Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment

ETA-16/0868 of 20 February 2023

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	PFEIFER anchor bolt PGS/G1-K
Product family to which the construction product belongs	Cast-in anchor bolt
Manufacturer	Pfeifer Seil- und Hebetechnik GmbH Dr.-Karl-Lenz-Str. 66 87700 Memmingen DEUTSCHLAND
Manufacturing plant	Production Plants A/B/C
This European Technical Assessment contains	14 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330924-01-0601, Edition 07/2022
This version replaces	ETA-16/0868 issued on 28 May 2020

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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, 18, 20, 22, 25, 28, 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, M27, 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 resistance under static and quasi-static tension load	See Annex B2 and C1
Characteristic resistance under static and quasi-static shear load	See Annex C2
Combined tension and shear under static and quasi-static load	See Annex C2
Displacement under static and quasi-static tension or shear load	See Annex 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. 330924-01-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

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

Issued in Berlin on 20 February 2023 by Deutsches Institut für Bautechnik

LBD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Müller

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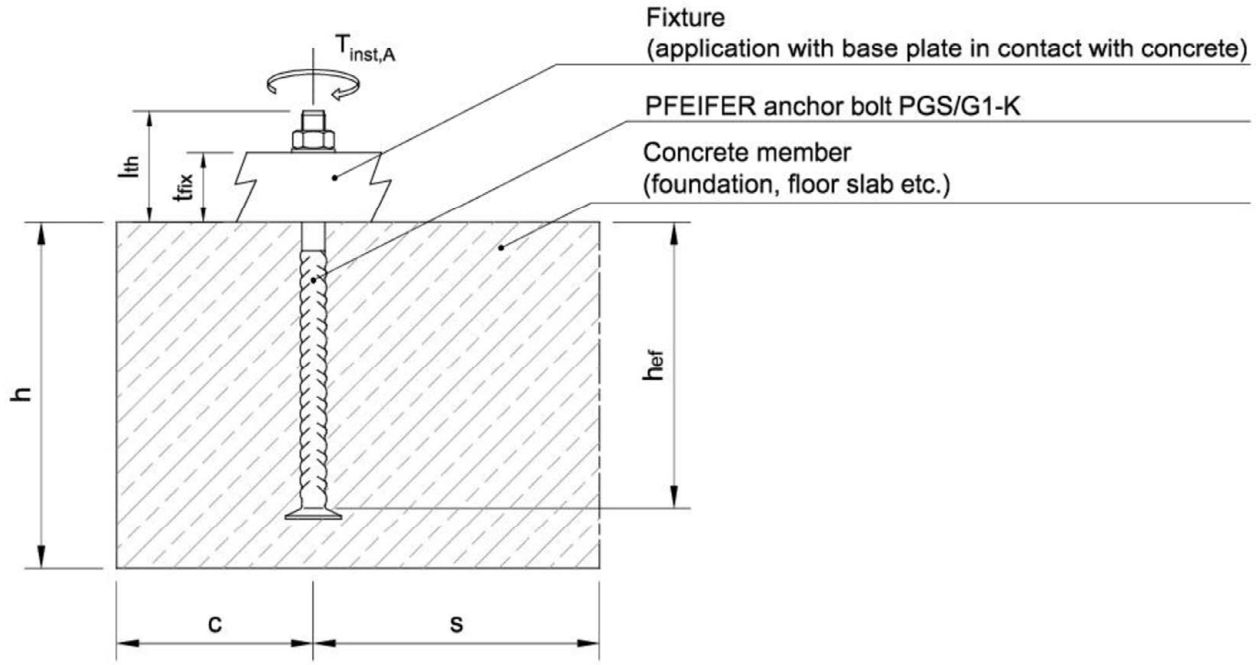
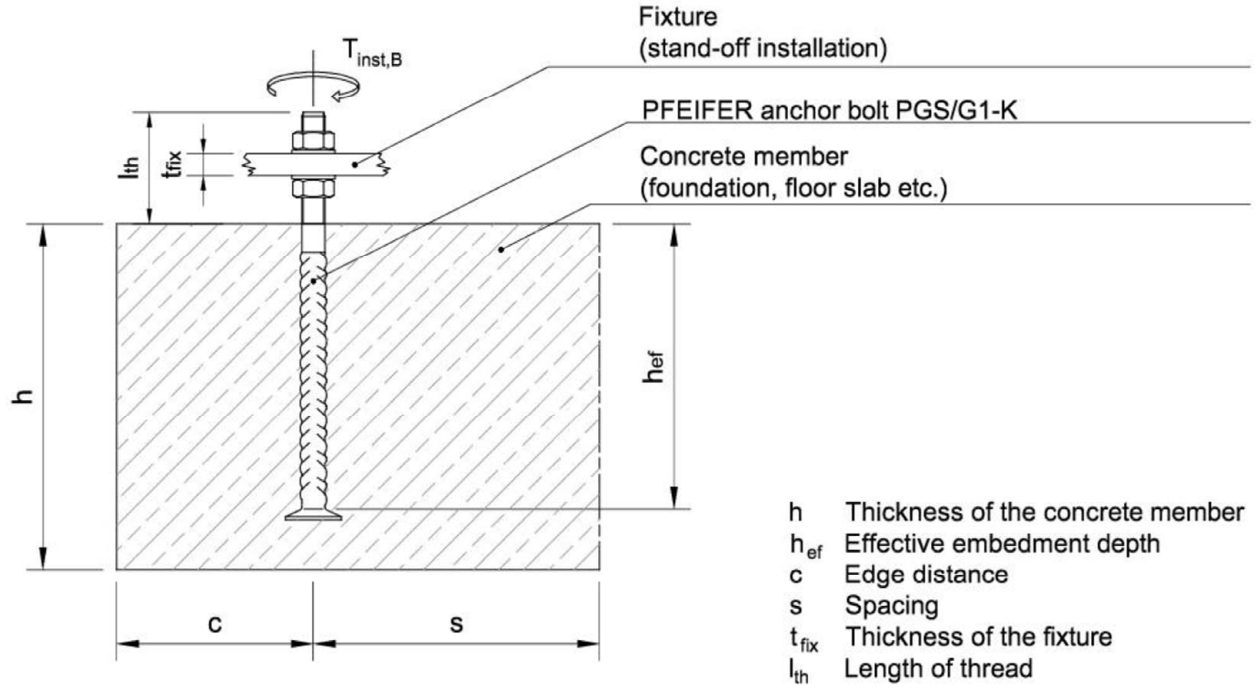
(A) General installation



