



Foundation Anchor PGS/G1-K

European Technical Assessment
ETA-16/0868

PFEIFER

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-16/0868
of 25 June 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Trade name of the construction product

Product family
to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment
contains

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

Deutsches Institut für Bautechnik

PFEIFER anchor bolt PGS/G1-K

Cast-in anchor bolt of ribbed reinforcing steel

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14 pages including 3 annexes which form an integral part
of this assessment

EAD 330924-00-0601

European Technical Assessment

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Specific Part

1 Technical description of the product

The PFEIFER anchor bolt PGS/G1-K consists of ribbed reinforcing steel of the diameters 16, 20, 25, 32, and 40 mm, two hexagon nuts and two washers. One of the ends of the bolt is provided with an anchor head and the other end with a thread of the sizes M16, M20, M24, M30, M36 and M39.

The anchor bolt is imbedded in concrete up to the threaded length.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 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.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic | Performance |
|--|--------------------|
| Characteristic resistances under static and quasi-static loads and displacements | See Annex C1 to C3 |

3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|--------------------------|-------------------------|
| Reaction to fire | Class A1 |
| Resistance to fire | No performance assessed |

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330924-00-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

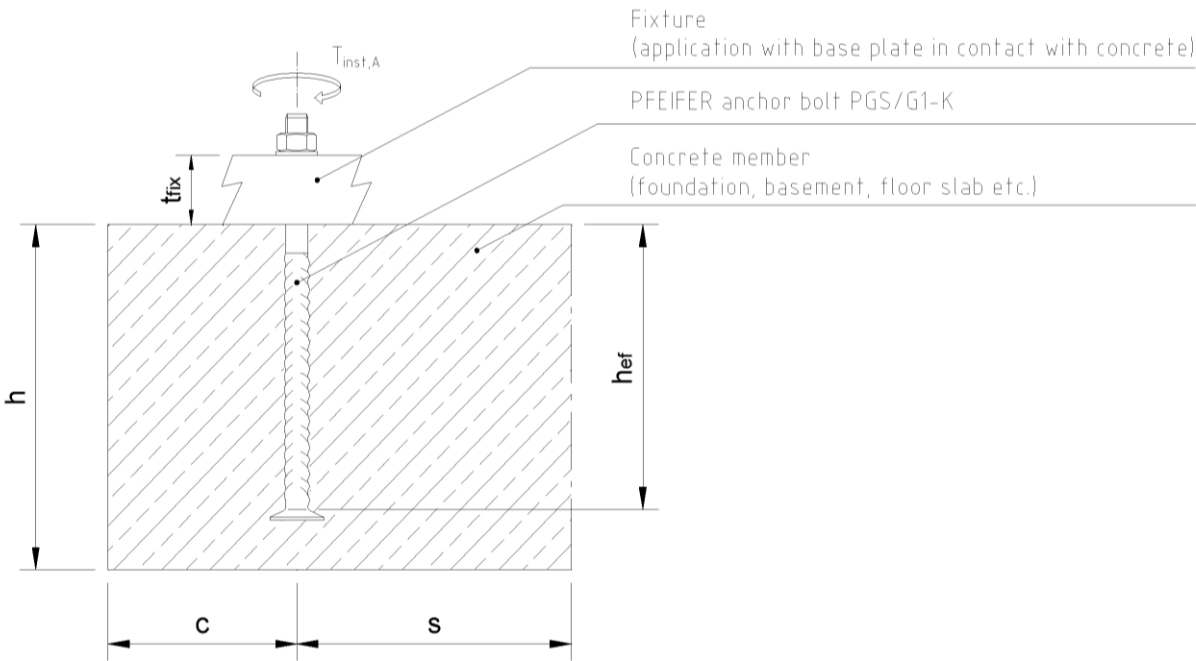
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 25 June 2018 by Deutsches Institut für Bautechnik

