

## European Technical Approval ETA-04/0039 PFEIFER Tension Rod System 860

valid to 22. Juli 2014

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**PFEIFER  
SEIL- UND HEBETECHNIK  
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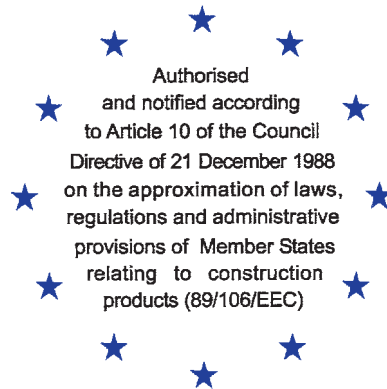
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# DIBt

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## European Technical Approval ETA-04/0039

English translation prepared by DIBt - Original version in German language

**Handelsbezeichnung**  
*Trade name*

Pfeifer Zugstabsystem 860

**Zulassungsinhaber**  
*Holder of approval*

Pfeifer Seil- und Hebeteknik GmbH  
Dr.-Karl-Lenz-Str. 66  
87700 Memmingen

**Zulassungsgegenstand  
und Verwendungszweck**  
*Generic type and use  
of construction product*

Vorgefertigtes Zugstabsystem  
*Prefabricated tension rod system*

**Geltungsdauer:** vom  
*Validity:* *from*  
*bis*  
*to*  
verlängert vom  
*extended from*  
*bis*  
*to*

21 July 2004  
21 July 2009  
22 July 2009  
22 July 2014

**Herstellwerk**  
*Manufacturing plant*

Pfeifer Seil- und Hebeteknik GmbH  
Dr.-Karl-Lenz-Str. 66  
87700 Memmingen  
GERMANY

**Diese Zulassung umfasst**  
*This Approval contains*

13 Seiten einschließlich 5 Anhänge  
*13 pages including 5 annexes*



Europäische Organisation für Technische Zulassungen  
European Organisation for Technical Approvals

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by law of 31 October 2006<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated in EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities N° L 40, 11 February 1989, p. 12

2 Official Journal of the European Communities N° L 220, 30 August 1993, p. 1

3 Official Journal of the European Union N° 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 N° L 17, 20 January 1994, p. 34

## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of product 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 steel gusset plates. The tension rods are connected to each other by steel threaded sleeves.

The tension rod system comprises tension rods, fork end connectors and threaded sleeves (couplers, adapters) with metric ISO threads M 10 to M 100.

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 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 glazings as well as bracings and truss structures.

The fork end connectors may also be connected to compression bars. The compression bars themselves are not part of the ETA.

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, 4 and 5. The dimensions and tolerances of the components of the tension rod system not indicated in Annexes 3, 4 and 5 shall correspond to the respective values and information laid down in the technical documentation<sup>7</sup> to this European technical approval.

##### **2.1.2 Material properties**

The material properties of the components of the tension rod system shall correspond to the values and European standards given in Annex 2. The relation to the different components is given in Annexes 3, 4 and 5. The material characteristics of the components of the tension rod system not indicated in Annex 2 shall correspond to the respective values and information laid down in the technical documentation<sup>7</sup> to this European technical approval.

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<sup>7</sup> The technical documentation to this European technical approval is deposited with Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure is handed over to the approved bodies.

## 2.1.3 Design values of resistance

### 2.1.3.1 Design tension resistance of the entire tension rod system

The design value  $N_{Rd}$  of the tension resistance of the entire tension rod system (tension rods, fork end connectors incl. pins, couplers, adapters and gusset plates) is the minimum value of the design tension resistance  $N_{Rd, \text{Tension Rod}}$  of the tension rod and the design bearing resistance  $N_{Rd, \text{Gusset Plate}}$  of the gusset plate.

