

## European Technical Approval ETA-11/0311

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
Trade name

HALFEN Zugstabsystem DETAN-E  
*HALFEN Tension Rod System DETAN-E*

Zulassungsinhaber  
Holder of approval

HALFEN GmbH  
Liebigstraße 14  
40764 Langenfeld  
DEUTSCHLAND

Zulassungsgegenstand  
und Verwendungszweck  
Generic type and use  
of construction product

Vorgefertigtes Zugstabsystem  
*Prefabricated Tension Rod System*

Geltungsdauer:  
Validity:

verlängert  
extended

vom  
from  
bis  
to  
vom  
from  
bis  
to

1 September 2011  
1 September 2016  
19 April 2013  
19 April 2018

Herstellwerk  
Manufacturing plant

HALFEN GmbH  
Otto-Brünner-Straße 3  
06556 Artern  
DEUTSCHLAND

Diese Zulassung umfasst  
This Approval contains

17 Seiten einschließlich 10 Anhänge  
17 pages including 10 annexes

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12  
<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1  
<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25  
<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812  
<sup>5</sup> *Bundesgesetzblatt Teil I 2011*, p. 2178  
<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of product/ products and intended use

#### 1.1 Definition of the construction product

The construction product is a prefabricated tension rod system of different sizes (system sizes) used as a kit. The tension rod system consists of stainless steel bars (tension rods) of grade S355 or S460 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 steel threaded sleeves (couplers, hexagon couplers, cross couplers) of grade S235 (couplers) or S355 (couplers, hexagon couplers, cross couplers).

The tension rod system comprises tension rods, fork end connectors 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.

#### 1.2 Intended use

The tension rod system is intended for the use in structures with predominantly static loads. Furthermore the installed tension rod system shall be accessible (in order) to facilitate replacement of individual components at any time.

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

The provisions made in this European technical approval are based on an assumed working life of the tension rod system of 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.

### 2 Characteristics of product and methods of verification

#### 2.1 Characteristics of product

##### 2.1.1 Dimensions

The dimensions of the components of the tension rod system shall correspond to the drawings given in Annexes 3 to 10. The dimensions and tolerances of the components of the tension rod system not indicated in Annexes 3 to 10 shall correspond to the respective values and information laid down in the technical documentation<sup>7</sup> to this European technical approval.

##### 2.1.2 Material properties

The material properties of the components of the tension rod system shall correspond to the details given in Annex 2. The relation to the different components is given in Annexes 3 to 10. The material characteristics of the components of the tension rod system not indicated in Annex 2 shall correspond to the respective values and information laid down in the technical documentation<sup>7</sup> to this European technical approval.

<sup>7</sup> The technical documentation to this European technical approval 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.

### 2.1.3 Design values of resistance

The design value  $N_{Rd}$  of the tension resistance of the entire tension rod system (tension rods, fork end connectors incl. pins, couplers, hexagon couplers, cross couplers, gusset plates and anchor discs) is the value of the design tension resistance  $N_{Rd, \text{Tension Rod}}$  of the tension rod, provided at least the values  $\gamma_{M1}$  and  $\gamma_{M2}$  as given below are taken into account.

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

$$N_{Rd, \text{Tension Rod}} = \min \{ A \cdot f_{y,k} / \gamma_{M1}; 0.9 \cdot A_S \cdot f_{u,k} / \gamma_{M2} \}$$

$A$  = 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 2

$f_{u,k}$  = characteristic value of the tensile strength of the tension rod according to  $R_m$  given in Annex 2

$\gamma_{M1}$  = 1.10

$\gamma_{M2}$  = 1.25

The values given for the partial safety factors  $\gamma_{M1}$  and  $\gamma_{M2}$  are recommended 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 (EN 1993).

### 2.1.4 Safety in case of fire

The tension rod system is considered to satisfy the requirements of performance class A1 of the characteristic reaction to fire.

## 2.2 Methods of verification

### 2.2.1 General

The assessment of fitness of the tension rod system for the intended use in relation to the requirements for mechanical resistance and stability, safety in case of fire and safety in use in the sense of the essential requirements No. 1, No. 2 and No. 4 has been made in accordance with section 3.2 of the Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.

