

# ANCHORING & FASTENING SYSTEMS

Technical Manual for the Design Professional

**MECHANICAL ANCHORS**

## HEAVY DUTY ANCHORS

PB-PRO-S Carbon Steel Zinc Plated



**MECHANICAL ANCHORS**

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## ANCHOR DESIGN MANUAL

The Powers Anchoring Systems contained in this design manual have been developed by Powers Fasteners and its dedicated team of engineers. Powers Fasteners was established in New York, USA in the year 1921 and has grown to become a recognized global leader in the fastening industry. Powers has extensive development, engineering and manufacturing expertise in mechanical anchors, adhesive anchor systems, light-duty fastening, screw fastening and forced entry fastening systems. The Powers brand is recognized for leadership in fastening innovation and patented fastening systems.

As the global anchoring industry has evolved, the Powers engineering team kept pace with an unparalleled attention on customer and end-user needs, endless internal R&D focus as well as continuous involvement in external research groups, world-wide technical committees and building code development groups.

In 2012, Powers Fasteners was acquired by Stanley Black & Decker and is now a premium brand of the CDiy (Construction Do-It-Yourself) division of the Stanley Black & Decker Group together with DEWALT. The Stanley Black & Decker group has over 40,000 employees worldwide based in 160 locations, including 25 manufacturing sites. As the world leader with over 160 years experience in the market, Stanley Black & Decker today holds a complete portfolio of premium and middle-market tool and construction brands including Black & Decker, Stanley, Bostitch, Facom, Mac Tools, Proto and Stanley Vidmar.















The Powers Fasteners technical group have developed a world class Powers Anchoring range that is contained in this manual. The combined Powers – DEWALT team now has an even stronger commitment to continue the existing leadership in providing innovative building-code compliant fastening systems, user-friendly technical documentation and design software as well as global engineering support with in-market engineering teams. In addition, the organizational excellence of Stanley Black & Decker ensures that this product offering exceeds expectations: from the specifier to the installer and each step in between.

The Anchor Design Manual was developed for you as the design professional to select, design and specify our anchoring products. Our goal was to keep it as concise as possible to enable easy sound design according to the latest anchor design theories and standards. We suggest this manual to be used in combination with our free anchor design software available at: [www.powers.com.au](http://www.powers.com.au)

Powers employs a national team of field engineers (Specification Managers) that work directly with design professionals to provide technical support and design assistance helping solve all your anchoring problems. To be placed in contact with one of our Specification Managers or for additional copies of this design manual please contact Powers on (03) 8669 5200.



**LOGOS USED IN THIS MANUAL**

<b>APPLICATION AND USE LOGOS</b>	
	The anchor is installed in dry internal conditions, sufficient corrosion protection of carbon steel anchors is provided by a 5 µm minimum zinc coating.
	The anchor is subject to atmospheric external conditions including industrial and maritime environments, or permanently damp internal conditions, stainless steel or special corrosion resistant coatings are required.
	Particular aggressive conditions require anchors made of high corrosion resistance (HCR) steel. Such aggressive environments are e.g. splash zone of sea water, chloride atmosphere of indoor swimming pools, or atmosphere with extreme chemical pollution including road tunnels where de icing materials are employed.
	Certain post installed anchors are only approved for 'Multiple use for non-structural applications'. This means that this specific anchor product and size may only be used for redundant anchorage of non-structural components. The minimum number of anchors as well as the maximum design load is given in ETAG 001 Part 6.
The minimum and maximum ambient temperatures are limited to ensure proper performance over the service life of the anchorage. Currently adhesive anchor systems can be approved for various service temperature ranges. Short term temperatures: vary over short intervals, e.g. day/night cycles and freeze/thaw cycles. Long term temperatures: will be approximately constant over significant periods of time.	
	Temperature range: -40°C to +40°C for short term and +24°C for long term temperatures, labeled 40/24°C.
	Temperature range: -40°C to +80°C for short term and +50°C for long term temperatures, labeled 80/50°C.
	Temperature range: -40°C to +72°C for short term and +43°C for long term temperatures, labeled 72/43°C.
	Temperature range: -40°C to +120°C for short term and +72°C for long term temperatures, labeled 120/72°C.
Adhesive curing depends on the temperature at which this chemical reaction takes place. For this reason, the minimum installation temperature is defined for the adhesive and the base material. The adhesive anchor system can be approved for various installation temperatures.	
	Moderate base material temperature as low as +5°C.
	Low base material temperature as low as -5°C.
	Very low base material temperature as low as -10°C.
	Curing of adhesives may be inhibited if they get wet during installation, e.g. by moistened bore holes due to rain on the construction site. Approved adhesives are suitable for installation in dry and wet base material.
	Some adhesives can be installed in completely water filled holes without the curing process being affected negatively.
	Adhesives can also be used to install reinforcement bars connecting new concrete elements to existing concrete structures. Post-installed rebars are basically designed according to reinforced concrete design codes.

