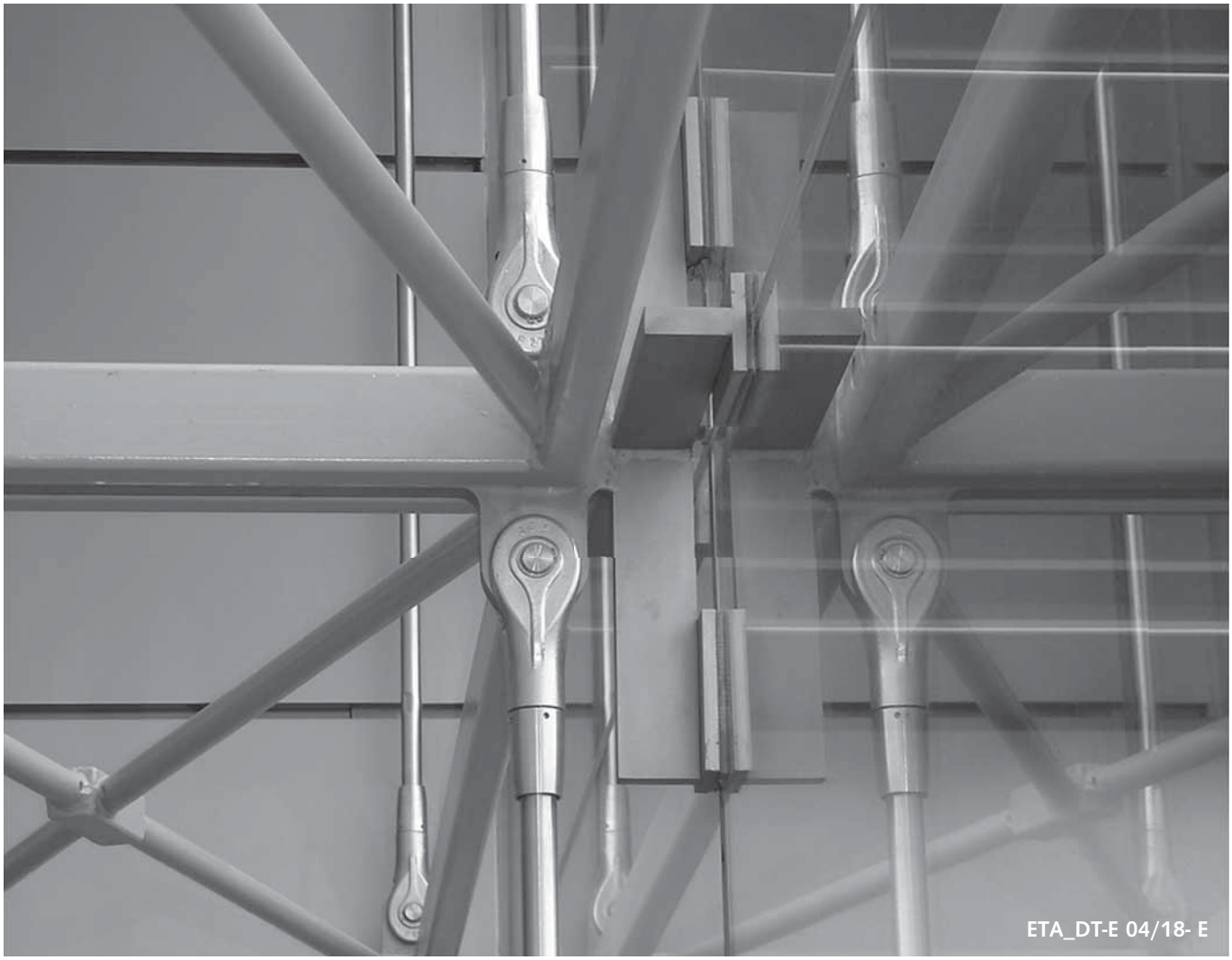
Leviat®
A CRH COMPANY

HALFEN

HALFEN TENSION ROD SYSTEM

DETAN-E / Stainless steel

European Technical Assessment ETA-11/0311



HALFEN TENSION ROD SYSTEMS
General Note

Use of third-party products

This approval only applies to original HALFEN products. The specifications in this approval are not transferable to other products. Users are fully liable for personal injuries and material damage caused by third-party products used instead of HALFEN products.

Deutsches Institut für Bautechnik

DIBt

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment ETA-11/0311 of 20 April 2018

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 Tension Rod System DETAN-E
Product family to which the construction product belongs	Prefabricated Tension Rod System
Manufacturer	HALFEN GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	HALFEN GmbH Otto-Brünner-Straße 3 06556 Artern DEUTSCHLAND
This European Technical Assessment contains	18 pages including 13 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 200032-00-0602
This version replaces	ETA-11/0311 issued on 19 April 2013

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Specific part

1 Technical description of the product

The construction product is a prefabricated tension rod system of different system sizes used as a kit. The tension rod system consists of stainless steel bars (tension rods) with external threads which are connected to each other and to the corresponding structure by special connecting devices. The tension rods are connected to the corresponding structure by stainless steel cast or drop-forged fork end connectors with two eye loops and internal thread. The fork end connectors are connected by double shear pin connections to corresponding gusset plates or anchor discs. The tension rods are connected to each other by stainless threaded steel sleeves (couplers, couplers with additional gusset plate, hexagon couplers and cross couplers).

