EUROPEAN ASSESSMENT DOCUMENT

EAD 200032-00-0602

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PREFABRICATED TENSION ROD SYSTEMS WITH SPECIAL END CONNECTORS

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description 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 either connected to the corresponding structure by steel or cast fork end connectors with two eye loops (incl. pin) and internal thread or by hexagon regular nuts (incl. washer) with corresponding dimensions and threads. The fork end connectors are connected by double shear pin connections to corresponding steel or cast (circular) gusset plates. The tension rods can be connected to each other by steel or cast threaded sleeves (e.g. turnbuckles, intersection couplers) (see Figure 1).

The tension rod system comprises tension rods, fork end connectors or hexagon regular nuts as well as threaded sleeves with metric ISO threads M 6 to M 180 incl. metric fine pitch threads. The elongation at break of the tension rod is limited to 12%.

The fork end connectors can also be used as end connector for compression rods (struts) with thread. The maximum strength class of the rods is S460N.

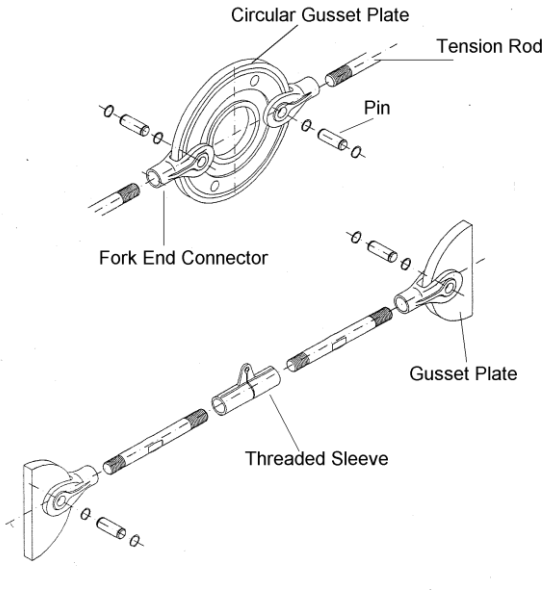


Figure 1: Schematic representation of the tension rod system

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The tension rod system is intended for the use in structures with predominantly static loads. It is not subjected to systematic bending. Furthermore the tension rod system shall only be used in accessible structures in order to facilitate replacement of individual components at any time.

The intended use comprises for instance the suspension of (glazed) roof constructions or vertical glazings as well as bracings and truss structures.

The fork end connectors can also be used as end connector for struts with thread.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the prefabricated tension rod systems with special end connectors for the intended use of 25 years when installed in the works (provided that the prefabricated tension rod systems with special end connectors is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[1].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[1] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the working life referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 to 4 shows how the performance of the components of the tension rod system is established in relation to the essential characteristics.

Table 1 Essential characteristics of the fork end connector and (circular) gusset plate and methods and criteria for assessing the performance of the products in relation to those essential characteristics

No	Essential characteristic	Assessment method	Expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Geometry incl. tolerances	2.2.1.1	Description
2	Dimensions incl. tolerances	2.2.1.1	Description
3	Thread incl. tolerances	2.2.1.1	Description
4	Material	2.2.1.1	Description
5	Load bearing capacity	2.2.1.1	Level
6	Resistance to corrosion	2.2.1.2	Description
Basic Works Requirement 2: Safety in case of fire			
7	Reaction to fire	2.2.1.3	Class
8	Resistance to fire	2.2.1.4	Class
Basic Works Requirement 4: Safety and accessibility in use			
10	Same as BWR 1		

Table 2 Essential characteristics of the tension rod and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Nominal rod diameter	2.2.2.1	Description
2	Thread incl. tolerances	2.2.3.1	Description
3	Yield strength	2.2.3.1	Description
4	Tensile strength	2.2.3.1	Description
5	Material	2.2.3.1	Description
6	Tension resistance	2.2.3.1	Level
7	Compression force	2.2.3.1	Level
8	Resistance to corrosion	2.2.3.2	Description
Basic Works Requirement 2: Safety in case of fire			
9	Reaction to fire	2.2.3.3	Class
10	Resistance to fire	2.2.3.4	Class
Basic Works Requirement 4: Safety and accessibility in use			
11	Same as BWR 1		