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

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

$A$  = minimum cross section of the unthreaded part of the tension rod

$A_S$  = cross section of the threaded part of the tension rod

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

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

$$N_{Rd, \text{Gusset Plate}} = 1.5 \cdot t_{GL} \cdot d_B \cdot f_{y,k} / \gamma_{M1}$$

$t_{GL}$  = thickness of gusset plate according to Annex 3

$d_B$  = pin diameter according to Annex 3

$f_{y,k}$  = characteristic value of the yield strength of the gusset plate material 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  $\gamma_{M1}$  and  $\gamma_{M2}$  are recommended values. They should be used in cases where no values are given in national regulations of the Member State where the tension rod system is used or in the respective National Annex to Eurocode 3.

### 2.1.3.2 Design compression resistance of the fork end connectors

The design compression resistance of the fork end connectors used for the connection to compression bars is at least equal to the tension resistance  $N_{Rd, \text{Tension Rod}}$  of the tension rods according to section 2.1.3.1.

### 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 sections 2.2.2 and 2.2.3.

### 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 four system sizes of the fork end connectors. The characteristic values of the tension resistance of the fork end connectors were determined by evaluating the test results of 3 tension tests carried out on each of the fork end connectors M 16, M 36, M 48 and M 100.

Comparison of characteristic values of resistance of the corresponding tension rods, gusset plates, couplers and adapters 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) as well as the tension resistance of the couplers is not relevant to the tension resistance of the entire tension rod system. The tension resistance of the adapters is at least identical to the tension resistance of the tension rods. Thus it is sufficient to calculate only the tension resistance of the tension rods and the bearing resistance of the gusset plates in order to determine the tension resistance of the entire tension rod system.

Due to the fact that the compression and tension resistance of the fork end connectors are identical the compression resistance of the fork end connectors is at least equal to the tension resistance of the tension rods.

## 3 Evaluation and attestation of conformity and CE marking

### 3.1 System of attestation of conformity

According to the Decision 98/214/EC of the European Commission<sup>8</sup> the 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 by the manufacturer 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".

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<sup>8</sup> 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 the European technical approval.

The manufacturer shall only use initial materials, stated in the technical documentation of the European technical approval.

The factory production control shall be in accordance with the control plan relating to the European technical approval ETA-04/0039 issued on 21 July 2004, validity extended on 22 July 2009 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.<sup>9</sup>

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 3.2.2. 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 ETA-04/0039 issued on 21 July 2004, validity extended on 22 July 2009.

### 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.

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<sup>9</sup> The "control plan" is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

### **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 100).

## **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 products on the basis of agreed data/information, deposited with 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 Deutsches Institut für Bautechnik before the changes are introduced. 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 Design**

The design of the tension rod system is carried out under the following conditions:

The loading is predominantly static.

Dimensions, material properties and screw-in lengths "ET" 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 design values of resistance stated in section 2.1 are used for design.

The rules given in EN 1090-2:2008 and EN ISO 12944 are taken into account.

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

### **4.3 Installation**

The installation of the tension rod system is carried out under the following conditions:

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 screw-in lengths are marked in an appropriate way. The keeping of the minimum screw-in lengths "ET" given in Annexes 3 and 4 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.