The tension rod system comprises tension rods, fork end connectors, gusset plate, anchor discs, pins and threaded sleeves with metric ISO threads M 6 to M 48.

Drawings of the tension rod system and the components as well as the essential dimensions of the components are given in the Annexes to this ETA.

The dimensions, tolerances and materials of the components of the tension rod system not indicated in Annexes shall correspond to the respective values and information laid down in the technical documentation[1] to this European Technical Assessment.

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

The tension rod system is intended for the use in structures with static or quasi-static loads in accordance with EN 1990:2002, where no verification of fatigue relating to EN 1993-1-9:2005 is necessary.

The intended use comprises for instance the suspension of roof structures or vertical glazing as well as bracing and truss structures.

The tension rod system is not subjected to systematic bending.

The fork end connectors may also be connected to compression rods. The compression rods themselves are not part of the ETA.

The performances given in Section 3 are only valid if the tension rod system is used in compliance with the specifications and conditions given in Annex A and Annexes B1 to B9.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the tension rod system of at least 25 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.

[1] The technical documentation to this European Technical Assessment is deposited with 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.

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

3.1 Mechanical resistance and stability (BWR 1)

3.1.1 Fork end connector, gusset plate, anchor disc, pin, threaded sleeves

Essential characteristic	Performance
Geometry incl. tolerances	See Annexes B3 to B9
Dimensions incl. tolerances	
Thread incl. tolerances	
Material	See Annex B2
Load bearing capacity	See Annex A
Resistance to corrosion	

3.1.2 Tension rod

Essential characteristic	Performance
Nominal rod diameter	See Annexes B4
Thread incl. tolerances	
Yield strength	See Annex B2
Tensile strength	
Material	
Tension resistance	See Annex A
Compression force	
Resistance to corrosion	

3.2 Safety in case of fire (BWR 2)

Tension rod, fork end connector, gusset plate, anchor disc, pin, threaded sleeves

Essential characteristic	Performance
Reaction to fire	Class A1 in accordance with EN 13501-1:2007+A1:2009

The components of the tension rod system satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC decision 96/603/EC (as amended).

3.3 Safety and accessibility in use (BWR 4)

Same as BWR 1.

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

In accordance with European Assessment Document EAD No. 200032-00-0602, the applicable European legal act is: 98/214/EC.

The system to be applied is: 2+

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

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

Issued in Berlin on 20 April 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Bertram

Annex A

A.1 Assumptions concerning design

The design of the tension rod system is carried out under the following conditions:

The loading is static or quasi-static in accordance with EN 1990:2002 without need of verification of fatigue relating to EN 1993-1-9:2005.

The tension rod systems are not used, when constructions are susceptible to vibrations under wind loads or wind-induced cross vibrations of the entire construction appear.[1]

Dimensions, material properties and screw-in lengths given in Annex B are observed.

The tension rod system is not subjected to systematic bending.

The verification concept stated in EN 1990:2002 as well as the design values of resistance stated below are used for design.

The rules given in EN 1090-2:2008, EN ISO 12944:1998 and EN 1993-1-4:2006 are taken into account.

Design is carried out by the designer of the structure experienced in the field of steel structures.

Design tension resistance of the entire tension rod system

The design value $F_{t,RD}$ of the tension resistance of the entire tension rod system (tension rods, fork end connectors, pins, couplers, hexagon couplers, cross couplers, gusset plates and anchor discs) is the value of the design tension resistance $F_{t,Rd,Tension\ Rod}$ of the tension rod.

The design value shall be determined according to EN 1993-1-1:2005 +AC:2009, EN 1993-1-4:2006 +A1:2015 and EN 1993-1-8:2005 +AC:2009 as follows:

$$F_{t,RD,Tension\ Rod} = \min \{A \cdot f_{y,k}/\gamma_{M0};\ 0.9 \cdot A_S \cdot f_{u,k}/\gamma_{M2}\}$$

A minimum cross section of the unthreaded part of the tension rod

A_S cross section of the threaded part of the tension rod

$f_{y,k}$ characteristic value of the yield strength of the tension rod according to $R_{p0,2}$ given in Annex B2

$f_{u,k}$ characteristic value of the tensile strength of the tension rod according to R_m given in Annex B2

γ_{M0} = 1.10 for stainless steel

γ_{M2} = 1.25

The values given for the partial safety factors γ_{M0} and γ_{M2} are recommended minimum values. They should be used in cases where no values are given in national regulations of the Member State where the tension rod system is used or in the respective National Annex to Eurocode 3.

The design tension resistance $F_{t,RD}$ of the entire tension rod system determined with the recommended partial safety factors γ_{M0} and γ_{M2} is given in Annex B10.

[1] The national provisions of the Member State applicable for the location where the product is incorporated in the works shall be taken into account.

Design values of the compression force of tension rods and compression rods

The design value of the compression force $F_{c,RD}$ of tension rods or compression rods in combination with fork end connectors in accordance with Annex B3 is the minimum value of

- the design value of the compression force of struts in the cross-section of the thread and
- the design value of the compression force of struts calculated in accordance with EN 1993-1-1:2005 and EN 1993-1-4:2006.

