Deutsches Institut für Bautechnik
Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt
Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts

Kolonnenstraße 30 B
D-10829 Berlin
Tel.: +49 30 78730-0
Fax: +49 30 78730-320
E-Mail: dibt@dibt.de
www.dibt.de

Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-06/0236

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*		Zugstabsystem m · connect *Tension Rod System m · connect*
Zulassungsinhaber *Holder of approval*		MÜRMANN Gewindetechnik GmbH Wölzower Weg 27 19243 Wittenburg DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*		Vorgefertigtes Zugstabsystem *Prefabricated Tension Rod System*
Geltungsdauer: *Validity:*	vom *from* bis *to*	24 October 2006 24 October 2011
verlängert *extended*	vom *from* bis *to*	25 October 2011 25 October 2016
Herstellwerk *Manufacturing plant*		MÜRMANN Gewindetechnik GmbH Wölzower Weg 27 19243 Wittenburg DEUTSCHLAND

Diese Zulassung umfasst *This Approval contains*	15 Seiten einschließlich 7 Anhänge *15 pages including 7 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[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- 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[4], as amended by law of 31 October 2006[5];
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6].

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.

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 2006*, p. 2407, 2416
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 or 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 steel cast or stainless steel / stainless steel cast fork end connectors with two eye loops and internal thread. The fork end connectors are connected by double shear pin connections to corresponding steel or stainless steel gusset plates. The tension rods are connected to each other by steel / steel cast or stainless steel / stainless steel cast threaded sleeves (couplers).

The tension rod system comprises tension rods, fork end connectors and threaded sleeves (couplers) with metric ISO threads M6 to M100.

A drawing of the tension rod system and the components as well as the essential dimensions of the components are given in the Annexes to this European technical approval.

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 6. The dimensions and tolerances of the components of the tension rod system not indicated in Annexes 3 to 6 shall correspond to the respective values and information laid down in the technical documentation[7] 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.

2.1.2 Material properties

The material properties of the components of the tension rod system shall correspond to the details given in Annexes 2.1. and 2.2. The material characteristics of the components of the tension rod system not indicated in Annexes 2.1. and 2.2 shall correspond to the respective values and information laid down in the technical documentation to this European technical approval.

2.1.3 Design values of resistance

The design value N_{Rd} of the tension resistance of the entire tension rod system 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 $N_{Rd,Gusset\ Plate}$ of the gusset plate.

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

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

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 2.1 or 2.2

$f_{u,k}$ = characteristic value of the tensile strength of the tension rod according to R_m given in Annex 2.1 or 2.2

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

A = minimum 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 2.1 or 2.2

$\mathbf{N_{Rd,\ Gusset\ Plate} = 1.5 \cdot t \cdot db \cdot f_{y,k}/\gamma_{M1}}$

t = thickness of the gusset plate according to Annex 3

db = pin diameter according to Annex 3

$f_{y,k}$ = characteristic value of the yield strength of the gusset plate according to $R_{p0,2}$ given in Annex 2.1 or 2.2

γ_{M1} = 1.1

γ_{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 according to EN 13501-1:2007.

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[6].

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 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 four system sizes of the steel cast fork end connectors (M10, M36, M56, M100).

Since the stainless steel / stainless steel cast fork end connectors have the same dimensions, yield strength and tensile strength as the steel cast fork end connectors, the test results can be applied to the steel cast fork end connectors as well as to the stainless steel / stainless steel cast fork end connectors. The relevant tension resistances are assumed to be the same.

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 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 Commission[8] system 2+ of the 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".

[8] Official Journal of the European Communities L 80 of 18.03.1998

3.2 Responsibilities

3.2.1 Tasks for 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 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 for the 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 this European technical approval.

3.2.2 Tasks for the 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 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,

[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.

- the number of the European technical approval,
- the name of the product,
- the system size and type (e.g., M 36).

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. The Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the 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 “m2” given in Annexes 3 and 5 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 as well as the values of resistance stated in section 2.1 are used for design.

