ANCHORING & FASTENING SYSTEMS

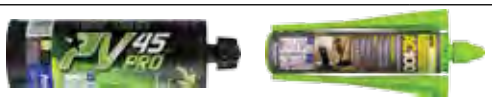
Technical Manual for the Design Professional

ADHESIVE ANCHORS

POLYESTER ADHESIVE ANCHORS

PV45-PRO/AC100e Concrete Anchoring System

PV45-PRO/AC100e Masonry Anchoring System



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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

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.

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LOGOS USED IN THIS MANUAL

APPLICATION AND USE LOGOS	
	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.

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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 ICONS	
	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 ICONS	
	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.

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BASE MATERIAL LOGOS	
	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.
OTHER LOGOS	
	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 www.powers.com.au 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 $F_{Rd}{}^{45°}$ for loads acting at 45°); $R_d = R_k / \gamma_M$

NOTATIONS USED IN THIS MANUAL

F	N	V	M	T
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
ρ	τ_k	γ_F	γ_M	γ_2
Bulk density of masonry unit	Characteristic bond stress	Partial safety factor for actions	Partial safety factor for material	Partial safety factor for installation

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Applications and Uses

Category	Type	Product	Base	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-ETA1-PRO		■			●	●	●	●	●	●	▲					■	■	
EXPANSION ANCHORS	Throughbolt	PTB-SS-ETA1 - PRO		■	■		●	●	●	●	●	●	▲					■	■	
EXPANSION ANCHORS	Heavy Duty Anchor	PB-PRO-S		■			●	●	●	●	●	●	▲					■		
EXPANSION ANCHORS	Drop-In Anchor	DM-PRO		■	◆		●	●	●	●	●	●	▲				■			
EXPANSION ANCHORS	Drop-In Anchor	DM-PRO Part 6		■	■		●	●	●	●	●	●	▲		■		■			
SCREW ANCHORS		BT (Blue-Tip)		■			●	●	●	●	●	●	▲					■		
SCREW ANCHORS		SNAKE-PRO		■			●	●	●	●	●	●	▲				■		■	
INJECTION ADHESIVE ANCHORS	Vinylester	AC100-PRO	Concrete	■	◆	◆	■	■	■	■	■	■	■	■			■		■	
INJECTION ADHESIVE ANCHORS	Vinylester	AC100-PRO	Masonry	■	◆	◆	■	■		■			■				■		■	
INJECTION ADHESIVE ANCHORS	Vinylester	AC100-PRO	Rebar	■	◆		■	■		■	■	■	■			■				
INJECTION ADHESIVE ANCHORS	Epoxy	PURE150-PRO	Concrete	■	◆	◆	■	■		■			■	■			■		■	
INJECTION ADHESIVE ANCHORS	Epoxy	PURE150-PRO	Core-Drilled	■	◆	◆	■	■		■			■	■			■		■	■
INJECTION ADHESIVE ANCHORS	Epoxy	PURE150-PRO	Rebar	■	◆		■	■		■			■			■				
INJECTION ADHESIVE ANCHORS	Epoxy	PURE110-PRO	Concrete	■	◆	◆	■	■		■			■	■		■	■		■	
INJECTION ADHESIVE ANCHORS	Polyester	PV45-PRO / AC100e	Concrete	■	◆		■			■	■		■				■		■	
INJECTION ADHESIVE ANCHORS	Polyester	PV45-PRO / AC100e	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

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

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!

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ADHESIVE ANCHOR OVERVIEW

Adhesive anchors offer many advantages for applications requiring high load capacities yet not allowing mechanical expansion forces in the base material. Adhesive systems also include the ability to be used with a variety of steel element materials.

The load transfer mechanism of adhesive anchors bases on bond formed by the adhesive between the anchor and the wall of the drilled hole. The annular gap is completely filled with adhesive, sealing the anchor hole against weather. Adhesive mortars consist of aggregates and binder in the form of unsaturated **polyester, vinylester,** vinylester with cement (**hybrid** systems) or **epoxy**. All adhesive types have different strengths and cost advantages.

Adhesive systems are further classified according to their delivery method. **Injection systems** provide the adhesive in plastic cartridges which is mixed through a static mixer and dispensed into the drilled hole. Sufficient cleaning of the drilled hole prior to installation of the anchor or reinforcement bar is of paramount importance. **Capsule systems** have the adhesive encapsulated in a glass capsule which is inserted into the drilled hole and mixed during anchor setting.