Table 3 Essential characteristics of hexagon regular nut and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Geometry incl. tolerances	2.2.3.1	Description
2	Dimensions incl. tolerances	2.2.3.1	Description
3	Thread incl. tolerances	2.2.3.1	Description
4	Material	2.2.3.1	Description
5	Resistance to corrosion	2.2.3.2	Description
Basic Works Requirement 2: Safety in case of fire			
7	Reaction to fire	2.2.3.3	Class
8	Resistance to fire	2.2.3.4	Class
Basic Works Requirement 4: Safety and accessibility in use			
9	Same as BWR 1		

Table 4 Essential characteristics of threaded sleeve and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Geometry incl. tolerances	2.2.4.1	Description
2	Dimensions incl. tolerances	2.2.4.1	Description
3	Thread incl. tolerances	2.2.4.1	Description
4	Material	2.2.4.1	Description
5	Load bearing capacity	2.2.4.1	Level
6	Resistance to corrosion	2.2.4.2	Description
Basic Works Requirement 2: Safety in case of fire			
7	Reaction to fire	2.2.4.3	Class
8	Resistance to fire	2.2.4.4	Class
Basic Works Requirement 4: Safety and accessibility in use			
9	Same as BWR 1		

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Characterisation of products to be assessed shall be done in accordance with available specifications, notably parameters as presented in the respective tables under 2.1 (Essential characteristics of the product).

The component having the smallest tension resistance is decisive for the value of the tension resistance of the tension rod system.

The systems shall be designed such that failure occurs in the tension rods.

The following options are possible:

- Tension tests as described in the following chapters,
- Calculation according to Eurocode 3 (the elongation at break should be limited to 12 % for all components),
- Numerical methods (e.g. finite element method) as described in the following chapters.

The minimum engagement depth for the tension rods to be screwed in the fork end connectors, hexagon regular nuts and threaded sleeves is such that failure should occur in the tension rod and not in the other components of the tension rod system. The minimum screw in length for the tension rods to be screwed in the fork end connectors and threaded sleeves is chosen such that longitudinal shear of internal and external threads loaded by tension forces can be excluded. The minimum screw in length should be $1.2 \cdot d_s$, where d_s = diameter of tension rod.

2.2.1 Fork end connector and (circular) gusset plate

Basic requirement for construction works 1 – Mechanical resistance and stability

2.2.1.1 Tension resistance of the fork end connector and (circular) gusset plate

The characteristic values of the tension resistance of the fork end connector and (circular) gusset plates shall be determined by tension tests if the conditions given in EN 1993-1-8, clause 3.13 is not satisfied. It is also possible to determine the tension resistance by using numerical methods (e. g. finite element method).

2.2.1.1.1 System sizes to be tested

Four unfavourable system sizes relating to the ratio of the tension resistance of the fork end connector and the tension resistance of the tension rod of one system size should be tested.

2.2.1.1.2 Determination of the characteristic and design values of the tension resistance of fork end connectors and (circular) gusset plate by tension tests

The tension tests described in the following are used for the determination of the characteristic values of the tension resistance of fork end connectors, (circular) gusset plates and threaded sleeves (see clause 2.2.4) as well as for checking the adequate engagement depth.

Within the context of the tests at least three tension tests shall be carried out for each of the system sizes which shall be tested according to clause 2.2.1.1.1. High-strength tension rods and gusset plates dimensioned accordingly or respective fork end connectors shall be used for the tests in order to force the failure of the fork end connectors (incl. original pins) or the (circular) gusset plates. The engagement depth of the high strength tension rods shall correspond to the minimum engagement depth allowed. The test load shall be increased deformation-controlled until failure of the fork end connectors or pins or of the (circular) gusset plates occurs. The load-deformation curves and the respective failure modes as well as the material properties (yield strength, tensile strength, notch impact value at -20°C and elongation), dimensions and geometry of the building components used for the tests (tension rod, fork end connector, pin, (circular) gusset plates) shall be documented in the test report.