The design value of the compression force of struts in the cross-section of the thread $F_{c,RD}$ should be determined as follows:

$$F_{c,RD} = \left[\frac{\gamma_{M2}}{A_S \cdot f_{u,c}} + \frac{\left(\frac{w-b}{2} + \frac{nRV}{50}\right) \cdot \gamma_{M0}}{W_{pl,s} \cdot f_{y,c}} \right]^{-1}$$

A_S tensile stress area of the thread

$W_{pl,S}$ plastic section modulus of the core cross section

$f_{y,c}$ characteristic value of the yield strength of the strut, where $f_{y,c} = R_{eH}$ characteristic value of the yield strength of the strut in accordance with product standard

$f_{u,c}$ characteristic value of the tension resistance of the strut, where $f_{u,c} = R_m$ characteristic value of the tensile strength of the strut in accordance with product standard

The dimensions of w, b, nRV are stated in Annex B3.

Recommended values for the partial safety factors γ_{M0} and γ_{M2} are:

γ_{M0} = 1.10 for stainless steel

γ_{M2} = 1.25

The design value of the compression force of struts has to be determined in accordance with EN 1993-1-1:2005 and EN 1993-1-4:2006 considering the additional bending strength in consequence of one-sided contact of the gusset plates.

In addition EN 1993-1-1:2005 and EN 1993-1-4:2006 applies for verification against buckling.

A.2 Assumptions concerning Installation

The installation of the tension rod system is carried out under the following conditions:

The installation is only carried out in accordance with the manufacturer's instructions. The manufacturer hands over the assembly instructions to the assembler. From the assembly instructions it is followed that, prior to installation, all components of the tension rod system shall be checked for their perfect condition and that damaged components shall not be used.

The fork end connectors are not subjected to sudden or impact loads (for instance pins shall not be adjusted by hammer blows).

The minimum screw-in lengths are marked in an appropriate way. The compliance of the minimum screw-in lengths, given in Annex B, is checked by the assembler in accordance with the assembly instructions. The compliance of the screw-in lengths shall be attested with a written confirmation by a person responsible for the construction site.

The pins of the tension rod system are secured in their position with circlips.

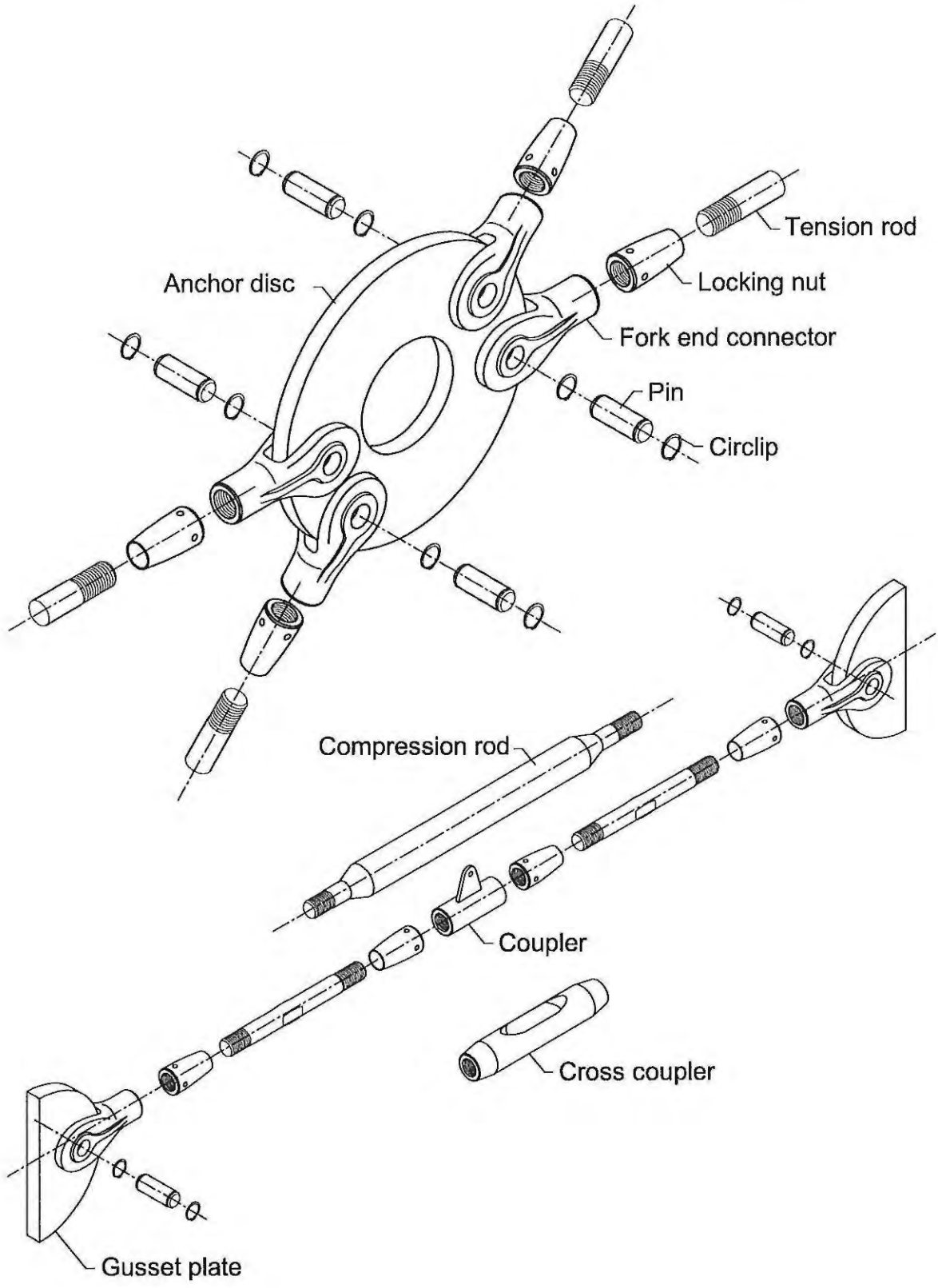
The conformity of the installed tension rod system with the provisions of the ETA is attested by the executing assembler.

