



European Technical Approval ETA-05/0207

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

HALFEN Zugstabsystem DETAN-S460
HALFEN Tension Rod System DETAN S-460

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:

10 January 2011

vom
from
bis
to

10 January 2016

verlängert
extended

vom
from
bis
to

19 April 2013

19 April 2018

Herstellwerk
Manufacturing plant

HALFEN GmbH
Otto-Brünnner-Straße 3
06556 Artern
DEUTSCHLAND

Diese Zulassung umfasst
This Approval contains

18 Seiten einschließlich 10 Anhänge
18 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 products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *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 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶.
- 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.
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- 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.

¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I 1998*, p. 812
⁵ *Bundesgesetzblatt Teil I 2011*, p. 2178
⁶ 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 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 cast 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 threaded sleeves (couplers, hexagon couplers, cross couplers).

The tension rod system comprises tension rods, fork end connectors and couplers with metric ISO threads M 6 to M 95.

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 documentation⁷ 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 documentation⁷ to this European technical approval.

⁷ 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, gusset plates and anchor discs) is the minimum value of the design tension resistance $N_{Rd, Tension\ Rod}$ of the tension rod, the design tension resistance $N_{Rd, Coupler}$ of the coupler and the design bearing resistance $N_{Rd, Gusset\ Plate/Anchor\ Disc}$ of the gusset plate or anchor disc.

The design values shall be determined according to EN 1993-1-1:2005 and EN 1993-1-8:2005 as follows:

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

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

$$N_{Rd, Coupler} = A \cdot f_{y,k} / \gamma_{M1}$$

A = cross section of the unthreaded part of the coupler

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

$$N_{Rd, Gusset\ Plate/Anchor\ Disc} = 1.5 \cdot b \cdot d_1 \cdot f_{y,k} / \gamma_{M1}$$

b = thickness of gusset plate or anchor disc according to Annexes 3 and 7

d_1 = pin diameter according to Annex 3

$f_{y,k}$ = characteristic value of the yield strength of the gusset plate or anchor disc according to $R_{p0,2}$ given in Annex 2

$$\gamma_{M1} = 1.10$$

$$\gamma_{M2} = 1.25$$

The values given for the partial safety factors γ_{M1} and γ_{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/EC⁶.

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 A 1 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 the fork end connectors is higher than the tension resistance of the corresponding tension rods made of steel grade S460N 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 six system sizes of the fork end connectors (M 16, M 30, M 42, M 56, M 64, M 95).

Comparison of characteristic values of resistance of the corresponding tension rods calculated according to EN 1993-1-1:2005 and EN 1993-1-8:2005 with the statistically evaluated test results (characteristic values) has shown that the tension resistance of the fork end connectors (including pins) is not relevant to the tension resistance of the entire tension rod system. Thus it is sufficient to calculate only the tension resistance of the tension rods and couplers as well as the bearing resistance of the gusset plates and anchor discs in order 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 Commission⁸ 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.

⁸ Official Journal of the European Communities L 80 of 18.03.1998

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.⁹

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 95).

⁹ 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.

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 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 and EN ISO 12944:1998 are taken into account.