Anchors may be used in three types of installation configurations:



For preset anchors, the anchor is installed first and then the fixture is attached. In this case, the clearance hole in the fixture can be smaller than the drilled hole in the base material.



For through installations, the fixture is put in place first and the anchor is then inserted through the clearance hole. In this case, the fixture may be used as a template, but the hole diameter in the fixture must be at least as large as the drilled hole diameter.



For a stand off installation, the element to be anchored is mounted in a distance from the surface of the base material. The lever arm of the applied loads creates a bending moment in the anchor bolt which needs to be taken care of in the design process.



Anchoring in reinforced concrete may require core drills (diamond coring) where reinforcement is expendable. As adhesive anchors are generally sensitive to the hole roughness, they need to be explicitly approved for application in smooth core drilled holes.

#### APPROVAL AND LISTING LOGOS



Anchor products holding a European Technical Approval/Assessment (ETA) are qualified according to one of the following technical guidelines (ETAG):

- ETAG 001 for metal anchors installed in concrete. (Option 1 for cracked concrete, Option 7 for uncracked concrete, Part 6 for multiple use for non-structural applications)
- ETAG 029 for metal injection anchors installed in masonry.
- EOTA TR 023 for post-installed reinforcement bars.

Products complying with European standards or approvals are marked with the CE Marking.



A fire resistance rating provides the duration of fire exposure for which the anchor is qualified based on ETA (EOTA TR020) or other relevant evaluation report. Ratings within the context of the European Organization of Technical Assessment (EOTA) are based on the following Technical Report (TR):

- EOTA TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". In general, the design strength is reduced if exposure to fire is taken into account. Maximum duration for fire resistance is given in the specific product section and generally ranges from 120 to 240 min, depending on whether the anchor product is qualified for concrete anchoring or post-installed rebar connections.



The German Technical Approval of post installed reinforcement bars certifies that the product meets the requirements to be installed by trained personnel. The German Technical Approvals are next to the European Technical Approvals the most renowned qualifications of anchor products.



The Evaluation Service of the International Code Council (ICC ES) provides test guidelines for anchor qualification in the US. The technical reports issued on the basis of these guidelines are internationally recognized and provide a high degree of safety.



NSF International is an independent organization that provides standards for e.g. product certification for public health and the environment.



Products tested for the emission of volatile substances in indoor air, with a risk of inhalation toxicity, on a scale ranging from class A + (very low emissions) to C (high emissions) level.

#### LOADING CONDITION LOGOS



Static loads are basically dead loads or other permanently or temporarily acting loads such as snow load.



Live loads varying at low rates such as traffic or moving loads are considered as quasi static loads.











Loads evolving from earthquakes are termed seismic loads and are characterized by cyclic loading.



Load demands deriving from moderate wind are covered by the approval for quasi static loading.



Anchors are considered fit for applications in areas prone to high wind such as typhoon or hurricanes if they are approved for seismic loading.

<b>BASE MATERIAL LOGOS</b>	
	The crack condition of the concrete is a critical factor in anchor selection. The concrete can either be uncracked or cracked. The concrete may only be assumed as uncracked if it can be shown that there is no tensile stress in the concrete.
	As a default, the concrete should be assumed as cracked. Anchors can generally be used for concrete strengths between 20 and 50 MPa (measured on cylindrical test specimens), corresponding to the European concrete strength classes C20/25 to C50/60.
	Material characteristics generally allow only certain anchor types to be used in masonry. Anchoring products qualified for masonry are generally adhesive type. The installation of adhesive anchors in solid bricks is basically identical to that in concrete.
	In case of hollow bricks, special sleeves inserted prior to the installation of the anchor prevents the adhesive to fully diminish into the brick voids. As masonry bricks available worldwide show a high diversity, the designer must check the specified brick carefully. On-site field testing in actual conditions is recommended.
<b>OTHER LOGOS</b>	
	Concrete anchor design is consistent but complex. The Powers Design Assistant (PDA) helps engineers to accelerate the design process. The design data of all Powers anchors holding a technical approval is readily available.
	The Powers Adhesive Volume Calculator is a tool designed to help you to determine the number of cartridges and to control the cost on the job site. It is available as a free download at <a href="http://www.powers.com.au">www.powers.com.au</a> or you can download the Powers AVC app for iPhone and Android platforms.
	We run a worldwide net of test laboratories for which experienced staff carry out tests for quality control and for research and development.
	Contact us if you need technical support in whatsoever, contact details are given at the end of this manual. Our field service experts will answer your questions.