The rules given in EN 1090-2:2008, 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

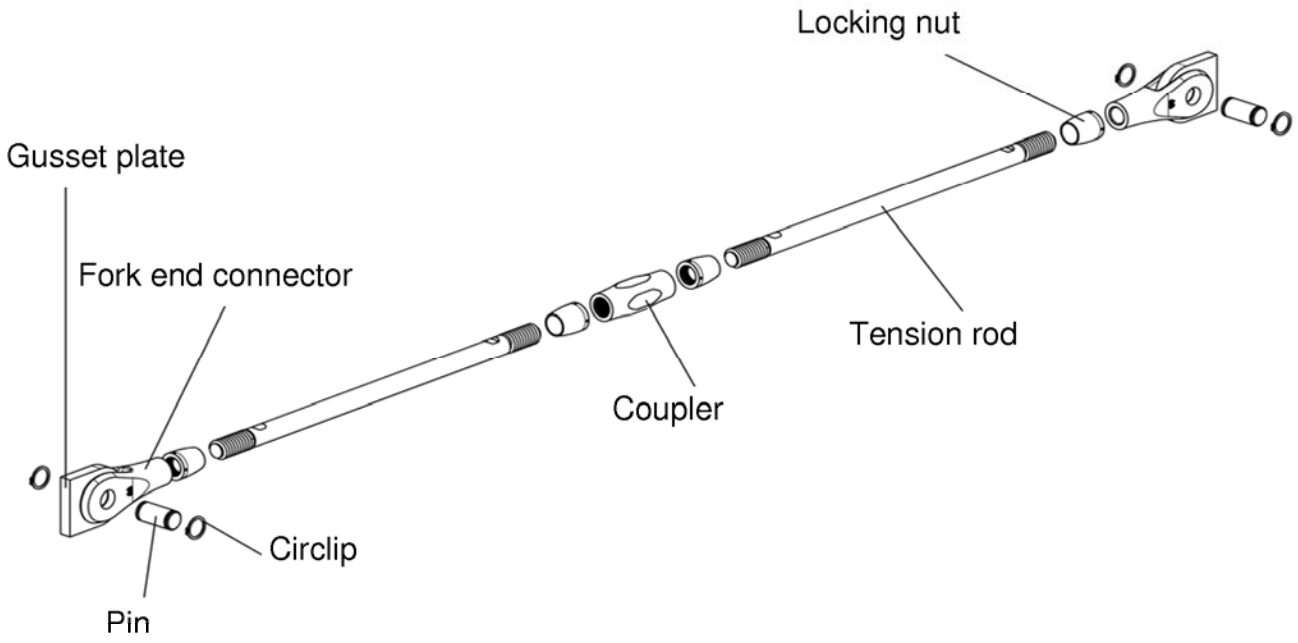
The manufacturer shall ensure that the information on the specific conditions according to sections 1, 2, 4.2 and 4.3 (including Annexes referred to) is given to those who are concerned. This information may be given by reproduction of the European technical approval.

In addition all essential installation data (e.g., minimum thread engagement according to Annexes 3 and 5) 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 and couplers).

Georg Feistel
Head of Department

beglaubigt:
Spohn



Tension Rod System m · connect	Annex 1
System, components	

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Tension Rod System m · connect