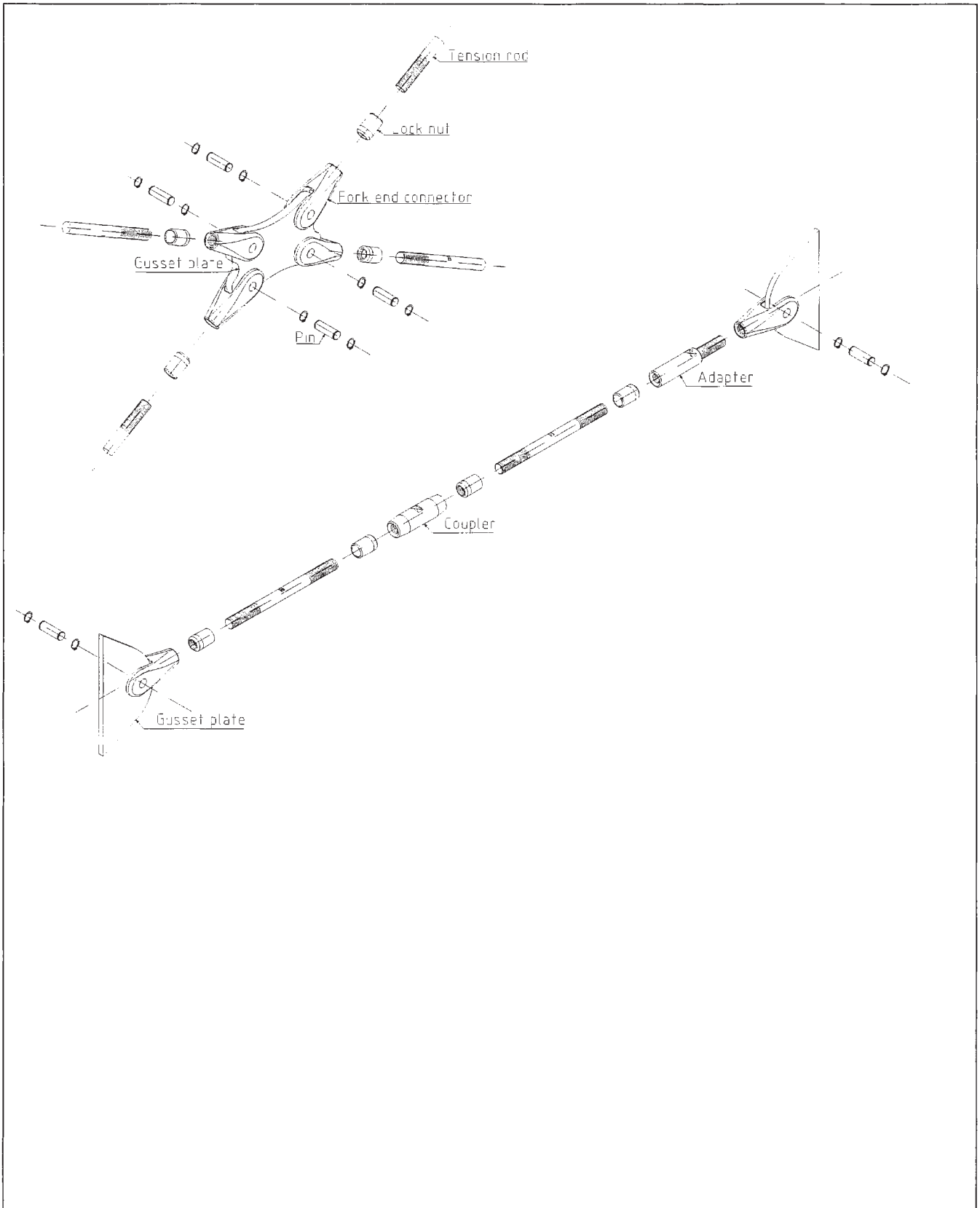
## **5 Recommendations for the manufacturer**

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 respective parts of the European technical approval. In addition all essential installation data (eg, minimum screw-in length "ET" according to Annexes 3 and 4) 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, adapters and prefabricated gusset plates). The fork end connectors used for the connection to compression bars may also be delivered separately.