A.3 Indications to the manufacturer

The manufacturer shall ensure that the information on the specific conditions is given to those who are concerned. This information may be given by reproduction of the European Technical Assessment. In addition all essential installation data (e.g. minimum screw-in length in accordance with Annex B) shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The prefabricated tension rod system shall be packaged and delivered as a complete unit only (tension rods, fork end connectors incl. pins, threaded sleeves).

Longer systems may be separated at the couplers for easier transportation.



HALFEN Tension Rod System DETAN-E	Annex B1
Components	

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Component	System Size	Material	Grade	$R_{p0,2}$ [N/mm²]	R_m [N/mm²]
Fork end connector	M6 - M30	1.4462	-	460	600
	M36 - M48	1.4470			
Tension rod	M6 - M48	1.4401, 1.4404 1.4062, 1.4162 1.4362, 1.4462 1.4571	S355	350	600
			S460	460	650
Pin	M6 - M48	1.4401, 1.4404 1.4362, 1.4462 1.4571	S460	460	600
Coupler	M6 - M48	1.4401, 1.4404 1.4362, 1.4462 1.4571	S235	240	500
			S355	350	600
			S460	460	650
Anchor disc	M6 - M48	1.4401, 1.4404 1.4362, 1.4462 1.4571	S235 (b<25)	240	500
			S235 (b>30)	200	500
Gusset plate	M6 - M48	1.4401, 1.4404 1.4362, 1.4462 1.4571	S235 (b≤25)	240	500
			S235 (b≥30)	200	500
		S355J2	acc. to EN 10025-2		

HALFEN Tension Rod System DETAN-E	Annex B2
Material properties of the components	

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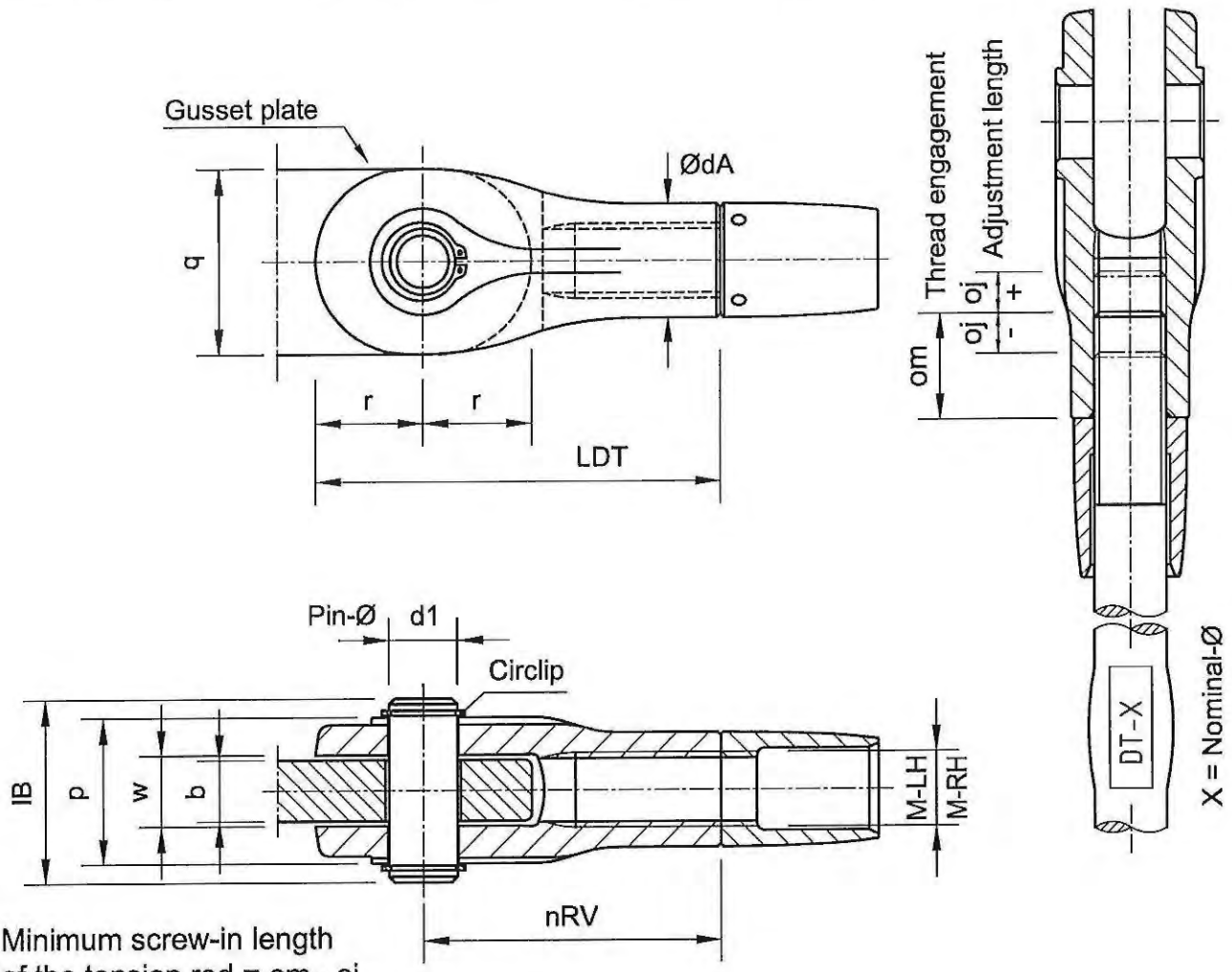