### 2.2.2 Essential requirement No. 2: Safety in case of fire

The tension rod system is considered to satisfy the requirements of performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that decision.

### 2.2.3 Essential requirement No. 1: Mechanical resistance and stability Essential requirement No. 4: Safety in use

In order to verify that the tension resistance of different components (i.e. fork end connectors, couplers, hexagon couplers, cross couplers, anchor discs and gusset plates) is higher than the tension resistance of the corresponding tension rods made of stainless steel grade S355 or S460 and thus not relevant to the resistance of the entire tension rod system, the characteristic values of the tension resistance of the fork end connectors were assessed by the evaluation of the results of tension tests. Tension tests were carried out on eight system sizes of the fork end connectors (M6, M8, M16, M24, M30, M42 and M48) as well as on five system sizes of the anchor discs (M6, M8, M24, M42 and M48) and on four system sizes of the gusset plates (M6, M30, M42 and M48).

Comparison of characteristic values of resistance of the corresponding tension rods calculated according to EN 1993-1-4:2006 and EN 1993-1-8:2005 +AC:2009 with the statistically evaluated test results (characteristic values) has shown that the tension resistance of the fork end connectors (including pins), couplers, hexagon couplers, cross couplers gusset plates and anchor discs is not relevant to the tension resistance of the entire tension rod system. The couplers of grade S235 shall only be used with tension rods of grade S355.

Thus it is sufficient to calculate only the tension resistance of the tension rods to determine the tension resistance of the entire tension rod system.

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to the decision 98/214/EC of the European Commission<sup>8</sup> as amended by 2001/596/EC<sup>9</sup> the system 2+ attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
  - (1) initial type-testing of the product;
  - (2) factory production control;
  - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- (b) Tasks for the approved body:
  - (4) certification of factory production control on the basis of:
    - initial inspection of factory and of factory production control;
    - continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

#### 3.2 Responsibilities

##### 3.2.1 Tasks of the manufacturer

###### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan relating to this European technical approval which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.<sup>10</sup>

<sup>8</sup> Official Journal of the European Communities L 80 of 18.03.1998

<sup>9</sup> Official Journal of the European Communities L 209 of 02.08.2001

<sup>10</sup> The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

#### 3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of tension rod systems in order to undertake the actions laid down in section 3.3. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval.

#### 3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial inspection of factory and of factory production control,
  - continuous surveillance, assessment and approval of factory production control,
- in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform the Deutsches Institut für Bautechnik without delay.

#### 3.3 CE marking

The CE marking shall be affixed on each packaging of the tension rod system. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval,
- the name of the product,
- the system size and type (e.g., M 48).

#### 4 Assumptions under which the fitness of the product for the intended use was favourably assessed

##### 4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the European technical approval and consequently the validity of the CE marking on the basis of the European technical approval and if so whether further assessment or alterations to the European technical approval shall be necessary.

#### 4.2 Installation

The installation is carried out such that the tension rod system is accessible for repair or maintenance at any time.

The installation is only carried out according to 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 of fork end connectors may not be adjusted by hammer blows).

The minimum thread engagement is marked in an appropriate way. The keeping of the minimum thread engagement given in Annex 3 is checked by the assembler. How to do this is described in the assembly instructions.

The stainless steel couplers of grade S235 must be used only with stainless steel tension rods of grade S355.

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

#### 4.3 Design

The loading is predominantly static.

Dimensions, material properties and the thread engagement as stated in the ETA are observed.

The tension rod system is not subjected to systematic bending.

The verification concept stated in EN 1990:2002 +A1:2005 +A1:2005/AC:2010 as well as the values of resistance stated in 2.1 are used for design.

The rules given in EN 1090-2:2008 +A1:2011 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.