(B) Steel to steel contact



h	Thickness of the concrete member
h_{ef}	Effective embedment depth
c	Edge distance
s	Spacing
t_{fix}	Thickness of the fixture
l_{th}	Length of thread

PFEIFER anchor bolt PGS/G1-K

Product description
Installed condition

Annex A1

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Anchor bolt

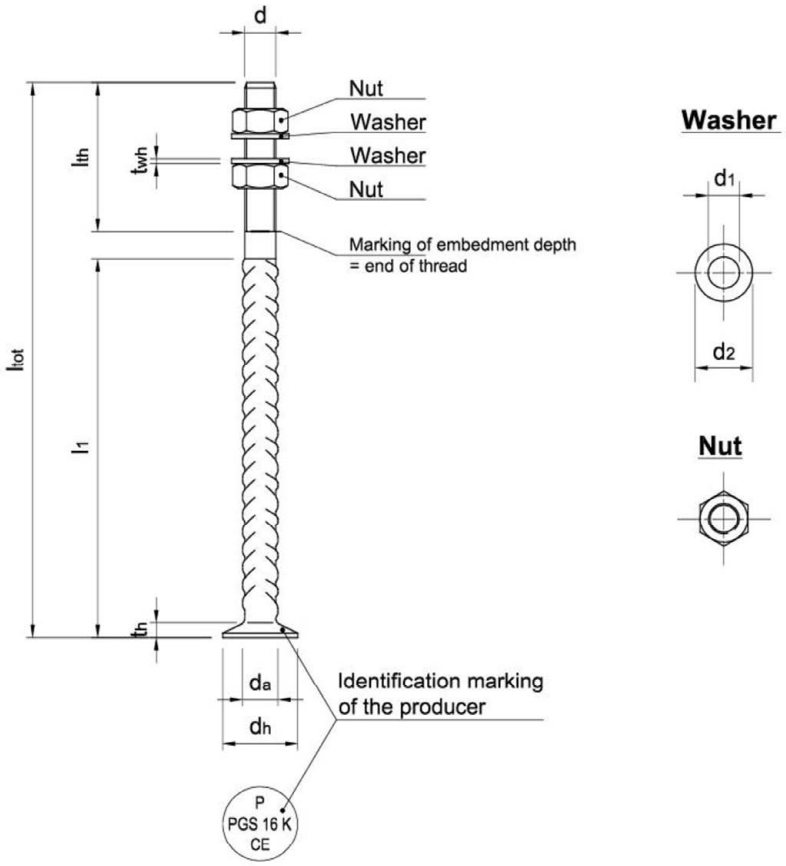

Table A1: **Dimensions**

Component	Anchor bolt							Washer			Nut
PGS/G1-K	d_a	d_h	d	l_{th}	t_h	$l_{tot,min}$	$l_{1,min}$	d_2	d_1	t_{wh}	[1]
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[-]
16	16 18[2]	38 39[2]	16	100	10	230	122	45	18	7	M16
20	20 22[2]	46 47[2]	20	110	12	290	170	45	22	6	M20
24	25	55	24	120	13	350	218	55	26	6	M24
27	28	63	27	130	14	400	258	60	29	8	M27
30	32	70	30	140	15	440	296	65	32	8	M30
36	40	80	36	170	18	570	384	75	38	8	M36
39	40	80	39	170	18	620	434	75	41	8	M39

1) Dimensions according to EN ISO 4032:2012
2) Design variant with a reinforcement diameter of 18 or 22 mm

PFEIFER anchor bolt PGS/G1-K

Product description
Components, dimensions

Annex A2

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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	S355JR / J0 / J2 acc. to EN 10025-2:2019
Hex nut	Hexagonal nut acc. to EN ISO 4032:2012 Strength class 8 acc. to EN ISO 898-2:2012

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static tension, shear or combination of tension and shear

Base material

- Reinforced normal weight concrete according to EN 206-1:2000
- Strength classes C20/25 to C90/105
- Cracked or uncracked concrete

Use conditions (Environmental conditions)

- Anchor bars made of steel or ribbed reinforcing steel, washer and hexagonal nut are made of steel:
  Anchor bolts for use in structures subject to dry internal conditions.
- Anchor bars made of steel or ribbed reinforcing steel, washer and hexagonal nut are made of steel with concrete cover according to EN 1992-1-1:2004 + AC:2010
  Anchor bolts for use in structures subject to appropriate exposition relating to the concrete cover.

Design

- Anchor bolts 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 anchor bars is indicated on the design drawings (e.g. position of the anchor bars relative to reinforcement or to support). The design drawings shall indicate the position of the anchorages, including the reinforcement required for anchoring.