Minimum screw-in length
of the tension rod = om - oj

DT-E M-LH/ M-RH	dA	LDT	d1	p	q	r	w	nRV	b	om	± oj	IB	Material	
	[mm]												Fork end connector	Pin
M 6	9,6	42	6	12	16,7	9,3	7	32,7	6	10,5	4,5	18	1.4462	1.4362, 1.4462, 1.4401, 1.4404, 1.4571
M 8	12,6	50	7	16	21,3	11,8	9	38,2	8	12,5	4,5	22		
M10	15,7	60	9	20,6	26,3	14,8	11	45,2	10	15	5	28		
M12	18,7	73	11	23,6	31,4	17,8	13	55,2	12	18,5	6,5	32		
M16	25	89	14	33	40,6	23,8	17	65,2	16	22,5	7,5	42		
M20	30,7	110	18	40	51,0	29,3	21	80,7	20	27	8	50		
M24	37,2	133	21	46,2	60,6	34,8	23	98,2	22	34	11	58		
M27	42	147	24	50,9	68,5	39,3	26	107,7	25	37,5	12,5	63		
M30	46,5	160	26	57,1	75,4	43,3	31	116,7	30	42,5	12,5	70		
M36	53,5	192	33	68	90,0	51,3	31	140,7	30	51	14	84	1.4470	
M42	63	225	40	79	105,2	59,8	36	165,2	35	55	15	97		
M48	74	265	46	90	118,5	70,3	41	194,7	40	62,5	17,5	111		

HALFEN Tension Rod System DETAN-E

Annex B3

Dimensions of the fork end connectors and minimum dimensions of the gusset plates

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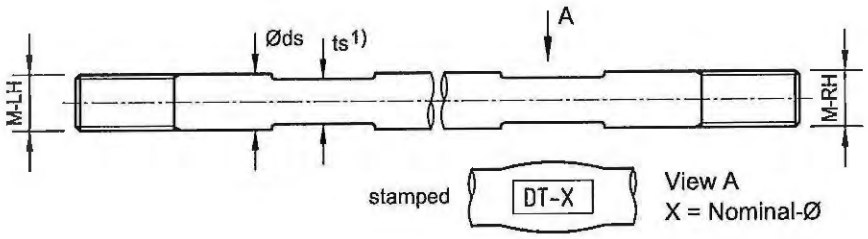
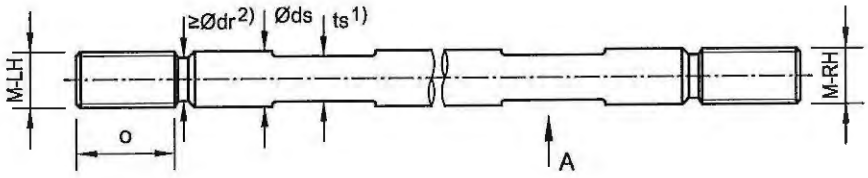
Cut thread