In Europe and many other countries, adhesive anchors used for applications in concrete are designed according to the **EOTA TR 029.** Adhesive anchors used for applications in **masonry** can be designed according to the **ETAG 029 Annex C**. Adhesive **rebar** anchoring systems are designed in compliance with structural concrete design codes as the Eurocode 2 EN 1992-1-1.

SECTION CONTENT

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GENERAL INFORMATION

PV45-PRO / AC100e in Hammer-Drilled Holes

Polyester Injection Adhesive Anchoring System

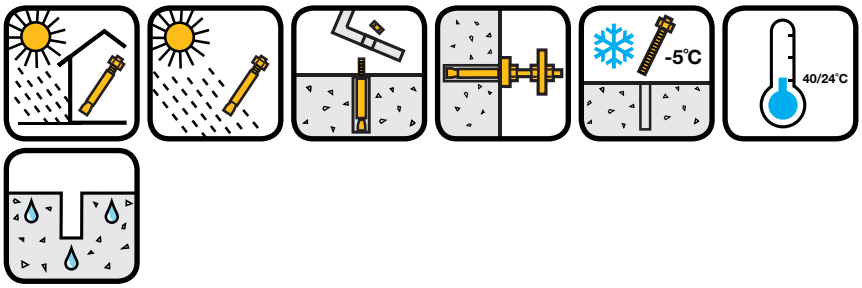
PRODUCT DESCRIPTION

The PV45-PRO / AC100e is a two-component styrene-free polyester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The PV45-PRO / AC100e is a price-competitive adhesive designed for common applications such as bonding threaded rods to uncracked concrete. **PV45-PRO / AC100e are not recommended for safety-critical long-term sustained load applications.**

PV45-PRO Polyester / AC100e Polyester

Threaded Rod

GENERAL APPLICATIONS AND USES

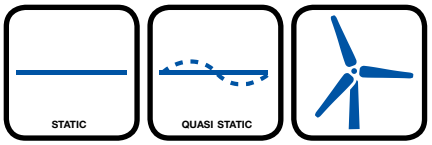


FEATURES AND BENEFITS

- Designed for use with standard threaded rods
- Simple and fast installation
- Versatile styrene-free formula with quick curing time
- Cartridge design allows multiple uses using extra mixing nozzle

APPROVALS AND LISTINGS

LOADING CONDITIONS



SUITABLE BASE MATERIALS

GRADES

Carbon Steel 4.8
Carbon Steel 5.8
Stainless Steel A4

APPROVALS

- ETA-13/0061 (PV45-PRO)
- ETA-14/0155 (AC100e)

PDA®
Real-Time Anchor Design Software
www.powersdesignassist.com

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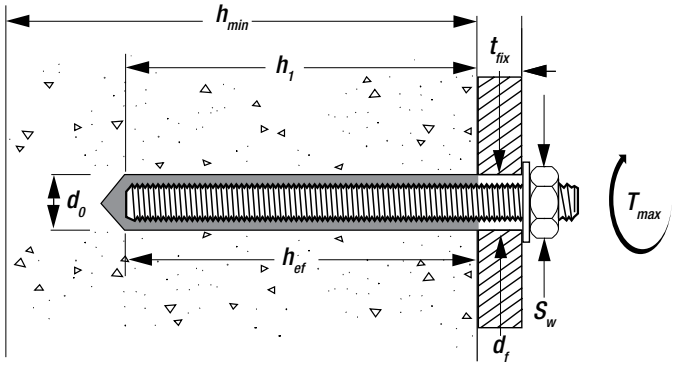
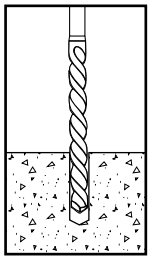
INSTALLATION INFORMATION

INSTALLATION DATA - THREADED ROD

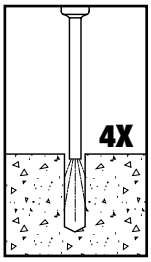
	Notation	Unit	PV45-PRO / AC100e - Threaded rod					
			M8	M10	M12	M16	M20	M24
Anchor diameter	d	[mm]	8	10	12	16	20	24
Nominal drill bit diameter	d_0	[mm]	10	12	14	18	24	28
Diameter of hole clearance in fixture	d_f	[mm]	9	12	14	18	22	26
Minimum diameter of steel brush	d_b	[mm]	10.5	12.5	14.5	18.5	24.5	28.5
Effective embedment and drill hole depth	$h_{ef} = h_1$	[mm]	80	90	110	125	170	210
Minimum member thickness	h_{min}	[mm]	110	120	140	160	215	260
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120
Maximum torque	T_{max}	[Nm]	10	20	40	60	120	150
Torque wrench socket size	S_w	[mm]	13	17	19	24	30	36