### 5 Indications to the manufacturer

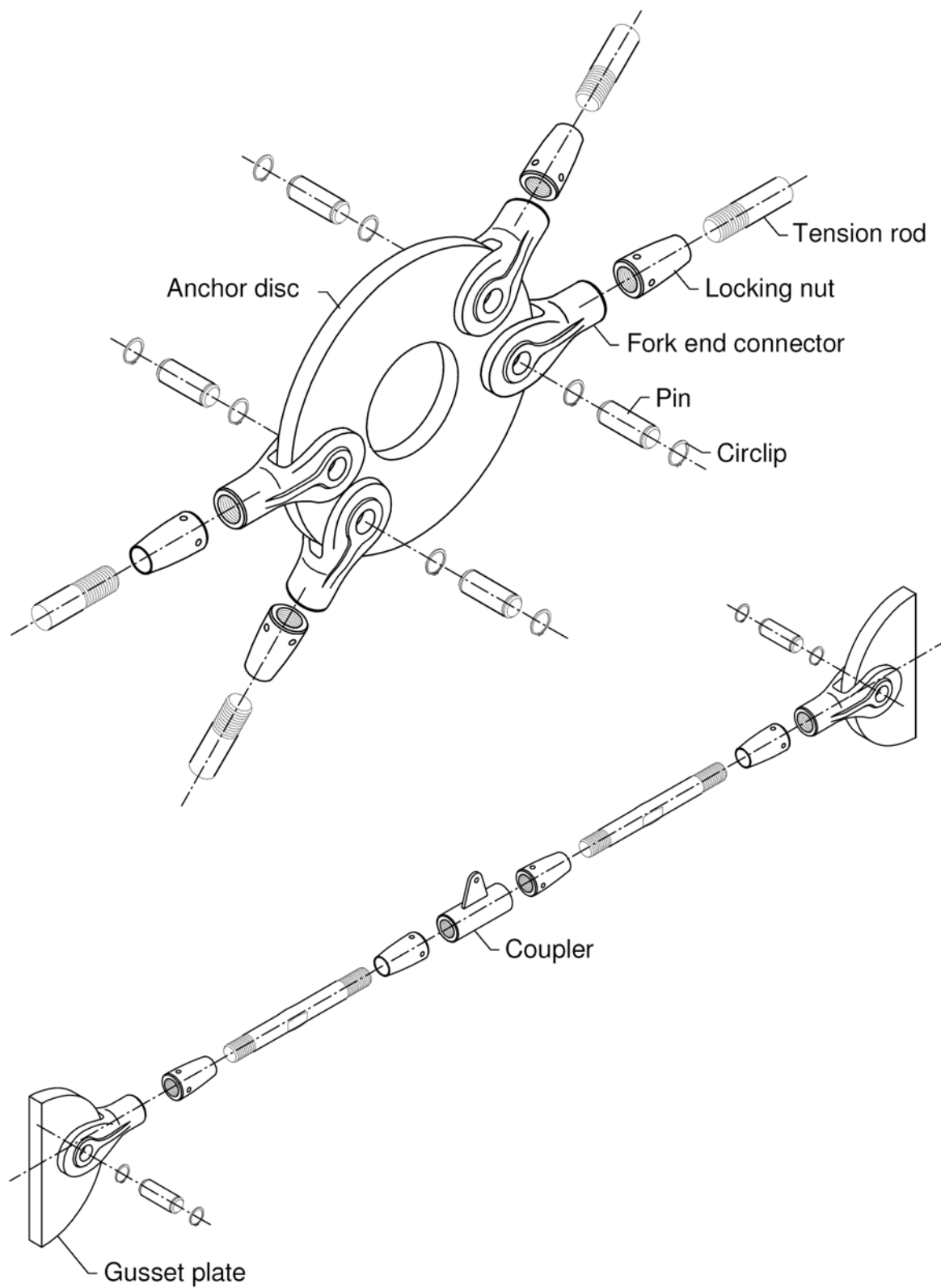
The manufacturer shall ensure that the information on the specific conditions according to 1, 2, 4.2 and 4.3 (including Annexes referred to) is given to those who are concerned. This information may be given by reproduction of the respective parts of the European technical approval. In addition all essential installation data (e.g., minimum thread engagement according to Annex 3) 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, couplers, hexagon couplers, cross couplers and anchor discs).

