅	[mm]	16	20	25	28	32
Resistance to static or quasi-static loading	failure of rebar	$f_{u,min,\ outside}$ [1]	[N/mm²]	540 / 575				
	failure inside splice length	$f_{u,min,\ inside}$ [2]	[N/mm²]	540 / 575				
		$f_{u,min,\ coupler}$ [3]	[N/mm²]	650				
		min $A_{gt,act}$	[%]	3,0				
Slip	under static or quasi-static load	max s_1 [4]	[mm]	0,1				
	after static or quasi-static loading	max s_2 [5]	[mm]	0,1				
Fatigue strength [6]	characteristic fatigue strength for $N = 2{\cdot}10^6$ load cycles	$\Delta\sigma_{Rsk}$ $N = 2{\cdot}10^6$	[N/mm²]	80		70		60
	stress exponents of S-N-curve for N load cycles	k_1 $N < 2{\cdot}10^6$	[-]	3,5		3,5		--
		k_1 $2{\cdot}10^6 \le N \le 10^7$	[-]	3,0		3,0		--
		k_2 $N > 10^7$	[-]	5,0		5,0		--
Resistance to low-cycle fatigue loading (seismic actions)	residual deformation	max u_{20}	[mm]	0,2				
	ultimate load	min $F_{u,B500B}$ [7]	[kN]	83,1	108,6	169,6	265,1	332,5
		min $F_{u,B500C}$ [8]	[kN]	88,5	115,6	180,6	282,3	354,1

1) $f_{u,min,\ outside} = 1{,}08{\cdot}R_{e,nom}$ for B500B / $1{,}15{\cdot}R_{e,nom}$ for B500C (in case of bar failure outside splice length)
2) $f_{u,min,\ inside} = 1{,}08{\cdot}R_{e,nom}$ for B500B / $1{,}15{\cdot}R_{e,nom}$ for B500C (in case of bar failure inside splice length)
3) $f_{u,min,\ coupler} = 1{,}3{\cdot}R_{e,nom}$ (in case of coupler failure)
4) slip under load $0{,}6{\cdot}R_{e,nom}$
5) slip after unloading from $0{,}6{\cdot}R_{e,nom}$ to $0{,}02{\cdot}R_{e,nom}$
6) fatigue strength $\Delta\sigma_{Rsk}$ for S-N-curve with specific k_1 and k_2
7) $F_{u,B500B} = 1{,}08{\cdot}A_{s,nom,bar}{\cdot}R_{e,nom,bar}$
8) $F_{u,B500C} = 1{,}15{\cdot}A_{s,nom,bar}{\cdot}R_{e,nom,bar}$



Halfen threaded coupler system HBS-05

Performance
Essential characteristics: HBS-05-RDZ

Annex C2

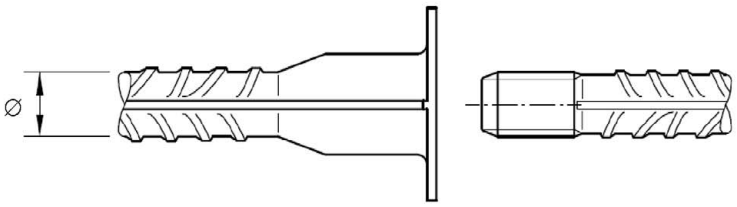
Deutsches Institut für Bautechnik DIBt

C.3 Essential characteristics HBS-05-B

Table C3: Essential characteristics of HBS-05-B according annex A6

		∅	[mm]	12	14	16	20	25	28
Resistance to static or quasi-static loading	failure of rebar	$f_{u,min,\ outside}$ 1)	[N/mm²]	540					
	failure inside splice length	$f_{u,min,\ inside}$ 2)	[N/mm²]	540					
		$f_{u,min,\ coupler}$ 3)	[N/mm²]	650					
		min $A_{gt,act}$	[%]	3,0					
Slip	under static or quasi-static load	max s_1 4)	[mm]	0,1					
	after static or quasi-static loading	max s_2 5)	[mm]	0,1					
Fatigue strength 6)	characteristic fatigue strength for $N = 2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk}$ $N = 2 \cdot 10^6$	[N/mm²]	80				70	
	stress exponents of S-N-curve for N load cycles	k_1 $N < 2 \cdot 10^6$	[-]	3,5				3,5	
		k_1 $2 \cdot 10^6 \leq N \leq 10^7$	[-]	3,0				3,0	
		k_2 $N > 10^7$	[-]	5,0				5,0	

1) $f_{u,min,\ outside} = 1{,}08 \cdot R_{e,nom}$ (in case of bar failure outside splice length)
2) $f_{u,min,\ inside} = 1{,}08 \cdot R_{e,nom}$ (in case of bar failure inside splice length)
3) $f_{u,min,\ coupler} = 1{,}3 \cdot R_{e,nom}$ (in case of coupler failure)
4) slip under load $0{,}6 \cdot R_{e,nom}$
5) slip after unloading from $0{,}6 \cdot R_{e,nom}$ to $0{,}02 \cdot R_{e,nom}$
6) fatigue strength $\Delta\sigma_{Rsk}$ for S-N-curve with specific k_1 and k_2



