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-21/0799 of 25 November 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	ZENTOR® - Rebar Splicing System
Product family to which the construction product belongs	Couplers for mechanical splices of reinforcing steel bars
Manufacturer	DUCA Systems AG Allmendstrasse 2 8105 Regensdorf SCHWEIZ
Manufacturing plant	DUCA Systems AG Allmendstrasse 2 8105 Regensdorf SCHWEIZ
This European Technical Assessment contains	22 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This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No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 ZENTOR® - Rebar Splicing 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 ZENTOR® - Rebar Splicing System not indicated in Annexes A1 to A8 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 ZENTOR® - Rebar Splicing 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 ZENTOR® - Rebar Splicing 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 – C7
Slip under static or quasi-static load	See Annex C1 – C7
Slip after static or quasi-static load	See Annex C1 – C7
Fatigue strength for $N = 2 \cdot 10^6$ load cycles	See Annex C1
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	No performance assessed
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 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 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)

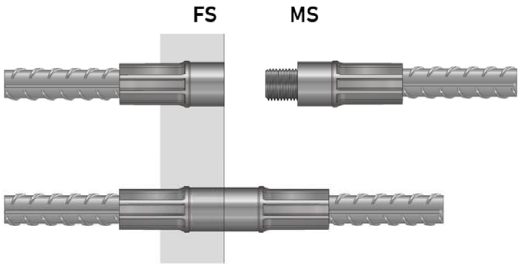
Issued in Berlin on 25 November 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

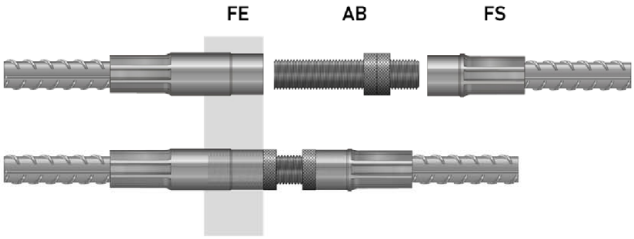
beglaubigt:
Kisan

Deutsches Institut für Bautechnik DIBt

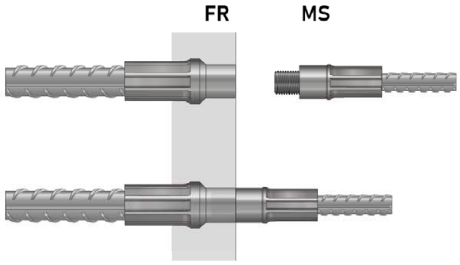
Standard Connection ‚S'



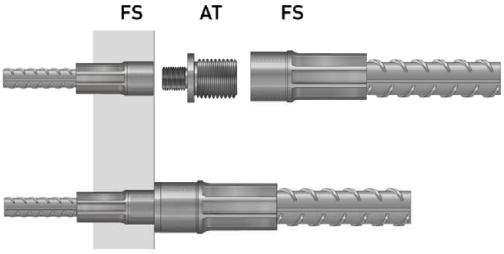
Bridge Connection ‚B'



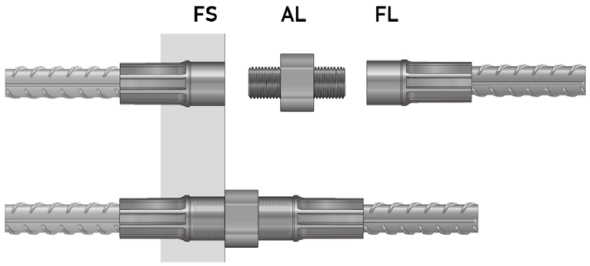
Female Reduction Connection ‚F'



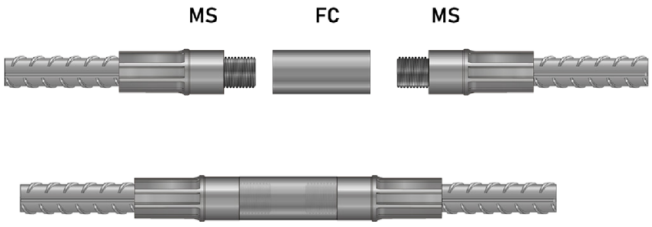
Transition Connection ‚T'



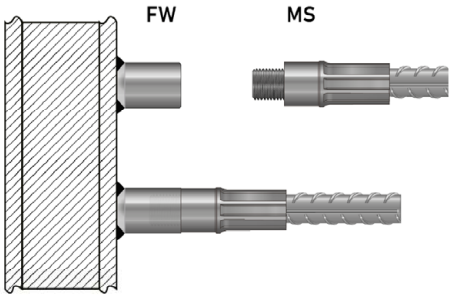
Left/Right Connection ‚L'



Coupler Connection ‚C'



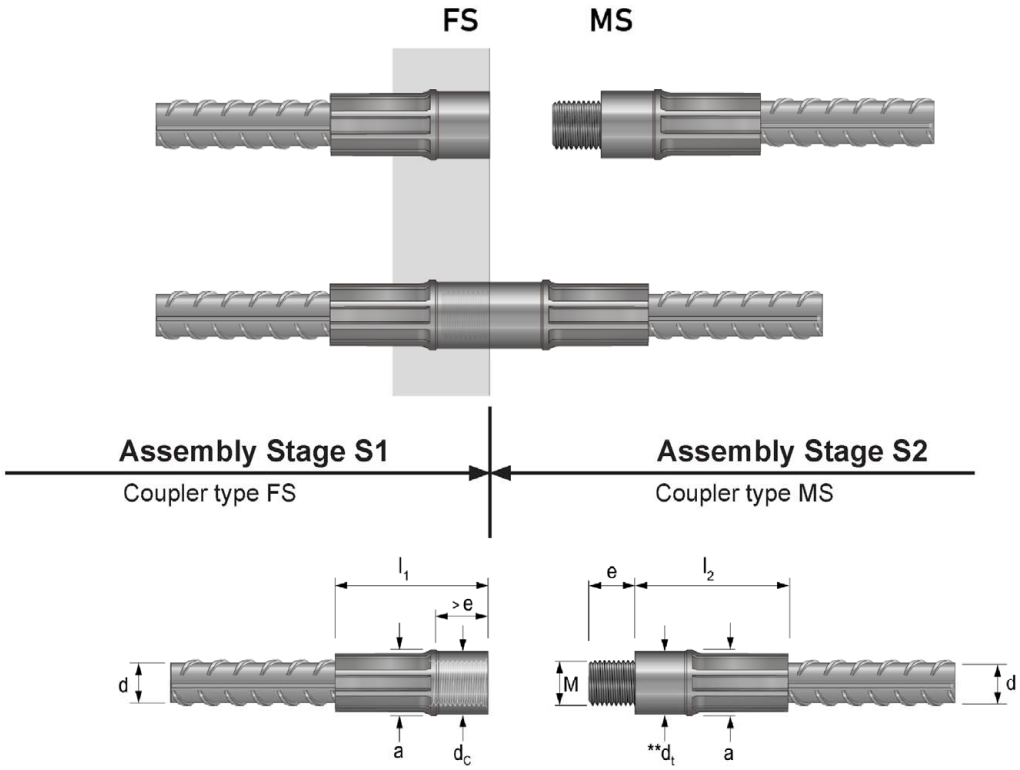
Welding Connection ‚W'