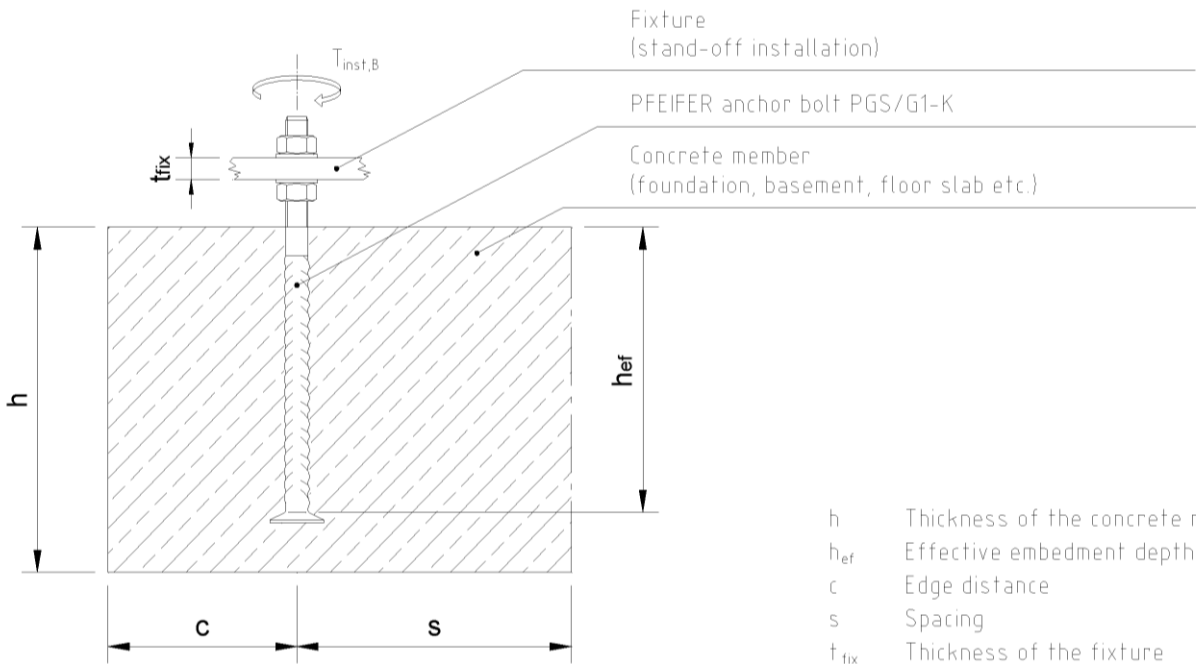
BD Dipl.-Ing. Andreas Kummerow
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beglaubigt:
Stiller