Material properties of steel / steel cast components

Component	Material		Techn. delivery condition	Mechanical properties (minimum values)			
	Material or steel grade	Material number		Yield strength $R_{p0,2}$ [N/mm²]	Tensile strength R_m [N/mm²]	Elongation A_5 [%]	Charpy impact value ISO-V [J/°C]
Fork end connector	G20Mn5 +QT	1.6220	according to techn. documentation①; EN 10293:2005	360	500	22	27 / -40
Locking nut	G20Mn5 +N	1.6220	EN 10293:2005	-			
	S460 N	1.8901	EN 10025-3:2004				
	S355 J2	1.0577	EN 10025-2:2004				
	S355 J0	1.0553					
	11SMn30	1.0715	EN 10087:1998				
Tension rod	S460 N	1.8901	according to techn. documentation①; EN 10025-3:2004	460	625	17	40 / -20
	21CrMoV5-7 +QT	1.7709	EN 10269:1999				
	S355 J2	1.0577	according to techn. documentation①; EN 10025-2:2004	360	490	17	27 / -20
	S355 J0	1.0553					
	Quenched and tempered steel		according to techn. documentation①; EN 10083-1:2006	according to techn. delivery condition but maximum strength of steel grade S460 N			
Coupler	G20Mn5 +QT	1.6220	according to techn. documentation①; EN 10293:2005	360	490	17	27 / -20
	S460 N	1.8901	EN 10025-3:2004				
	S355 J2	1.0577	according to techn. documentation①; EN 10025-2:2004				
	S355 J0	1.0553					
	21CrMoV5-7 +QT	1.7709	EN 10269:1999				
Pin	8.8	-	EN ISO 898-1:2009	640	800	12	according to techn. delivery condition
	10.9						
	34CrNiMo6 +QT	1.6582	EN 10269:1999				
Gusset plate	S355 J2	1.0577	according to techn. documentation①; EN 10025-2:2004	Thickness ≤40mm ⇒ 360	490	22	27 / -20
				Thickness >40mm ⇒ 335		21	
				Thickness >63mm ⇒ 325		20	
	S460 N	1.8901	EN 10025-3:2004	according to techn. delivery condition			
Circlip	-	-	according to techn. documentation①	-			

① The technical documentation is deposited at Deutsches Institut für Bautechnik.

Annex 2.1

Deutsches Institut für Bautechnik

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Component	Material		Techn. delivery condition	Mechanical properties (minimum values)			
	Material or steel grade	Material number		Yield strength $R_{p0,2}$ [N/mm²]	Tensile strength R_m [N/mm²]	Elongation A_5 [%]	Charpy impact value ISO-V [J/°C]
Fork end connector	GX2CrNiMoN22-5-3 ②	1.4470	EN 10283:2010	360	500	according to techn. delivery condition	
	GX2CrNiMoN25-6-3 ②	1.4468					
	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-3:2005				
Locking nut	GX2CrNiMoN22-5-3 ②	1.4470	EN 10283:2010	-			
	GX2CrNiMoN25-6-3 ②	1.4468					
	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-3:2005				
Tension rod	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-3:2005	460	625	according to techn. delivery condition	
	X3CrNiMo13-4	1.4313	EN 10088-3:2005				
Coupler	GX2CrNiMoN22-5-3 ②	1.4470	EN 10283:2010	360	490	according to techn. delivery condition	
	GX2CrNiMoN25-6-3 ②	1.4468					
	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-3:2005				
Pin	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-3:2005	640	800	according to techn. delivery condition	
	X3CrNiMo13-4	1.4313	EN 10088-3:2005				
	X5CrNiCuNb14-5	1.4542					
	X4CrNiMo16-5-1	1.4418					
Gusset plate	X2CrNiMoN22-5-3	1.4462	according to techn. documentation①; EN 10088-2:2005	460	640	according to techn. delivery condition	
	S355 J2	1.0577	according to techn. documentation①; EN 10025-2:2004	Thickness ≤40mm ⇒ 360	490	22	27 / -20
				Thickness >40mm ⇒ 335		21	
				Thickness >63mm ⇒ 325		20	
Circlip	-	1.4122	-	-			
		1.4034					