Halfen threaded coupler system HBS-05	Annex C3
Performance Essential characteristics: HBS-05-B	

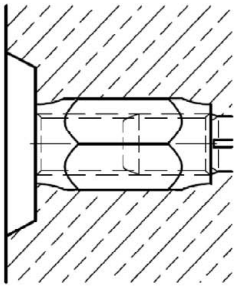
Deutsches Institut für Bautechnik DIBt

C.4 Essential characteristics HBS-05-P

Table C4: Essential characteristics of HBS-05-P acccording annex A7

		∅	[mm]	12	14	16	20	25	28	32
Resistance to static or quasi-static loading	failure of rebar	$f_{u,min,\ outside}$ 1)	[N/mm²]	540 / 575						
	failure inside splice length	$f_{u,min,\ inside}$ 2)	[N/mm²]	540 / 575						
		$f_{u,min,\ coupler}$ 3)	[N/mm²]	650						
		min $A_{gt,act}$	[%]	3,0						
Slip	under static or quasi-static load	max s_1 4)	[mm]	0,1						
	after static or quasi-static loading	max s_2 5)	[mm]	0,1						
Fatigue strength 6)	characteristic fatigue strength for $N = 2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk}$ $N = 2 \cdot 10^6$	[N/mm²]	80				70		60
	stress exponents of S-N-curve for N load cycles	k_1 $N < 2 \cdot 10^6$	[-]	3,5				3,5		--
		k_1 $2 \cdot 10^6 \leq N \leq 10^7$	[-]	3,0				3,0		--
		k_2 $N > 10^7$	[-]	5,0				5,0		--

1) $f_{u,min,\ outside}$ = 1,08·$R_{e,nom}$ for B500B / 1,15·$R_{e,nom}$ for B500C (*in case of bar failure outside splice length*)
2) $f_{u,min,\ inside}$ = 1,08·$R_{e,nom}$ for B500B / 1,15·$R_{e,nom}$ for B500C (in case of bar failure inside splice length)
3) $f_{u,min,\ coupler}$ = 1,3·$R_{e,nom}$ (in case of coupler failure)
4) slip under load 0,6·$R_{e,nom}$
5) slip after unloading from 0,6·$R_{e,nom}$ to 0,02·$R_{e,nom}$
6) fatigue strength $\Delta\sigma_{Rsk}$ for S-N-curve with specific k_1 and k_2



Halfen threaded coupler system HBS-05

Performance
Essential characteristics: HBS-05-P

Annex C4

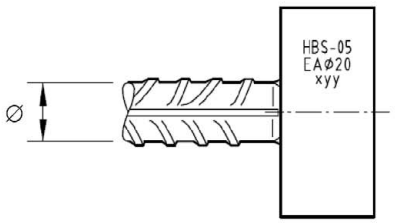
Deutsches Institut für Bautechnik DIBt

C.5 Essential characteristics HBS-05-EA

Table C5 Essential characteristics of HBS-05-EA according annex A9

		∅		[mm]	12	14	16	20	25	28	32
Resistance to static or quasi-static loading	failure of rebar	$f_{u,min,\ outside}$ 1)		[N/mm²]	540 / 575						
	failure inside splice length	$f_{u,min,\ inside}$ 2)		[N/mm²]	540 / 575						
		$f_{u,min,\ coupler}$ 3)		[N/mm²]	650						
		min $A_{gt,act}$		[%]	3,0						
Slip	under static or quasi-static load	max s_1 4)		[mm]	0,1						
	after static or quasi-static loading	max s_2 5)		[mm]	0,1						
Fatigue strength 6)	characteristic fatigue strength for $N = 2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk}$	$N = 2 \cdot 10^6$	[N/mm²]	80				70		60
	stress exponents of S-N-curve for N load cycles	k_1	$N < 2 \cdot 10^6$	[-]	3,5				3,5		--
			$2 \cdot 10^6 \leq N \leq 10^7$	[-]	3,0				3,0		--
		k_2	$N > 10^7$	[-]	5,0				5,0		--

1) $f_{u,min,\ outside} = 1{,}08 \cdot R_{e,nom}$ for B500B / $1{,}15 \cdot R_{e,nom}$ for B500C (*in case of bar failure outside splice length*)
2) $f_{u,min,\ inside} = 1{,}08 \cdot R_{e,nom}$ for B500B / $1{,}15 \cdot R_{e,nom}$ for B500C (in case of bar failure inside splice length)
3) $f_{u,min,\ coupler} = 1{,}3 \cdot R_{e,nom}$ (in case of coupler failure)
4) slip under load $0{,}6 \cdot R_{e,nom}$
5) slip after unloading from $0{,}6 \cdot R_{e,nom}$ to $0{,}02 \cdot R_{e,nom}$
6) fatigue strength $\Delta\sigma_{Rsk}$ for S-N-curve with specific k_1 and k_2



Halfen threaded coupler system HBS-05

Performance
Essential characteristics: HBS-05-EA

Annex C5