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

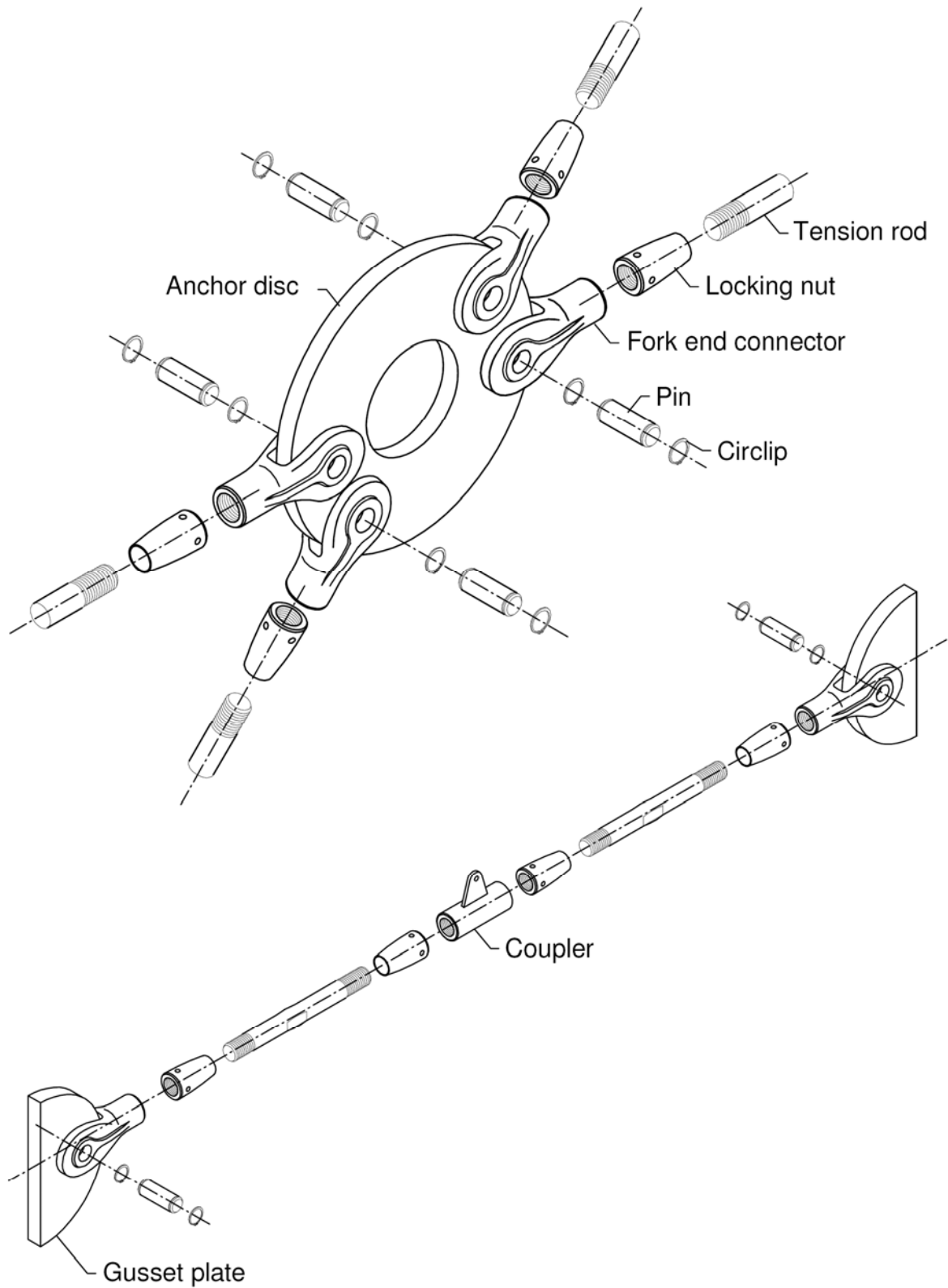
5 Indications to the manufacturer

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 and anchor discs).