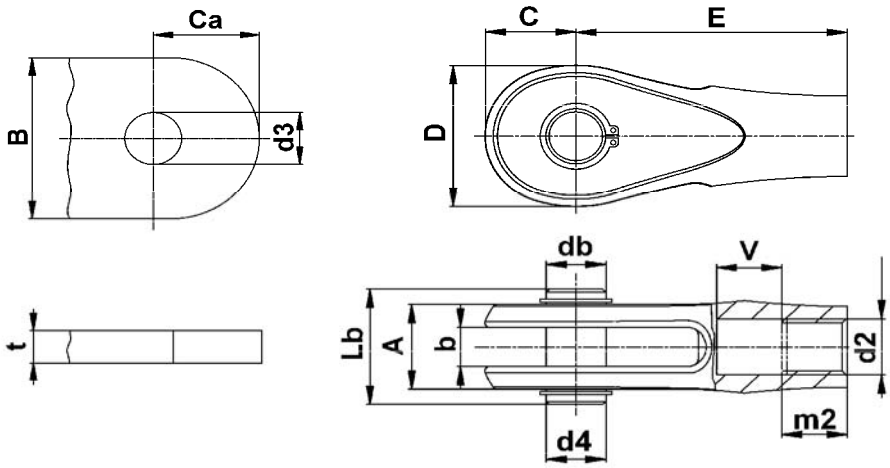
① The technical documentation is deposited at Deutsches Institut für Bautechnik.

② In order to improve the corrosion behaviour a clean metallic surface is recommended.

Tension Rod System m · connect

Material properties of stainless steel / stainless steel cast components

Annex 2.2



m2 = minimum thread engagement
V = adjustment

① maximum d3, maximum d4= min {1.1*db ; db+3} [mm]

Fork end connector										Pin		Gusset plate			
System size	d2 [mm]	A [mm]	b [mm]	E [mm]	C [mm]	d4 [mm]	D [mm]	V [mm]	m2 [mm]	db [mm]	Lb [mm]	B [mm]	t [mm]	Ca [mm]	d3 [mm]
M6	6	10.2	5.2	38	9.2	6.4	15.7	10	7.5	6	16.0	18.0	4	11.2	6.5
M8	8	13.5	6.5	47	12.0	8.4	20.4	12	9.5	8	20.5	24.5	5	15.1	8.5
M10	10	16.0	8.0	60	15.7	10.5	27.0	16	12.0	10	24.0	31.2	6	19.1	10.5
M12	12	20.0	10.0	70	18.6	12.5	32.0	20	14.0	12	29.0	35.7	8	22.1	12.5
M16	16	25.0	12.0	90	25.0	16.5	43.3	25	18.5	16	36.0	49.7	10	30.4	16.5
M20	20	31.0	14.0	106	30.5	20.5	52.5	25	23.0	20	44.0	63.0	12	38.3	20.5
M24	24	37.5	17.5	120	37.0	24.5	63.0	30	27.0	24	53.0	74.0	15	45.2	24.5
M30	30	48.5	22.5	136	45.0	30.5	78.6	30	34.0	30	67.5	90.4	20	55.4	30.5
M36	36	55.0	25.0	163	55.0	35.5	92.0	40	38.5	35	77.5	111.5	22	67.6	35.5
M42	42	64.0	28.0	198	65.4	42.5	110.0	50	47.0	42	89.5	134.0	25	81.2	42.5
M48	48	75.0	33.0	215	73.3	47.5	124.5	50	53.5	47	102.0	148.4	30	90.0	47.5
M56 x 4	56	86.0	38.0	251	87.0	55.5	148.5	60	60.0	55	117.0	175.4	35	106.2	55.5
M64 x 4	64	99.5	43.5	285	99.0	63.5	168.5	70	67.5	63	133.0	200.6	40	121.5	63.5
M72 x 4	72	119.5	53.55	318	108.7	72.5	187.0	80	75.0	72	156.0	222.5	50	135.5	72.5
M80 x 4	80	132.5	58.55	341	121.5	80.5	207.0	80	82.0	80	173.0	248.3	55	151.0	80.5
M90 x 4	90	147.5	63.5	383	135.7	90.5	232.5	90	91.0	90	192.0	283.2	60	171.8	90.5
M100 x 4	100	163.5	73.5	418	152.5	98.5	261.5	100	100.0	98	210.0	308.6	70	187.2	98.5