(A) General installation



(B) Steel to steel contact



PFEIFER anchor bolt PGS/G1-K

Product description
Installed condition

Annex A1

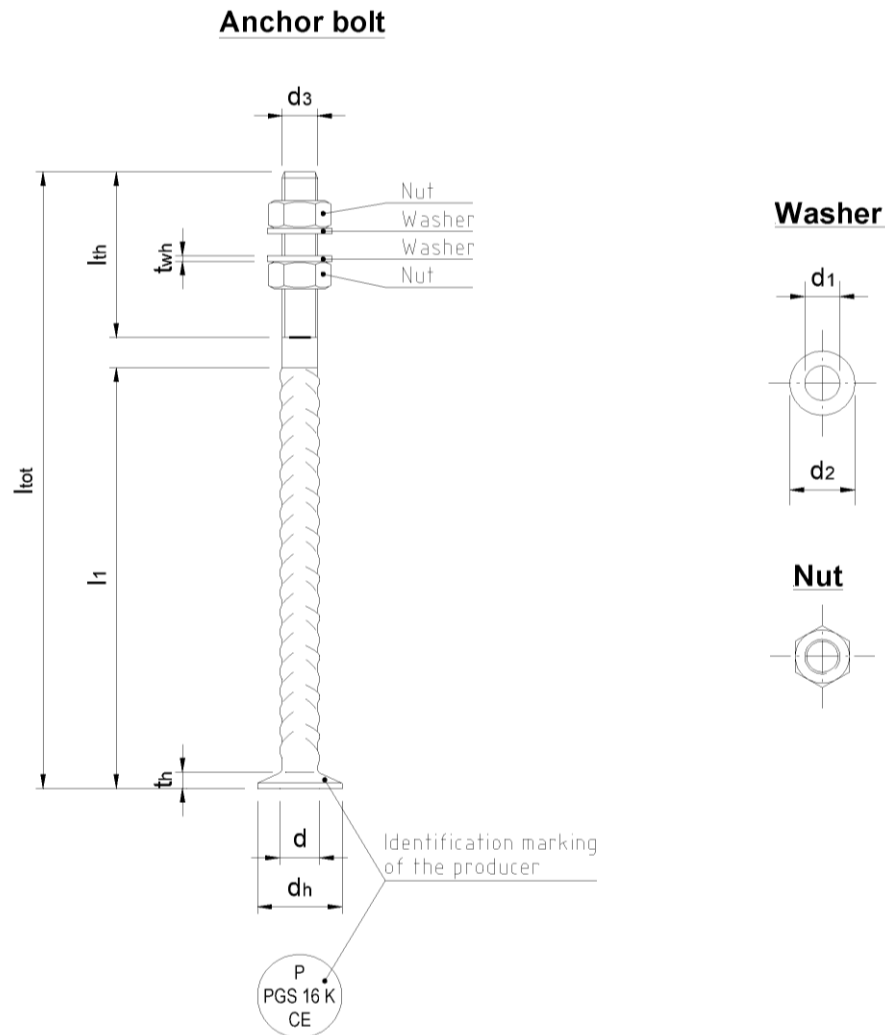


Table A1: **Dimensions**

| Component | Anchor bolt | | | | | | | | Washer | | | Nut |
|-----------|-------------|----------------|----------------|-----------------|----------------|------------------|----------------|-----|----------------|----------------|-----------------|-----|
| PGS/G1-K | d | d _h | d ₃ | l _{th} | t _h | l _{tot} | l ₁ | | d ₂ | d ₁ | t _{wh} | 1) |
| | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | ≥ | ≤ | [mm] | [mm] | [mm] | [-] |
| 16 | 16 | 38 | 16 | 100 | 10 | 280 | 150 | 180 | 45 | 18 | 7 | M16 |
| 20 | 20 | 46 | 20 | 110 | 12 | 350 | 210 | 240 | 46 | 22 | 6 | M20 |
| 24 | 25 | 55 | 24 | 120 | 13 | 430 | 270 | 310 | 55 | 26 | 6 | M24 |
| 30 | 32 | 70 | 30 | 140 | 15 | 550 | 370 | 410 | 65 | 32 | 8 | M30 |
| 36 | 40 | 80 | 36 | 170 | 18 | 700 | 490 | 530 | 75 | 38 | 8 | M36 |
| 39 | 40 | 80 | 39 | 170 | 18 | 750 | 540 | 580 | 75 | 41 | 8 | M39 |

1) Dimensions according to EN ISO 4032:2012

PFEIFER anchor bolt PGS/G1-K

Product description
Components, dimensions

Annex A2

Table A2: **Specifications, materials**

| | |
|--------------------|--|
| Anchor bolt | Reinforcement steel rebar B500B/B500C (heat treated from the heat of rolling) according to EN 1992-1-1:2004 + AC:2010, Annex C |
| Washer | S355 acc. to EN 10025:2004 |
| Hex nut | Hexagonal nut acc. to EN ISO 4032:2012 Strength class 8 acc. to EN ISO 898-2:2012 |

PFEIFER anchor bolt PGS/G1-K

Product description
Materials

Annex A3

Specifications of intended use

Anchorage subject to:

- Static and quasi-static load
- Tension loads, Shear loads or combination of tension and shear loads

Anchoring base material

- Reinforced normal concrete of strength class C20/25 to C50/60 acc. EN 206:2013
- Cracked or uncracked concrete

Use conditions (Environmental conditions)

- Components under the provision of dry conditions.
- For anchors, that are planned to be installed with a concrete cover, the EN 1992-1-1:2004 + AC:2010, section 4, applies.

Design

- Anchorages are designed under the responsibility of an engineer experienced in anchorage and concrete structures.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be anchored. The position of the anchors is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to support). The design drawings shall indicate the position of the anchorages, including the reinforcement required for anchoring.
- Anchorages under static and quasi static actions are designed in accordance with: CEN/TS 1992-4:2009, Part 1 and 2 (Design of fastenings for use in concrete)

Minimum reinforcement

A reinforcement has to be present to resist the splitting forces and limits the crack width to $w_k \leq 0,3 \text{ mm}$. See CEN/TS 1992-4:2009, Section 6.2.6.2.