An example for the test setup is shown in Annex A1

The test results (failure loads) shall be multiplied by a correction factor which takes account of the ratio of nominal guaranteed minimum tensile/yield strength[2] and the tensile/yield strength of the building components used in the tests. The corrected test results shall be evaluated statistically According to EN 1990, Annex D, table D.1, assuming that the variation coefficient V_x is unknown. It is allowed to include all tests carried out when regarding the number of tests n. The calculation of the characteristic value has to be done separately for each system size.). Generally a normal distribution can be assumed. The corrected and statistically evaluated test results (5 % fractiles) are the characteristic values $F_{t,Rk}$ of the tension resistance of the system sizes tested. The design values of tension resistance are determined by dividing the characteristic values by partial safety factor γ_{M2}. Recommended value for the partial safety factor γ_{M2} is 1.25 in accordance with EN 1993-1-1 and EN 1993-1-8, table 2.1.

In addition for fork end connectors the following applies:

If at least four system sizes were tested and a linear correlation of the cross section of the tension rods and the tension resistance of the fork end connectors was verified (cf. clause 2.2.1.1.1), the characteristic values of the system sizes which were not tested shall be determined by interpolation of the characteristic values $F_{t,Rk,exp}$ determined by tests.

If at least four system sizes were tested and no linear correlation of the cross section of the tension rods and the tension resistance of the fork end connectors was verified, the characteristic values $F_{t,Rk}$ of the untested system sizes shall be determined on the safe side as follows:

1. The smallest values min α_1 and min α_2 of the ratios
   $\alpha_1 = F_{t,Rk,exp} / F_{t,Rk1,\text{Tension Rod,calc}}$

[2] The ratio resulting in a smaller correction factor is relevant. If fracture occurs as a failure mode the tensile strength shall be used in order to determine the correction factor.

and

$\alpha_2 = F_{t,Rk,exp} / F_{t,Rk2,Tension\ Rod,calc}$

and

α_1 and $\alpha_2 \leq 1,0$

are determined for the tested system sizes. The corresponding tension rod is used as basis for the determination of the characteristic resistances $F_{t,Rk1,Tension\ Rod,calc}$ and $F_{t,Rk2,Tension\ Rod,calc}$. The calculation follows clause 2.2.2.1.2.

2. The characteristic value $F_{t,Rk,calc}$ of the untested system sizes is
$F_{t,Rk,calc} = \min \{\min \alpha_1 \cdot F_{t,Rk1,Tension\ Rod,calc}; \min \alpha_2 \cdot F_{t,Rk2,Tension\ Rod,calc}\}$

The corresponding tension rod is used as basis for the determination of the characteristic resistances $F_{t,Rk1,Tension\ Rod,calc}$ and $F_{t,Rk2,Tension\ Rod,calc}$. The calculation follows clause 2.2.2.1.2.

2.2.1.1.3 Determination of the characteristic and design values of the tension resistance of fork end connectors and (circular) gusset plate by using numerical methods (if necessary in combination with threaded sleeves)

To determine the tension resistance by using numerical methods (e.g. finite element method) a benchmark to proof the accuracy of the numerical model has to be carried out as follows:

- Numerical calculation of at least two system sizes of the fork end connector using mechanical material properties given in 3.1-certificates according to EN 10204,
- Experimental tests on the two system sizes calculated before (three tests per system size),
- Comparison of numerical and experimental result (mean values):
  If the difference is ≤ 10 % the system can be calculated by using the numerical model (with characteristic values for the material properties).
  If the difference is > 10 % the numerical model is not accurate enough. In this case it is not allowed to determine the tension resistance using this model.

2.2.1.2 Resistance of corrosion

The corrosion protection of components which are not made of corrosion-resistant steel shall be carried out according to EN ISO 12944, EN 1993-1-1 and/or EN ISO 10684. For stainless steel components the rules given in EN 1993-1-4 shall apply to the material selection and to the manufacture of corrosion-resistant structures. Further references for a corrosion-resistant execution are given in EN 1090-2.

For components which are not made of corrosion-resistant steel or EN 1993-1-4 for stainless steel components EN ISO 12944 and/or EN ISO 10684 apply.

Basic requirement for construction works 2 – Safety in case of fire

2.2.1.3 Reaction to fire

Case 1: Conditions of case 2 are not given:

The reaction to fire of the components of the tension rod system shall be tested in order to be classified according to EN 13501-1.