Georg Feistel  
Head of Department

*beglaubigt:*  
Hahn





HALFEN Tension Rod System DETAN-E

Components

Annex 1



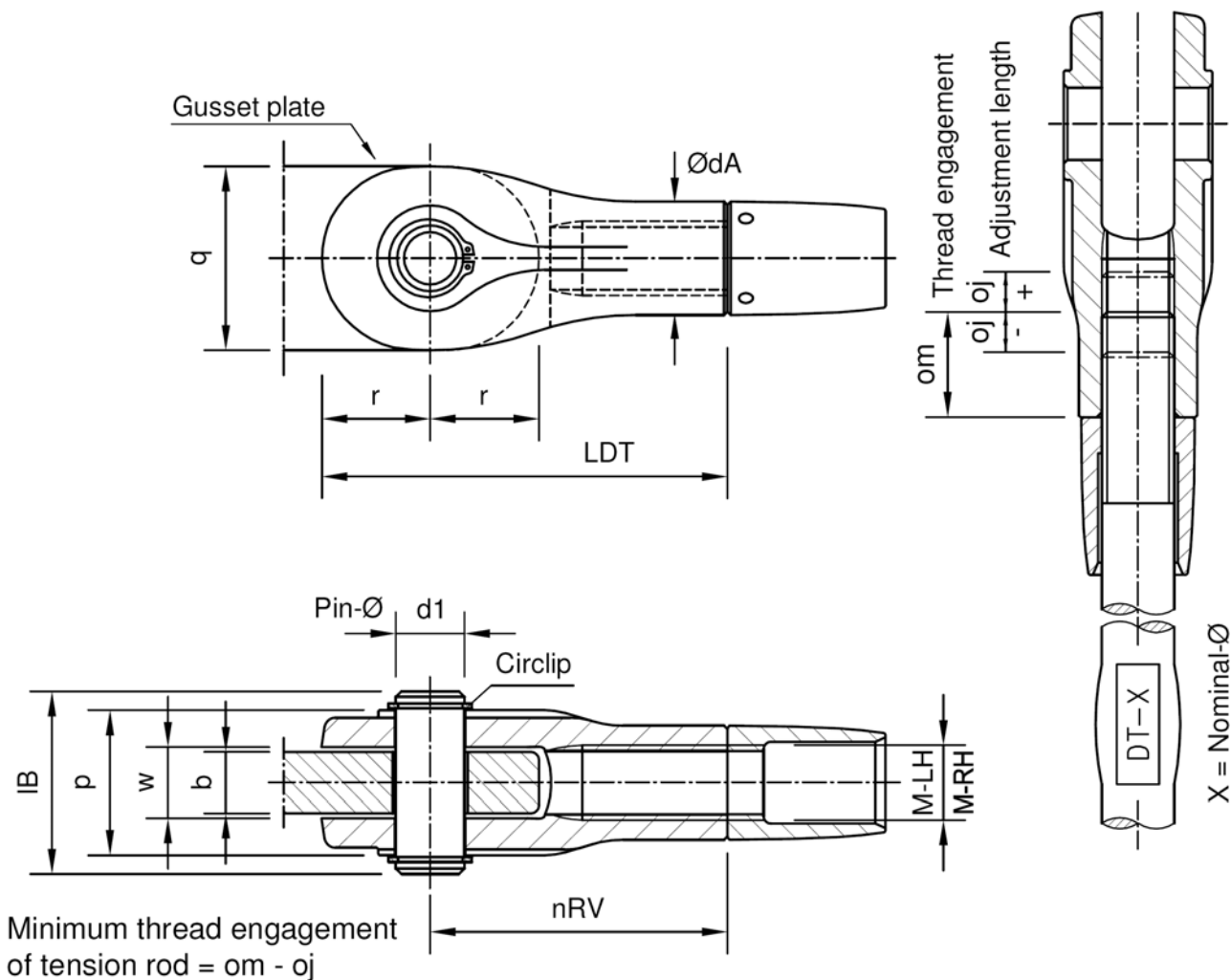
Component	System Size	Material	Grade	$R_{p0,2}$ [ N/mm <sup>2</sup> ]	$R_m$ [ N/mm <sup>2</sup> ]
Fork end connector	M6 - M30	1.4462	-	460	600
	M36 - M48	1.4470			
Tension rod	M6 - M48	1.4401, 1.4404 1.4062, 1.4162 1.4362, 1.4462 1.4571	S355	350	600
			S460	460	650
Pin	M6 - M48	1.4401, 1.4404 1.4362, 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
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		