Georg Feistel
Head of Department

beglaubigt:
Hahn



Electronic copy of the ETA by DIBt: ETA-05/0207

HALFEN Tension Rod System DETAN S-460

Components

Annex 1

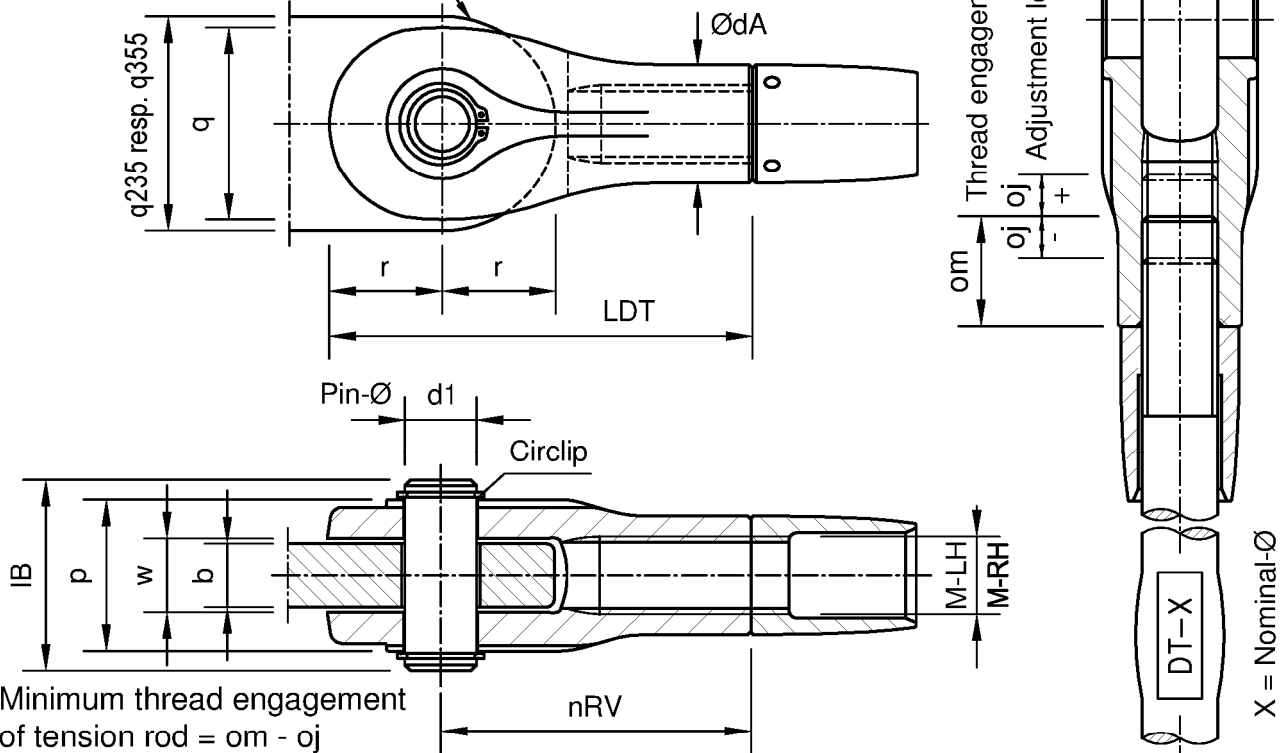
Component	System Size	Material	Standard	$R_{p0,2}$ [N/mm ²]	R_m [N/mm ²]
Fork end connector	M6 - M30	S355J2	EN 10025-2	360	500
	M16 - M95	G20 Mn5+QT	EN 10293	360	500
Tension rod	M6 - M12	S355J2	EN 10025-2	acc. to EN 10025-2	
	M6 - M95	S460N	EN 10025-3	460	625
Pin	M6 - M60	C45E+QT	EN 10083-1	470	610
	M6 - M60	S460N	EN 10025-3	470	610
	M64 - M95	C45+QT	EN 10083-2	430	580
	M64 - M95	S460N	EN 10025-3	430	580
Coupler	M6 - M95	S355J2	EN 10025-2	acc. to EN 10025-2	
Gusset plate	M6 - M12	S235JR	EN 10025-2	acc. to EN 10025-2	
	M6 - M95	S355J2	EN 10025-2	acc. to EN 10025-2	
Anchor disc	M6 - M95	S355J2	EN 10025-2	acc. to EN 10025-2	

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Material properties of the components