Case 2: Products classified without the need for (further) testing (CWFT)

The tension rod system is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the EC Decision 96/603/EC[3], amended by EC decision 2000/605/EC[4] and EC decision 2003/424/EC[5]without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

Therefore the performance of the components of the tension rod system is Class A1.

[3] Official Journal of the European Communities № L 267, 19.10.1996

[4] Official Journal of the European Communities № L 258, 12.10.2000

[5] Official Journal of the European Communities № L 144, 12.6.2003

2.2.1.4 Resistance to fire

Fire resistance performance cannot be claimed for individual products or for a single component of the system (non-installed), but for the installed tension rod system in the structure. So the product or a component cannot be classified according to EN 13501-2.

Furthermore a testing procedure or reference to an appropriate standard for testing the resistance to fire of the installed tension rod system should be given.

Basic requirement for construction works 4 – Safety and accessibility in use

Same as BWR 1.

2.2.2 Tension rod

Basic requirement for construction works 1 – Mechanical resistance and stability

2.2.2.1 Tension resistance of the tension rod

The characteristic values of the tension resistance of tension rods shall be determined by calculation according to Eurocode 3. If the conditions given in these standards are not satisfied the characteristic values of the tension resistance of tension rods shall be determined by tests.

2.2.2.1.1 System sizes to be tested

It is sufficient to carry out tension tests only on some of the system sizes. At least four sizes should be tested, namely one small one and two medium sizes as well as the largest size.

2.2.2.1.2 Determination of the characteristic and design values of the tension resistance of tension rods

The tension tests described in the following are used for the determination of characteristic values of the tension resistance of tension rods.

Within the context of the tests at least three tension tests shall be carried out for each of the system sizes which shall be tested according to clause 2.2.1.1.1. High-strength fork end connectors or hexagon regular nuts shall be used for the tests in order to force the failure of the tension rods. If relevant the tension rods can be connected to each other by threaded sleeves of a corresponding higher strength than the rods. After rolling or cutting the thread on the tension rod it shall be ensured that the remaining peeled section of the tension rod is long enough to determine the 0.2 % yield strength as well as the ultimate elongation in this section during testing.

The test load shall be increased deformation-controlled until failure of the tension rods occurs. The load-deformation curves and the failure modes as well as the material properties (yield strength, tensile strength and elongation), dimensions and geometry of the tension rods used for the tests (tension rod, fork end connector or hexagon regular nut, pin and if relevant the sleeve) shall be documented in the test report. The material properties of the initial material of the tension rods used for the tests shall be determined by the manufacturer by tests according to EN ISO 6892-1.

The test results shall be documented by means of inspection certificates "3.1" according to EN 10204. The results have to correspond to the material specifications given by the manufacturer.

For the determination and evaluation of the characteristic values the rules given in clause 2.2.1.1.2 shall apply accordingly. The values determined by tests are limited to the values determined by calculation.

In case the material properties of the tension rods correspond to EN 1993-1-11 and EN 1993-1-1 or EN 1993-1-8 and EN 1993-1-4 the tension resistance shall be calculated according to EN 1993-1-11, EN 1993-1-1 and EN 1993-1-8 as follows:

$$F_{t,Rk1,Tension\ Rod,calc} = A_{Tension\ Rod} \cdot f_{y,Tension\ Rod}$$

$$F_{t,Rk2,Tension\ Rod,calc} = 0,9 \cdot A_{S,Tension\ Rod} \cdot f_{u,Tension\ Rod}$$

Where

$A_{Tension\ Rod}$	shank cross section of the tension rod
$f_{y,Tension\ Rod}$.....	characteristic value of the yield strength of the tension rod material

$F_{t,Rk1,Tension\ Rod,calc}$ characteristic tension resistance of the shank cross section $A_{Tension\ Rod}$ of the tension rod

$A_{S,Tension\ Rod}$.... threaded cross section of the tension rod

$f_{u,Tension\ Rod}$..... characteristic value of the tensile strength of the tension rod material

$F_{t,Rk2,Tension\ Rod,calc}$ characteristic tension resistance of the threaded cross section of the tension rod

The design tension resistance shall be determined as follows:

$F_{t,Rd,Tension\ Rod,calc} = \min \{F_{t,Rd1,Tension\ Rod,calc}, F_{t,Rd2,Tension\ Rod,calc}\}$