- For static and quasi-static loading the anchor bolts are designed in accordance with EN 1992-4:2018.
- The occurring splitting forces are resisted by the reinforcement. The required cross section of the minimum reinforcement is determined according to EN 1992-4:2018, Section 7.2.1.7.

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PFEIFER anchor bolt PGS/G1-K	Annex B1
Intended use Specifications	

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Installation

- The installation of anchor bolts is carried out by appropriately qualified personnel under the supervision of the person responsible for the technical matters on site
- Use of the product only as supplied by the manufacturer without any manipulation or exchanging of components
- Installation in accordance with the manufacturers product installation instructions given in Annex B3 and Annex B4
- The anchor bolts are fixed to the formwork such that no movement of the product will occur during the time of laying the reinforcement and of placing and compacting the concrete
- The anchor bolts are embedded in concrete up to the marking of embedmend depth
- The concrete under the anchor bar head is properly compacted
- The maximum installation torque according to Table B1 must not be exceeded

Table B1: **Installation parameters**

Anchor bolt PGS/G1-K			**16**	**20**	**24**	**27**	**30**	**36**	**39**
Effective embedment depth	h_{ef}	[mm]	$h_{ef} = l_{tot} - l_{th} - t_h$						
Minimum effective embedment depth	$h_{ef,min}$	[mm]	120	168	217	256	285	382	432
Minimum spacing	s_{min}	[mm]	80	100	100	120	130	150	150
Minimum edge distance	c_{min}	[mm]	50	70	70	90	100	130	130
Thread length	l_{th}	[mm]	100	110	120	130	140	170	170
Minimum thickness of concrete member	h_{min}	[mm]	$h_{min} = h_{ef} + t_h + c_{nom}$ [1)]						
Max. installation torque (General installation)	$T_{inst,g}$	[Nm]	≤ 15	≤ 35	≤ 55	≤ 80	≤ 110	≤ 190	≤ 240
Max. installation torque (Steel to steel contact)	$T_{inst,s}$	[Nm]	≤ 95	≤ 185	≤ 325	≤ 475	≤ 645	≤1130	≤1460

1) Concrete cover acc. to EN 1992-1-1:2004 + AC:2010

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PFEIFER anchor bolt PGS/G1-K

Intended use
Specifications, installation parameters

Annex B2

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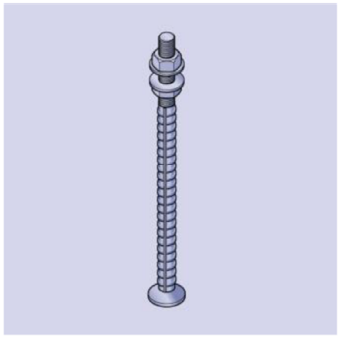
Installation instructions