ZENTOR® - Rebar Splicing System	**Annex A1**
Product Discription - Type Overview	

Deutsches Institut für Bautechnik DIBt

Connection of bars with the same diameter, which are freely rotatable



Coupler type		Rebar diameter	Thread size	Thread length	Outer-Ø	Outer-Ø (female)	Coupler length	
		d [mm]	M	e [mm]	a [mm]	d_c [mm]	l_1 [mm]	l_2 [mm]
FS10	MS10	10	M12	13.5	17.5	16.1	48	48
FS12	MS12	12	M16	16.5	21.0	20.5	55	55
FS14	MS14	14	M18	20.0	25.0	23.9	66	66
FS16	MS16	16	M20	21.0	28.0	26.9	72	72
FS18	MS18	18	M22	24.0	31.0	29.2	79	79
FS20	MS20	20	M24	25.0	34.0	32.2	87	87
FS22	MS22	22	M27	26.0	37.5	36.0	91	91
FS26 *	MS26 *	25 / 26	M30	30.5	44.0	41.1	111	111
FS28	MS28	28	M33	31.5	48.0	45.5	117	117
FS30	MS30	30	M36	35.5	51.0	48.4	126	126
FS32	MS32	32	M39	36.5	54.0	52.1	131	131
FS34	MS34	34	M42	39.0	58.0	56.1	142	142
FS36	MS36	36	M42	40.0	61.0	57.8	150	150
FS40	MS40	40	M48	44.5	67.5	64.9	164	164

* Type 26 can be used for rebar Ø25mm & 26mm ** Dimension $d_t = d_c - 0.50$mm

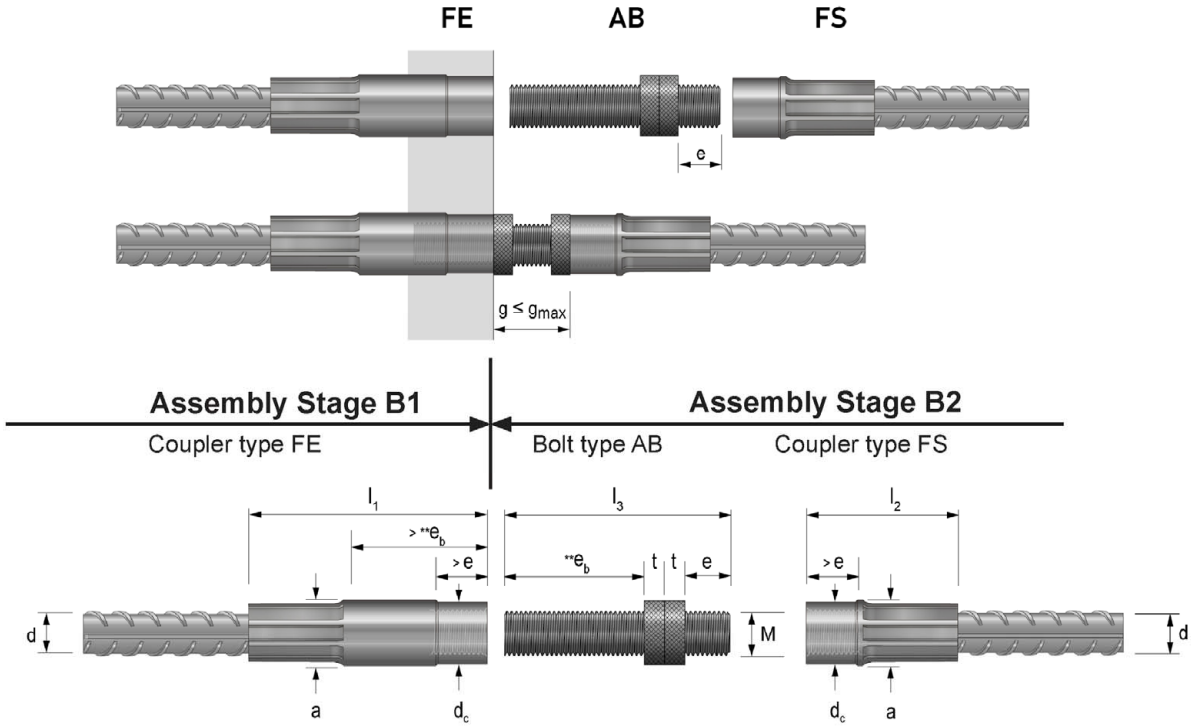
ZENTOR® - Rebar Splicing System

Product Description - Standard Connection 'S'

Annex A2

Deutsches Institut für Bautechnik DIBt

Connection of bars with the same diameter, which are not freely rotatable and conditionally axially displaceable



Coupler-/ bolt type			Rebar - Ø	Thread size	Thread length	Outer-Ø (female)		Nuts wide	Coupler-/ bolt length			g_{max}
			d [mm]	M	e [mm]	a [mm]	d_c [mm]	t [mm]	l_1 [mm]	l_3 [mm]	l_2 [mm]	[mm]
FE10	AB10	FS10	**10**	M12	13.5	17.5	16.1	7.0	71	65.5	48	38.5
FE12	AB12	FS12	**12**	M16	16.5	21.0	20.5	7.0	83	76.5	55	43.5
FE14	AB14	FS14	**14**	M18	20.0	25.0	23.9	8.0	100	91.0	66	51
FE16	AB16	FS16	**16**	M20	21.0	28.0	26.9	8.0	110	96.0	72	54
FE18	AB18	FS18	**18**	M22	24.0	31.0	29.2	10.0	121	111.0	79	63
FE20	AB20	FS20	**20**	M24	25.0	34.0	32.2	10.0	132	116.0	87	66
FE22	AB22	FS22	**22**	M27	26.0	37.5	36.0	10.0	139	121.0	91	69
FE26 *	AB26	FS26 *	**25 / 26**	M30	30.5	44.0	41.1	12.0	165	142.5	111	81.5
FE28	AB28	FS28	**28**	M33	31.5	48.0	45.5	12.0	174	147.5	117	84.5
FE30	AB30	FS30	**30**	M36	35.5	51.0	48.4	15.0	190	167.5	126	96.5
FE32	AB32	FS32	**32**	M39	36.5	54.0	52.1	15.0	201	172.5	131	99.5
FE34	AB34	FS34	**34**	M42	39.0	58.0	56.1	16.0	215	184.0	142	106
FE36	AB36	FS36	**36**	M42	40.0	61.0	57.8	16.0	222	189.0	150	109
FE40	AB40	FS40	**40**	M48	44.5	67.5	64.9	18.0	243	210.5	164	121.5