$F_{t,Rd1,Tension\ Rod,calc} = F_{t,Rk1,Tension\ Rod,calc} / \gamma_{M0}$

$F_{t,Rd2,Tension\ Rod,calc} = F_{t,Rk2,Tension\ Rod,calc} / \gamma_{M2}$

According to EN 1993-1-1 and EN 1993-1-8, table 2.1 recommended values for the partial safety factors γ_{M0} and γ_{M2} are:

γ_{M0} = 1.0 for steel

γ_{M0} = 1.10 for stainless steel

γ_{M2} = 1.25

2.2.2.1.3 Design values of the compression force of tension rods

The design value of the compression force $N_{c,Rd}$ of struts is either

- the design value of the compression force of struts in the cross-section of the thread or
- the design value of the compression force of struts calculated according to EN 1993-1-1 or EN 1993-1-4.

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

$$F_{c,Rd} = \left[\frac{\gamma_{M2}}{A_S \cdot f_{u,c}} + \frac{\left(\frac{B - t_{GI}}{2} + \frac{H}{50} \right) \cdot \gamma_{M0}}{W_{pl,S} \cdot f_{y,c}} \right]^{-1}$$

Where:

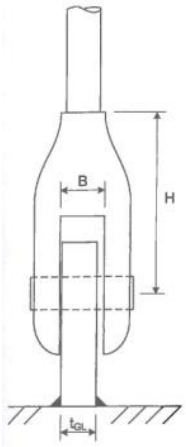
A_S tensile stress area of the thread

$W_{pl,S}$ 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 according to 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 according to product standard

B, H and t_{GI} according to the following picture:



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

γ_{M0} = 1.0 for steel

γ_{M0} = 1.10 for stainless steel

γ_{M2} = 1.25

The design value of the compression force of struts has to be determined according to EN 1993-1-1 or EN 1993-1-4 considering the additional bending strength in consequence of one-sided contact of the gusset plates.

In addition EN 1993-1-1 or EN 1993-1-4 applies for verification against buckling.

2.2.2.2 Resistance of corrosion

See Clause 2.2.1.2.

Basic requirement for construction works 2 – Safety in case of fire

2.2.2.3 Reaction to fire

See Clause 2.2.1.3

2.2.2.4 Resistance to fire

See Clause 2.2.1.4.

Basic requirement for construction works 4 – Safety and accessibility in use

Same as BWR 1.

2.2.3 Hexagon regular nut

Basic requirement for construction works 1 – Mechanical resistance and stability

2.2.3.1 Tension resistance of the hexagon regular nut

Geometry, dimension, thread and material as well as the strength class of the used hexagon regular nut shall correspond to ISO 4032 and ISO 898-2 and shall have at least the same strength class as the tension rod. The height of the hexagon regular nut shall correspond to the tension rod.

The conformity of the hexagon regular nuts to ISO 4032 and ISO 898-2 shall be declared by the manufacturer in form of inspection certificates.

2.2.3.2 Resistance of corrosion

See Clause 2.2.1.2.

Basic requirement for construction works 2 – Safety in case of fire

2.2.3.3 Reaction to fire

See Clause 2.2.1.3.

2.2.3.4 Resistance to fire

See Clause 2.2.1.4.

Basic requirement for construction works 4 – Safety and accessibility in use

Same as BWR 1.

2.2.4 Threaded sleeve

Basic requirement for construction works 1 – Mechanical resistance and stability

2.2.4.1 Tension resistance of the threaded sleeve

The characteristic values of the tension resistance of threaded sleeves shall be determined by tension tests if the conditions given in Eurocode 3, especially EN 1993-1-1, table 3.1 or EN1993-1-4 are not satisfied. Otherwise the tension resistance can be determined without testing by calculation according to the corresponding part of Eurocode 3.

Type and extent of the test procedure as well as the rules for the determination of characteristic values given in clause 2.2.1.1.2 also apply to tests on threaded sleeves. If necessary the threaded sleeves can be tested in combination with the tests on fork end connectors by connecting two high- strength tension rods to each other by one threaded sleeve.

An example for the test setup is shown in Annex A2.