Dipl.-Ing. Erich Jasch  
President of Deutsches Institut für Bautechnik  
Berlin, 22 July 2009

*beglaubigt*  
Spohn



|                                       |  |
|---------------------------------------|--|
| <b>Pfeifer Tension Rod System 860</b> | <b>Annex 1</b>                                       |
| System, components                    | to European Technical Approval<br><b>ETA-04/0039</b> |

| Component  | Steel grade / material | Yield strength                     |  | Tensile strength           |  |
|--|------------------------|------------------------------------|--|----------------------------|--|
|  |                        | $R_{p0.2}$<br>[N/mm <sup>2</sup> ] |  | Rm<br>[N/mm <sup>2</sup> ] |  |
| <b>Fork end connector</b>  | EN-GJS-400-18-LT       | according to EN 1563               |  |                            |  |
| <b>Tension rod</b>   | S460N                  | 460                                |  | 625                        |  |
| <b>Pin</b>   | 34CrNiMo 6+QT          | according to EN 10083-3            |  |                            |  |
| <b>Lock nut</b>  | S355J2                 | according to EN 10025-2            |  |                            |  |
| <b>Individually fabricated gusset plate according to Annex 3</b> | S355J2                 | according to EN 10025-2            |  |                            |  |
|  | S235J2                 |                                    |  |                            |  |
| <b>Adapter</b>   | S460N                  | 460                                |  | 625                        |  |
| <b>Coupler</b>   | S355J2                 | according to EN 10025-2            |  |                            |  |
| <b>Prefabricated gusset plate according to Annex 5</b>           | S355J2                 | according to EN 10025-2            |  |                            |  |