* Type 26 can be used for rebar Ø25mm & 26mm ** $e_b = l_3 - e - 2 \cdot t$

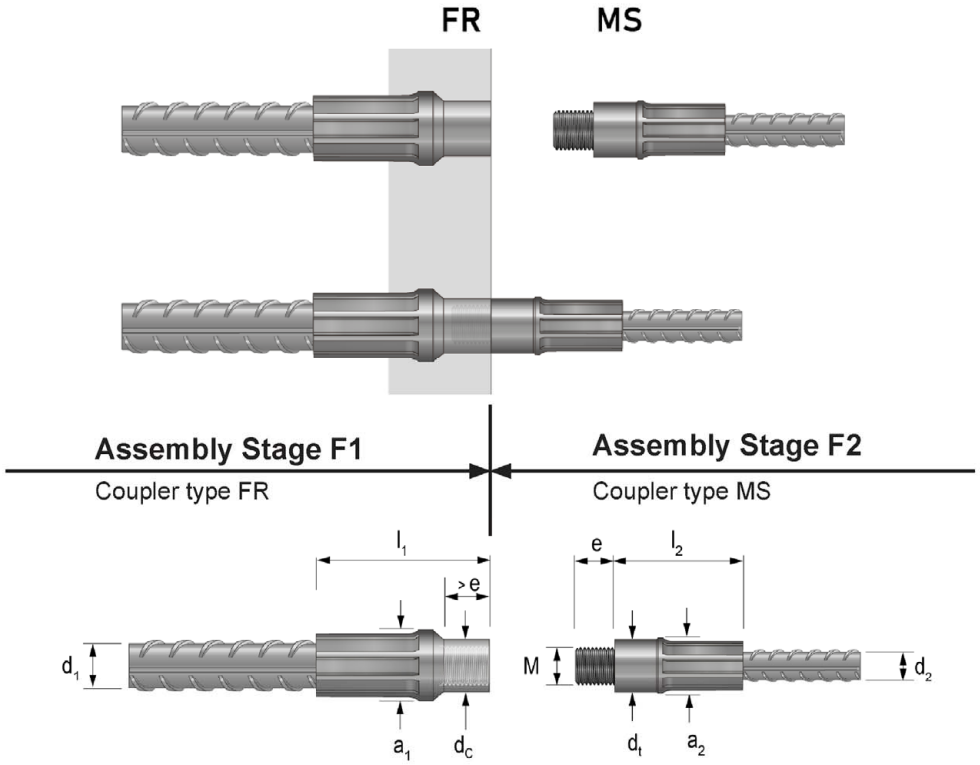
ZENTOR® - Rebar Splicing System

Product Description - Bridge Connection 'B'

Annex A3

Deutsches Institut für Bautechnik DIBt

Connection of bars with different nominal diameter, which are freely rotatable



Coupler type		Rebar diameter		Thread size	Thread length	Outer-Ø female	Outer-Ø male	Outer-Ø	Coupler length	Outer-Ø	Coupler length	further possible combinations with FR: MS..
		d_1 [mm]	min. d_2 [mm]	M	e [mm]	d_c [mm]	d_t [mm]	a_1 [mm]	l_1 [mm]	a_2 [mm]	l_2 [mm]	
FR1210	MS10	**12**	**10**	M12	13.5	18.2	15.6	21.0	54	17.5	48	-
FR1410	MS10	**14**	**10**	M12	13.5	20.9	15.6	25.0	64	17.5	48	12
FR1612	MS12	**16**	**12**	M16	16.5	24.8	20.0	28.0	69	21.0	55	14
FR1812	MS12	**18**	**12**	M16	16.5	26.3	20.0	31.0	76	21.0	55	14/16
FR2014	MS14	**20**	**14**	M18	20.0	28.9	23.4	34.0	87	25.0	66	16/18
FR2216	MS16	**22**	**16**	M20	21.0	32.1	26.4	37.5	91	28.0	72	18/20
FR2620*	MS20	**25 / 26**	**20**	M24	25.0	37.9	31.7	44.0	109	34.0	87	22
FR2820	MS20	**28**	**20**	M24	25.0	40.6	31.7	48.0	117	34.0	87	22/25/26
FR3020	MS20	**30**	**20**	M24	25.0	42.1	31.7	51.0	126	34.0	87	22/25/26
FR3226*	MS26*	**32**	**25 / 26**	M30	30.5	46.9	40.6	54.0	132	44.0	111	25/28
FR3426*	MS26*	**34**	**25 / 26**	M30	30.5	49.5	40.6	58.0	143	44.0	111	25/30
FR3628	MS28	**36**	**28**	M33	31.5	53.0	45.0	61.0	147	48.0	117	30/32
FR4030	MS30	**40**	**30**	M36	35.5	58.3	47.9	67.5	164	51.0	126	32/34/36

* Type 26 can be used for rebar Ø25mm & 26mm

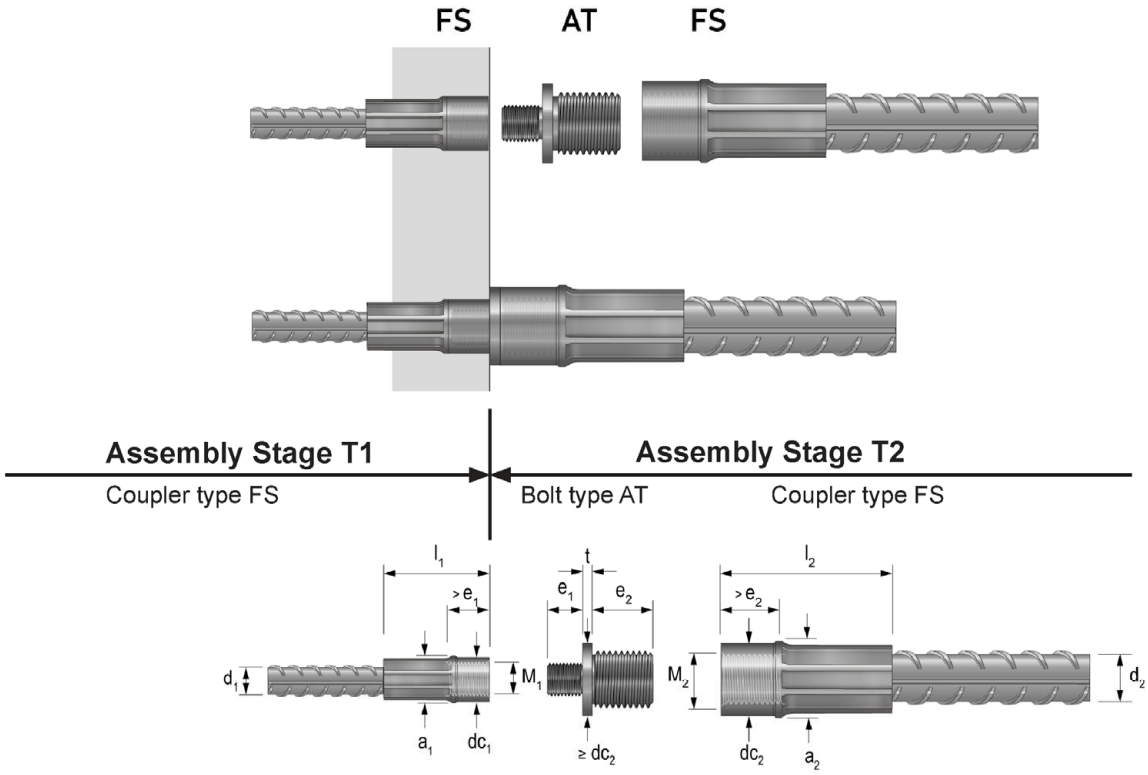
ZENTOR® - Rebar Splicing System

Product Description - Female Reduction 'F'

Annex A4

Deutsches Institut für Bautechnik DIBt

Connection of bars with different or same nominal diameter, which are freely rotatable