2.2.4.2 Resistance of corrosion

See Clause 2.2.1.2.

Basic requirement for construction works 2 – Safety in case of fire

2.2.4.3 Reaction to fire

See Clause 2.2.1.3.

2.2.4.4 Resistance to fire

See Clause 2.2.1.4.

Basic requirement for construction works 4 – Safety and accessibility in use

Same as BWR 1.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 1998/214/EC

The system is: 2+

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 5.

Table 5 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	**Check of material properties of components**				
	Check of material properties of components	Check if material properties stated in the ETA correspond to the material properties stated in the inspection certificate "type 3.1"	Inspection certificate "type 3.1" according to EN 10204 100% compliance to material properties stated in ETA	Every component	Every production unit
2	**Check of outer and inner conditions of steel cast components**				
2a	Check of outer conditions	Check if the outer conditions of the steel cast material stated in the ETA correspond to the severity level stated in the annex to inspection certificate "type 3.1"	Annex to inspection certificate "type 3.1" according to EN 10204 Severity level: SM2/LM2/AM2 according to EN 1369	The number of samples is determine in the ETA depending on the amount of the production unit	Every production unit
2b	Check of inner conditions	Check if the inner conditions of the steel cast material stated in the ETA correspond to the severity level stated in the annex to inspection certificate "type 3.1"	Annex to inspection certificate "type 3.1" according to EN 10204 Severity level 2 according to EN 12680-1 or severity level 3 according to EN 12681		
3	**Check of outer and inner conditions of iron cast components**				
3a	Check of outer conditions	Check if the outer conditions of the iron cast material stated in the ETA correspond to the severity level stated in the annex to inspection certificate "type 3.1"	Annex to inspection certificate "type 3.1" according to EN 10204 Severity level: SM2/LM2/AM2 according to EN 1369	The number of samples is determined in the ETA depending on the amount of the production unit	Every production unit
3b	Check of inner conditions	Check if the inner conditions of the iron cast material stated in the ETA correspond to the severity level stated in the annex to inspection certificate "type 3.1"	Annex to inspection certificate "type 3.1" according to EN 10204 Severity level 2 according to EN 12680-3 or severity level 3 according to EN 12681		

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
4	**Check of outer and inner conditions of investment steel cast, austenitic and austenitic-ferritic stainless steel cast components**				
4a	Check of outer conditions	Check if the outer conditions of investment steel cast, austenitic and austenitic-ferritic stainless steel material stated in the ETA correspond to the severity level stated in the annex to inspection certificate “type 3.1”	Annex to inspection certificate “type 3.1” according to EN 10204 Severity level: LP6/AP6 according to EN 1371-2	The number of samples is determined in the ETA depending on the amount of the production unit	Every production unit
4b	Check of inner conditions	Check if the inner conditions of investment steel cast, austenitic and austenitic-ferritic stainless steel material stated in the ETA correspond to the severity level stated in the annex to inspection certificate “type 3.1”	Annex to inspection certificate “type 3.1” according to EN 10204 Severity level 3 according to EN 12681		
4c	Check of dimensions of components	Check of dimensions stated in the ETA	-	The number of samples is determined in the ETA depending on the amount of the production unit	Every production unit

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 6.

Table 6 Control plan for the notified body; cornerstones

No	Subject/type of control	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control		
1	Inspection of factory and factory production control	Before certification
2	Inspection of the testing facilities of the manufacturer	
3	The notified body shall ascertain that, in accordance with the control plan, the manufacturing plant of the single product manufacturer, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous and orderly manufacturing of the tension rod system according the European Technical Assessment.	
Continuous surveillance, assessment and evaluation of factory production control		
3	Surveillance and assessment of factory production control	Once a year
4	Surveillance of the testing facilities of the manufacturer	
5	It shall be verified that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	