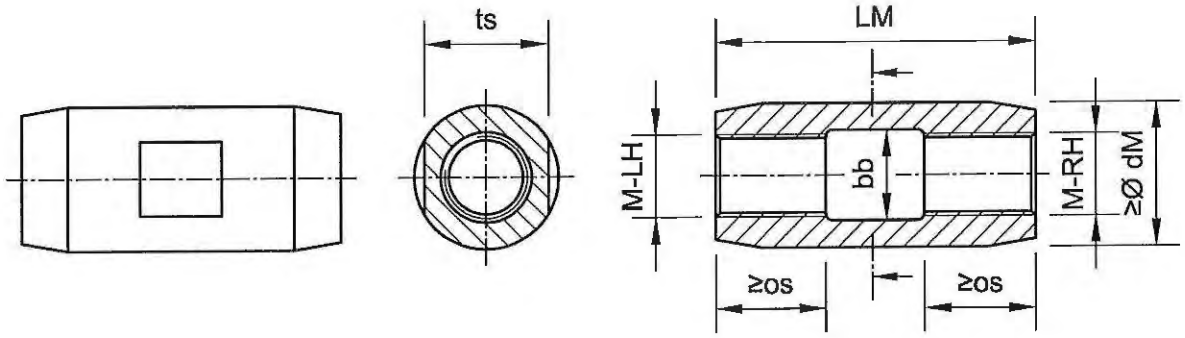
Rolled thread



DT-E M-LH / M-RH	Øds	o	ts	Ødr	Material
	[mm]				
M 6 x 1,0	6	18	5	5,21	1.4401, 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4462 grade S355 or S460
M 8 x 1,25	8	21	6	7,04	
M10 x 1,5	10	25	8	8,86	
M12 x 1,75	12	31	10	10,68	
M16 x 2,0	16	38	14	14,50	
M20 x 2,5	20	45	18	18,16	
M24 x 3,0	24	57	21	21,80	
M27 x 3,0	27	64	24	24,80	
M30 x 3,5	30	70	27	27,46	
M36 x 4,0	36	83	32	33,12	
M42 x 4,5	42	91	36	38,78	
M48 x 5,0	48	104	41	44,43	

1) alternatively with tooled spanner flats and rod marking
2) Ødr possible for the complete rod in case of rolled threads

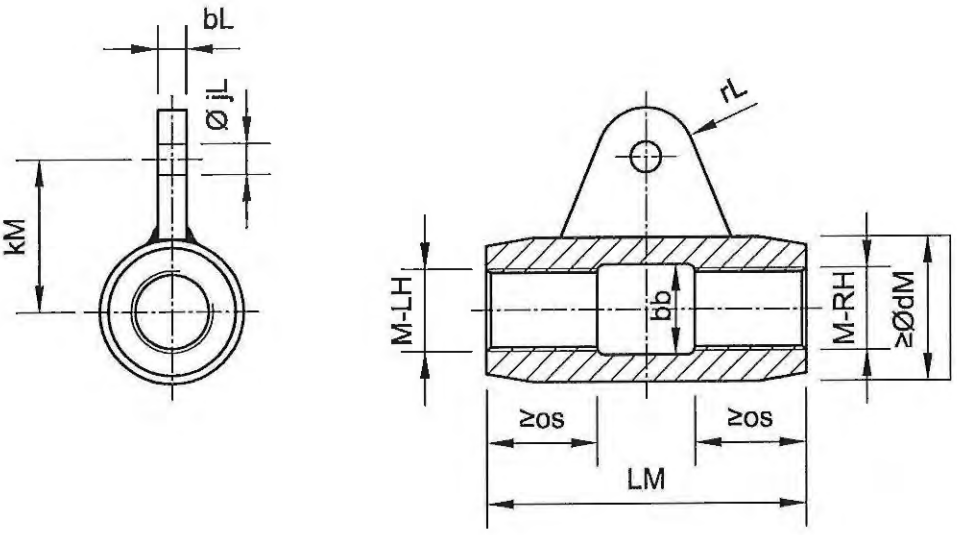
HALFEN Tension Rod System DETAN-E	Annex B4
Dimensions of the tensions rods	



Minimum screw-in length of the tension rod = om - oj according to Annex B3

DT-E M-LH / M-RH	min dM	LM	os	bb	ts	Material
	[mm]					
M 6	12	34	17	—	10	1.4401, 1.4404, 1.4362, 1.4462, 1.4571 grade S235, S355 or S460
M 8	15	40	20	—	13	
M10	20	40	20	—	17	
M12	22	50	25	—	19	
M16	28	62	31	—	24	
M20	35	78	39	—	30	
M24	42	94	47	—	36	
M27	47	104	37	28,4	41	
M30	53	120	40,5	31,5	46	
M36	64	140	55	37,8	55	
M42	75	158	64	44,1	65	
M48	87	180	75	50,4	75	

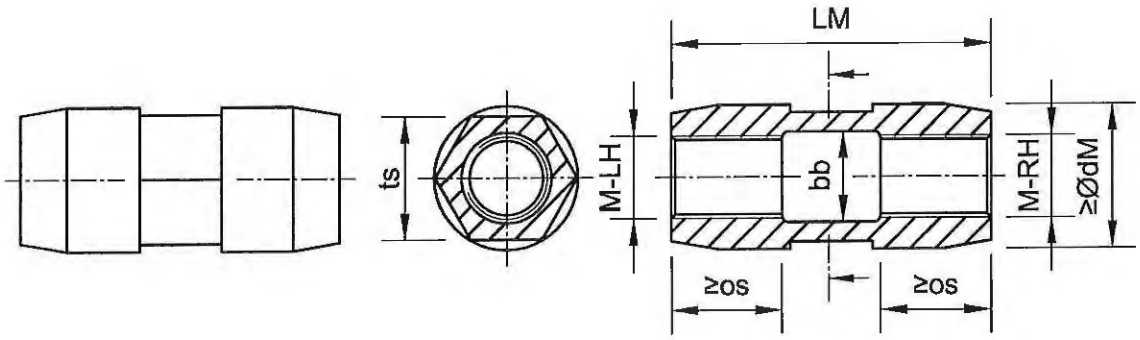
HALFEN Tension Rod System DETAN-E	Annex B5
Dimensions of the couplers	