Coupler-/ bolt type			Rebar diameter		Coupler 1			Thread 1			Coupler 2			Thread2		Further possible combi-nations of d1 (exem-plarily)
			d_1 [mm]	max. d_2 [mm]	a_1 [mm]	dc_1 [mm]	l_1 [mm]	M1	e_1 [mm]	t [mm]	a_2 [mm]	dc_2 [mm]	l_2 [mm]	M2	e_2 [mm]	
FS10	AT1012	FS12	**10**	**12**	17.5	16.1	47.5	M12	13.5	3	21.0	20.5	54.6	M16	16.5	10
FS10	AT1014	FS14	**10**	**14**	17.5	16.1	47.5	M12	13.5	4	25.0	23.9	65.8	M18	20.0	10 - 12
FS12	AT1216	FS16	**12**	**16**	21.0	20.5	54.6	M16	16.5	4	28.0	26.9	71.7	M20	21.0	12 - 14
FS12	AT1218	FS18	**12**	**18**	21.0	20.5	54.6	M16	16.5	5	31.0	29.2	79.5	M22	24.0	12 - 16
FS14	AT1420	FS20	**14**	**20**	25.0	23.9	65.8	M18	20.0	5	34.0	32.2	87.2	M24	25.0	14 - 18
FS16	AT1622	FS22	**16**	**22**	28.0	26.9	71.7	M20	21.0	5	37.5	36.0	91.0	M27	26.0	16 - 20
FS20	AT2026	FS26*	**20**	**26**	34.0	32.2	87.2	M24	25.0	5	44.0	41.1	110.9	M30	30.5	20 - 25
FS20	AT2028	FS28	**20**	**28**	34.0	32.2	87.2	M24	25.0	5	48.0	45.5	116.6	M33	31.5	20 - 26
FS20	AT2030	FS30	**20**	**30**	34.0	32.2	87.2	M24	25.0	5	51.0	48.4	126.1	M36	35.5	20 - 28
FS26*	AT2632	FS32	**25 /26**	**32**	44.0	41.1	110.9	M30	30.5	5	54.0	52.1	130.9	M39	36.5	25 - 30
FS26*	AT2634	FS34	**25/26**	**34**	44.0	41.1	110.9	M30	30.5	5	58.0	56.1	142.1	M42	39.0	25 - 32
FS28	AT2836	FS36	**28**	**36**	48.0	45.5	116.6	M33	31.5	5	61.0	57.8	149.7	M42	40.0	28 - 34
FS30	AT3040	FS40	**30**	**40**	51.0	48.4	126.1	M36	35.5	5	67.5	64.9	163.5	M48	44.5	30 - 40

* Type 26 can be used for rebar Ø25mm & 26mm
With the appropriate transition bolt type "AT", female ZENTOR® couplers of any size can be connected to one another.

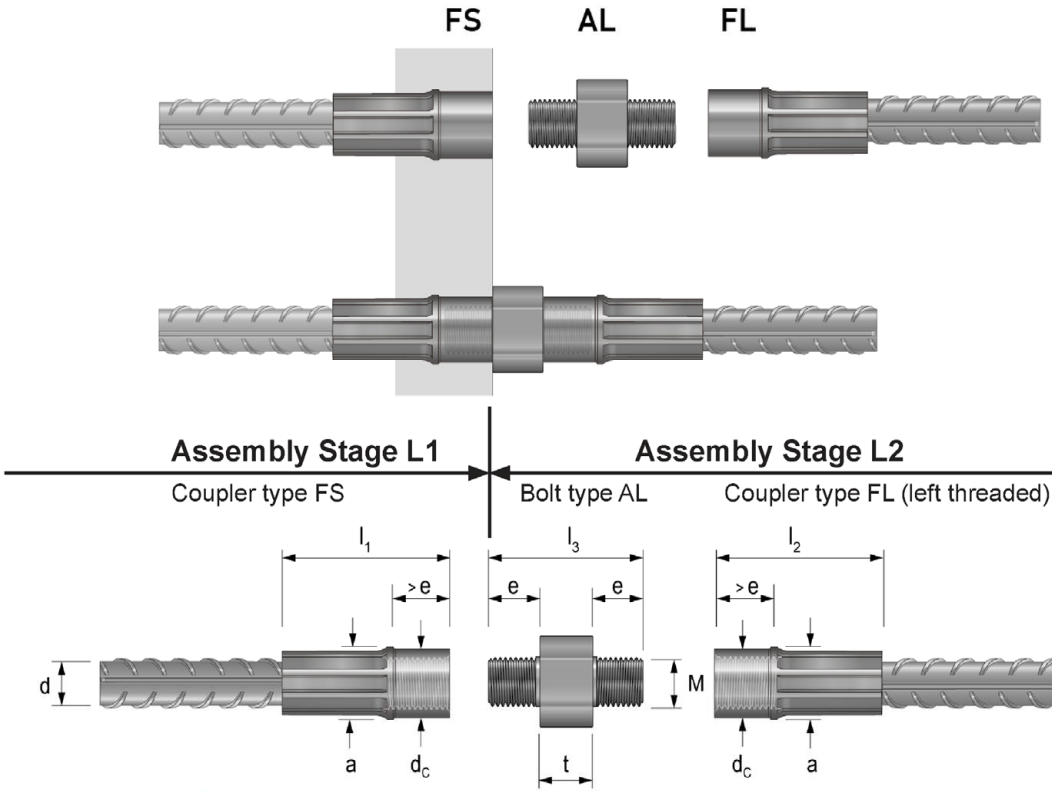
ZENTOR® - Rebar Splicing System

Product Description - Coupler Transition Connection 'T'

Annex A5

Deutsches Institut für Bautechnik DIBt

Connection of bars with the same diameter, which are not freely rotatable



Coupler-/ bolt type			**Rebar diameter**	Thread size	Thread length	Outer-Ø	Outer-Ø	Nut wide	Coupler-/ bolt length		
			d [mm]	M	e [mm]	d_c [mm]	a [mm]	t [mm]	l_1 [mm]	l_3 [mm]	l_2 [mm]
FS10	AL10	FL10	**10**	M12	13.5	16.1	17.5	15.0	48	42	48
FS12	AL12	FL12	**12**	M16	16.5	20.5	21.0	16.0	55	49	55
FS14	AL14	FL14	**14**	M18	20.0	23.9	25.0	16.0	66	56	66
FS16	AL16	FL16	**16**	M20	21.0	26.9	28.0	18.0	72	60	72
FS18	AL18	FL18	**18**	M22	24.0	29.2	31.0	19.0	79	67	79
FS20	AL20	FL20	**20**	M24	25.0	32.2	34.0	19.0	87	69	87
FS22	AL22	FL22	**22**	M27	26.0	36.0	37.5	21.0	91	73	91
FS26 *	AL26 *	FL26 *	**25 / 26**	M30	30.5	41.1	44.0	21.0	111	82	111
FS28	AL28	FL28	**28**	M33	31.5	45.5	48.0	24.0	117	87	117
FS30	AL30	FL30	**30**	M36	35.5	48.4	51.0	25.0	126	96	126
FS32	AL32	FL32	**32**	M39	36.5	52.1	54.0	26.0	131	99	131
FS34	AL34	FL34	**34**	M42	39.0	56.1	58.0	26.0	142	104	142
FS36	AL36	FL36	**36**	M42	40.0	57.8	61.0	27.0	150	107	150
FS40	AL40	FL40	**40**	M48	44.5	64.9	67.5	27.0	164	116	164

