

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



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

European Technical Assessment

ETA-11/0311

English translation prepared by DIBt

Page 2 of 18 | 20 April 2018

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific part

1 Technical description of the product

The 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 documentation¹ 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

$\gamma_{M0} = 1.10$ for stainless steel

$\gamma_{M2} = 1.25$

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:

$\gamma_{M0} = 1.10$ for stainless steel

$\gamma_{M2} = 1.25$

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.

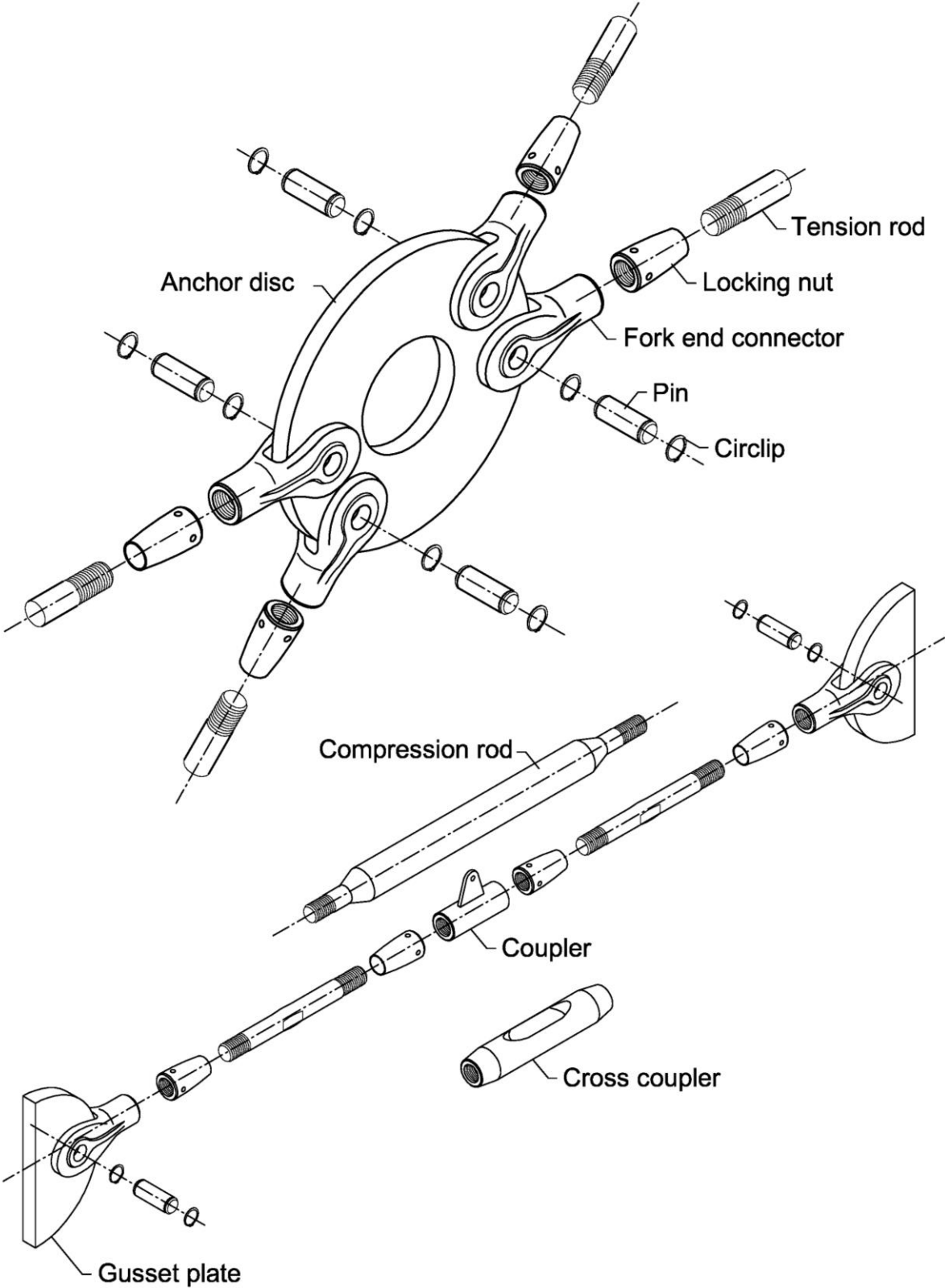
A.3 Indications to the manufacturer

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.