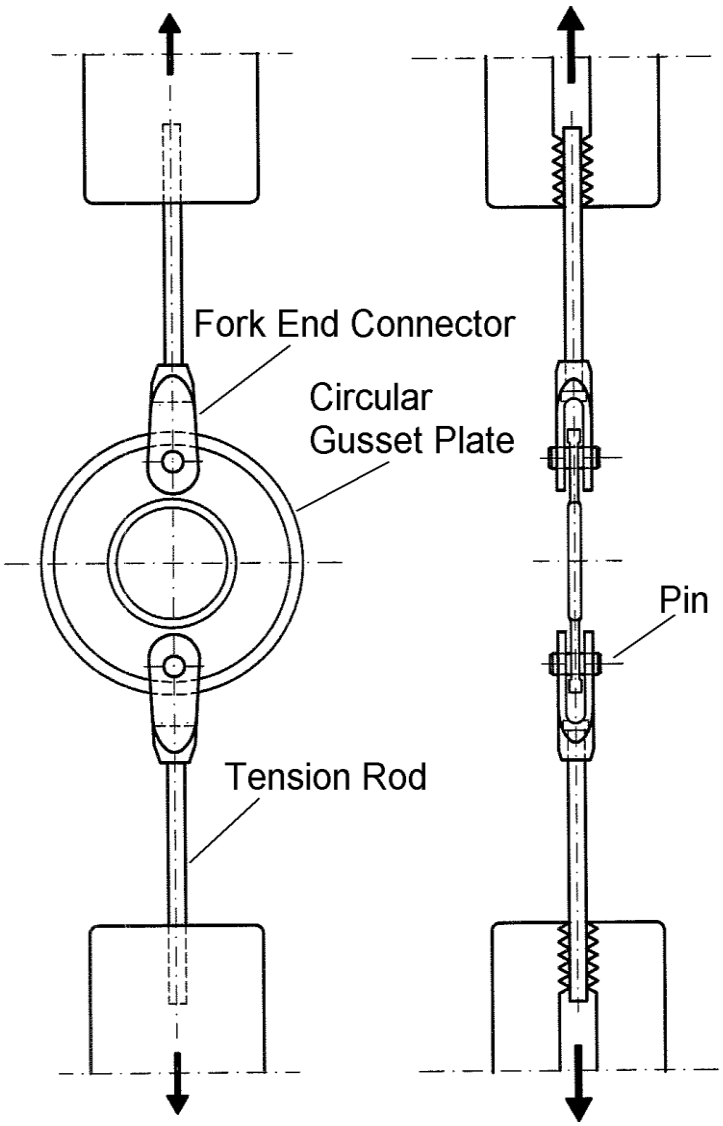
4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of technical specifications thereafter, the content in its current version at the time of issuing the European Technical Assessment is of relevance.

EN 1990	Eurocode: Basis of structural design
EN 1090-2	Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures
EN 1369	Founding – Magnetic particle inspection
EN 1371-2	Founding – Liquid penetrant testing – Part 2: Investment casting
EN 1993-1-1	Eurocode 3 Design of steel structures – Part 1-1: General rules and rules for buildings
EN 1993-1-4	Part 1-4: General rules - Supplementary rules for stainless steels
EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of joints
EN 1993-1-11	Eurocode 3: Design of steel structures – Part 1-11: Design of structures with tension components
EN ISO 6892-1	Metallic materials - Tensile testing – Part 1: Method of test at room temperature
EN 10204	Metallic products - Types of inspection documents
EN 12680-1	Ultrasonic examination – Part 1: Steel castings for general purposes
EN 12680-3	Ultrasonic examination – Part 3: Spheroidal graphite cast iron castings
EN 12681	Founding – Radiographic examination
EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
EN 13501-2	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN ISO 12944-1	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 1: General introduction
EN ISO 12944-2	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments
EN ISO 12944-3	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 3: Design considerations
EN ISO 12944-4	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 4: Types of surface and surface preparation
EN ISO 12944-5	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems
EN ISO 12944-6	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods
EN ISO 12944-7	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 7: Execution and supervision of paint work
EN ISO 12944-8	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 8: Development of specifications for new work and maintenance
EN ISO 10684	Fasteners - Hot dip galvanized coatings
EN ISO 898-2	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread
EN ISO 4032	Hexagon regular nuts (style 1) - Product grades A and B
EN ISO 148-1	Metallic materials - Charpy pendulum impact test - Part 1: Test method

ANNEX A
DESCRIPTION OF TEST SETUPS

ANNEX A1 Test setup for tension test on circular gusset plates



Annex A2

Test Setup for Tension Tests on Fork End Connectors and Threaded Sleeve