* Type 26 can be used for rebar Ø25mm & 26mm

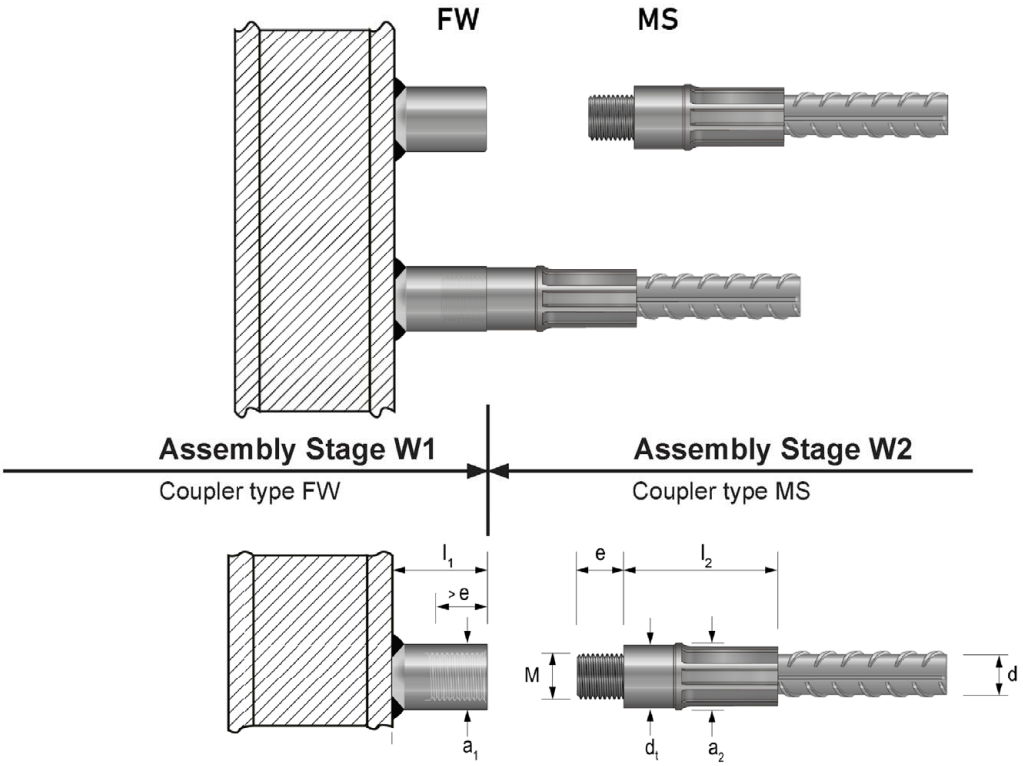
ZENTOR® - Rebar Splicing System

Product Description - Left/Right Connection 'L'

Annex A6

Deutsches Institut für Bautechnik DIBt

Connection of bars with steel construction



Coupler type		**Rebar diameter**	Thread size	Thread length	Outer-Ø	Outer-Ø	Coupler length	Outer-Ø	Coupler length
		d [mm]	M	e [mm]	d_t [mm]	a_1 [mm]	l_1 [mm]	a_2 [mm]	l_2 [mm]
FW10	MS10	**10**	M12	13.5	15.6	20.0	31	17.5	48
FW12	MS12	**12**	M16	16.5	20.0	22.0	35	21.0	55
FW14	MS14	**14**	M18	20.0	23.4	26.0	39	25.0	66
FW16	MS16	**16**	M20	21.0	26.4	30.0	41	28.0	72
FW18	MS18	**18**	M22	24.0	28.7	32.0	45	31.0	79
FW20	MS20	**20**	M24	25.0	31.7	35.0	46	34.0	87
FW22	MS22	**22**	M27	26.0	35.5	40.0	48	37.5	91
FW26 *	MS26 *	**25 / 26**	M30	30.5	40.6	45.0	54	44.0	111
FW28	MS28	**28**	M33	31.5	45.0	50.0	55	48.0	117
FW30	MS30	**30**	M36	35.5	47.9	52.0	60	51.0	126
FW32	MS32	**32**	M39	36.5	51.6	58.0	61	54.0	131
FW34	MS34	**34**	M42	39.0	55.6	60.0	65	58.0	142
FW36	MS36	**36**	M42	40.0	57.3	64.0	66	61.0	150
FW40	MS40	**40**	M48	44.5	64.4	70.0	73	67.5	164

* Type 26 can be used for rebar Ø25mm & 26mm

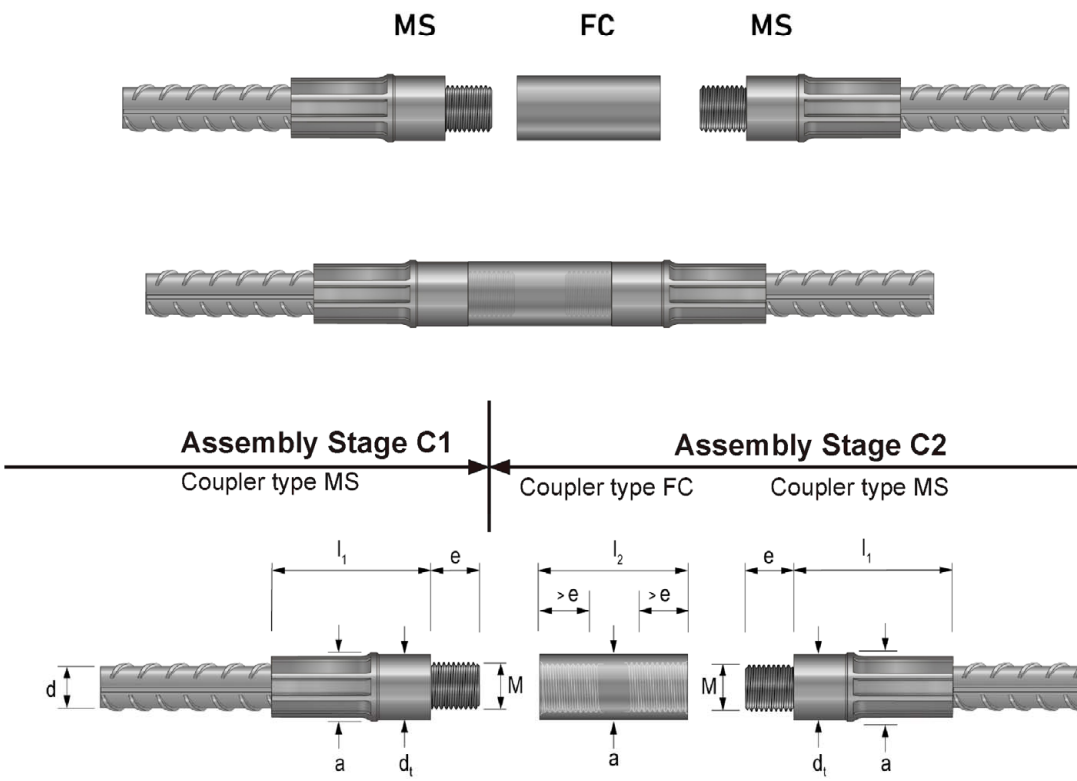
ZENTOR® - Rebar Splicing System

Product Description - Welding Connection 'W'