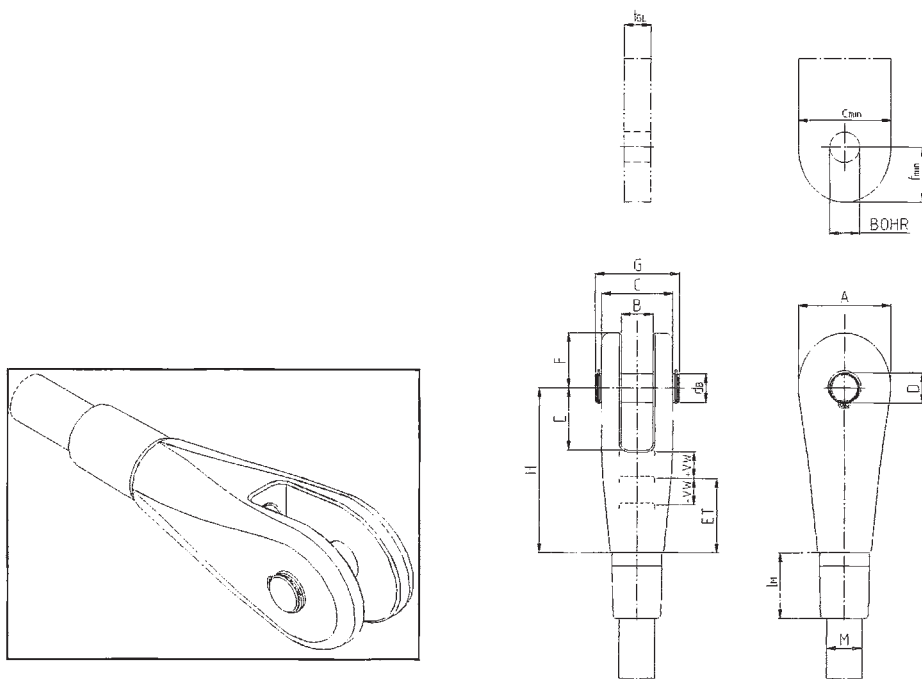
**Pfeifer Tension Rod System 860**

Material properties of components

**Annex 2**

to European Technical Approval

**ETA-04/0039**



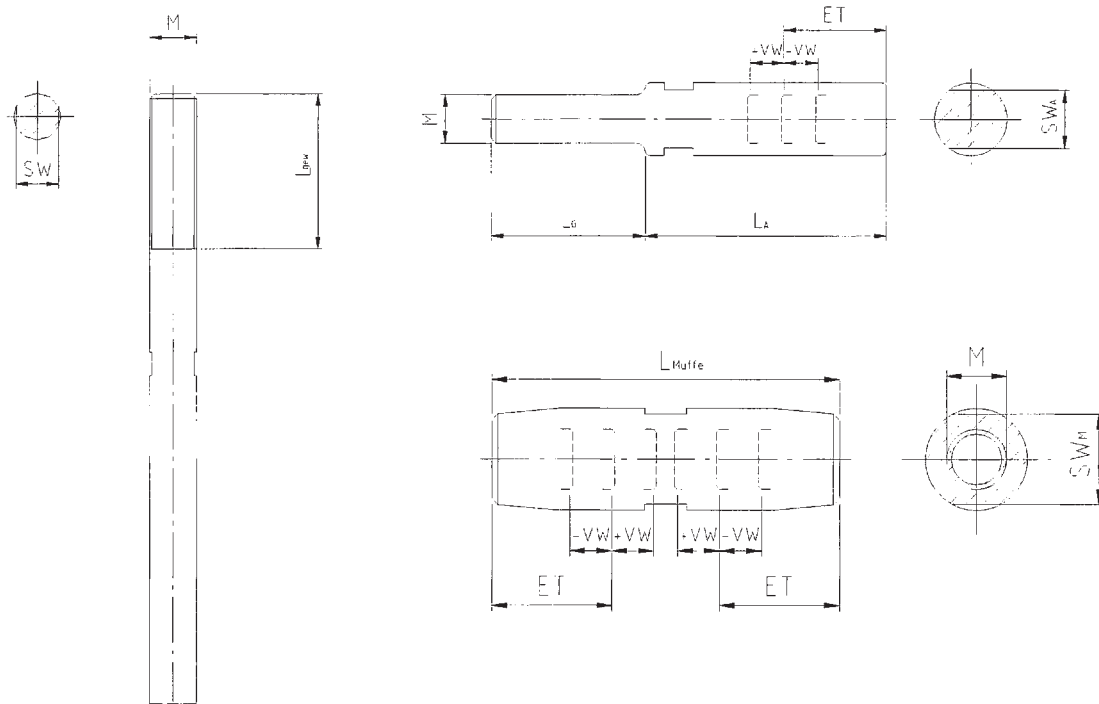
| Fork end connector<br>EN-GJS-400-18-LT |         |         |         |         |         |         |         |         |          |           | Pin<br>34 CrNiMo 6+QT |         | Lock nut<br>S355J2G3 | Gusset plate<br>S355J2G3<br>S235J2G3 |                        |                        |            |
|--|---------|---------|---------|---------|---------|---------|---------|---------|----------|-----------|-----------------------|---------|----------------------|--------------------------------------|------------------------|------------------------|------------|
| Size                                   | M<br>mm | A<br>mm | B<br>mm | C<br>mm | D<br>mm | E<br>mm | F<br>mm | H<br>mm | ET<br>mm | ±VW<br>mm | d <sub>B</sub><br>mm  | G<br>mm | l <sub>M</sub><br>mm | t <sub>GL</sub><br>mm                | f <sub>min</sub><br>mm | C <sub>min</sub><br>mm | BOHR<br>mm |
| M 10                                   | 10      | 25      | 10      | 20      | 10      | 19      | 16      | 52      | 20       | 7         | 9                     | 27.0    | 21                   | 8                                    | 16                     | 25                     | 10         |
| M 12                                   | 12      | 29      | 12      | 24      | 11      | 21      | 18      | 58      | 22       | 6         | 10                    | 31.0    | 25                   | 10                                   | 17                     | 29                     | 11         |
| M 16                                   | 16      | 42      | 15      | 32      | 15      | 30      | 26      | 77      | 34       | 12        | 14                    | 41.0    | 33                   | 12                                   | 23                     | 42                     | 15         |
| M 20                                   | 20      | 52      | 18      | 40      | 17      | 35      | 31      | 93      | 42       | 15        | 16                    | 50.2    | 41                   | 15                                   | 27                     | 52                     | 17         |
| M 24                                   | 24      | 58      | 23      | 48      | 23      | 46      | 39      | 115     | 50       | 18        | 22                    | 59.8    | 49                   | 20                                   | 36                     | 58                     | 23         |
| M 27                                   | 27      | 68      | 23      | 54      | 25      | 47      | 44      | 125     | 56       | 20        | 24                    | 66.6    | 55                   | 20                                   | 39                     | 68                     | 25         |
| M 30                                   | 30      | 77      | 28      | 60      | 29      | 52      | 51      | 138     | 62       | 22        | 28                    | 74.8    | 62                   | 25                                   | 47                     | 77                     | 30         |