Tension Rod System m · connect

Dimensions of fork end connectors, pins and gusset plates

Annex 3

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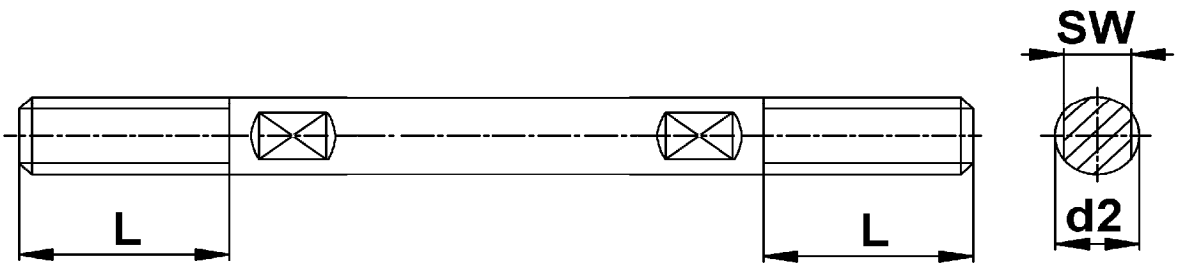
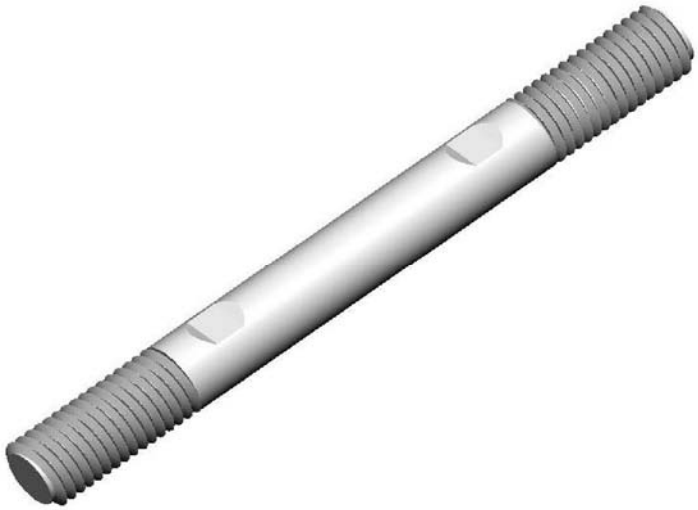




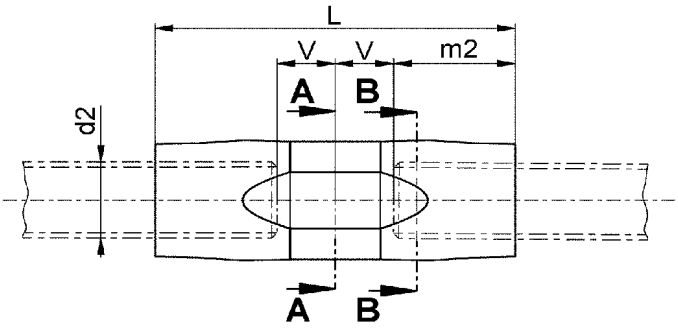
Tension rod			
System size	d2 [mm]	L [mm]	SW [mm]
M6	6	21	5
M8	8	26	7
M10	10	33	9
M12	12	40	10
M16	16	52	14
M20	20	58	18
M24	24	69	22
M30	30	79	28
M36	36	96	32
M42	42	118	38
M48	48	127	41
M56 x 4	56	148	50
M64 x 4	64	169	60
M72 x 4	72	191	65
M80 x 4	80	202	75
M90 x 4	90	226	85
M100 x 4	100	250	95