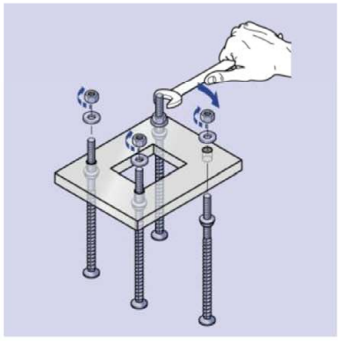
1. Components



Anchor bolt PGS/G1-K, consisting of:

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

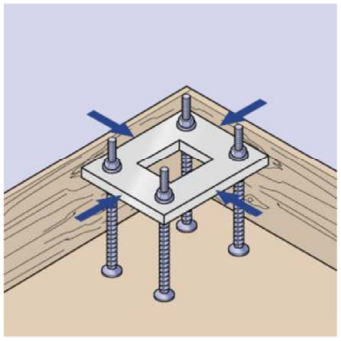
2. Positioning



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

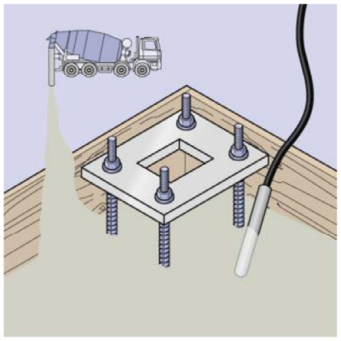
1. Prepare suitable template of steel or wood
   → Check location of anchors bolts !
2. Fix anchor bolts at template by using nuts and washers
3. Verify template with anchor bolts finally

3. Fixing at the formwork



1. Position template with anchor bolts at formwork
   → Mind the correct embedment depth (end of thread) !
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 by force !

PFEIFER anchor bolt PGS/G1-K	**Annex B3**
Intended use Installation instructions	

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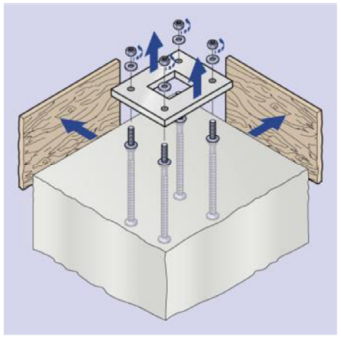
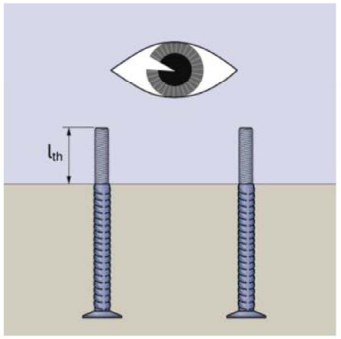
Installation instructions

5. Removal of formwork



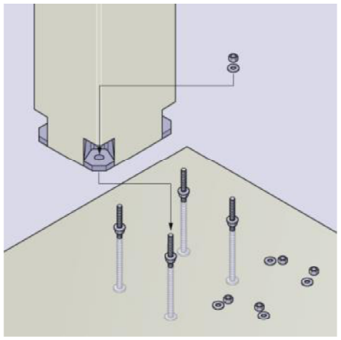
1. Remove formwork and accessories
2. Remove upper nuts and washers
3. Remove template
4. Remove lower nuts and washers

6. Verification



1. Check threads of anchor bolts regarding contamination
   Clean them if necessary !
2. Check the protrusion of anchor bolts using the length of the thread l_{th} according to Annex A2
3. Check location of anchor bolts according to specifications

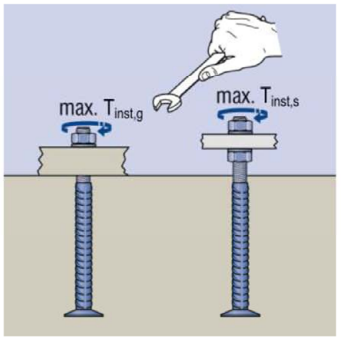
7. Mounting of fixture



1. Ensure, that concrete has reached its designed strength
2. Check nuts and special washers regarding contamination
   Clean them if necessary !
3. Mount fixture
   → Consider maximum installation 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 installation torques T_{inst} for PFEIFER anchor bolts PGS/G1-K