electronic copy of the eta by dibt: eta-11/0311



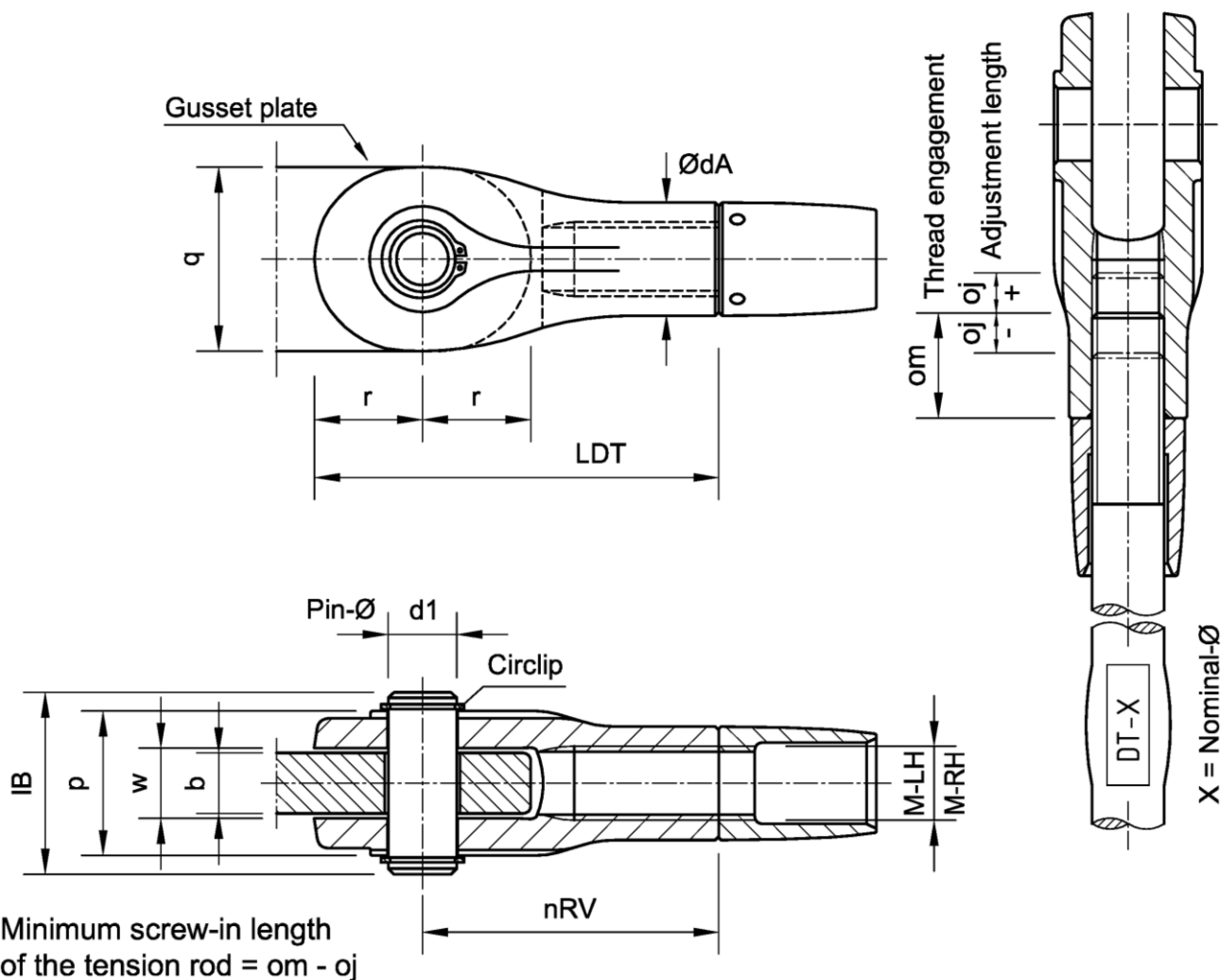
| | |
|-----------------------------------|----------|
| HALFEN Tension Rod System DETAN-E | Annex B1 |
| Components | |

| Component | System Size | Material | Grade | $R_{p0,2}$ [N/mm ²] | R_m [N/mm ²] |
|--------------------|-------------|--|--------------------|-------------------------------------|--------------------------------|
| 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