| M 36                                   | 36      | 90      | 28      | 72      | 33      | 64      | 58      | 167     | 74       | 26        | 32                    | 89.3    | 74                   | 25                                   | 53                     | 90                     | 34         |
| M 42                                   | 42      | 104     | 33      | 84      | 37      | 70      | 66      | 190     | 87       | 31        | 36                    | 103.5   | 86                   | 30                                   | 59                     | 104                    | 38         |
| M 48                                   | 48      | 120     | 38      | 96      | 41      | 78      | 74      | 213     | 99       | 34        | 40                    | 118.7   | 99                   | 35                                   | 66                     | 120                    | 42         |
| M 52                                   | 52      | 136     | 43      | 104     | 46      | 85      | 84      | 231     | 106      | 37        | 45                    | 126.7   | 107                  | 40                                   | 73                     | 136                    | 47         |
| M 56                                   | 56      | 148     | 43      | 112     | 51      | 95      | 91      | 254     | 116      | 41        | 50                    | 138.3   | 115                  | 40                                   | 81                     | 148                    | 52         |
| M 60                                   | 60      | 162     | 48      | 120     | 56      | 106     | 100     | 275     | 123      | 43        | 55                    | 146.3   | 124                  | 45                                   | 90                     | 162                    | 58         |
| M 64                                   | 64      | 170     | 53      | 128     | 56      | 107     | 103     | 286     | 131      | 45        | 55                    | 154.8   | 132                  | 50                                   | 90                     | 170                    | 58         |
| M 70                                   | 70      | 185     | 58      | 140     | 61      | 117     | 113     | 315     | 144      | 51        | 60                    | 166.8   | 144                  | 55                                   | 98                     | 185                    | 63         |
| M 80                                   | 80      | 210     | 68      | 160     | 71      | 133     | 132     | 359     | 164      | 58        | 70                    | 187.8   | 165                  | 65                                   | 114                    | 210                    | 73         |
| M 90                                   | 90      | 240     | 78      | 180     | 80      | 150     | 150     | 402     | 184      | 64        | 79                    | 211.5   | 185                  | 75                                   | 128                    | 240                    | 82         |
| M 100                                  | 100     | 265     | 83      | 200     | 90      | 170     | 165     | 448     | 204      | 71        | 89                    | 232.5   | 205                  | 80                                   | 144                    | 265                    | 92         |