**General Safety Concept:**

$$S_d \leq R_d$$

Where:

$S_d$  = value of design action;  $S_d = \gamma_f \cdot F_k$

$R_d$  = value of design resistance ( $N_{Rd}$  for tension,  $V_{Rd}$  for shear, or  $F_{Rd}^{45^\circ}$  for loads acting at 45°);  $R_d = R_k / \gamma_M$

**NOTATIONS USED IN THIS MANUAL**

<b>F</b>	<b>N</b>	<b>V</b>	<b>M</b>	<b>T</b>
Force in general	Normal force	Shear force	Moment in general	Torsion moment
$F_k$	$R_k$	$c$	$c_{cr}$	$c_{min}$
Characteristic resistance of an action	Characteristic resistance of anchor or anchor group	Concrete edge distance	Characteristic edge distance	Minimum allowable edge distance
$d$	$d_f$	$d_{nom}$	$d_0$	$f_b$
Diameter of anchor bolt	Diameter of clearance hole in the fixture	Outside diameter of an anchor	Nominal diameter of drilled hole	Normalized mean compression strength of masonry unit
$f_c$	$f_y$	$f_u$	$h$	$h_{ef}$
Concrete compressive strength of concrete	Steel yield strength or steel proof strength respectively	Steel ultimate tensile strength	Thickness of concrete member in which the anchor is installed	Effective embedment depth
$h_{min}$	$s$	$s_{cr}$	$s_{min}$	$t_{fix}$
Minimum allowed thickness of concrete member	Anchor spacing	Characteristic anchor spacing	Minimum allowable anchor spacing	Thickness of the fixture
$\rho$	$\tau_k$	$\gamma_f$	$\gamma_M$	$\gamma_2$
Bulk density of masonry unit	Characteristic bond stress	Partial safety factor for actions	Partial safety factor for material	Partial safety factor for installation

**SELECTION GUIDE**

Applications and Uses																			
Product		Interior Installation	Exterior Installation	Adverse Atmosphere	Moderate Service Temp Range	High Service Temp Range	Very High Service Temp Range	Moderate Installation Temp Range	Low Installation Temp Range	Very Low Installation Temp Range	Dry and Wet Base Material	Water-Filled Holes	Multiple Fastening	Post-Installed Rebar Design	Preset Installation	Through Installation	Stand-Off Installation	Core Drilling	
EXPANSION ANCHORS	Throughbolt	PTB-EIAT1-PRO	■		●	●	●	●	●	●	▲					■	■		
		PTB-SS-EIAT1-PRO	■	■		●	●	●	●	●	●	▲					■	■	
	Drop-In Anchor	DM-PRO Part 6	■	■		●	●	●	●	●	▲		■		■				
		DM-PRO	■	◆		●	●	●	●	●	▲								
	Heavy Duty Anchor	PB-PRO-5	■			●	●	●	●	●	▲						■		
SCREW ANCHORS	BT (Blue-Tip)	■			●	●	●	●	●	▲						■			
	SNAKE-PRO	■			●	●	●	●	●	▲					■		■		
INJECTION ADHESIVE ANCHORS	Vinylester	AC100-PRO	Concrete	■	◆	◆	■	■	■	■	■	■			■		■		
			Masonry	■	◆	◆	■	■	■	■	■	■			■		■		
			Rebar	■	◆		■	■	■	■	■	■	■		■			■	
	Epoxy	PURE150-PRO	Concrete	■	◆	◆	■	■	■	■	■	■	■			■		■	■
			Core-Drilled	■	◆	◆	■	■	■	■	■	■	■			■		■	■
			Rebar	■	◆		■	■	■	■	■	■	■			■			
Polyester	PV45-PRO / AC100e	Concrete	■	◆	◆	■	■	■	■	■	■			■		■		■	
		Masonry	■	◆		■	■	■	■	■	■			■		■		■	
CAPSULE ADHESIVE ANCHOR	SC-PRO Concrete	■	◆	◆	■	■	■	■	■	■	■			■		■		■	

Legend: ■ Suitable ◆ Suitable depending on the steel material used ● Mechanical anchors are suitable for all temperatures without further approval testing ▲ Performance of mechanical anchors is not affected by wet surfaces, however, corrosion effects need to be considered