Material properties of the components

Annex B2



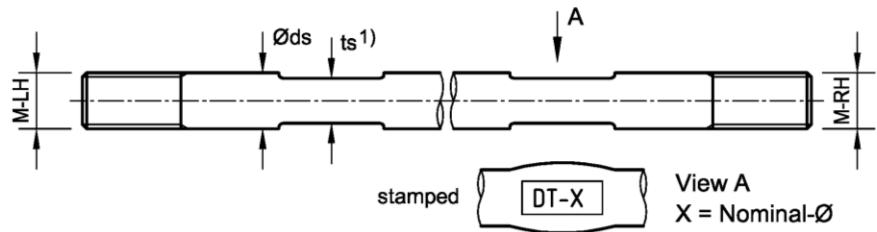
| DT-E M-LH/ M-RH | dA | LDT | d1 | p | q | r | w | nRV | b | om | ± oj | IB | Material | |
|-----------------------|--------|-----|----|------|-------|------|----|-------|----|------|------|-----|-----------------------|--|
| | [mm] | | | | | | | | | | | | Fork end connector | Pin |
| M 6 | 9,6 | 42 | 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

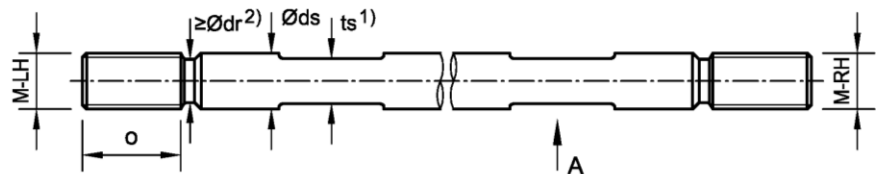
Dimensions of the fork end connectors and minimum dimensions of the gusset plates

Annex B3

Cut thread



Rolled thread



| DT-E M-LH / M-RH | Øds | o | ts | Ødr | Material | 1.4401, 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4462 grade S355 or S460 |
|---------------------|--------|-----|----|-------|----------|---|
| | [mm] | | | | | |
| M 6 x 1,0 | 6 | 18 | 5 | 5,21 | | |
| 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 | | |

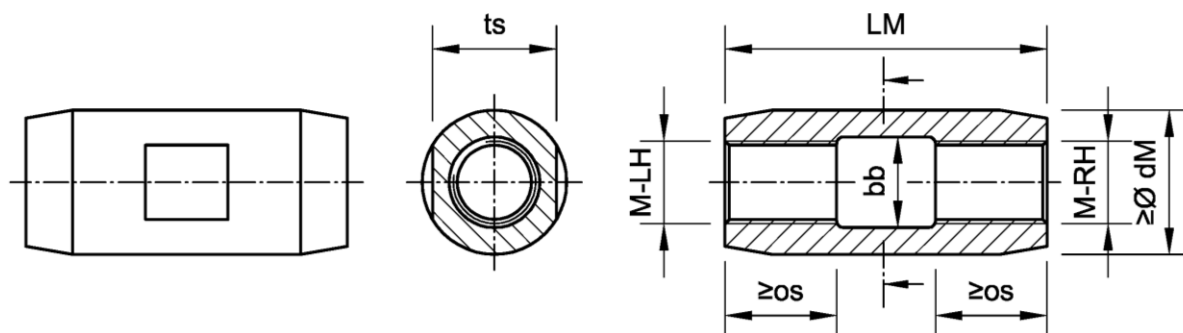
1) alternatively with tooled spanner flats and rod marking