Annex 2

Gusset plate grade S355 for all sizes or S235 for M6 to M12



Minimum thread engagement of tension rod = $om - oj$

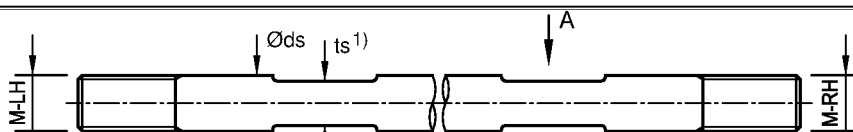
DT-S460 M-LH/ M-RH	dA	LDT	d1	p	q	q235	q355	r	w	nRV	b	om	± oj	IB	Material	
	[mm]														Fork end connector	Pin
M 6	9,6	42	6	12	16,7	18	16,7	9,3	5,6	32,7	5	10,5	4,5	18	S355J2	C45E+QT or S460N
M 8	12,6	50	7	16	21,3	21	21,3	11,8	7,7	38,2	7	12,5	4,5	22		
M10	15,7	60	9	19,7	26,3	28	26,3	14,8	8,7	45,2	8	15	5	28		
M12	18,7	73	11	23,6	31,4	33	31,4	17,8	10,7	55,2	10	18,5	6,5	32		
M16	25	89	15	33	40,6		40	23,8	16	65,2	15	22,5	7,5	44	G20 Mn5+QT or S355J2	
M20	31	110	19	40	51		51	29,3	19	80,7	18	27	8	52		
M24	37	133	23	46,5	60,6		64	34,8	21	98,2	20	34	11	60		
M27	42	147	26	51	68,5		73	39,3	23	107,7	22	37,5	12,5	65		
M30	46,5	160	29	57	75,4		80	43,3	26	116,7	25	42,5	12,5	72	G20 Mn5+QT	
M36	53,5	192	33	68	90		94	51,3	31	140,7	30	51	14	84		
M42	63	225	40	79	105,2		113	59,8	36	165,2	35	55	15	97		
M48	74	265	46	90	118,5		129	70,3	41	194,7	40	62,5	17,5	111		
M52	80	285	48	98	125		142	76	46	209	45	70,5	20	119	C45+QT or S460N	
M56	86	305	52	107	136,5		151	82,5	51	222,5	50	77,5	22,5	130		
M60	91	335	56	116	146		161	88	56	247	55	85	25	139		
M64	116	380	65	128	176		182	107	57	273	55	95	30	157		
M76	134	460	75	146	196		216	129	67	331	65	115	39	180		
M85	152	520	85	166	216		240	149	77	371	75	130	45	202		
M95	173	580	95	189	236		270	159	88	421	85	155	60	229		

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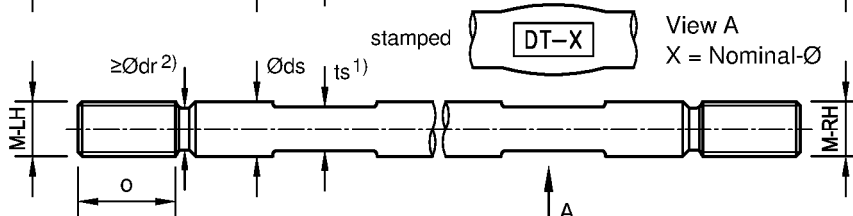
Dimensions of the fork end connectors and minimum dimensions of the gusset plates

Annex 3

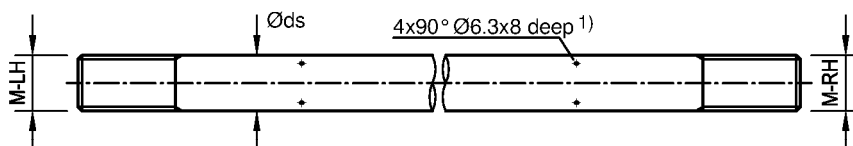
Cut thread



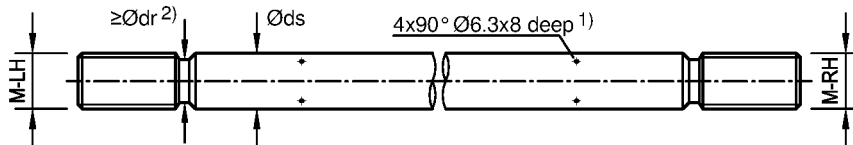
Rolled thread



Cut thread
(M64-M95)



Rolled thread
(M64-M95)