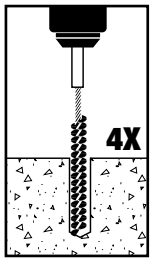
INSTALLATION INSTRUCTIONS



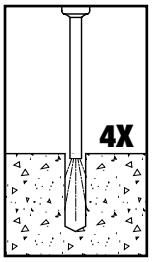
1.) *Using the proper drill bit size, drill a hole into the base material to the required depth.*



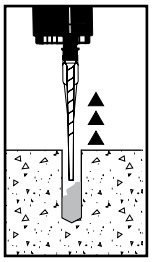
2.) *Blow the hole clean using a hand pump or compressed air 4 times minimum.*



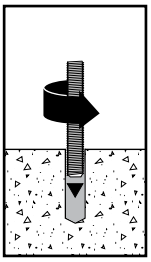
3.) *Brush the hole with the proper wire brush 4 times minimum.*



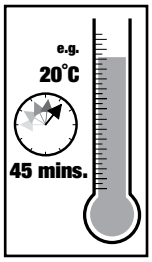
4.) *Blow the hole clean using a hand pump or compressed air 4 times minimum.*



5.) *Squeeze out separately and discard a minimum of 3 full strokes until the mortar is uniformly mixed and shows consistent colour. Fill the hole upto approximately 2/3 with uniformly mixed adhesive.*



6.) *Push the steel element into the hole while turning slightly.*



7.) *Allow the adhesive to cure for the time specified for the actual concrete temperature prior to applying any load.*

For complete installation instructions, see technical approval.

Concrete temperature	Working time	Minimum curing time[1)]
- 5°C to -1°C	90 min	360 min
0°C to + 4°C	45 min	180 min
+ 5°C to + 9°C	25 min	120 min
+ 10°C to + 14°C	20 min	100 min
+ 15°C to + 19°C	15 min	80 min
+ 20°C to + 29°C	6 min	45 min
+ 30°C to + 34°C	4 min	25 min
+ 35°C to + 39°C	2 min	20 min
Cartridge temperature	+ 5°C to + 40°C	

1) Time data for dry concrete, double curing time for wet concrete

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DESIGN INFORMATION

TENSION LOAD CAPACITIES - PARAMETERS FOR CALCULATION OF DESIGN STRENGTH

According to EOTA TR 029.

	Notation	Unit	PV45-PRO / AC100e - Threaded rod					
			M8	M10	M12	M16	M20	M24
Steel failure								
Carbon steel								
Characteristic resistance, strength class 4.8	$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms} [1)]	[-]	1.5					
Characteristic resistance, strength class 5.8	$N_{Rk,s}$	[kN]	18	29	42	79	123	177
Partial safety factor	γ_{Ms} [1)]	[-]	1.5					
A4 steel								
Characteristic resistance, strength class 70	$N_{Rk,s}$	[kN]	26	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]	1.9					
Combined pullout and concrete failure								
Characteristic resistance in uncracked concrete, dry and wet concrete C20/25								
Temperature Range: 40°C / 24°C	$N_{Rk,p}$	[kN]	16	35	35	50	75	95
Partial safety factor	$\gamma_{Mc}=\gamma_{Mp}$ [1)]	[-]	1.8 [2)]					
Increasing factor for concrete strength								
C30/37	ψ_c	[-]	1.08					
C40/50	ψ_c	[-]	1.15					
C50/60	ψ_c	[-]	1.19					
Concrete failure								
Concrete cone failure								
Characteristic spacing	$s_{cr,N}$	[mm]	$3 \cdot h_{ef}$ [3)]					
Characteristic edge distance	$c_{cr,N}$	[mm]	$1.5 \cdot h_{ef}$ [3)]					
Partial safety factor	γ_{Mc} [1)]	[-]	1.8 [2)]					
Splitting failure								
Characteristic spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$					
Characteristic edge distance	$c_{cr,sp}$	[mm]	$(5 \cdot h_{ef} - 2 \cdot h)$ but $\geq 1 \cdot h_{ef}$ and $\leq 2.4 \cdot h_{ef}$					
Partial safety factor for uncracked concrete	γ_{Msp} [1)]	[-]	1.8 [2)]					
Increasing factor for concrete strength								
C30/37	ψ_c	[-]	1.21					
C40/50	ψ_c	[-]	1.41					
C50/60	ψ_c	[-]	1.55					

