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European Technical Assessment

ETA-12/0174 of 04/03/2014

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**POWERS PB-PRO-S**
Famille de produit *Product family*	**Cheville métallique à expansion par vissage à couple contrôlé, de fixation dans le béton fissuré et non fissuré diamètres M8, M10, M12 et M16** ***Torque-controlled expansion anchor for use in cracked and uncracked concrete: sizes M8, M10, M12 and M16***
Titulaire *Manufacturer*	Powers Fasteners Europe Stanley Black&Decker Deutschland GmbH European Anchor Development Center Black-&-Decker Str. 40 65510 Idstein Germany
Usine de fabrication e *Manufacturing plants*	Plant 1 & 2
Cette evaluation contient: *This Assessment contains*	17 pages incluant 14 annexes qui font partie intégrante de cette évaluation 17 *pages including 14 annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	ETAG 001, Version April 2013, utilisée en tant que DEE *ETAG 001, Edition April 2013 used as EAD*
Cette evaluation remplace: *This Assessment replaces*	*ATE 12/0174 du 06/01/2014* *ETA-12/0174 of 06/01/2014*

Specific part

1 Technical description of the product

The POWERS PB-PRO-S anchor is an anchor made of zinc electroplated steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The anchor is placed into a drilled hole and anchored by torque-controlled expansion.

The illustration and the description of the product are given in Annexes A.

2 Specification of the intended use

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

The provisions made in this European technical assessment are based on an assumed working life of the anchor of 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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic tension resistance acc. ETAG001, Annex C	See Annex C 1
Characteristic shear resistance acc. ETAG001, Annex C	See Annex C 2
Characteristic tension resistance acc. CEN/TS 1992-4	See Annex C 5
Characteristic shear resistance acc. CEN/TS 1992-4	See Annex C 6
Characteristic resistance under seismic action acc. TR045	See Annex C 9
Displacements	See Annex C 10

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Characteristic tension resistance under fire acc. ETAG001, Annex C	See Annex C 3
Characteristic shear resistance under fire acc. ETAG001, Annex C	See Annex C 4
Characteristic tension resistance under fire acc. CEN/TS 1992-4	See Annex C 7
Characteristic shear resistance under fire acc. CEN/TS 1992-4	See Annex C 8

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical approval, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

For Basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

3.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.

4 Assessment and verification of constancy of performance (AVCP)

According to the Decision 96/582/EC of the European Commission[1], as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	1

5 Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

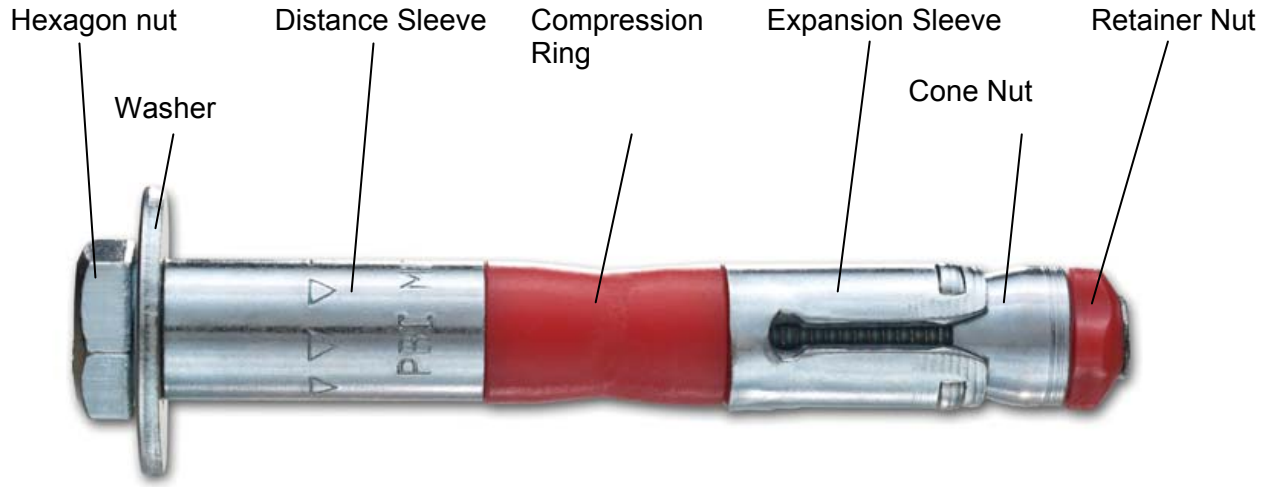
Issued in Marne La Vallée on 04-03-2014 by