2) Ødr possible for the complete rod in case of rolled threads

HALFEN Tension Rod System DETAN-E

Dimensions of the tensions rods

Annex B4



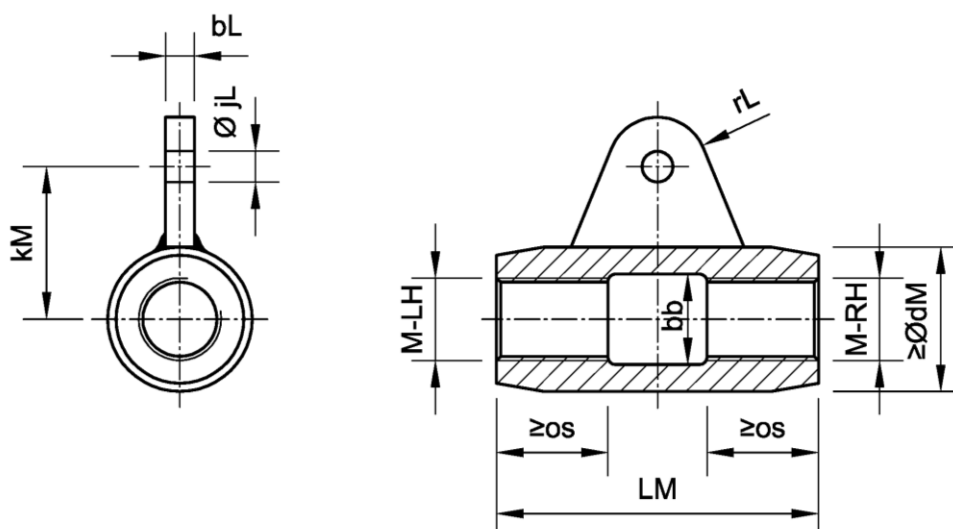
Minimum screw-in length of the tension rod = $o_m - o_j$ according to Annex B3

| 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

Dimensions of the couplers

Annex B5



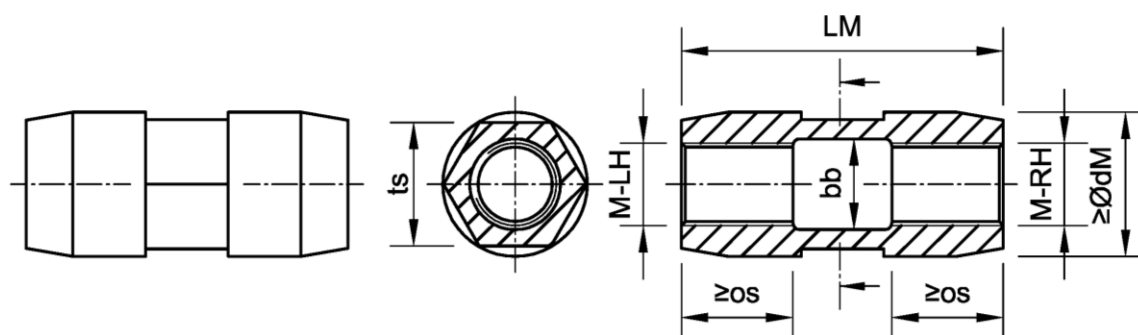
Minimum screw-in length of the tension rod = $o_m - o_j$ according to Annex B3

| 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

Dimensions of the couplers with additional gusset plate

Annex B6



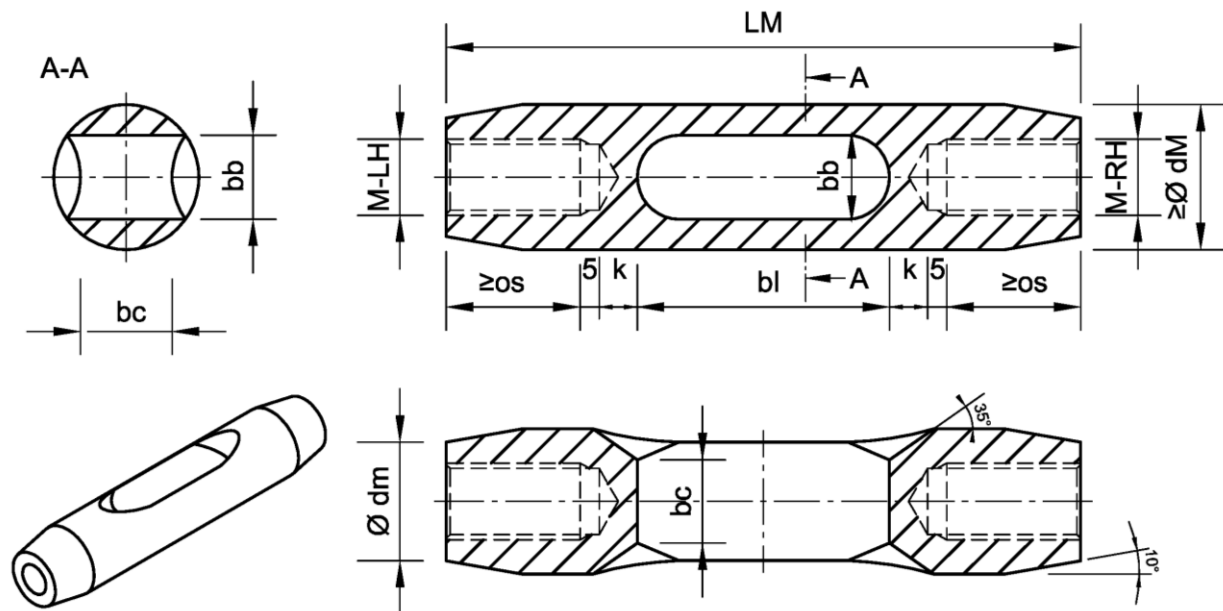
Minimum screw-in length of the tension rod = $o_m - o_j$ according to Annex B3