1) In absence of other national regulations
2) Partial safety factor $\gamma_2 = 1.2$ is included
3) ETA provides $s_{cr,N} = 2 \cdot h_{ef}$ and $c_{cr,N} = 1 \cdot h_{ef}$. To be in the line with EOTA TR 029, the more conservative design values $s_{cr,N} = 3 \cdot h_{ef}$ and $c_{cr,N} = 1.5 \cdot h_{ef}$ are given in this technical manual.

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SHEAR LOAD CAPACITIES - PARAMETERS FOR CALCULATION OF DESIGN STRENGTH

According to EOTA TR 029.

	Notation	Unit	PV45-PRO / AC100e - Threaded rod					
			M8	M10	M12	M16	M20	M24
Steel failure								
Steel failure without lever arm								
Carbon steel								
Characteristic resistance, strength class 4.8	$V_{Rk,s}$	[kN]	7	12	17	31	49	71
Partial safety factor	γ_{Ms} [1)]	[-]	1.25					
Characteristic resistance, strength class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88
Partial safety factor	γ_{Ms} [1)]	[-]	1.25					
A4 steel								
Characteristic resistance, strength class 70	$V_{Rk,s}$	[kN]	13	20	30	55	86	124
Partial safety factor	γ_{Ms} [1)]	[-]	1.56					
Steel failure with lever arm (bending)								
Carbon steel								
Characteristic resistance, strength class 4.8	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449
Partial safety factor	γ_{Ms} [1)]	[-]	1.25					
Characteristic resistance, strength class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	66	166	325	561
Partial safety factor	γ_{Ms} [1)]	[-]	1.25					
A4 steel								
Characteristic resistance, strength class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786
Partial safety factor	γ_{Ms} [1)]	[-]	1.56					
Concrete failure								
Pry-out failure								
Factor in Equation (5.7) of TR 029	k	[-]	2					
Partial safety factor	γ_{Mcp} [1)]	[-]	1.5 [2)]					
Edge failure								
Partial safety factor	γ_{Mc} [1)]	[-]	1.5 [2)]					

1) In absence of other national regulations
2) Partial safety factor of γ_2=1.0 is included

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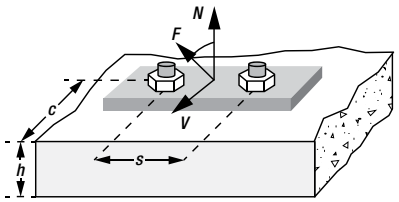
PRECALCULATED TENSION AND SHEAR CAPACITIES

According to EOTA TR 029.

- 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.
- Precalculated design resistance capacities are given for threaded rods only, values for internal sleeves and reinforcement bars can be found in the relevant approval documents.
- For further details and background information please see the introduction of this manual.



Influence of steel grades					
Size	**Property**	**4.8**	**5.8**	**A4-50**	**A4-70**
M8	N_{Rd} [kN]	7.5	12.0	6.4	13.9
	V_{Rd} [kN]	4.2	7.2	3.8	8.3
M10	N_{Rd} [kN]	11.5	19.3	10.2	21.9
	V_{Rd} [kN]	7.2	12.0	6.1	12.8
M12	N_{Rd} [kN]	17.0	28.0	14.8	31.6
	V_{Rd} [kN]	10.2	16.8	8.9	19.2
M16	N_{Rd} [kN]	31.5	52.0	27.4	58.8
	V_{Rd} [kN]	18.6	31.2	16.5	35.3
M20	N_{Rd} [kN]	49.0	81.3	42.8	91.4
	V_{Rd} [kN]	29.3	48.8	25.7	55.1
M24	N_{Rd} [kN]	70.5	117.3	61.7	132.1
	V_{Rd} [kN]	42.5	70.4	37.0	79.5

Instructions:

- The steel grade potentially influences the load capacity of the anchor. Left table depicts ultimate steel strengths of threaded rods for given steel grades.
- The steel strength equals the load capacity of the anchor provided other failure modes, i.e. concrete failure or pullout failure, do not yield lower strengths and therefore do not control the anchor capacity.
- To determine the critical failure mode, the steel strength identified in the left table has to be compared with the concrete and pullout strengths in the following tables.