Charles Baloche *The original French version is signed*

Directeur technique

[1] Official Journal of the European Communities L 254 of 08.10.1996

Hex head version:

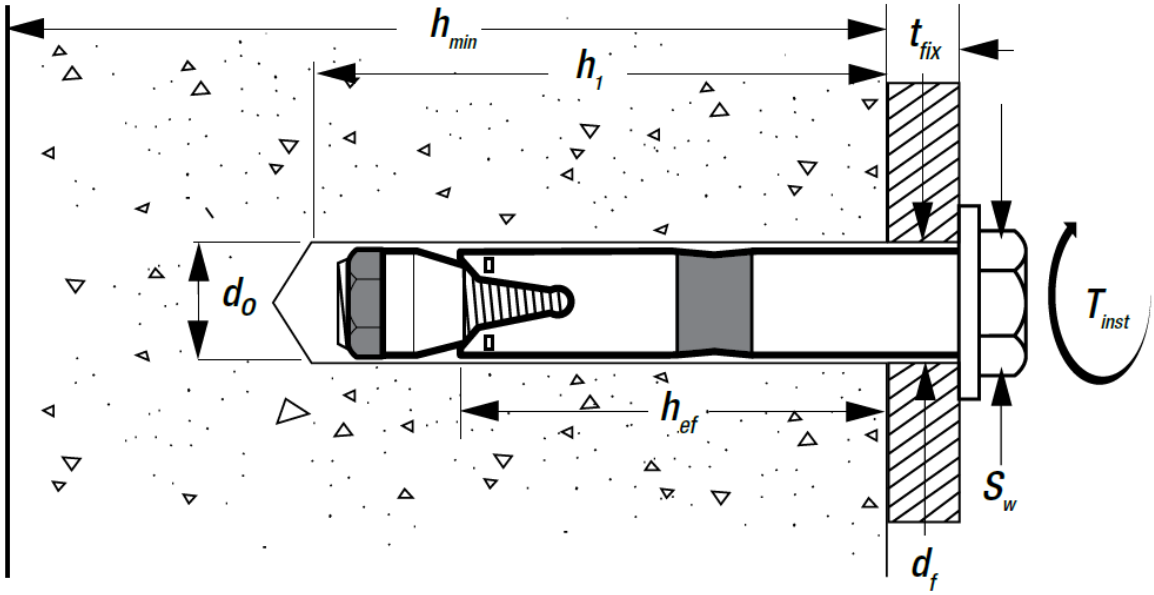


Marking on the bolt: PB1 (product name)

followed by MX/Y-Z where

MX	=	thread diameter
Y	=	nominal drill diameter
Z	=	fixture thickness

Intended use:



POWERS HEAVY DUTY ANCHOR PB-PRO-S	**Annex A1**
Product description Installation condition	

Different parts of the anchor:

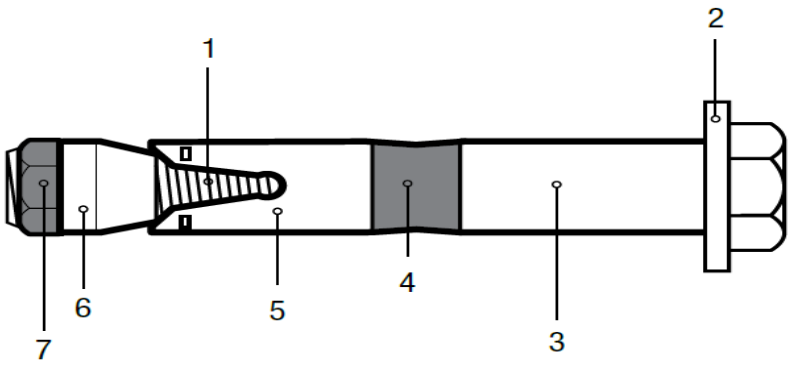


Table 1: Materials

Part	Designation	Material	Protection
1	Threaded bolt	C-Steel f_{uk}≥ 800N/mm²	Zinc plated > 5 µm
2	Washer	Steel property class 8.8 acc. to EN ISO 7093	Zinc plated > 5 µm
3	Distance sleeve	C-steel	Zinc plated > 5 µm
4	Compression ring	Plastic element, HDPE	
5	Expansion sleeve	C-steel	Zinc plated > 5 µm
6	Cone nut	C-steel	Zinc plated > 5 µm
7	Retainer nut	Plastic element, HDPE	

Specifications of intended use

Anchorages subject to:

- Static, quasi-static, seismic loads and fire.

Base materials:

- Cracked concrete and non-cracked concrete
- Reinforced or unreinforced normal weight concrete of strength classes C 20/25 at least to C50/60 at most according to ENV 206: 2000-12.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.

Design:

- The anchorages are designed in accordance with the ETAG001 Annex C “Design Method for Anchorages” or CEN/TS 1992-4-4 " Design of fastenings for use in concrete” under the responsibility of an engineer experienced in anchorages and concrete work.
- For seismic application the anchorages are designed in accordance with TR045 “Design of Metal Anchors For Use In Concrete Under Seismic Actions”.
- For application with resistance under fire exposure the anchorages are designed in accordance with method given in TR020 “Evaluation of Anchorage in Concrete concerning Resistance to Fire”.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor.
- Anchor installation in accordance with the manufacturer’s specifications and drawings and using the appropriate tools.
- Effective anchorage depth, edge distances and spacing not less than the specified values without minus tolerances.
- Hole drilling by hammer drill.
- Cleaning of the hole of drilling dust.
- Application of specified torque moment using a calibrated torque wrench.
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength mortar and no shear or oblique tension loads in the direction of aborted hole.

Table 2: Anchor dimensions

				PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Length of the anchor	**Min.**	**L**	**[mm]**	77	91	86	130
	Max.		**[mm]**	176	200	201	229
Fixture thickness	**Min.**	t_{fix}	**[mm]**	1	1	1	1
	Max.		**[mm]**	100	100	100	100
Length expansion sleeve		l_{clip}	**[mm]**	21,5	27	33	44
Width torque wrench		**SW**	**[mm]**	13	17	19	24

Table 3: Installation data

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Drill hole diameter	d_{cut}	**[mm]**	≤ 12,50	≤ 15,50	≤ 18,50	≤ 24,55
Drill hole depth	h_1	**[mm]**	95	110	125	155
Embedment depth	h_{ef}	**[mm]**	60	70	80	100
Installation torque	T_{inst}	**[Nm]**	30	45	90	130
Diameter through hole fixture	d_f	**[mm]**	14	17	20	26
Min. member thickness	h_{min}	**[mm]**	120	140	160	200
Minimum edge distance	c_{min}	**[mm]**	80	100	120	140
Corresponding spacing	**s ≥**	**[mm]**	140	180	220	230
Minimum spacing	s_{min}	**[mm]**	65	65	100	130
Corresponding edge distance	**c ≥**	**[mm]**	140	150	220	240

POWERS HEAVY DUTY ANCHOR PB- PRO-S

Intended Use
Installation parameters

Annex B3

Table 4: Characteristic values for tension loads in case of static and quasi static loading for design design method A acc. ETAG001, Annex C

				PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure							
Char. resistance		$N_{Rk,s}$	[kN]	29,3	46,4	67,4	125,6
Partial safety factor		γ_{Ms} [1)]	[-]	1,5			
Pullout failure $N_{Rk,p} = \Psi_c \times N^0_{Rk,p}$							
Char. resistance in concrete C20/25	cracked	$N^0_{Rk,p}$	[kN]	12	16	20	30
	non-cracked	$N^0_{Rk,p}$	[kN]	12	25	30	35
Partial safety factor for cracked or non-cracked concrete		γ_{Mp} [1)]	[-]	1,5 [2)]			
Increasing factor for N_{RK}	concrete C30/37	Ψ_c	[-]	1,22			
	concrete C40/50		[-]	1,41			
	concrete C50/60		[-]	1,55			
Concrete cone failure and splitting failure							
Effective embedment depth		h_{ef}	[mm]	60	70	80	100
Partial safety factor for craked or non-cracked concrete		$\gamma_{Mc}=\gamma_{Msp}$ [1)]		1,5 [2)]			
Increasing factor for N_{RK}	concrete C30/37	Ψ_c	[-]	1,22			
	concrete C40/50		[-]	1,41			
	concrete C50/60		[-]	1,55			
Char. spacing	concrete cone failure	$s_{cr,N}$	[mm]	180	210	240	300
	splitting failure	$s_{cr,sp}$	[mm]	300	350	400	500
Char. edge distance	concrete cone failure	$c_{cr,N}$	[mm]	90	105	120	150
	splitting failure	$c_{cr,sp}$	[mm]	150	175	200	250

[1)] In absence of other national regulations
[2)] The value contains an installation safety factor γ_2= 1.0

POWERS HEAVY DUTY ANCHOR PB- PRO-S

Design according to ETAG001, Annex C

Characteristic resistance under tension loads

Annex C1

Table 5: Characteristic values for shear loads in case of static and quasi static loading for design design method A acc. ETAG001, Annex C

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure without lever arm						
Char. resistance	$V_{Rk,s}$	[kN]	32,7	53,6	76,6	89,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
Steel failure with lever arm						
Char. bending resistance	$M^0_{Rk,s}$	[Nm]	30,0	59,8	104,8	266,4
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
Concrete pry-out failure						
Factor in equation (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	2,0			
Partial safety factor	γ_{Mc} [1)]	[-]	1,5			
Concrete edge failure						
Effective length of anchor under shear loading	l_f	[mm]	60	70	80	100
Outside diameter of anchor	d_{nom}	[mm]	12	15	18	24
Partial safety factor	γ_{Mc} [1)]	[-]	1,5			

[1)] In absence of other national regulations

Table 6: Characteristic tension resistance in cracked and non-cracked concrete under fire exposure for design method A acc. ETAG001, Annex C

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Pullout failure (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R60 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R90 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R120 $N_{Rk,p,fi}$	[kN]	2,4	3,2	4,0	6,0
Concrete cone and splitting failure[2] (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R60 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R90 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R120 $N^0_{Rk,c,fi}$	[kN]	4,0	5,9	8,2	14,4
Characteristic spacing	$s_{cr,N,fi}$	[mm]	240	280	320	400
Characteristic edge distance	$c_{cr,N,fi}$	[mm]	120	140	160	200

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.1.

[2] As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed.

TR 020 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \cdot h_{ef}$.

Table 7: Characteristic shear resistance in cracked and non-cracked concrete under fire exposure for design method A acc. ETAG001, Annex C

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure without lever arm						
Characteristic resistance	R30 $V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Steel failure with lever arm						
Characteristic bending moment	R30 $M^0_{Rk,s,fi}$	[Nm]	0,4	1,1	2,6	6,7
	R60 $M^0_{Rk,s,fi}$	[Nm]	0,3	1,0	2,0	5,0
	R90 $M^0_{Rk,s,fi}$	[Nm]	0,3	0,7	1,7	4,3
	R120 $M^0_{Rk,s,fi}$	[Nm]	0,2	0,6	1,3	3,3
Concrete pry-out failure						
Factor in equation (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	2,0			
Characteristic resistance	R30 $V_{Rk,cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R60 $V_{Rk,\ cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R90 $V_{Rk,\ cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R120 $V_{Rk,\ cp,fi}$	[kN]	8,0	10,8	16,4	28,8
Concrete edge failure						
Eff. length of anchor under shear loading	l_f	[mm]	60	70	80	100
Outside diameter of anchor	d_{nom}	[mm]	12	15	18	24

[1)] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.2.