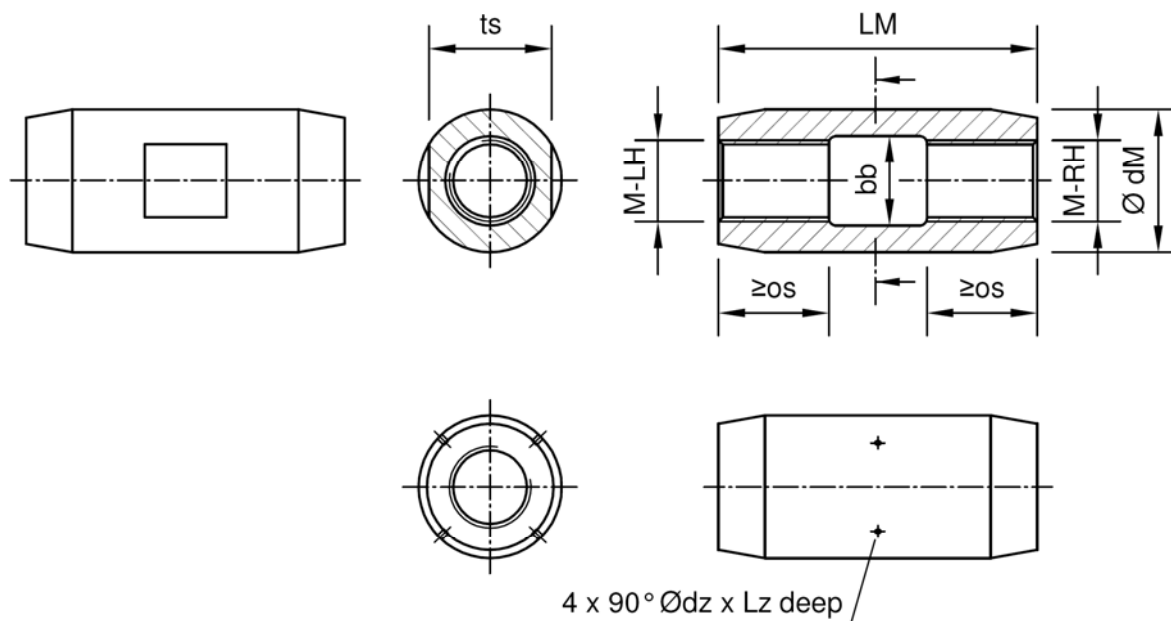
DT-S460 M-LH / M-RH	\varnothing_{ds}	o	ts	\varnothing_{dr}	Material
	[mm]				
M 6 x 1,0	6	18	5	5,21	S355J2 or S460N
M 8 x 1,25	8	21	6	7,04	
M10 x 1,5	10	25	8	8,86	
M12 x 1,75	12	31	10	10,68	
M16 x 2,0	16	38	14	14,50	S460N
M20 x 2,5	20	45	18	18,16	
M24 x 3,0	24	57	21	21,80	
M27 x 3,0	27	64	24	24,80	
M30 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	
M52 x 5,0	52	116	46	48,43	
M56 x 5,5	56	128	50	52,09	
M60 x 5,5	60	140	55	56,09	
M64 x 6,0	64	157	55	59,74	
M76 x 6,0	76	192	65	71,74	
M85 x 6,0	85	218	75	80,74	
M95 x 6,0	95	263	85	90,72	

1) alternatively with tolled spanner flats and rod marking
2) \varnothing_{dr} possible for the complete rod in case of rolled threads

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Dimensions of the tension rods

Annex 4



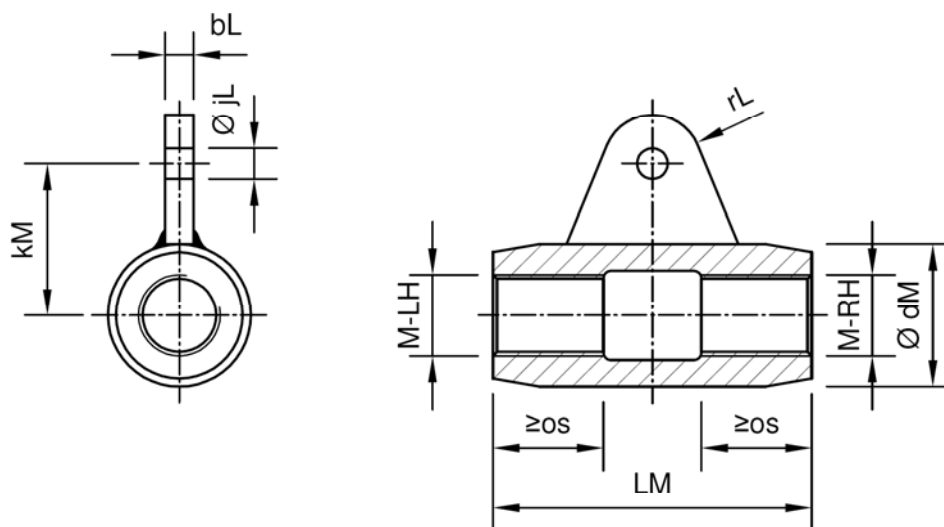
Minimum thread engagement of the tension rod = $o_m - o_j$ according to annex 3