1) Efectis Report

		Listings and Approvals						Loading Condition					Base Material			
		European Technical Approval	Fire Rating	ICC-ES (ACI)	NSF / WQA	VOC	German Technical Approval	Static Load	Quasi-Static Loads	Seismic Loads	Moderate Wind Loads	High Wind Loads	Uncracked Concrete	Cracked Concrete	Solid Brick Masonry	Hollow Brick Masonry
Product																
EXPANSION ANCHORS		Throughbolt			■	■										
		PTB-ETA1 - PRO	PTB-SS-ETA1 - PRO													
EXPANSION ANCHORS		Heavy Duty Anchor			■	■										
		PB-PRO-5	DM-PRO													
EXPANSION ANCHORS		Drop-In Anchor			■	■ <sup>1)</sup>										
		DM-PRO Part 6	BT (Blue-Tip)													
EXPANSION ANCHORS		SNAKE-PRO			■	■ <sup>1)</sup>										
		BT (Blue-Tip)	BT (Blue-Tip)													
INJECTION ADHESIVE ANCHORS		Vinylester			■	■	■	■	■	■	■	■	■	■	■	■
		AC100-PRO	Concrete													
INJECTION ADHESIVE ANCHORS		Epoxy			■	■	■	■	■	■	■	■	■	■	■	■
		PURE150-PRO	Concrete													
INJECTION ADHESIVE ANCHORS		Polyester			■	■	■	■	■	■	■	■	■	■	■	■
		PURE110-PRO	Concrete													
INJECTION ADHESIVE ANCHORS		Polyester			■	■	■	■	■	■	■	■	■	■	■	■
		PV45-PRO / AC100e	Concrete													
CAPSULE ADHESIVE ANCHOR		Concrete			■											
CAPSULE ADHESIVE ANCHOR		Concrete			■											

Legend: ■ Suitable   ♦ Suitable depending on the steel material used   ● Mechanical anchors are suitable for all temperatures without further approval testing  
 ▲ Performance of mechanical anchors is not affected by wet surfaces, however, corrosion effects need to be considered

1) Efectis Report

**TECHNICAL SUPPORT**

This Anchor Design Technical Manual gives you valuable information on anchor technology and the powerful anchor products engineered by Powers. The specifications enable you to select the best anchor choice for every application. We strongly encourage you to use the Powers Design Assist for the efficient design of single and multiple anchor connections. This software contains design data of most Powers anchor products and allows you to design anchorages easily. To download this software for free, go to: [www.powersdesignassist.com](http://www.powersdesignassist.com).



Innovation has always been a core strength of Powers. Since the foundation, Powers has been delivering innovative anchoring solutions for attachment to concrete, masonry, steel and wood. To do so, Powers employs a large team of senior anchor design and test engineers, many of them have master's and doctoral degrees in the fields of architectural engineering, civil engineering, mechanical engineering, metallurgy, chemical engineering, materials engineering, and manufacturing. The cooperation of Powers experts in these various disciplines in combination with the massive engineering resources of Stanley Black & Decker ensures Powers will continue to provide innovative, high-quality anchoring solutions. Powers research and development is carried out in several world-class testing laboratories with principal testing taking place in USA, Germany, China and Australia.



In-house QC inspection and testing is conducted to ensure continual supply of high quality products to our customers. Our experienced technical personnel check and inspect all Powers products to ensure only quality products enter the market place. The development of



new, innovative anchoring solutions requires both know-how and equipment. Powers laboratories contain state-of-the art testing equipment, specialized for testing and evaluating anchors. Moreover, we have a worldwide network of regional branches. For technical support, just contact the closest branch which contact details you find on the at the end of this manual. Our engineers will be pleased to help you solving any of your anchoring problems. We also offer training

seminars for your individual needs to back your confidence in Powers products!





## MECHANICAL ANCHOR OVERVIEW

Mechanical anchors are available in many variations and choices and can usually be loaded immediately after installation which is an advantage in many applications. Mechanical anchors may also have a greater resistance to the effects of elevated temperature when compared with adhesive anchors.

Mechanical anchors can be described by their functional principle and categorized by their load transfer mechanism which either bases on mechanical **friction** or on mechanical **interlock**:

Anchor types which load transfer mechanism bases on friction are in general **expansion anchors**. These anchor types are designed with expansion elements that compress against the wall of the drilled hole. When the anchor is loaded, frictional force between expansion elements and concrete allows the anchor to transfer the load to the base material. **Torque-controlled expansion anchors** are installed by applying a specified torque to the bolt head or nut with a torque wrench. Torque-controlled expansion anchors may be further classified as either sleeve type (also commonly named 'heavy duty anchor' or 'high load anchor') or bolt type (also commonly named 'wedge anchor' or 'throughbolt'). **Displacement-controlled expansion anchors** are set by the axial displacement of the expansion plug within the sleeve. They are commonly called 'drop-in anchors'.

Anchors which load transfer mechanism bases on interlock are either screw or undercut type. **Screw anchors** have a thread similar to that of a wood screw which allows the anchor to cut into the base material during installation in a drilled hole. The anchor develops its load capacity by the interlock of the thread and concrete. **Undercut anchors** provide a bearing area which undercuts into the wall of the drilled hole by a special installation procedure. The large bearing area allows transferring the load into the base material by mechanical interlock.

In Europe and many other countries, mechanical anchors are in general designed according the **ETAG 001 Annex C Method A**. Anchors qualified for **multiple use for non-structural applications** according to ETAG 001 Part 6 are designed according to simplified rules stipulated in **ETAG 001 Annex C**.