TR 020 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \cdot h_{ef}$.

Table 8: Characteristic values for tension loads in case of static and quasi static loading for design design method A acc. CEN/TS 1992-4

				PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure							
Char. resistance		$N_{Rk,s}$	[kN]	29,3	46,4	67,4	125,6
Partial safety factor		γ_{Ms} [1)]	[-]	1,5			
Pullout failure $N_{Rk,p} = \Psi_c \times N^0_{Rk,p}$							
Char. resistance in concrete C20/25	cracked	$N^0_{Rk,p}$	[kN]	12	16	20	30
	non-cracked	$N^0_{Rk,p}$	[kN]	12	25	30	35
Partial safety factor for cracked or non-cracked concrete		γ_{Mp} [1)]	[-]	1,5 [2)]			
Increasing factor for $N_{RK,p}$	concrete C30/37	Ψ_c	[-]	1,22			
	concrete C40/50		[-]	1,41			
	concrete C50/60		[-]	1,55			
Concrete cone failure and splitting failure							
Effective embedment depth		h_{ef}	[mm]	60	70	80	100
Factor for cracked concrete		k_{cr}		7,2			
Factor for non cracked concrete		k_{ucr}		10,1			
Partial safety factor		$\gamma_{Mc}=\gamma_{Msp}$ [1)]		1,5 [2)]			
Char. spacing	concrete cone failure	$s_{cr,N}$	[mm]	180	210	240	300
	splitting failure	$s_{cr,sp}$	[mm]	300	350	400	500
Char. edge distance	concrete cone failure	$c_{cr,N}$	[mm]	90	105	120	150
	splitting failure	$c_{cr,sp}$	[mm]	150	175	200	250

[1)] In absence of other national regulations
[2)] The value contains an installation safety factor γ_2= 1.0

POWERS HEAVY DUTY ANCHOR PB- PRO-S

Design according to CEN/TS 1992-4

Characteristic resistance under tension loads

Annex C5

Table 9: Characteristic values for shear loads in case of static and quasi static loading for design design method A acc. CEN/TS 1992-4

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure without lever arm						
Char. resistance	$V_{Rk,s}$	[kN]	32,7	53,6	76,6	89,8
Factor considering ductility	k_2	[-]	0,8			
Partial safety factor	γ_{Ms} 1)	[-]	1,25			
Steel failure with lever arm						
Char. bending moment	$M^0_{Rk,s}$	[Nm]	30,0	59,8	104,8	266,4
Partial safety factor	γ_{Ms} 1)	[-]	1,25			
Concrete pry-out failure						
Factor in equation (16) of CEN TS 1992-4-4, § 6.2.2.3	k_3	[-]	2,0			
Partial safety factor	γ_{Mc} 1)	[-]	1,5			
Concrete edge failure						
Effective length of anchor under shear loading	l_f	[mm]	60	70	80	100
Outside diameter of anchor	d_{nom}	[mm]	12	15	18	24
Partial safety factor	γ_{Mc} 1)	[-]	1,5			

1) In absence of other national regulations

Table 10: Characteristic tension resistance in cracked and non-cracked concrete under fire exposure for design method A acc. CEN/TS 1992-4

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Pullout failure (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R60 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R90 $N_{Rk,p,fi}$	[kN]	3,0	4,0	5,0	7,5
	R120 $N_{Rk,p,fi}$	[kN]	2,4	3,2	4,0	6,0
Concrete cone and splitting failure[2] (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R60 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R90 $N^0_{Rk,c,fi}$	[kN]	5,0	7,4	10,3	18,0
	R120 $N^0_{Rk,c,fi}$	[kN]	4,0	5,9	8,2	14,4
Characteristic spacing	$s_{cr,N,fi}$	[mm]	240	280	320	400
Characteristic edge distance	$c_{cr,N,fi}$	[mm]	120	140	160	200

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.1.

[2] As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed.

TR 020 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \cdot h_{ef}$.