Annex A7

Deutsches Institut für Bautechnik DIBt

Connection of bars with the same diameter, which are freely rotatable



Coupler type			**Rebar diameter**	Thread size	Thread length	Outer-Ø	Outer-Ø	Coupler length	Coupler length
			d [mm]	M	e [mm]	a [mm]	d_t [mm]	l_1 [mm]	l_2 [mm]
MS10	FC10	MS10	**10**	M12	13.5	17.5	15.6	48	31
MS12	FC12	MS12	**12**	M16	16.5	21.0	20.0	55	37
MS14	FC14	MS14	**14**	M18	20.0	25.0	23.4	66	45
MS16	FC16	MS16	**16**	M20	21.0	28.0	26.4	72	46
MS18	FC18	MS18	**18**	M22	24.0	31.0	28.7	79	53
MS20	FC20	MS20	**20**	M24	25.0	34.0	31.7	87	55
MS22	FC22	MS22	**22**	M27	26.0	37.5	35.5	91	57
MS26 *	FC26 *	MS26 *	**25 / 26**	M30	30.5	44.0	40.6	111	68
MS28	FC28	MS28	**28**	M33	31.5	48.0	45.0	117	70
MS30	FC30	MS30	**30**	M36	35.5	51.0	47.9	126	78
MS32	FC32	MS32	**32**	M39	36.5	54.0	51.6	131	80
MS34	FC34	MS34	**34**	M42	39.0	58.0	55.6	142	86
MS36	FC36	MS36	**36**	M42	40.0	61.0	57.3	150	88
MS40	FC40	MS40	**40**	M48	44.5	67.5	64.4	164	98

* Type 26 can be used for rebar Ø25mm & 26mm

ZENTOR® - Rebar Splicing System

Product Description - Coupler Connection 'C'

Annex A8

Deutsches Institut für Bautechnik DIBt

Intended Use

Mechanical Splicing System ZENTOR® according to EN 1992-1-1 and EN 1998-1 and Annex C.

- 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 fatique 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)
- Welding Connection "W" is used to connect reinforcing steel bars with steel components. The load transmission from the reinforcing steel bar to the steel component via the welds has to be verfied for each case by responsible engineer.

Installation Requirements

- Mechanical splices with ZENTOR® may be loaded up to 100% in the same way as non-spliced bar under static and quasi-static tensile and compression load, EN 1992-1-1, 8.7.2 (4) applies.
- With regard to the concrete cover to the outer edge of a coupler and the clear distance between two adjacent Coupler surfaces, the same values apply as for non-lapped bars according to EN 1992-1-1. Installation of the Splicing Systems ZENTOR® shall be done by trained staff and under the supervision of supervisor.
- Rebar coupler ZENTOR® are only allowed to connect with other ZENTOR® Rebar coupler.
- Before assembly, the threads shall be checked for damage. Only threads of the same size may be screwed together.
- Appropriate measures shall be taken to prevent cement or other contaminants from penetrating the female couplers.
- Bends in the rebar may only begin from a minimum distance of 5x rebar diameter, measured between the coupler the beginning of the bend.
- Installation of Rebar Splicing System acc. to Installation manual, Annex B2 and B3
- All threads shall be protected against penetration of water and dirt.
- In order to connect the Welding connection 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 the 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.

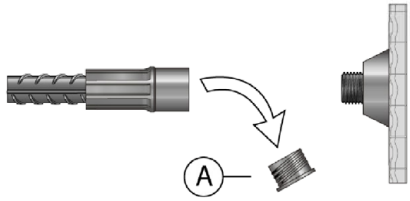
Rebar Splicing System ZENTOR® must be tightened with the torque related to the diameter after assembly.

Rebar diameter [mm]	10/12	14/16	18/20	22	25/26	28/30/32	34/36	40
Torque [Nm]	60	80	100	140	200	240	260	280

It must be ensured that the torque wrenches are calibrated and comply with the normative specifications.

ZENTOR® - Rebar Splicing System	**Annex B1**
ZENTOR® - Intended Use and Installation Requirements	

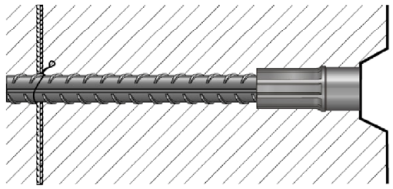
Deutsches Institut für Bautechnik DIBt



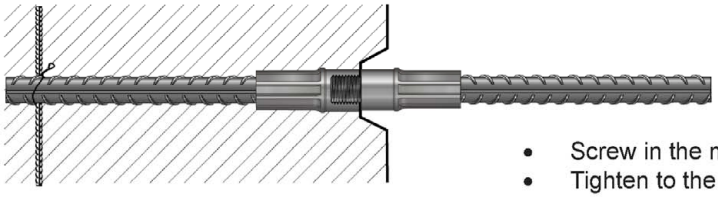
- Fasten the nail cone to the formwork
- Remove protection cap (A) from the coupler

- Fasten the coupler onto the nail cone
- Fasten the rebar securly (B)

- Fill in concrete



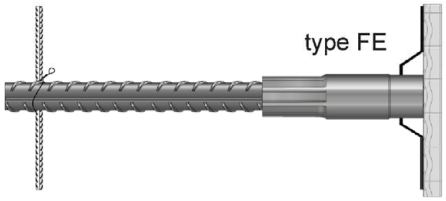
- Remove the formwork
- Remove the nail cone



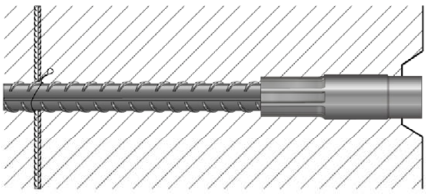
- Screw in the male coupler and fasten it securly
- Tighten to the prescribed torque

ZENTOR® - Rebar Splicing System	**Annex B2**
ZENTOR® - Intended Use and Installation manual for Connection 'S'	

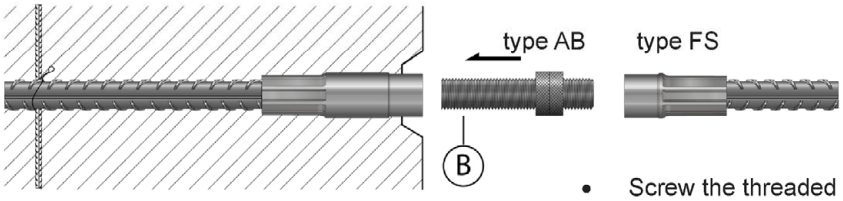
Deutsches Institut für Bautechnik DIBt



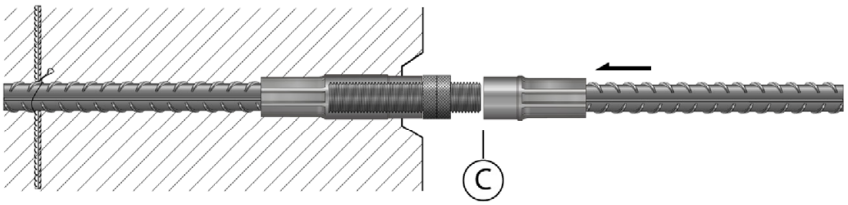
- Fix the female bar type FE to the formwork, e.g. using a plug-in plate
- Fasten the coupler rebar type FE in the position (A)



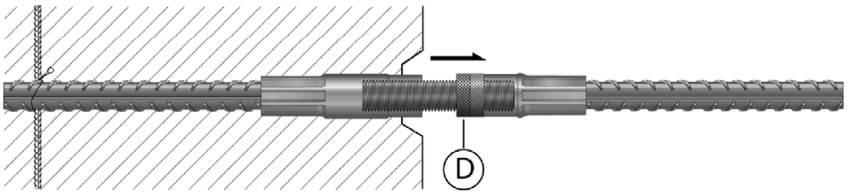
-
- Fill in concrete
- Remove formwork
- Remove the cap from the coupler