## SECTION CONTENT

### Expansion Anchors

*Throughbolt*

PTB-ETA1-PRO

PTB-SS-ETA1-PRO

*Heavy Duty Anchor*

PB-PRO-S

*Drop-In Anchor*

DM-PRO

*Screw Anchors*

BT (BLUE-TIP)

SNAKE-PRO

**GENERAL INFORMATION**

**PB-PRO-S**

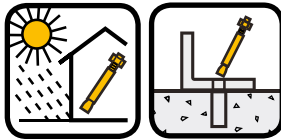
Heavy Duty Anchor

**PRODUCT DESCRIPTION**

The PB-PRO-S is a heavy duty, torque controlled, sleeve style anchor for high load capacities in tension and shear. It is easy to install and its design ensures a tight and reliable connection. The wide range of available PB-PRO-S anchor sizes covers all common capacity demands. The internal bolt is removable after installation, making the PB-PRO-S suitable for temporary applications.



**GENERAL APPLICATIONS AND USES**



**FEATURES AND BENEFITS**

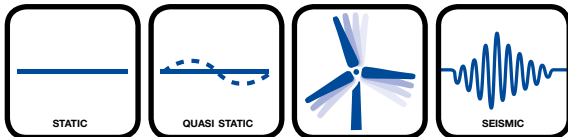
- High load capacity
- Excellent performance in tension and shear
- Anchor can be removed after installation

**APPROVALS AND LISTINGS**



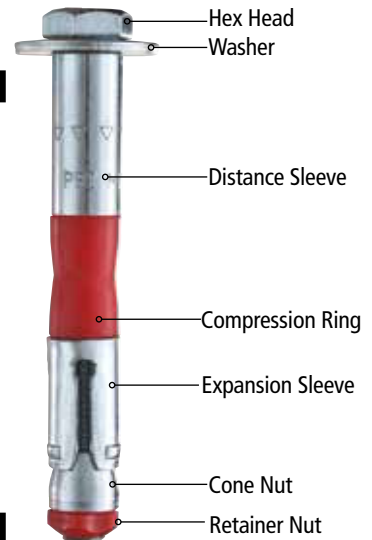
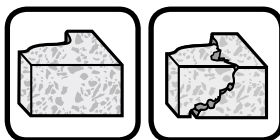
\* Please refer to ETA-12/0174 for load capacities under fire