Pfeifer Tension Rod System 860

Fork end connector, pin, lock nut, individually fabricated gusset plate

Annex 3

to European Technical Approval  
 ETA-04/0039



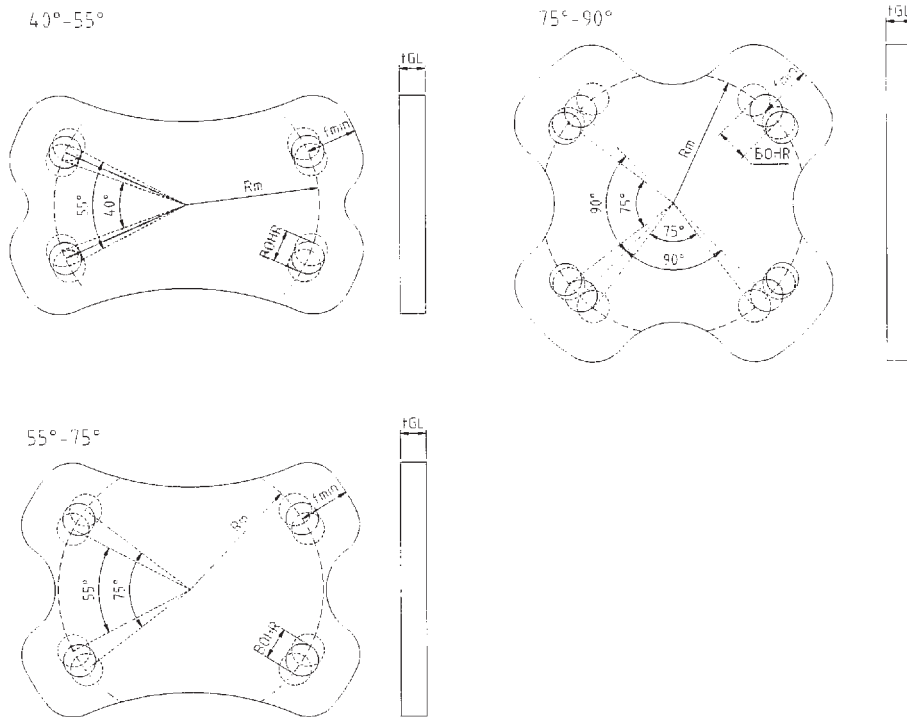
| Size  | Tension rod |                  |    | Adapter        |                |                 |     |      | Coupler            |                 |     |      |
|-------|-------------|------------------|----|----------------|----------------|-----------------|-----|------|--------------------|-----------------|-----|------|
|       | M           | L <sub>gew</sub> | SW | L <sub>G</sub> | L <sub>A</sub> | SW <sub>A</sub> | ET  | ± VW | L <sub>Muffe</sub> | SW <sub>M</sub> | ET  | ± VW |
| mm    | mm          | mm               | mm | mm             | mm             | mm              | mm  | mm   | mm                 | mm              | mm  | mm   |
| M 10  | 10          | 33               | 9  | 31             | 50             | 12              | 20  | 7    | 58                 | 15              | 20  | 7    |
| M 12  | 12          | 39               | 10 | 36             | 60             | 14              | 22  | 6    | 72                 | 17              | 22  | 6    |
| M 16  | 16          | 54               | 14 | 50             | 80             | 19              | 34  | 12   | 94                 | 24              | 34  | 12   |
| M 20  | 20          | 67               | 18 | 62             | 100            | 24              | 42  | 15   | 116                | 30              | 42  | 15   |
| M 24  | 24          | 80               | 22 | 74             | 115            | 30              | 50  | 18   | 138                | 36              | 50  | 18   |
| M 27  | 27          | 90               | 25 | 83             | 130            | 32              | 56  | 20   | 156                | 41              | 56  | 20   |
| M 30  | 30          | 100              | 28 | 92             | 140            | 36              | 62  | 22   | 172                | 46              | 62  | 22   |
| M 36  | 36          | 120              | 33 | 110            | 170            | 46              | 74  | 26   | 207                | 55              | 74  | 26   |
| M 42  | 42          | 140              | 39 | 128            | 195            | 50              | 87  | 31   | 242                | 65              | 87  | 31   |
| M 48  | 48          | 159              | 45 | 145            | 220            | 60              | 99  | 34   | 273                | 75              | 99  | 34   |
| M 52  | 52          | 172              | 49 | 156            | 240            | 65              | 106 | 37   | 295                | 80              | 106 | 37   |
| M 56  | 56          | 187              | 53 | 170            | 255            | 70              | 116 | 41   | 321                | 85              | 116 | 41   |
| M 60  | 60          | 199              | 57 | 180            | 275            | 75              | 123 | 43   | 341                | 90              | 123 | 43   |
| M 64  | 64          | 211              | 60 | 191            | 295            | 80              | 131 | 45   | 362                | 95              | 131 | 45   |
| M 70  | 70          | 233              | 65 | 210            | 325            | 90              | 144 | 51   | 400                | 110             | 144 | 51   |
| M 80  | 80          | 266              | 75 | 238            | 375            | 105             | 164 | 58   | 456                | 125             | 164 | 58   |
| M 90  | 90          | 297              | 85 | 264            | 425            | 115             | 184 | 64   | 508                | 140             | 184 | 64   |
| M 100 | 100         | 328              | 95 | 290            | 450            | 130             | 204 | 71   | 560                | 155             | 204 | 71   |