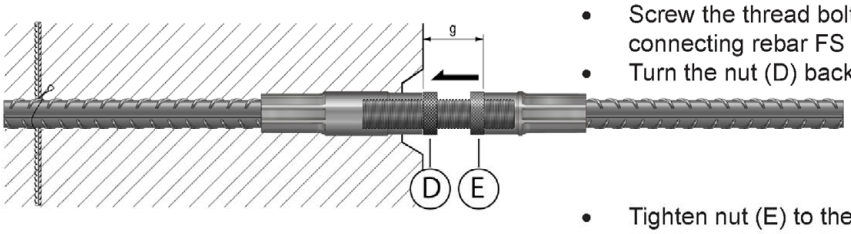
- Screw the threaded bolt type AB (B) completely into the coupler with the longer part as shown



- Bring the connection rebar type FS into position (C)



- Screw the thread bolt completely into the coupler of the connecting rebar FS by using the nut (D).
- Turn the nut (D) back to the concreted-in coupler type FE

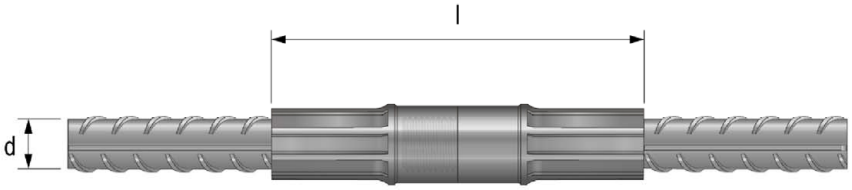


- Tighten nut (E) to the prescribed torque
- Tighten nut (D) to the prescribed torque
- Attention: dimension ‚g' must be ≤ g_{max}!

ZENTOR® - Rebar Splicing System	**Annex B3**
ZENTOR® - Intended Use and Installation manual for Connection 'B'	

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Standard Connection ‚S' with Rebar B500B / B550B



Type	Nom. diameter d [mm]	Length l [mm]	Combination	Slip value under static or quasi-static loading **) s_1 [mm]	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *) $f_{u,min,bar,outside}$ [N/mm²]	Fatique strength N = 2 · 10⁶ $\Delta\sigma_{Rsk}$ [N/mm²]	Slip value after static or quasi-static loading ***) s_2 [mm]	Resistance to low-cycle loading (seismic action) for B500B / B550B	
								u_{20} [mm]	****) $F_{u,min}$ [kN]
S10	10	96	FS10-MS10	0.10	540 / 594	62.4	< 0.10	0.20	42.4 / 46.7
S12	12	110	FS12-MS12	0.11					61.1 / 67.2
S14	14	132	FS14-MS14	0.12		54.6			83.1 / 91.4
S16	16	144	FS16-MS16	0.12					108.6 / 119.4
S18	18	158	FS18-MS18	0.13					137.4 / 151.2
S20	20	174	FS20-MS20	0.14					169.9 / 186.6
S22	22	182	FS22-MS22	0.14					205.3 / 225.8
S26	25 / 26	222	FS26-MS26	0.16		50.7			286.7 / 315.4
S28	28	234	FS28-MS28	0.17				no performance assessed	
S30	30	252	FS30-MS30	0.18					
S32	32	262	FS32-MS32	0.18					
S34	34	284	FS34-MS34	0.19		46.8			
S36	36	300	FS36-MS36	0.20					
S40	40	328	FS40-MS40	0.20					

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

****) $F_{u,min} = (\pi \cdot d^2) / 4 \cdot f_{u,min}$

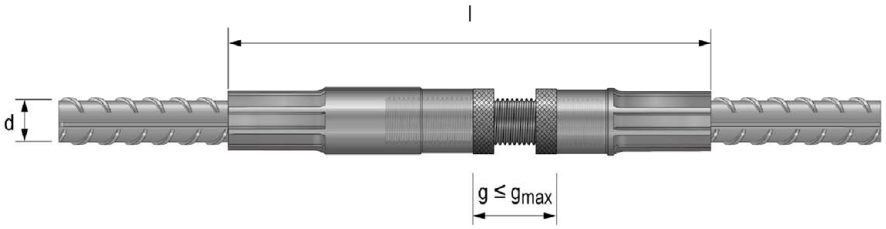
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'S'

Annex C1

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Bridge Connection ‚B' with Rebar B500B / B550B



Type	Nominal diameter d [mm]	Length with g_{min} l [mm]	Combination	Slip value under static or quasi-static loading **) s_1 [mm]	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *) $f_{u,min,bar,outside}$ [N/mm²]	Slip value after static or quasi-static loading ***) s_2 [mm]
B10	10	133	FE10-AB10-FS10	0.12	540 / 594	< 0.10
B12	12	152	FE12-AB12-FS12	0.13		
B14	14	182	FE14-AB14-FS14	0.14		
B16	16	198	FE16-AB16-FS16	0.15		
B18	18	220	FE18-AB18-FS18	0.16		
B20	20	239	FE20-AB20-FS20	0.17		
B22	22	250	FE22-AB22-FS22	0.18		
B26	25 / 26	300	FE26-AB26-FS26	0.20		
B28	28	315	FE28-AB28-FS28	0.20		
B30	30	346	FE30-AB30-FS30	0.20		
B32	32	362	FE32-AB32-FS32	0.20		
B34	34	389	FE34-AB34-FS34	0.20		
B36	36	404	FE36-AB36-FS36	0.20		
B40	40	443	FE40-AB40-FS40	0.20		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

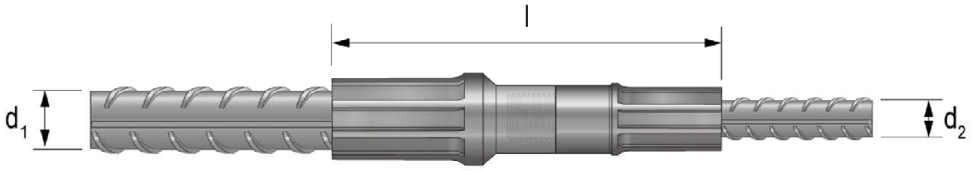
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'B'

Annex C2

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Female Reduction Connection ‚F' with Rebar B500B / B550B



Type	Nominal diameter		Length	Combination	Slip value under static or quasi-static loading **)	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *)	Slip value after static or quasi-static loading ***)
	d_1 [mm]	d_2 [mm]	l [mm]		s_1 [mm]	$f_{u,min,bar,outside}$ [N/mm²]	s_2 [mm]
F1210	12	10	102	FR1210-MS10	0.10	540 / 594	< 0.10
F1410	14	10	112	FR1410-MS10	0.11		
F1612	16	12	124	FR1612-MS12	0.11		
F1812	18	12	131	FR1812-MS12	0.12		
F2014	20	14	153	FR2014-MS14	0.13		
F2216	22	16	163	FR2216-MS16	0.13		
F2620	25 / 26	20	196	FR2620-MS20	0.15		
F2820	28	20	204	FR2820-MS20	0.15		
F3020	30	20	213	FR3020-MS20	0.16		
F3226	32	25 / 26	243	FR3226-MS26	0.17		
F3426	34	25 / 26	254	FR3426-MS26	0.18		
F3628	36	28	264	FR3628-MS28	0.18		
F4030	40	30	290	FR4030-MS30	0.20		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

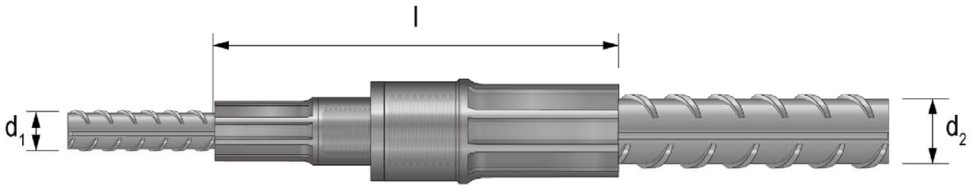
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'F'