\* couplers grade S235 to be used with tension rods grade S355

HALFEN Tension Rod System DETAN-E

Material properties of the components

Annex 2



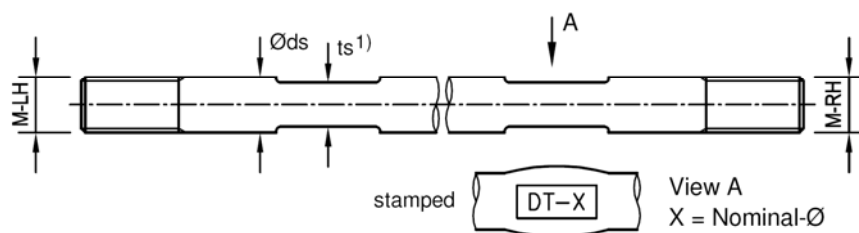
DT-E M-LH/ M-RH	dA	LDT	d1	p	q	r	w	nRV	b	om	± oj	IB	Material	
	[ mm ]												Fork end connector	Pin
M 6	9,6	42	6	12	16,7	9,3	7	32,7	6	10,5	4,5	18	1.4462	1.4362, 1.4462, 1.4401, 1.4404, 1.4571
M 8	12,6	50	7	16	21,3	11,8	9	38,2	8	12,5	4,5	22		
M10	15,7	60	9	20,6	26,3	14,8	11	45,2	10	15	5	28		
M12	18,7	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	1.4470	
M36	53,5	192	33	68	90,0	51,3	31	140,7	30	51	14	84		
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

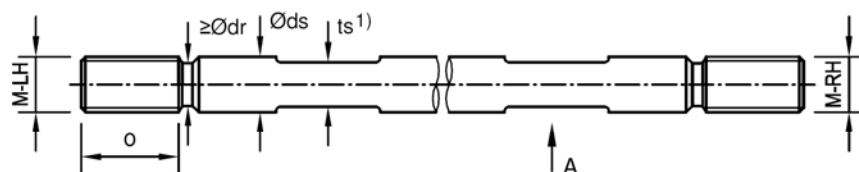
Dimensions of the fork end connectors and minimum dimensions of the gusset plates

Annex 3

Cut thread



Rolled thread



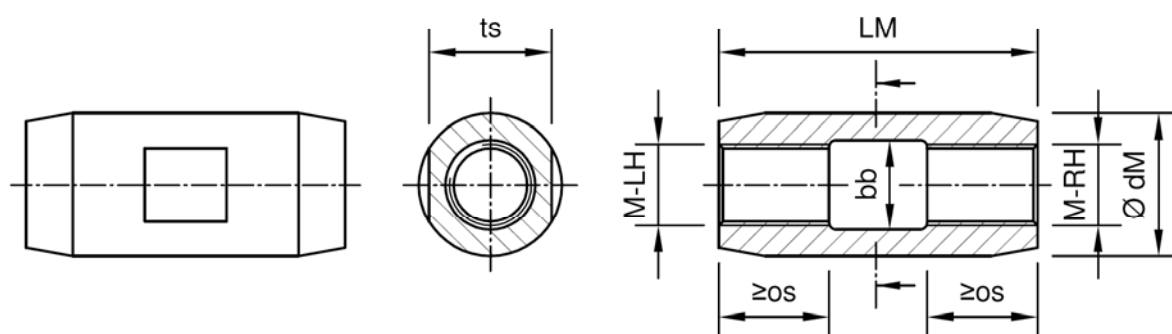
DT-E M-LH / M-RH	Øds	o	ts	Ødr	Material
	[ mm ]				
M 6 x 1,0	6	18	5	5,21	1.4401, 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4462 grade S355 or S460
M 8 x 1,25	8	21	6	7,04	
M10 x 1,5	10	25	8	8,86	
M12 x 1,75	12	31	10	10,68	
M16 x 2,0	16	38	14	14,50	
M20 x 2,5	20	45	18	18,16	
M24 x 3,0	24	57	21	21,80	
M27 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 tolled spanner flats and rod marking