Pfeifer Tension Rod System 860

Tension rod, adapter, coupler

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| Size  | t <sub>GL</sub><br>mm | BOHR<br>mm | Gusset plate<br>40°-55°<br>S355J2G3 |                      | Gusset plate<br>55°-75°<br>S355J2G3 |                      | Gusset plate<br>75°-90°<br>S355J2G3 |                      |
|-------|-----------------------|------------|-------------------------------------|----------------------|-------------------------------------|----------------------|-------------------------------------|----------------------|
|       |                       |            | f <sub>min</sub><br>mm              | R <sub>m</sub><br>mm | f <sub>min</sub><br>mm              | R <sub>m</sub><br>mm | f <sub>min</sub><br>mm              | R <sub>m</sub><br>mm |
| M 10  | 8                     | 10         | 16                                  | 41                   | 16                                  | 41                   | 16                                  | 41                   |
| M 12  | 10                    | 11         | 17                                  | 53                   | 17                                  | 53                   | 17                                  | 53                   |
| M 16  | 12                    | 15         | 23                                  | 71                   | 23                                  | 71                   | 23                                  | 71                   |
| M 20  | 15                    | 17         | 27                                  | 86                   | 27                                  | 86                   | 27                                  | 86                   |
| M 24  | 20                    | 23         | 36                                  | 99                   | 36                                  | 99                   | 36                                  | 99                   |
| M 27  | 20                    | 25         | 39                                  | 114                  | 39                                  | 114                  | 39                                  | 114                  |
| M 30  | 25                    | 30         | 47                                  | 131                  | 47                                  | 131                  | 47                                  | 131                  |
| M 36  | 25                    | 34         | 53                                  | 153                  | 53                                  | 153                  | 53                                  | 153                  |
| M 42  | 30                    | 38         | 59                                  | 171                  | 59                                  | 171                  | 59                                  | 171                  |
| M 48  | 35                    | 42         | 66                                  | 194                  | 66                                  | 194                  | 66                                  | 194                  |
| M 52  | 40                    | 47         | 73                                  | 219                  | 73                                  | 219                  | 73                                  | 219                  |
| M 56  | 40                    | 52         | 81                                  | 236                  | 81                                  | 236                  | 81                                  | 236                  |
| M 60  | 45                    | 58         | 90                                  | 260                  | 90                                  | 260                  | 90                                  | 260                  |
| M 64  | 50                    | 58         | 90                                  | 283                  | 90                                  | 283                  | 90                                  | 283                  |
| M 70  | 55                    | 63         | 98                                  | 313                  | 98                                  | 313                  | 98                                  | 313                  |
| M 80  | 65                    | 73         | 114                                 | 352                  | 114                                 | 352                  | 114                                 | 352                  |
| M 90  | 75                    | 82         | 128                                 | 390                  | 128                                 | 390                  | 128                                 | 390                  |
| M 100 | 80                    | 92         | 144                                 | 425                  | 144                                 | 425                  | 144                                 | 425                  |

**Pfeifer Tension Rod System 860**

Prefabricated gusset plate

**Annex 5**

to European Technical Approval

**ETA-04/0039**