PFEIFER anchor bolt PGS/G1-K

Intended use
Specifications

Annex B1

Installation

- Installation of anchors is carried out by appropriately qualified workers under supervision of the person responsible for technical matters on site
- Usage of anchors only as supplied by the manufacturer without any manipulation or exchanging of components
- Installation of anchors in accordance with manufacturer's specifications given in Annex B3 and Annex B4
- Anchors have to be fixed on the formwork so that no movement of the anchors will occur during the time of laying the reinforcement and of placing and compacting the concrete
- Concrete around anchors and especially under the heads of foot-mounted anchors has to be compacted properly
- Area of the thread has to be protected against penetration of concrete, water and oil
- Maximum setting torques given in Table B1 and in the Annex B4 must not be exceeded

Table B1: **Installation parameters**

| Anchor bolt PGS/G1-K | | | 16 | 20 | 24 | 30 | 36 | 39 |
|---|--------------|------|--|-------|-------|-------|--------|--------|
| Embedment depth | h_{ef} | [mm] | 170 | 228 | 297 | 395 | 512 | 562 |
| Minimum spacing | s_{min} | [mm] | 80 | 100 | 100 | 130 | 150 | 150 |
| Minimum edge distance | c_{min} | [mm] | 50 | 70 | 70 | 100 | 130 | 130 |
| Thread length | l_{th} | [mm] | 100 | 110 | 120 | 140 | 170 | 170 |
| Minimum thickness of concrete member | h_{min} | [mm] | $h_{min} = h_{ef} + k + c_{nom}$ ¹⁾ | | | | | |
| Max. installation torque (General installation) | $T_{inst,A}$ | [Nm] | ≤ 25 | ≤ 50 | ≤ 80 | ≤ 160 | ≤ 280 | ≤ 305 |
| Max. installation torque (Steel to steel contact) | $T_{inst,B}$ | [Nm] | ≤ 95 | ≤ 185 | ≤ 325 | ≤ 645 | ≤ 1130 | ≤ 1460 |

¹⁾ Concrete cover acc. to EN 1992-1-1:2011-01 + A1:2015-03

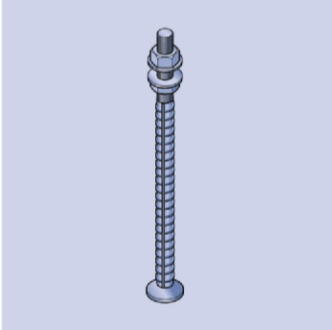
PFEIFER anchor bolt PGS/G1-K

Intended use
Specifications, installation parameters

Annex B2

Installation instructions

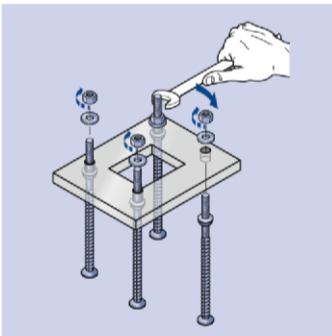
1. Components



Anchor bolt PGS/G1-K, consisting of:

1. Headed bolt (hot forged) with external thread, surface untreated
2. For **general installation**: 1x hexagon nut, surface untreated
1x washer, surface untreated
- For **steel to steel contact**: 2x hexagon nut, surface untreated
2x washer, surface untreated

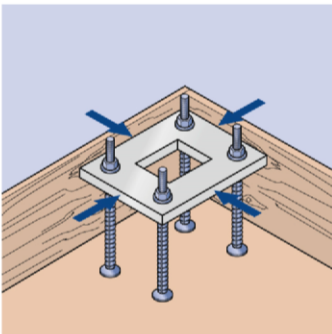
2. Positioning



Depending on the further usage anchor bolts have to be fixed at the formwork precisely:

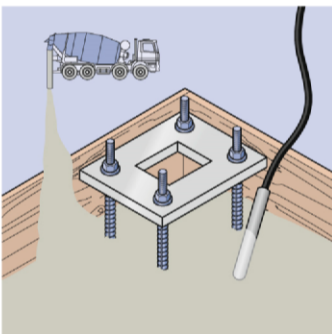
1. Prepare suitable template of steel or wood
→ Check the stability !
2. Fix anchor bolts at template by using nuts and washers
3. Verify template with anchor bolts finally

3. Fixing at the formwork



1. Position template with anchor bolts at formwork
2. Fix template with anchor bolts at formwork
→ Mind exact leveling !

4. Pouring and compacting



1. Fill in concrete carefully, mind fixed anchors !
2. Compact concrete properly, avoid contact between vibrating device and anchor bolts
→ Don't move or damage anchor bolts !