HALFEN Tension Rod System DETAN-E

Dimensions of the tension rods

Annex 4



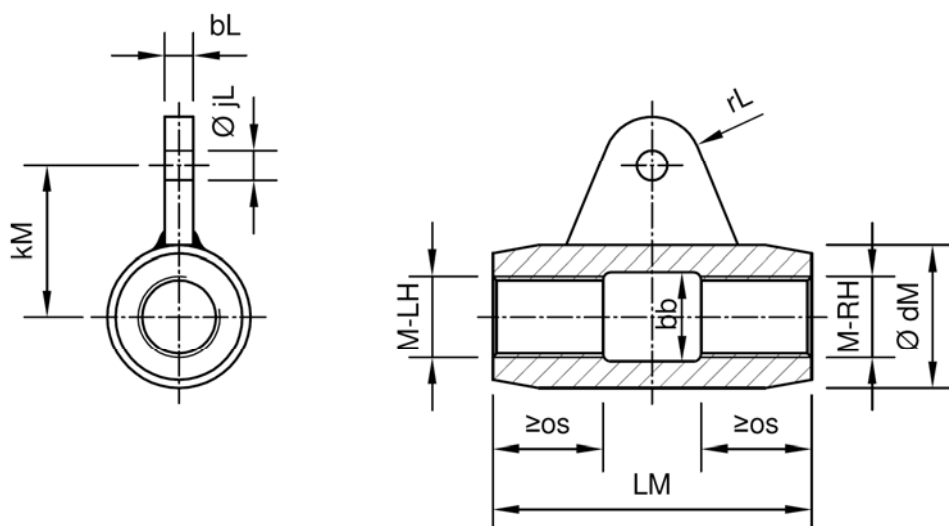
Minimum thread engagement of the tension rod =  $o_m - o_j$  according to annex 3

DT-E M-LH / M-RH	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 or S355
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

Dimensions of the couplers

Annex 5



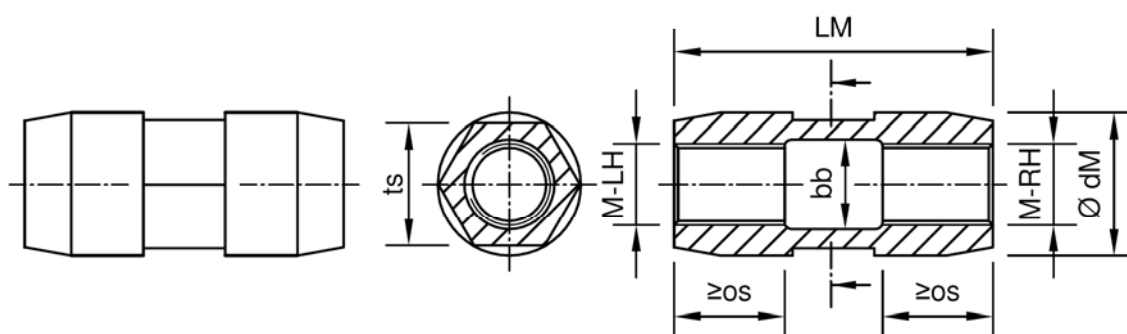
Minimum thread engagement of the tension rod =  $o_m - o_j$  according to annex 3

DT-E M-LH / M-RH	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 or S355
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