Annex C3

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Transition Connection ‚T' with Rebar B500B / B550B



Type	Nominal diameter		Length	Combination	Slip value under static or quasi-static loading **)	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *)	Slip value after static or quasi-static loading ***)
	d_1 [mm]	d_2 [mm]	l [mm]		s_1 [mm]	$f_{u,min,bar,outside}$ [N/mm²]	s_2 [mm]
T1012	10	12	106	FS10-AT1012-FS12	0.10	540 / 594	< 0.10
T1014	10	14	118	FS10-AT1014-FS14	0.11		
T1216	12	16	131	FS12-AT1216-FS16	0.12		
T1218	12	18	139	FS12-AT1218-FS18	0.12		
T1420	14	20	158	FS14-AT1420-FS20	0.13		
T1622	16	22	168	FS16-AT1622-FS22	0.13		
T2026	20	25 / 26	203	FS20-AT2026-FS26	0.15		
T2028	20	28	209	FS20-AT2028-FS28	0.15		
T2030	20	30	218	FS20-AT2030-FS30	0.16		
T2632	25 / 26	32	247	FS26-AT2632-FS32	0.17		
T2634	25 / 26	34	258	FS26-AT2634-FS34	0.18		
T2836	28	36	271	FS28-AT2836-FS36	0.19		
T3040	30	40	295	FS30-AT3040-FS40	0.20		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

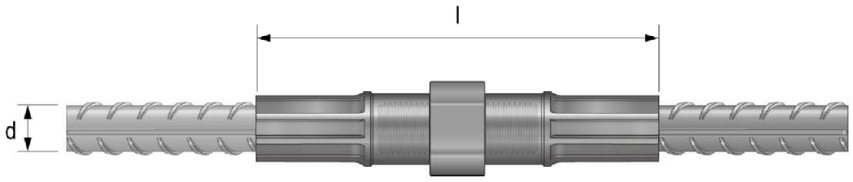
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'T'

Annex C4

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Left/Right Connection ‚L' with Rebar B500B / B550B



Type	Nom. diameter d [mm]	Length l [mm]	Combination	Slip value under static or quasi-static loading **) s_1 [mm]	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *) $f_{u,min,bar,outside}$ [N/mm²]	Slip value after static or quasi-static loading ***) s_2 [mm]
L10	10	111	FS10-AL10-FL10	0.11	540 / 594	< 0.10
L12	12	126	FS12-AL12-FL12	0.11		
L14	14	148	FS14-AL14-FL14	0.12		
L16	16	162	FS16-AL16-FL16	0.13		
L18	18	177	FS18-AL18-FL18	0.14		
L20	20	193	FS20-AL20-FL20	0.15		
L22	22	203	FS22-AL22-FL22	0.15		
L26	25 / 26	243	FS26-AL26-FL26	0.17		
L28	28	258	FS28-AL28-FL28	0.18		
L30	30	277	FS30-AL30-FL30	0.19		
L32	32	288	FS32-AL32-FL32	0.19		
L34	34	310	FS34-AL34-FL34	0.20		
L36	36	327	FS36-AL36-FL36	0.20		
L40	40	355	FS40-AL40-FL40	0.20		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

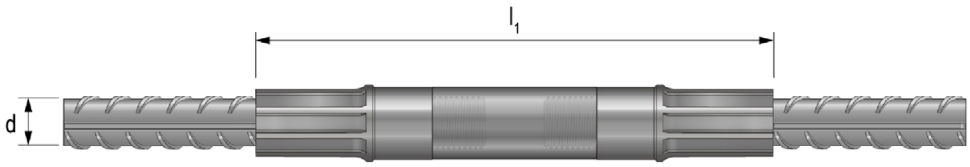
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'L'

Annex C5

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Connection ‚C' with Rebar B500B / B550B



Type	Nominal diameter d [mm]	Length l [mm]	Combination	Slip value under static or quasi-static loading **) s_1 [mm]	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *) $f_{u,min,bar,outside}$ [N/mm²]	Slip value after static or quasi-static loading ***) s_2 [mm]
C10	10	127	FS10-FC10-FS10	0.11	540 / 594	< 0.10
C12	12	147	FS12-FC12-FS12	0.12		
C14	14	177	FS14-FC14-FS14	0.14		
C16	16	190	FS16-FC16-FS16	0.15		
C18	18	211	FS18-FC18-FS18	0.16		
C20	20	229	FS20-FC20-FS20	0.16		
C22	22	239	FS22-FC22-FS22	0.17		
C26	25 / 26	290	FS26-FC26-FS26	0.20		
C28	28	304	FS28-FC28-FS28	0.20		
C30	30	330	FS30-FC30-FS30	0.20		
C32	32	342	FS32-FC32-FS32	0.20		
C34	34	370	FS34-FC34-FS34	0.20		
C36	36	388	FS36-FC36-FS36	0.20		
C40	40	426	FS40-FC40-FS40	0.20		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

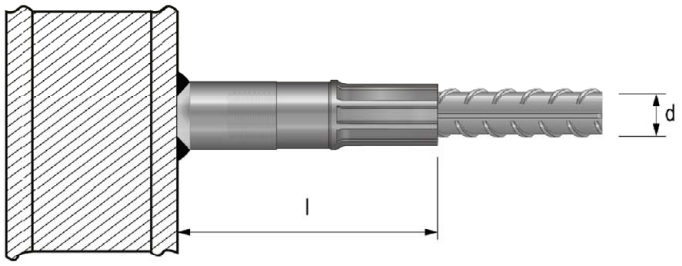
ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'C'

Annex C6

Deutsches Institut für Bautechnik DIBt

ZENTOR® - Welding Connection ‚W' with Rebar B500B / B550B



Type	Nominal diameter d [mm]	Length l [mm]	Combination	Slip value under static or quasi-static loading **) s_1 [mm]	Resistance to static or quasi-static loading for B500B/B550B (tension and compression) *) $f_{u,min,bar,outside}$ [N/mm²]	Slip value after static or quasi-static loading ***) s_2 [mm]
W10	10	79	FW10-FS10	0.10	540 / 594	< 0.10
W12	12	90	FW12-FS12	0.10		
W14	14	105	FW14-FS14	0.10		
W16	16	113	FW16-FS16	0.10		
W18	18	124	FW18-FS18	0.10		
W20	20	133	FW20-FS20	0.10		
W22	22	139	FW22-FS22	0.10		
W26	25 / 26	165	FW26-FS26	0.11		
W28	28	172	FW28-FS28	0.11		
W30	30	186	FW30-FS30	0.11		
W32	32	192	FW32-FS32	0.12		
W34	34	207	FW34-FS34	0.12		
W36	36	216	FW36-FS36	0.13		
W40	40	237	FW40-FS40	0.13		

*) $f_{u,min,bar,outside} = f_{yk} \cdot 1,08$ with f_{yk}= 500 N/mm² (B500B), resp. with f_{yk}=550 N/mm² (B550B)

**) Slip within the connection under loading measured at $0,6 \cdot f_{yk}$

***) Slip within the connection after loading measured at $0,02 \cdot f_{yk}$

ZENTOR® - Rebar Splicing System

Performance Parameter for Connection 'W'

Annex C7