**LOADING CONDITIONS**



\* Please refer to ETA-12/0174 for seismic performance load data

**SUITABLE BASE MATERIALS**



**VERSIONS**

- Hex Head
- Carbon Steel

**APPROVALS**

- ETA-12/0174



Real-Time Anchor Design Software  
www.powersdesignassist.com

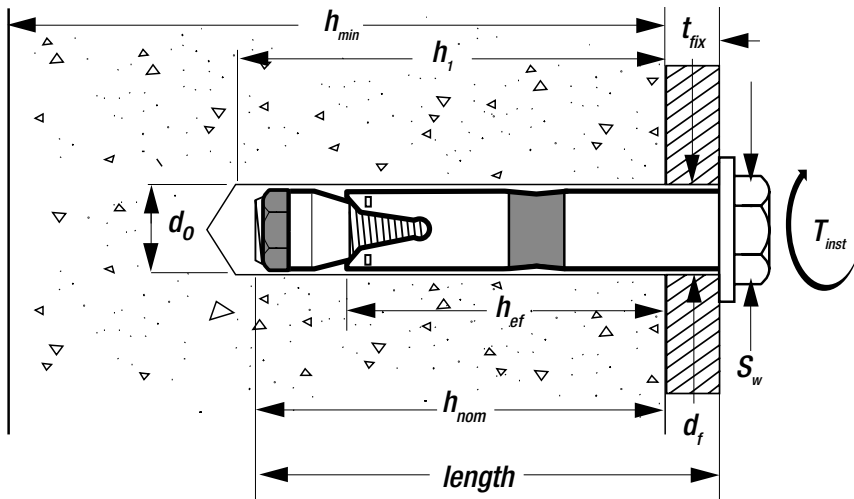
**INSTALLATION INFORMATION**

**MECHANICAL ANCHORS**

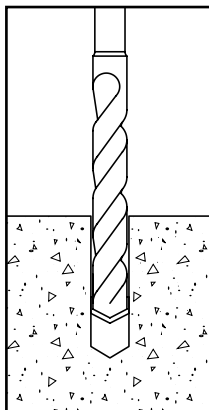
**PB-PRO-S**  
HEAVY DUTY ANCHOR

**INSTALLATION DATA**

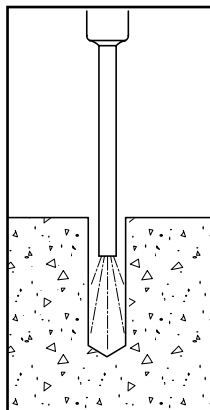
	Notation	Unit	PB-PRO-S			
			M8	M10	M12	M16
Anchor diameter	$d_{nom}$	[mm]	12	15	18	24
Nominal drill bit diameter	$d_o$	[mm]	12	15	18	24
Diameter of hole clearance in fixture	$d_f$	[mm]	14	17	20	26
Effective embedment depth	$h_{ef}$	[mm]	60	70	80	100
Nominal embedment depth	$h_{nom}$	[mm]	76	90	101	129
Drill hole depth for $h_{ef}$	$h_1$	[mm]	95	110	125	155
Minimum member thickness	$h_{min}$	[mm]	120	140	160	200
Minimum spacing	$s_{min}$	[mm]	65	65	100	130
Corresponding edge distance for above $s_{min}$	for $c \geq$	[mm]	140	150	220	240
Minimum edge distance	$c_{min}$	[mm]	80	100	120	140
Corresponding spacing for above $c_{min}$	for $s \geq$	[mm]	140	180	220	230
Installation torque	$T_{inst}$	[Nm]	30	45	90	130
Torque wrench socket size	$S_w$	[mm]	13	17	19	24



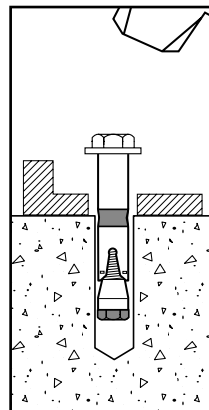
**INSTALLATION INSTRUCTIONS**



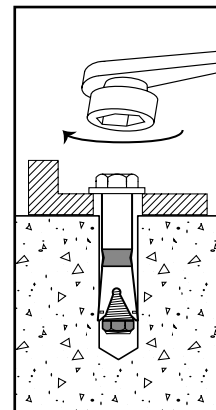
1.) Using the proper drill bit size, drill a hole into the base material to the required depth.



2.) Remove dust and debris from the hole using a hand pump or compressed air.



3.) Drive the anchor into the hole at least to the minimum required embedment depth.



4.) Tighten the anchor with a torque wrench by applying the required installation torque  $T_{inst}$ .

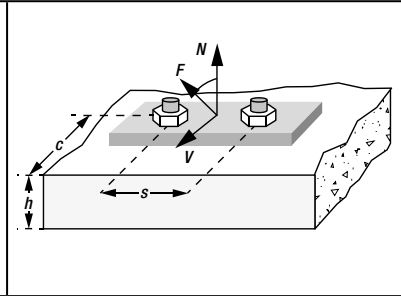
For complete installation instructions, see technical approval.

**DESIGN INFORMATION**

**PRECALCULATED TENSION AND SHEAR CAPACITIES**

According to ETAG 001 Annex C Method A.

- Every reasonable effort has been applied to ensure the accuracy of the tabulated data.
- The tables are intended to aid the user in the preliminary design process. It is the user's responsibility to interpret the data and to select, design and specify the correct product suitable for the application and its intended use.
- The given values are valid for normal concrete C20/25 and static/quasi-static loads with the exact dimensional information given. For any other conditions, the use of PDA is recommended.
- The values in the table below are design level loads. This assumes a safety factor is included both on the loading and the resistance.
- For cracked concrete, splitting failure is not considered assuming that a reinforcement is present which limits the crack width to 0.3 mm.
- For further details and background information please see the introduction of this manual.



M8	C20/25	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	$h_{ef}$ [mm]	60									
Member thickness	$h$ [mm]	120									
Edge distance	$c$ [mm]	-	-	-	-	-	80	80	80	80	80
Anchor spacing	$s$ [mm]	-	65	180	65	180	-	140	180	140	180
	$N_{Rd}$ [kN]	8.0	15.2	16.0	20.7	32.0	8.0	16.0	16.0	32.0	32.0
	$F_{Rd}^{45^\circ}$ [kN]	10.0	17.2	20.0	23.4	40.0	6.2	10.8	11.4	13.5	14.5
	$V_{Rd}$ [kN]	22.3	30.4	44.6	41.3	89.2	6.7	10.5	11.6	10.5	11.6
	$N_{Rd}$ [kN]	8.0	16.0	16.0	28.9	32.0	8.0	15.1	16.0	24.3	29.4
	$F_{Rd}^{45^\circ}$ [kN]	10.4	19.7	20.8	32.7	41.6	7.3	12.7	13.8	15.7	17.9
	$V_{Rd}$ [kN]	26.2	42.5	52.3	57.9	104.6	9.4	14.9	16.4	14.9	16.4

■ - Steel strengths controls ■ - Concrete strength controls ■ - Anchor pullout strength controls



The Powers Design Assist is a powerful anchor design software which helps you to design simple and complex anchorages. The design data of all Powers anchor products is readily available. To download this software for free, go to [www.powersdesignassist.com](http://www.powersdesignassist.com)