Minimum screw-in length of the tension rod = om - oj according to Annex B3

DT-E M-LH / M-RH	min dM	LM	os	bb	jL	bL	rL	kM	Material
	[mm]								
M 6	12	34	17	—	6,5	6	9,3	21	1.4401, 1.4404, 1.4362, 1.4462, 1.4571 grade S235, S355 or S460
M 8	15	40	20	—	6,5	6	9,3	21	
M10	20	40	20	—	6,5	6	9,3	23,5	
M12	22	50	25	—	6,5	6	9,3	27,5	
M16	28	62	31	—	6,5	6	9,3	33	
M20	35	78	39	—	7,5	8	12	37	
M24	42	94	47	—	7,5	8	12	44	
M27	47	104	37	28,4	9,5	10	15	50,5	
M30	53	120	40,5	31,5	9,5	10	15	57,5	
M36	64	140	55	37,8	9,5	8	15	72	
M42	75	158	64	44,1	9,5	8	15	86,5	
M48	87	180	75	50,4	11,5	10	18	98,5	

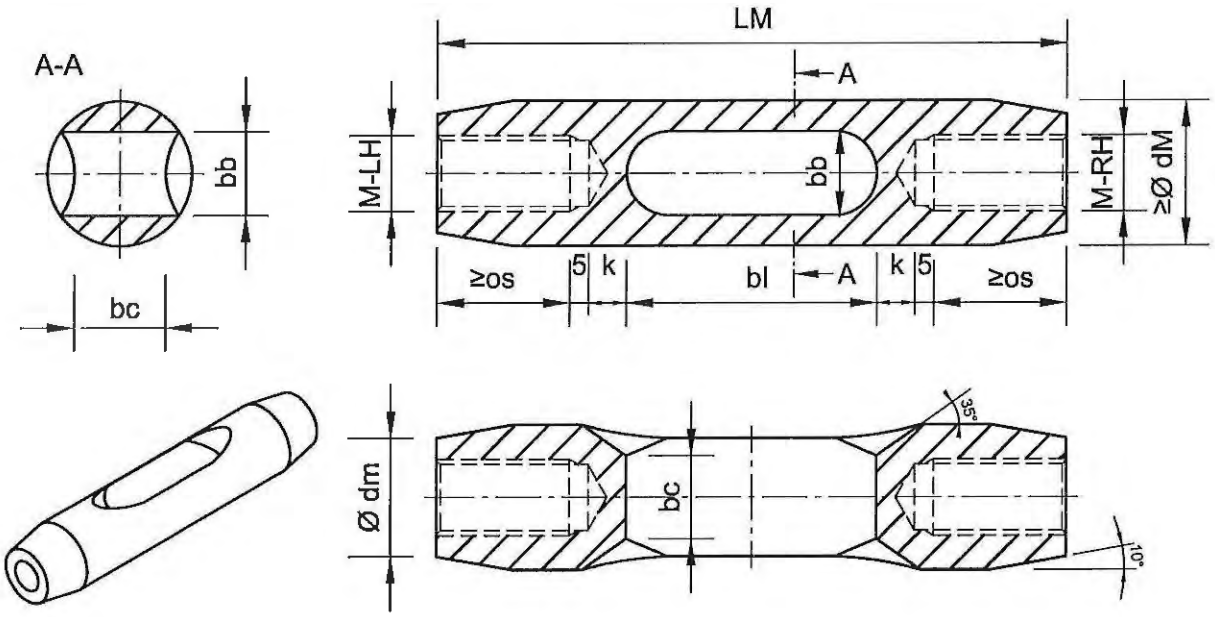
HALFEN Tension Rod System DETAN-E	Annex B6
Dimensions of the couplers with additional gusset plate	



Minimum screw-in length of the tension rod = om - oj according to Annex B3

DT-E M-LH / M-RH	min dM	LM	os	bb	ts	Material
	[mm]					
M 6	12	34	17	-	10	1.4401, 1.4404, 1.4362, 1.4462, 1.4571 grade S355 or S460
M 8	15	40	20	-	13	
M10	20	40	20	-	17	
M12	22	50	25	-	19	
M16	28	62	31	-	24	
M20	35	78	39	-	30	
M24	42	94	47	-	36	
M27	47	104	37	28,4	41	
M30	53	120	40,5	31,5	46	
M36	64	140	55	37,8	55	
M42	75	158	64	44,1	65	
M48	87	180	75	50,4	75	