Type of installation		16 [Nm]	20 [Nm]	24 [Nm]	27 [Nm]	30 [Nm]	36 [Nm]	39 [Nm]
A)	General $T_{inst,g}$	≤ 15	≤ 35	≤ 55	≤ 80	≤ 110	≤ 190	≤ 240
B)	Steel to steel contact $T_{inst,s}$	≤ 95	≤ 185	≤ 325	≤ 475	≤ 645	≤ 1130	≤ 1460

PFEIFER anchor bolt PGS/G1-K

Intended use
Installation instructions

Annex B4

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Table C1: **Characteristic resistances under tension load**

Anchor bolt PGS/G1-K			**16**	**20**	**24**	**27**	**30**	**36**	**39**
Steel failure									
Characteristic resistance	$N_{Rk,s}$	[kN]	86,4	134,8	194,2	252,5	308,6	449,4	536,8
Partial factor	γ_{Ms} [1)]	[-]	1,4						
Pull-out failure									
Characteristic Resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	195,9	283,0	395,8	525,3	639,3	791,7	791,7
Characteristic Resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	140,0	202,2	282,7	375,2	456,6	565,5	565,5
Increase factor for higher concrete grades for $N_{Rk,p}$ $N_{Rk,p} = N_{Rk,p\,(C20/25)} \cdot \psi_c$	ψ_c	C25/30	1,25						
		C30/37	1,50						
		C35/45	1,75						
		C40/50	2,00						
		C45/55	2,25						
		C50/60	2,50						
		C55/67	2,75						
		≥ C60/75	3,00						
Partial factor	γ_{Mp} [1)]	[-]	1,5						
Concrete cone failure									
Effective embedment depth	h_{ef}	[mm]	$h_{ef} = l_{tot} - l_{th} - t_h$						
	$h_{ef,min}$	[mm]	120	168	217	256	285	382	432
Factor for the influence of the load transfer mechanism	$k_{ucr,N}$		12,7						
	$k_{cr,N}$	[-]	8,9						
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	$1,5 \cdot h_{ef}$						
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	$3 \cdot h_{ef}$						
Partial factor	γ_{Mc} [1)]	[-]	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 EN 1992-4:2018, Section 7.2.1.7.									

1) In absence of other national regulations

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Table C2: **Characteristic resistances under shear load**

Anchor bolt PGS/G1-K			**16**	**20**	**24**	**27**	**30**	**36**	**39**
Steel failure under shear load without lever arm									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	43,1	67,3	96,9	126,3	154,2	224,6	268,3
Factor according to EN 1992-4:2018, sec. 7.2.2.3.1	k_7	[-]	1,0						
Partial factor	γ_{Ms} 2)	[-]	1,5						
Steel failure under shear load with lever arm									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	183	357	616	917	1236	2173	2838
Partial factor	γ_{Ms} 2)	[-]	1,5						
Concrete pry-out failure									
Factor for application acc. to EN 1992-4:2018, sec. 7.2.2.4	k_8 1)	[-]	2,0						
Partial factor	γ_{Mcp} 2)	[-]	1,5						
Concrete edge failure									
Effective embedment depth under shear load	$l_f = h_{ef}$	[mm]	$l_f = l_{tot} - l_{th} - t_h$						
	$l_{f,min} = h_{ef,min}$		120	168	217	256	285	382	432
Effective outer diameter	$d_{nom} = d$	[mm]	16	20	24	27	30	36	39
Partial factor	γ_{Mc} 2)	[-]	1,5						

1) If supplementary reinforcement is present, the factor k_8 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 EN 1992-4:2018, sec. 7.2.3.2	k_{11}	[-]	2/3

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Table C3: **Displacement under tension load**

Anchor bolt PGS/G1-K			**16**	**20**	**24**	**27**	**30**	**36**	**39**
tension load	N	[kN]	44	69	99	129	157	229	274
short-term displacement	δ_{N0}	[mm]	0,7	0,8	0,9	0,9	1,0	1,3	1,8
long-term displacement	$\delta_{N\infty}$	[mm]	1,4	1,6	1,8	1,8	2,0	2,6	3,6

Table C4: **Displacement under shear load**

Anchor bolt PGS/G1-K			**16**	**20**	**24**	**27**	**30**	**36**	**39**
shear load	V	[kN]	21	32	46	60	73	107	128
short-term displacement	δ_{V0}	[mm]	1,0	1,0	0,9	0,9	0,9	0,8	1,0
long-term displacement	$\delta_{V\infty}$	[mm]	1,5	1,5	1,4	1,4	1,4	1,2	1,5

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PFEIFER anchor bolt PGS/G1-K

Performances
Displacements under tension and / or shear load

Annex C3