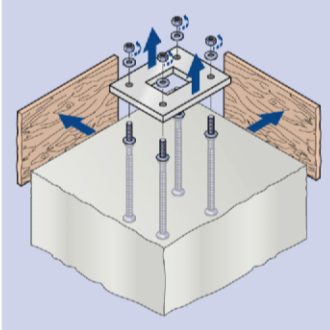
PFEIFER anchor bolt PGS/G1-K

Intended use
Installation instructions

Annex B3

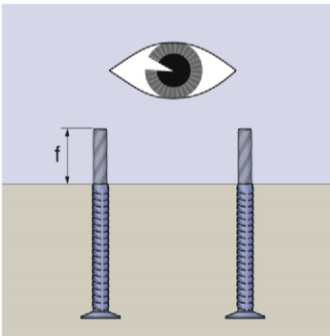
Installation instructions

5. Removal of formwork



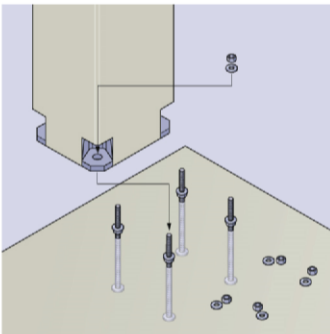
1. Remove formwork and accessories
2. Remove upper nuts and washers
3. Remove template
4. Remove lower nuts and washers

6. Verification



1. Check threads of anchor bolts regarding dirt/contamination
Clean them if necessary !
2. Check overlapping of threaded area according to specifications
3. Check positioning of anchor bolts according to specifications

7. Mounting of fixture

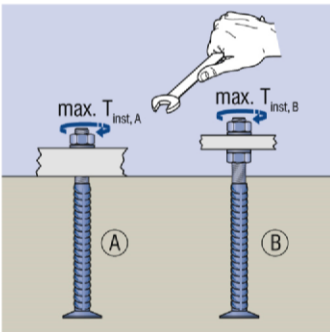


1. Ensure, that concrete has reached its designed strength
2. Check nuts and washers regarding dirt/contamination
Clean them if necessary !
3. Mount fixture
 - Consider maximum setting torques given below !
 - Note additional information regarding the fixture !

General installation: Fixture with direct contact to the concrete

Steel to steel contact: Distance between fixture and surface of concrete

8. Maximum setting torques



Maximum setting torques T_{inst}
for PFEIFER anchor bolts PGS/G1-K

| Type of installation | 16 [Nm] | 20 [Nm] | 24 [Nm] | 30 [Nm] | 36 [Nm] | 39 [Nm] |
|---------------------------|------------|------------|------------|------------|------------|------------|
| A) General | ≤ 25 | ≤ 50 | ≤ 80 | ≤ 160 | ≤ 280 | ≤ 305 |
| B) Steel to steel contact | ≤ 95 | ≤ 185 | ≤ 325 | ≤ 645 | ≤ 1130 | ≤ 1460 |

PFEIFER anchor bolt PGS/G1-K

Intended use
Installation instructions

Annex B4

Table C1: Characteristic resistances under tension load for static and quasi-static loads

| Anchor bolt PGS/G1-K | | | 16 | 20 | 24 | 30 | 36 | 39 |
|--|------------------------|------|--------------------|-------|-------|-------|-------|-------|
| Steel failure | | | | | | | | |
| characteristic resistance | $N_{Rk,s}$ | [kN] | 86,4 | 134,7 | 194,2 | 308,7 | 449,3 | 536,8 |
| partial safety factor | γ_{Ms} | [-] | 1,4 | | | | | |
| Pull-out failure | | | | | | | | |
| characteristic Resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 195,9 | 283,0 | 395,8 | 639,3 | 791,7 | 791,7 |
| characteristic Resistance in craked concrete C20/25 | $N_{Rk,p}$ | [kN] | 140,0 | 202,2 | 282,7 | 456,6 | 565,5 | 565,5 |
| partial safety factor | $\gamma_{Mp}^{1)}$ | [-] | 1,5 | | | | | |
| Concrete cone failure | | | | | | | | |
| effective embedment depth | h_{ef} | [mm] | 170 | 228 | 297 | 395 | 512 | 562 |
| factor to take into account the influence of the load transfer mechanism | k_{ucr} | | 11,9 | | | | | |
| | k_{cr} | [-] | 8,5 | | | | | |
| characteristic spacing | $s_{cr,N} = s_{cr,sp}$ | [mm] | $3 \cdot h_{ef}$ | | | | | |
| characteristic edge distance | $c_{cr,N} = c_{cr,sp}$ | [mm] | $1,5 \cdot h_{ef}$ | | | | | |
| partial safety factor | γ_{Mc} | [-] | 1,5 | | | | | |
| Splitting | | | | | | | | |
| A reinforcement has to be present to resist the splitting forces and limits the crack width to $w_k \leq 0,3$ mm. See CEN/TS 1992-4:2009, Section 6.2.6.2 | | | | | | | | |
| Concrete blow-out | | | | | | | | |
| partial safety factor | $\gamma_{Mcb}^{1)}$ | [-] | 1,5 | | | | | |