M10	C20/25	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	$h_{ef}$ [mm]	70									
Member thickness	$h$ [mm]	140									
Edge distance	$c$ [mm]	-	-	-	-	-	100	100	100	100	100
Anchor spacing	$s$ [mm]	-	65	210	65	210	-	180	210	180	210
	$N_{Rd}$ [kN]	10.7	18.4	21.3	24.1	42.7	10.7	21.3	21.3	42.7	42.7
	$F_{Rd}^{45^\circ}$ [kN]	13.1	20.8	26.2	27.3	52.5	8.4	14.8	15.3	18.5	19.4
	$V_{Rd}$ [kN]	28.1	36.8	56.2	48.2	112.4	9.2	14.7	15.6	14.7	15.6
	$N_{Rd}$ [kN]	16.7	25.8	33.3	33.7	66.7	13.5	20.4	21.6	33.8	38.0
	$F_{Rd}^{45^\circ}$ [kN]	19.9	29.2	39.7	38.2	79.5	11.2	17.5	18.5	21.8	23.7
	$V_{Rd}$ [kN]	39.4	51.5	78.7	67.5	157.4	13.0	20.7	22.0	20.7	22.0

■ - Steel strengths controls ■ - Concrete strength controls ■ - Anchor pullout strength controls

<b>M12</b>	<b>C20/25</b>	<b>Anchoring located far from any edge</b>					<b>Anchoring located close to an edge</b>				
Embedment depth	$h_{ef}$ [mm]	80									
Member thickness	$h$ [mm]	160									
Edge distance	$c$ [mm]	-	-	-	-	-	120	120	120	120	120
Anchor spacing	$s$ [mm]	-	100	240	100	240	-	220	240	220	240
	$N_{Rd}$ [kN]	13.3	24.3	26.7	34.5	53.3	13.3	26.7	26.7	53.3	53.3
	$F_{Rd}^{45^\circ}$ [kN]	16.3	27.5	32.6	39.0	65.2	10.7	19.0	19.4	24.1	24.7
	$V_{Rd}$ [kN]	34.3	48.7	68.7	68.9	137.4	12.0	19.3	20.0	19.3	20.0
	$N_{Rd}$ [kN]	20.0	34.1	40.0	48.3	80.0	16.9	26.2	27.1	44.3	47.4
	$F_{Rd}^{45^\circ}$ [kN]	24.0	38.5	47.9	54.6	95.9	14.4	22.7	23.5	28.7	30.0
	$V_{Rd}$ [kN]	48.1	68.1	96.2	96.5	192.3	16.9	27.3	28.2	27.3	28.2

■ - Steel strengths controls ■ - Concrete strength controls ■ - Anchor pullout strength controls

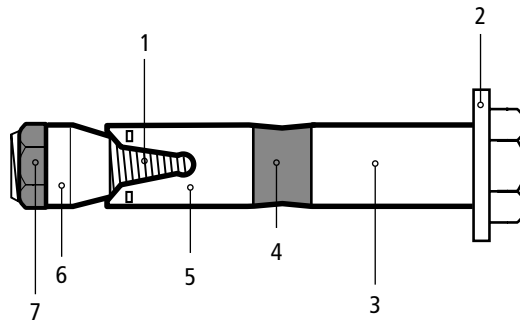
<b>M16</b>	<b>C20/25</b>	<b>Anchoring located far from any edge</b>					<b>Anchoring located close to an edge</b>				
Embedment depth	$h_{ef}$ [mm]	100									
Member thickness	$h$ [mm]	200									
Edge distance	$c$ [mm]	-	-	-	-	-	140	140	140	140	140
Anchor spacing	$s$ [mm]	-	130	300	130	300	-	230	300	230	300
	$N_{Rd}$ [kN]	20.0	34.4	40.0	49.3	80.0	20.0	40.0	40.0	72.0	80.0
	$F_{Rd}^{45^\circ}$ [kN]	24.0	38.9	47.9	55.8	95.8	15.4	26.5	28.2	32.1	35.6
	$V_{Rd}$ [kN]	48.0	68.8	96.0	98.6	192.0	16.6	25.6	28.4	25.6	28.4
	$N_{Rd}$ [kN]	23.3	46.7	46.7	69.0	93.3	22.7	33.2	36.4	52.8	64.4
	$F_{Rd}^{45^\circ}$ [kN]	29.4	53.3	58.8	78.1	117.6	19.6	29.4	32.4	36.4	41.9
	$V_{Rd}$ [kN]	67.2	96.3	134.4	138.1	268.8	23.4	36.2	40.1	36.2	40.1

■ - Steel strengths controls ■ - Concrete strength controls ■ - Anchor pullout strength controls