Dimensions of the couplers with additional gusset plate

Annex 6



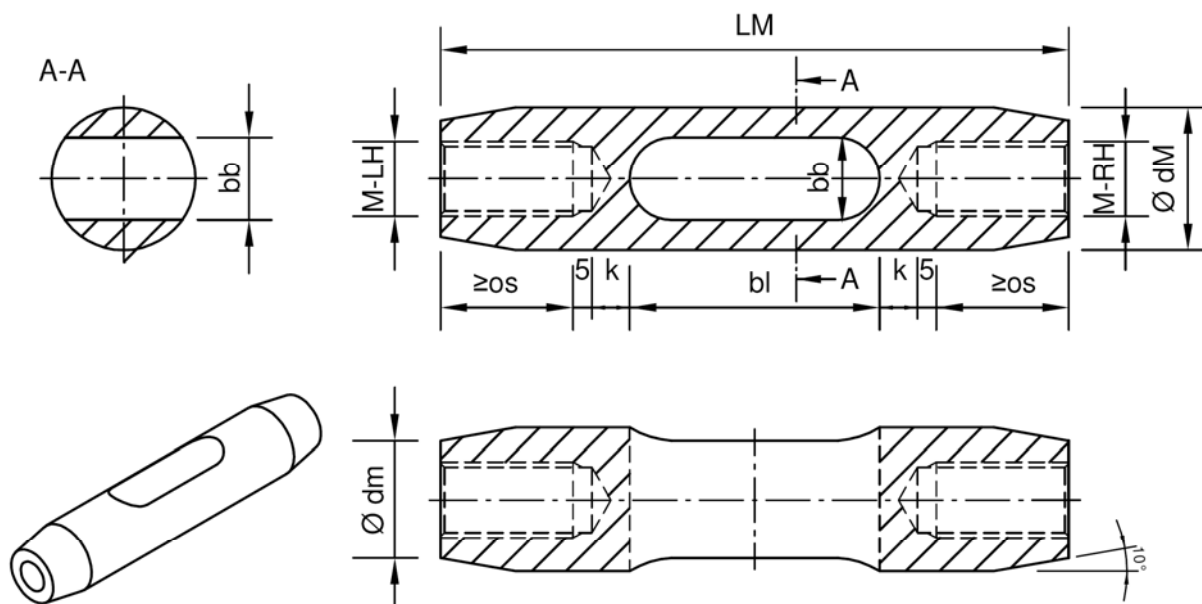
Minimum thread engagement of the tension rod =  $om - oj$  according to annex 3

DT-E M-LH / M-RH	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
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

Dimensions of the hexagon couplers

Annex 7



Minimum thread engagement of the tension rod =  $o_m - o_j$  according to annex 3

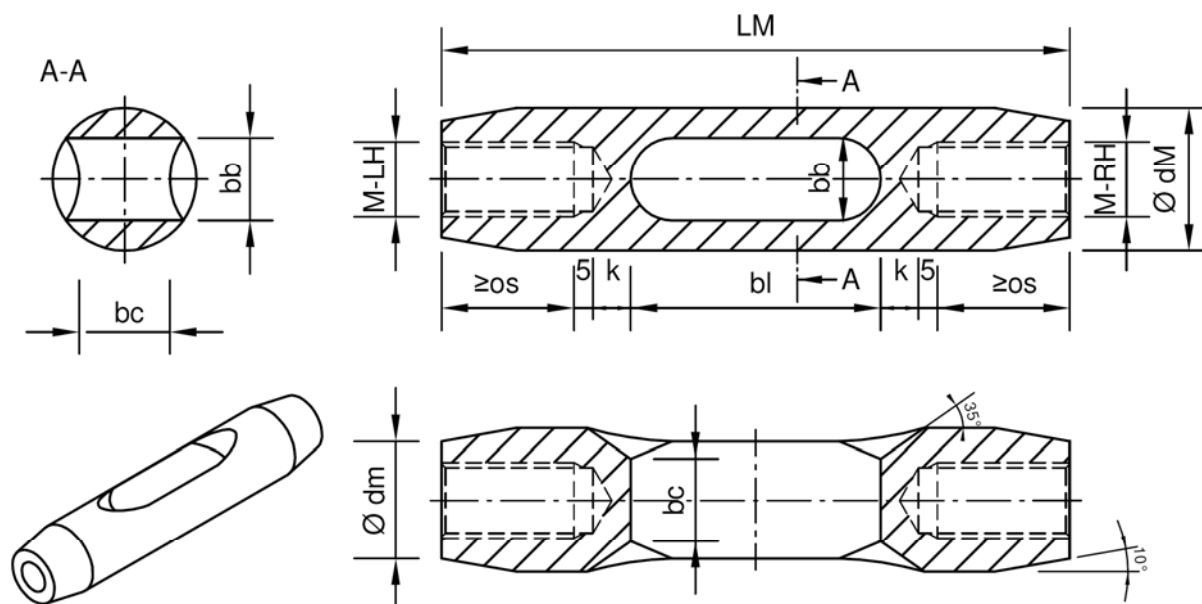
DT-E M-LH / M-RH	dM	LM	os	bb	bl	dm	k	Material
	[ mm ]							
M6	14	70	15	8	24	9,6	3	1.4401, 1.4404, 1.4362, 1.4462, 1.4571 grade S355
M8	17-18	85	17	10	33	12,6	4	
M10	20	100	20	12	38	15,7	6	
M12	24	120	25	14	46	18,7	7	
M16	32	142	30	18	54	25	9	
M20	39-40	166	35	22	66	31	10	
M24	46-50	200	45	26	78	37	11	
M27	52-55	222	50	29	87	42	12,5	
M30	57-60	242	55	32	96	46,5	13	
M36	70	284	65	38	114	53,5	15	
M42	80	310	70	44	128	63	16	
M48	91-95	348	80	50	142	74	18	