¹⁾ In absence of other national regulations

PFEIFER anchor bolt PGS/G1-K

Performances

Characteristic resistances under tension load for static and quasi-static loads

Annex C1

Table C2: Characteristic resistances under shear load for static and quasi-static loads

| Anchor bolt PGS/G1-K | | | 16 | 20 | 24 | 30 | 36 | 39 |
|--|---------------------|-------|-------|-------|-------|--------|--------|--------|
| Steel failure under shear load without lever arm | | | | | | | | |
| characteristic resistance | $V_{Rk,s}^0$ | [kN] | 38,9 | 60,6 | 87,4 | 138,9 | 202,2 | 241,6 |
| Factor for the verification of group fastenings under shear load without lever arm according to CEN/TS 1992-4-2:2009, art. 6.3.3.1 | k_2 | [---] | 0,8 | | | | | |
| partial safety factor | γ_{Ms} | [---] | 1,5 | | | | | |
| Steel failure under shear load with lever arm | | | | | | | | |
| characteristic resistance | $M_{Rk,s}^0$ | [kNm] | 183,2 | 356,9 | 617,4 | 1237,5 | 2173,4 | 2850,2 |
| partial safety factor | γ_{Ms} | [---] | 1,5 | | | | | |
| Concrete pry-out failure | | | | | | | | |
| factor for application according to CEN/TS 1992-4-2:2009, eq. (32) | $k_3^{1)}$ | [---] | 2,0 | | | | | |
| partial safety factor | $\gamma_{Mcp}^{2)}$ | [---] | 1,5 | | | | | |
| Concrete edge failure | | | | | | | | |
| effective embedment depth under shear load | $l_f = h_{ef}$ | [mm] | 170 | 228 | 297 | 395 | 512 | 562 |
| effective outer diameter | $d_{nom} = d_3$ | [mm] | 16 | 20 | 24 | 30 | 36 | 39 |
| partial safety factor | $\gamma_{Mc}^{2)}$ | [---] | 1,5 | | | | | |

1) If supplementary reinforcement is present, the factor k_3 has to be multiplied by 0,75

2) In the absence of national regulations

| | | | | | | | | |
|--|-------|-------|-----|--|--|--|--|--|
| Combined tension and shear load with additional reinforcement | | | | | | | | |
| Factor according to CEN/TS 1992-4-2:2009, art. 6.4.1.3 | k_7 | [---] | 2/3 | | | | | |

PFEIFER anchor bolt PGS/G1-K

Performances

Characteristic resistances under shear load for static and quasi-static loads
Combined tension and shear load with additional reinforcement

Annex C2

Table C3: **Displacement under tension load**

| Anchor bolt PGS/G1-K | | | 16 | 20 | 24 | 30 | 36 | 39 |
|-----------------------------|--------------------|------|------|------|------|-------|-------|-------|
| tension load (working load) | N | [kN] | 44,1 | 68,7 | 99,1 | 157,5 | 229,2 | 273,9 |
| short time displacement | δ_{N0} | [mm] | 0,7 | 0,9 | 1,0 | 1,0 | 1,4 | 1,9 |
| long time displacement | $\delta_{N\infty}$ | [mm] | 1,3 | 1,5 | 1,6 | 1,7 | 2,2 | 3,2 |

Table C4: **Displacement under shear load**

| Anchor bolt PGS/G1-K | | | 16 | 20 | 24 | 30 | 36 | 39 |
|-----------------------------|--------------------|------|------|------|------|------|------|-------|
| tension load (working load) | V | [kN] | 18,5 | 28,9 | 41,6 | 66,1 | 96,3 | 115,0 |
| short time displacement | δ_{V0} | [mm] | 0,9 | 0,9 | 0,8 | 0,8 | 0,7 | 0,9 |
| long time displacement | $\delta_{V\infty}$ | [mm] | 1,3 | 1,3 | 1,2 | 1,2 | 1,1 | 1,3 |

PFEIFER anchor bolt PGS/G1-K

Performances

Displacements under tension and shear load for static and quasi-static loads

Annex C3

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