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## MATERIAL INFORMATION

## MATERIAL SPECIFICATION



Part No.	Designation	Material	Protection
1	Threaded bolt	C-steel grade 8.8	Zinc plated 5 $\mu\text{m}$
2	Washer	Steel Property class 8.8 acc. to EN ISO 7093	Zinc plated 5 $\mu\text{m}$
3	Distance sleeve	C-steel	Zinc plated 5 $\mu\text{m}$
4	Compression ring	Plastic element HDPE	-
5	Expansion sleeve	C-steel	Zinc plated 5 $\mu\text{m}$
6	Cone nut	C-steel	Zinc plated 5 $\mu\text{m}$
7	Retainer nut	Plastic element HDPE	-

## ORDERING INFORMATION

Part No.	Description	Dia. [mm]	Length [mm]	$h_{\text{nom}}$ [mm]	Max. $t_{\text{fix}}$	Box Qty.	Carton Qty.
<b>PB-PRO-S Hex head heavy duty load anchor - zinc plated</b>							
27462S-PWR	12-M8/10 Heavy duty load anchor - zinc plated	M8	86	76	10	50	200
27464S-PWR	12-M8/30 Heavy duty load anchor - zinc plated	M8	106	76	30	50	200
27466S-PWR	12-M8/50 Heavy duty load anchor - zinc plated	M8	126	76	50	25	100
27468S-PWR	15-M10/5 Heavy duty load anchor - zinc plated	M10	95	90	5	25	100
PB1510100-PWR	15-M10/10 Heavy duty load anchor - zinc plated	M10	100	90	10	25	100
PB1515105-PWR	15-M10/15 Heavy duty load anchor - zinc plated	M10	105	90	15	25	100
27470S-PWR	15-M10/25 Heavy duty load anchor - zinc plated	M10	115	90	25	25	100
27472S-PWR	15-M10/45 Heavy duty load anchor - zinc plated	M10	135	90	45	25	100
27474S-PWR	15-M10/85 Heavy duty load anchor - zinc plated	M10	175	90	85	20	80
27478S-PWR	18-M12/5 Heavy duty load anchor - zinc plated	M12	106	101	5	10	40
PB1810111-PWR	18-M12/10 Heavy duty load anchor - zinc plated	M12	111	101	10	10	40
PB1815116-PWR	18-M12/15 Heavy duty load anchor - zinc plated	M12	116	101	15	10	40
PB1825126-PWR	18-M12/25 Heavy duty load anchor - zinc plated	M12	126	101	25	10	40
27480S-PWR	18-M12/35 Heavy duty load anchor - zinc plated	M12	136	101	35	10	40
27482S-PWR	18-M12/55 Heavy duty load anchor - zinc plated	M12	156	101	55	10	40
27484S-PWR	18-M12/85 Heavy duty load anchor - zinc plated	M12	186	101	85	10	40
27486S-PWR	24-M16/20 Heavy duty load anchor - zinc plated	M16	149	129	20	5	20
27488S-PWR	24-M16/50 Heavy duty load anchor - zinc plated	M16	179	129	50	5	20



PB-PRO-S



## TECHNICAL SUPPORT CONTACT INFORMATION

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### Disclaimer for Recommendations, Information and Use of Data

The recommendations, information and data contained in this manual are put together with the greatest care and accuracy possible. It is based on principles, equations and safety factors set out in the technical documentation of Stanley Black & Decker that are believed to be correct and current as of June 2017. The information and data is subject to change after such date as Stanley Black & Decker reserves the right to change the designs, materials and specifications of the products in this manual without notice.

It is the responsibility of the design professional to ensure that a suitable product is selected, properly designed and used in the intended application. This includes that the selected product and its use is compliant with the applicable building codes and other legal requirements and will satisfy durability and performance criteria and margins of safety which they determine are applicable. The products must be used, handled, applied and installed strictly in accordance with all current instructions for use published by Stanley Black & Decker.

The performance data given in this manual are the result of the evaluation of tests conducted under laboratory conditions. It is the responsibility of the designer and installer in charge to consider the conditions on site and to ensure the performance data given in the manual is applicable to the actual conditions. In particular the base material and environmental conditions have to be checked prior to installation. In case of doubt, contact the technical support of Stanley Black & Decker.

#### *Limitation of Liability*

Stanley Black & Decker offers a limited product warranty to customers or end users that the product meets its applicable specifications. Except for the express warranty in the immediately preceding sentence, Stanley Black & Decker grants no other warranties, express or implied, regarding the products, their fitness for any purpose, their quality, their merchantability or otherwise. Further, Stanley Black & Decker shall have no liability with respect to changes in the design, materials and specifications in the products presented in this manual, nor with respect to any product which has been modified or installed improperly, regardless

of any specific instructions to the installer. The responsible designer and installer shall indemnify, defend, and hold harmless Stanley Black & Decker for any and all claimed loss or damage occasioned, in a whole or in part, by the modified products or deviation in product installation procedures.

#### *Limitation of Damages*

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