HALFEN Tension Rod System DETAN-E

Dimensions of the cross couplers KR 60

Annex 8





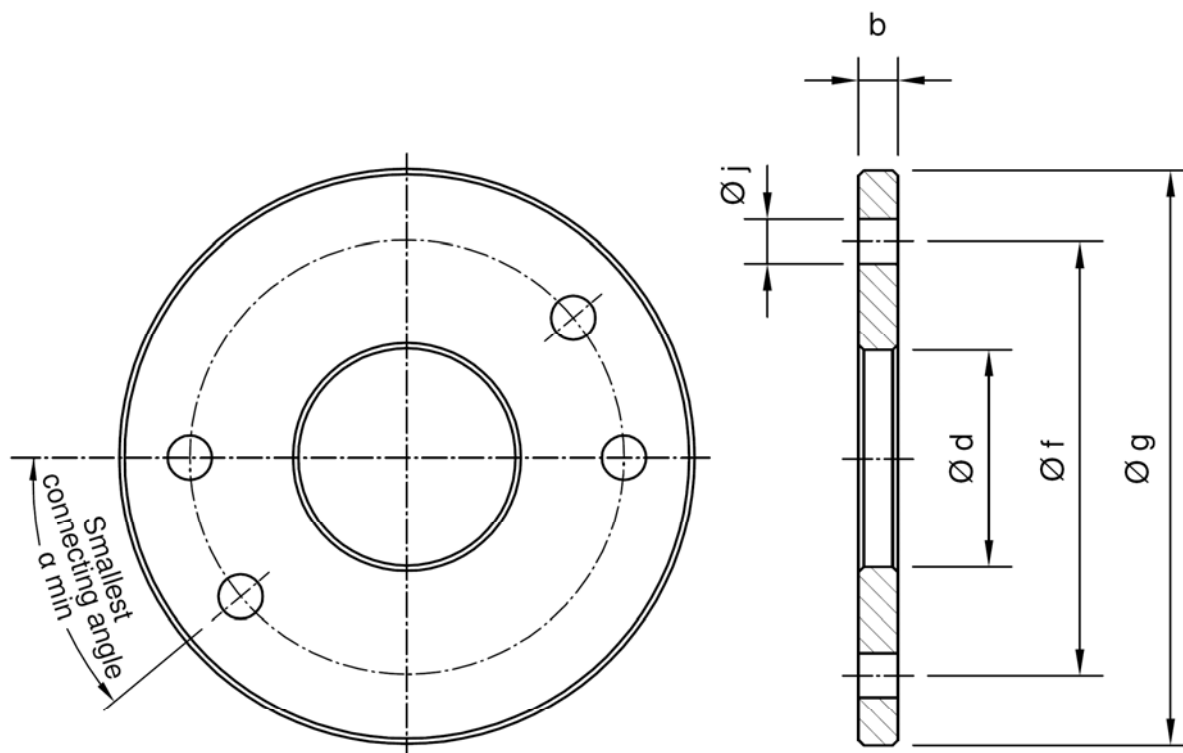
Minimum thread engagement of the tension rod =  $om - oj$  according to annex 3

DT-E M-LH / M-RH	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
M8	17-18	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	39-40	166	35	22	66	19,4	31	10	
M24	46-50	200	45	26	78	22,9	37	11	
M27	52-55	222	50	29	87	25,5	42	12,5	
M30	57-60	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	91-95	348	80	50	142	38,4	74	18	

HALFEN Tension Rod System DETAN-E

Dimensions of the cross couplers KR 40

Annex 9



DT-E M-LH / M-RH			$\alpha \min = 40^\circ$			$\alpha \min = 60^\circ$			$\alpha \min = 80^\circ$			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 anchor discs K40, K60, K80

Annex 10