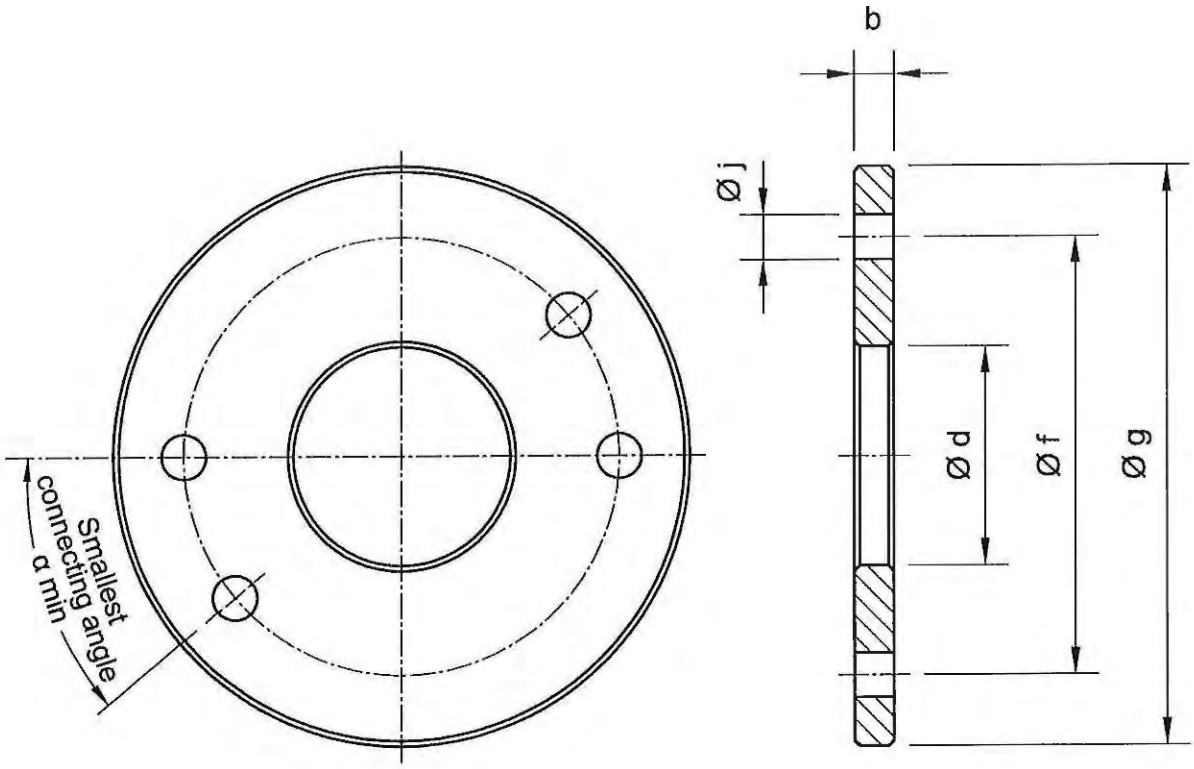
HALFEN Tension Rod System DETAN-E	Annex B7
Dimensions of the hexagon couplers	



Minimum screw-in length of the tension rod = om - oj according to Annex B3

DT-E M-LH / M-RH	min dM	LM	os	bb	bl	bc	dm	k	Material
	[mm]								
M6	14	70	15	8	24	7,0	9,6	3	1.4401, 1.4404, 1.4362, 1.4462, 1.4571 grade S355 or S460
M8	17	85	17	10	33	10,9	12,6	4	
M10	20	100	20	12	38	12,0	15,7	6	
M12	24	120	25	14	46	15,1	18,7	7	
M16	32	142	30	18	54	15,8	25	9	
M20	39	166	35	22	66	19,4	31	10	
M24	46	200	45	26	78	22,9	37	11	
M27	52	222	50	29	87	25,5	42	12,5	
M30	57	242	55	32	96	28,2	46,5	13	
M36	70	284	65	38	114	33,4	53,5	15	
M42	80	310	70	44	128	35,9	63	16	
M48	91	348	80	50	142	38,4	74	18	

HALFEN Tension Rod System DETAN-E	Annex B8
Dimensions of the cross couplers	



DT-E M-LH / M-RH			α min = 40°			α min = 60°			α min = 80°			Material
	b	Ø j	Ø d	Ø f	Ø g	Ø d	Ø f	Ø g	Ø d	Ø f	Ø g	
	[mm]											
M 6	6	6,5	27	55	73	22	45	63	12	33	51	1.4401, 1.4404, 1.4463, 1.4462, 1.4571 grade S235
M 8	8	7,5	37	75	99	25	55	79	15	42	66	
M10	10	9,5	46	90	120	33	70	100	20	55	85	
M12	12	11,5	56	110	146	35	80	116	22	65	101	
M16	16	14,5	70	140	186	50	110	156	28	85	131	
M20	20	18,5	94	180	238	57	130	188	35	105	163	
M24	22	21,5	106	210	280	63	150	220	40	125	195	
M27	25	24,5	120	240	318	72	170	248	45	140	218	
M30	30	26,5	132	260	346	82	190	276	52	155	241	
M36	30	33,5	156	310	412	92	220	322	62	185	287	
M42	35	41	182	360	480	100	250	370	72	215	335	
M48	40	47	212	420	558	125	300	438	82	250	388	

HALFEN Tension Rod System DETAN-E

Dimensions of the ancor discs K40, K60, K80

Annex B9

Deutsches Institut für Bautechnik DIBt

System Size	design tension resistance of the tension rod system $F_{t,Rd}$ [kN]	
	S460	S355
M6	9,42	8,69
M8	17,13	15,81
M10	27,14	24,99
M12	39,44	35,99
M16	73,32	63,97
M20	114,6	99,96
M24	165,0	143,9
M27	215,0	182,2
M30	262,4	224,9
M36	382,2	323,9
M42	524,6	440,8
M48	689,4	575,8

(γ_{M0} =1,1 und γ_{M2}=1,25 note Annex A)

HALFEN Tension Rod System DETAN-E	Annex B10
design tension resistance of the entire tension rod system	

For more information on the products featured here, please contact Leviat:

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Mount Druitt Sydney, NSW 2770
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