DT-S460 M-LH / M-RH	dM	LM	os	bb	ts	dz	Lz	Material
M 6	12	34	9	6,3	10	—	—	S355J2
M 8	15	40	11	8,4	13	—	—	
M10	20	40	13,5	10,5	17	—	—	
M12	22	50	16,5	12,6	19	—	—	
M16	28	62	31	16,8	24	—	—	
M20	35	78	39	21	30	—	—	
M24	42	94	47	25,2	36	—	—	
M27	47	104	39,5	28,4	41	—	—	
M30	53	120	47,5	31,5	46	—	—	
M36	64	140	55	37,8	55	—	—	
M42	75	158	64	44,1	65	—	—	
M48	87	180	75	50,4	75	—	—	
M52	93	195	80	54,6	80	—	—	
M56	98	210	87,5	58,8	85	—	—	
M60	104	245	105	63	90	—	—	
M64	135	270	110	67	—	8,3	12	
M76	155	328	139	79	—	8,3	12	
M85	180	370	155	88	—	10,3	12	
M95	195	450	200	98	—	10,3	12	

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Dimensions of the couplers

Annex 5



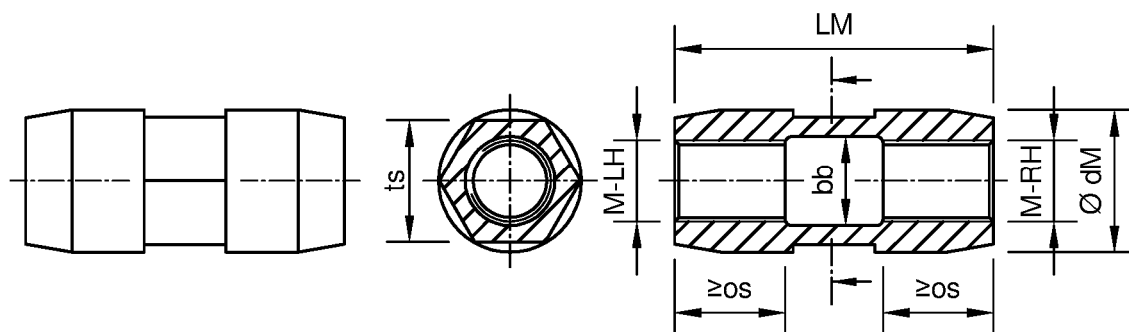
Minimum thread engagement of the tension rod = $o_m - o_j$ according to annex 3

DT-S460 M-LH / M-RH	dM	LM	os	bb	jL	bL	rL	kM	Material
	[mm]								
M 6	12	34	9	6,3	6,5	5	9,3	21	S355J2
M 8	15	40	11	8,4	6,5	5	9,3	21	
M10	20	40	13,5	10,5	6,5	5	9,3	23,5	
M12	22	50	16,5	12,6	6,5	5	9,3	27,5	
M16	28	62	31	16,8	6,5	5	9,3	33	
M20	35	78	39	21	7,5	7	12	37	
M24	42	94	47	25,2	7,5	7	12	44	
M27	47	104	39,5	28,4	9,5	8	15	50,5	
M30	53	120	47,5	31,5	9,5	8	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	
M52	93	195	80	54,6	11,5	10	18	111,5	
M56	98	210	87,5	58,8	11,5	10	18	124,5	
M60	104	245	105	63	11,5	10	18	137	
M64	135	270	110	67	11,5	10	18	130	
M76	155	328	139	79	11,5	10	18	140	
M85	180	370	155	88	15,5	15	24	150	
M95	195	450	200	98	15,5	15	24	157,5	

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Dimensions of the couplers with additional gusset plate