| 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

Dimensions of the hexagon couplers

Annex B7



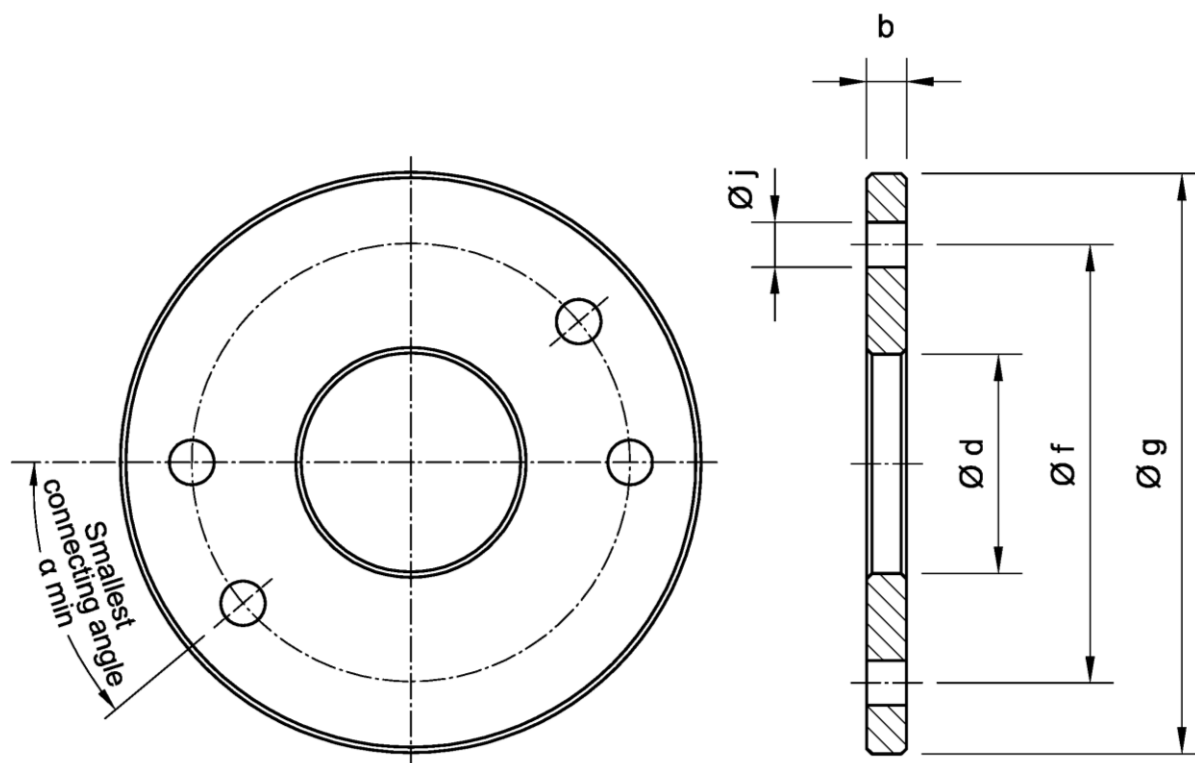
Minimum screw-in length of the tension rod = $om - oj$ according to Annex B3

| 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

Dimensions of the cross couplers

Annex B8



| 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

| 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 |

($\gamma_{M0}=1,1$ und $\gamma_{M2}=1,25$ note Annex A)

HALFEN Tension Rod System DETAN-E

design tension resistance of the entire tension rod system

Annex B10