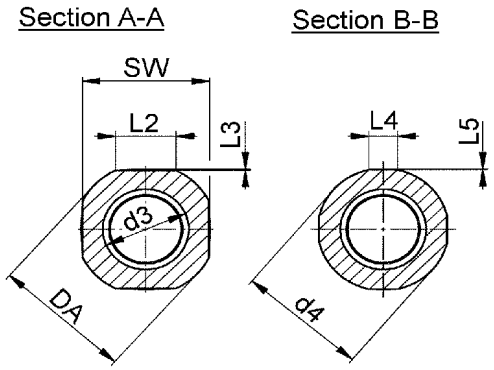
Tension Rod System m · connect

Dimensions of tension rods

Annex 4

Deutsches Institut für Bautechnik DIBt





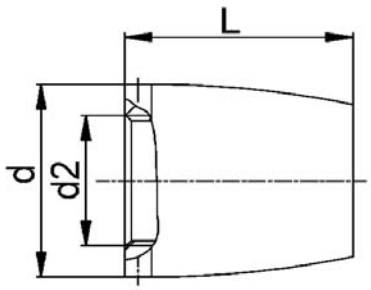
m2 = minimum thread engagement
V = adjustment

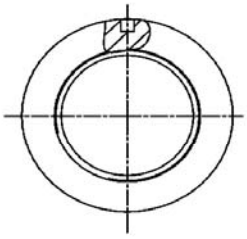
Coupler												
System size	DA [mm]	d2 [mm]	d3 [mm]	d4 [mm]	L [mm]	L2 [mm]	L3 [mm]	L4 [mm]	L5 [mm]	SW [mm]	m2 [mm]	V [mm]
M6	11.2	6	6.5	10.99	35	5.04	0.60	4.56	0.50	10	7.5	10
M8	14.5	8	8.5	14.28	43	6.42	0.75	5.92	0.64	13	9.5	12
M10	18.0	10	10.5	17.67	56	8.25	1.00	7.50	0.83	16	12.0	16
M12	20.0	12	13.0	19.71	68	8.72	1.00	8.03	0.86	18	14.0	20
M16	27.0	16	17.0	26.66	87	12.37	1.50	11.61	1.33	24	18.5	25
M20	33.0	20	21.0	32.89	96	13.75	1.50	13.48	1.44	30	23.0	25
M24	40.0	24	25.0	39.82	114	17.44	2.00	17.02	1.91	36	27.0	30
M30	51.0	30	31.5	47.50	128	22.02	2.50	11.85	0.75	46	34.0	30
M36	61.0	36	37.5	56.12	157	26.38	3.00	11.17	0.56	55	38.5	40
M42	72.0	42	43.5	65.87	194	30.97	3.50	10.65	0.43	65	47.0	50
M48	83.0	48	50.0	76.42	207	35.55	4.00	14.66	0.71	75	53.5	50
M56 x 4	94.0	56	58.0	87.60	240	40.14	4.50	21.19	1.30	85	60.0	60
M64 x 4	111.0	64	66.0	101.54	275	48.18	5.50	17.61	0.77	100	67.5	70
M72 x 4	122.0	72	74.0	112.64	310	52.76	6.00	24.24	1.32	110	75.0	80
M80 x 4	138.5	80	82.0	127.30	324	59.64	6.75	24.11	1.15	125	82.0	80
M90 x 4	155.0	90	92.0	142.85	362	66.52	7.50	28.40	1.43	140	91.0	90
M100 x 4	172.0	100	102.0	158.35	400	74.56	8.50	32.42	1.68	155	100.0	100

Tension Rod System m · connect

Dimensions of couplers

Annex 5





Locking nut			
System size	d2 [mm]	L [mm]	d [mm]
M6	6	16.5	9.0
M8	8	20.0	11.5
M10	10	25.5	14.5
M12	12	31.0	17.5
M16	16	39.5	23.5
M20	20	42.5	29.0
M24	24	51.0	35.0
M30	30	55.5	44.0
M36	36	57.5	52.5
M42	42	71.0	61.5
M48	48	73.5	70.5
M56 x 4	56	88.0	82.5
M64 x 4	64	101.5	94.5
M72 x 4	72	116.0	106.0
M80 x 4	80	120.0	118.0
M90 x 4	90	135.0	133.0
M100 x 4	100	150.0	147.5

Tension Rod System m · connect

Dimensions of locking nuts

Annex 6