Annex 6



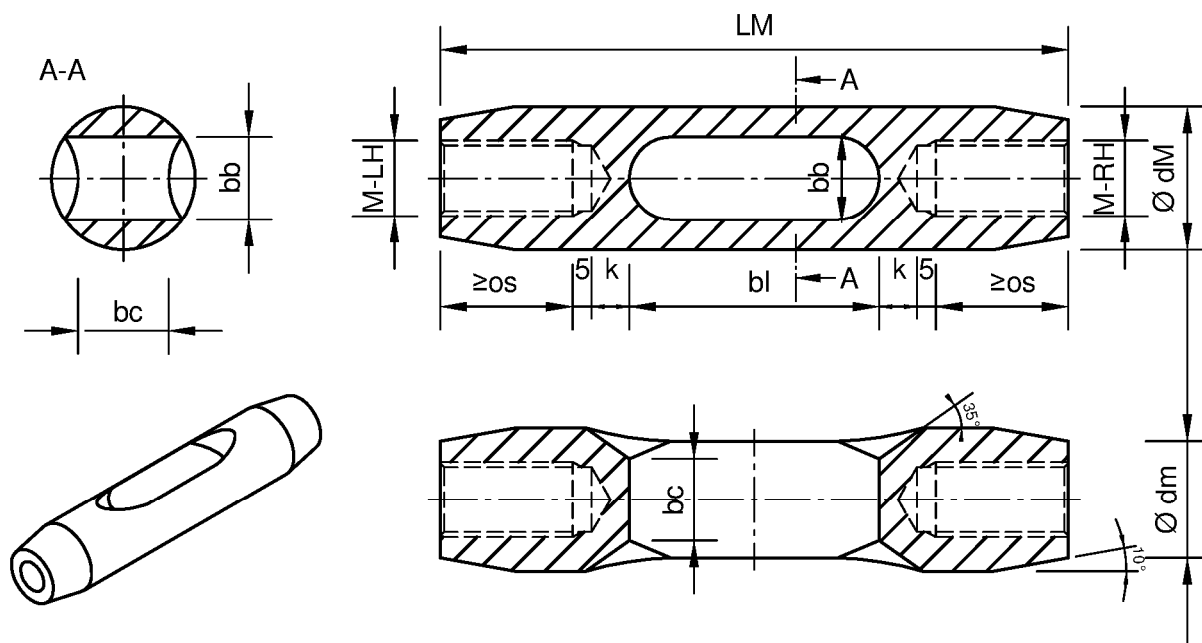
Minimum thread engagement of the tension rod = $o_m - o_j$ according to annex 3

DT-S460 M-LH / M-RH	dM	LM	os	bb	ts	dz	Lz	Material
	[mm]							
M 6	12	34	9	6,3	10	—	—	S355J2
M 8	15	40	11	8,4	13	—	—	
M10	20	40	13,5	10,5	17	—	—	
M12	22	50	16,5	12,6	19	—	—	
M16	28	62	31	16,8	24	—	—	
M20	35	78	39	21	30	—	—	
M24	42	94	47	25,2	36	—	—	
M27	47	104	39,5	28,4	41	—	—	
M30	53	120	47,5	31,5	46	—	—	
M36	64	140	55	37,8	55	—	—	
M42	75	158	64	44,1	65	—	—	
M48	87	180	75	50,4	75	—	—	
M52	93	195	80	54,6	80	—	—	
M56	98	210	87,5	58,8	85	—	—	
M60	104	245	105	63	90	—	—	