Table 11: Characteristic shear resistance in cracked and non-cracked concrete under fire exposure for design method A acc. CEN/TS 1992-4

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Steel failure without lever arm						
Characteristic resistance	R30 $V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Steel failure with lever arm						
Characteristic bending moment	R30 $M^0_{Rk,s,fi}$	[Nm]	0,4	1,1	2,6	6,7
	R60 $M^0_{Rk,s,fi}$	[Nm]	0,3	1,0	2,0	5,0
	R90 $M^0_{Rk,s,fi}$	[Nm]	0,3	0,7	1,7	4,3
	R120 $M^0_{Rk,s,fi}$	[Nm]	0,2	0,6	1,3	3,3
Concrete pry-out failure						
Factor in equation (16) of CEN TS 1992-4-4, § 6.2.2.3	k_3	[-]	2,0			
Characteristic resistance	R30 $V_{Rk,cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R60 $V_{Rk,cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R90 $V_{Rk,cp,fi}$	[kN]	10,0	14,8	20,6	36,0
	R120 $V_{Rk,cp,fi}$	[kN]	8,0	10,8	16,4	28,8
Concrete edge failure						
Eff. length of anchor under shear loading	l_f	[mm]	60	70	80	100
Outside diameter of anchor	d_{nom}	[mm]	12	15	18	24

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.2.

TR 020 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \cdot h_{ef}$.

POWERS HEAVY DUTY ANCHOR PB- PRO-S

Design according to CEN/TS 1992-4
Characteristic shear resistance under fire exposure

Annex C8

Table 12: Characteristic values for resistance in case of seismic performance category C1 acc. TR045 "Design of Metal anchor under Seismic Actions"

Anchor sizes			**PB-PRO-S M8/12**	**PB-PRO-S M10/15**	**PB-PRO-S M12/18**	**PB-PRO-S M16/24**
Tension load						
Steel failure						
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	29,3	46,4	67,4	125,6
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,5			
Pull-out failure $N_{Rk,p,seis} = \Psi_c \times N^0_{Rk,p,seis}$						
Characteristic resistance	$N^0_{Rk,p,seis}$	[kN]	12,0	16,0	20,0	30,0
Partial safety factor	$\gamma_{Mp,\ seis}$ [1)]	[-]	1,5[1)]			
Shear loads						
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	21,7	28,9	45,5	69,6
Partial safety factor	$\gamma_{Ms,\ seis}$	[-]	1,25			

[1)] In absence of other national regulations

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Table 13: Displacements under tension loading

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Tension load in non-cracked concrete C20/25 [kN]			5,7	11,9	14,3	16,7
Displacement	δ_{N0}	[mm]	0,18	0,40	0,50	0,63
	$\delta_{N\infty}$	[mm]	1,21	1,18	1,37	1,41
Tension load in non-cracked concrete C50/60 [kN]			8,9	18,5	22,1	25,8
Displacement	δ_{N0}	[mm]	0,28	0,61	0,77	0,98
	$\delta_{N\infty}$	[mm]	1,21	1,18	1,37	1,41
Tension load in cracked concrete C20/25 [kN]			5,7	7,6	9,5	14,3
Displacement	δ_{N0}	[mm]	0,28	0,34	0,38	0,44
	$\delta_{N\infty}$	[mm]	1,21	1,18	1,37	1,41
Tension load in cracked concrete C50/60 [kN]			8,9	11,8	14,8	22,1
Displacement	δ_{N0}	[mm]	0,44	0,53	0,59	0,68
	$\delta_{N\infty}$	[mm]	1,21	1,18	1,37	1,41

Table 14: Displacements under shear loads

			PB-PRO-S M8/12	PB-PRO-S M10/15	PB-PRO-S M12/18	PB-PRO-S M16/24
Shear load in cracked and non-cracked concrete C20/25 to C50/60		**[kN]**	18,7	30,6	43,8	31,3
Displacement	δ_{V0}	[mm]	0,01	0,50	1,39	3,23
	$\delta_{V\infty}$	[mm]	0,02	0,74	2,09	4,85

Additional displacement due to anular gap between anchor and fixture is to be taken into account.