HALFEN Tension Rod System DETAN S-460

Dimensions of hexagon couplers

Annex 7



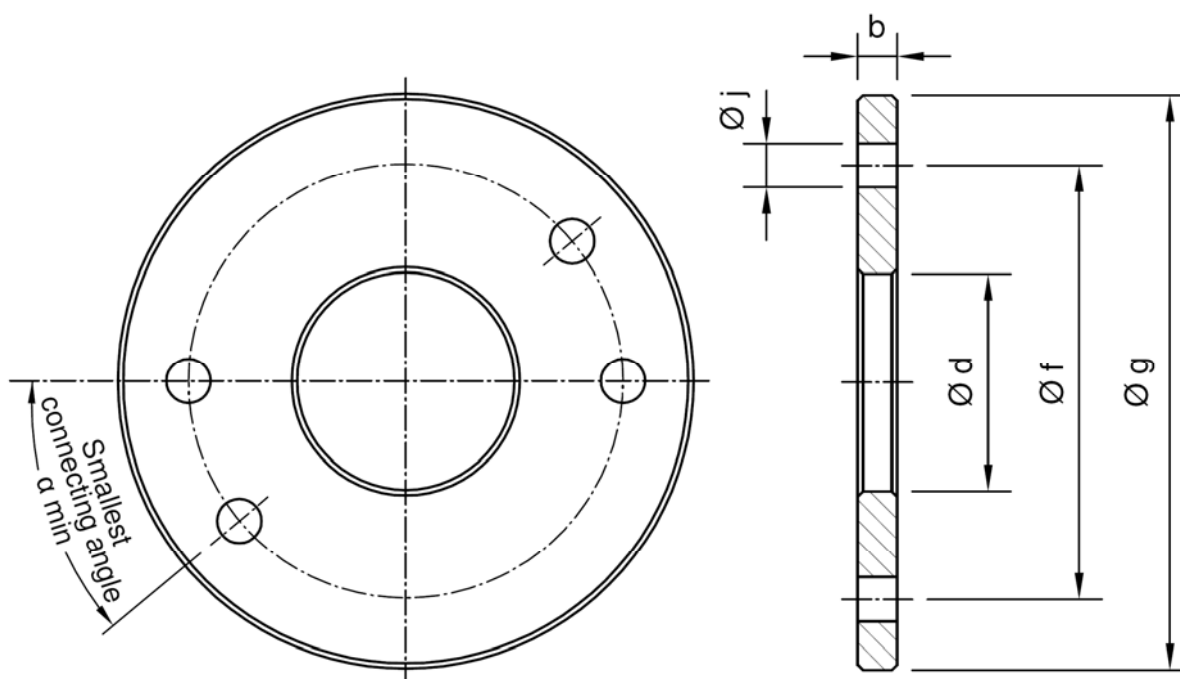
Minimum thread engagement of the tension rod = $o_m - o_j$ according to annex 3

DT-S460 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	S355J2
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	92,5-95	348	80	50	142	38,4	74	18	
M52	101-115	400	90,5	54	174	55,9	93	17,5	
M56	112-115	440	100	60	191	60,5	98	19,5	
M60	120	478	110	64	206	66,1	104	21	
M64	128-130	524	125	68	220	71,0	116	22	
M76	154-160	631	154	80	263	86,5	134	25	
M85	173-180	710	175	90	294	96	152	28	
M95	194-200	830	215	100	330	109	173	30	

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Dimensions of the cross couplers KR 40

Annex 9



DT-S460 M-LH / M-RH	$\alpha \text{ min} = 40^\circ$			$\alpha \text{ min} = 60^\circ$			$\alpha \text{ min} = 80^\circ$			Material		
	b	Øj	Ød	Øf	Øg	Ød	Øf	Øg	Ød		Øf	Øg
[mm]												
M 6	5	6,5	27	55	73	22	45	63	12	33	51	S355J2
M 8	7	7,5	37	75	99	25	55	79	15	42	66	
M10	8	9,5	46	90	120	33	70	100	20	55	85	
M12	10	11,5	56	110	146	35	80	116	22	65	101	
M16	15	15,5	70	140	186	50	110	156	28	85	131	
M20	18	19,5	94	180	238	57	130	188	35	105	163	
M24	20	23,5	106	210	280	63	150	220	40	125	195	
M27	22	26,5	120	240	318	72	170	248	45	140	218	
M30	25	29,5	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	
M52	45	49	228	450	600	130	320	470	90	270	420	
M56	50	53	248	490	652	145	350	512	100	295	457	
M60	55	57	262	520	692	150	370	542	105	315	487	
M64	55	65,7	270	596	810	160	426	640	100	351	565	
M76	65	75,7	325	702	960	180	502	760	120	422	680	
M85	75	85,7	360	777	1075	200	562	860	135	482	780	
M95	85	95,7	395	832	1150	225	612	930	150	522	840	

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Dimensions of the anchor discs K40, K60, K80

Annex 10