M8	**C20/25 5.8 steel dry/wet concrete**	**Anchoring located far from any edge**					**Anchoring located close to an edge**				
Embedment depth	h_{ef} [mm]	80									
Member thickness	h[mm]	220					110				
Edge distance	c [mm]	-	-	-	-	-	40	40	40	40	40
Anchor spacing	s [mm]	0	40	240	40	240	0	40	240	40	240
40/24°C	N_{Rd} [kN]	8.9	12.7	17.8	18.6	35.6	5.6	8.0	11.2	12.5	22.3
	$F_{Rd}^{45°}$ [kN]	6.8	11.4	13.5	19.2	27.0	3.8	5.2	7.6	6.0	9.5
	V_{Rd} [kN]	7.2	14.4	14.4	28.8	28.8	3.7	5.0	7.5	5.0	7.5

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

M10	**C20/25 5.8 steel dry/wet concrete**	**Anchoring located far from any edge**					**Anchoring located close to an edge**				
Embedment depth	h_{ef} [mm]	90									
Member thickness	h [mm]	240					120				
Edge distance	c [mm]	-	-	-	-	-	50	50	50	50	50
Anchor spacing	s [mm]	0	50	270	50	270	0	50	270	50	270
40/24°C	N_{Rd} [kN]	19.3	24.6	38.7	31.8	77.3	11.0	14.0	22.1	19.4	44.1
	$F_{Rd}^{45°}$ [kN]	12.6	20.6	25.1	32.5	50.3	6.1	8.0	12.2	12.2	14.6
	V_{Rd} [kN]	12.0	24.0	24.0	48.0	48.0	5.3	7.1	10.7	7.1	10.7

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

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M12	C20/25 5.8 steel dry/wet concrete	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	h_{ef} [mm]	110									
Member thickness	h [mm]	280					140				
Edge distance	c [mm]	-	-	-	-	-	60.0	60.0	60.0	60.0	60.0
Anchor spacing	s [mm]	0	60.0	330	60.0	330	0	60.0	330	60.0	330
40/24°C	N_{Rd} [kN]	19.4	26.7	38.9	37.8	77.8	12.0	16.6	24.1	25.0	48.1
	$F_{Rd}^{45°}$ [kN]	15.5	25.3	30.6	41.1	61.2	7.7	10.4	15.4	11.9	19.0
	V_{Rd} [kN]	16.8	33.6	33.6	67.2	67.2	7.3	9.8	14.6	9.8	14.8

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

M16	C20/25 5.8 steel dry/wet concrete	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	h_{ef} [mm]	125									
Member thickness	h [mm]	320					160				
Edge distance	c[mm]	-	-	-	-	-	80	80	80	80	80
Anchor spacing	s [mm]	0	80	375	80	375	0	80	375	80	375
40/24°C	N_{Rd} [kN]	27.8	37.4	55.6	51.5	111.1	17.4	23.5	34.9	34.6	69.8
	$F_{Rd}^{45°}$ [kN]	24.9	39.7	49.9	61.8	99.8	11.8	15.7	23.5	18.0	29.3
	V_{Rd} [kN]	31.2	62.4	62.4	123.8	124.8	11.5	15.3	23.0	15.3	23.0

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

M20	C20/25 5.8 steel dry/wet concrete	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	h_{ef} [mm]	170									
Member thickness	h [mm]	430					215				
Edge distance	c [mm]	-	-	-	-	-	100	100	100	100	100
Anchor spacing	s [mm]	0	100	510	100	510	0	100	510	100	510
40/24°C	N_{Rd} [kN]	41.7	57.2	83.3	80.5	166.7	27.0	37.1	54.0	54.3	108.1
	$F_{Rd}^{45°}$ [kN]	38.1	61.2	76.3	96.4	152.6	17.8	24.0	35.6	27.3	44.2
	V_{Rd} [kN]	48.8	97.6	97.6	193.2	195.2	17.2	22.9	34.3	22.9	34.3

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

M24	C20/25 5.8 steel dry/wet concrete	Anchoring located far from any edge					Anchoring located close to an edge				
Embedment depth	h_{ef} [mm]	210									
Member thickness	h [mm]	520					260				
Edge distance	c [mm]	-	-	-	-	-	120	120	120	120	120
Anchor spacing	s [mm]	0	120	630	120	630	0	120	630	120	630
40/24°C	N_{Rd} [kN]	52.8	74.3	105.6	107.2	211.1	35.7	50.2	71.4	72.9	142.8
	$F_{Rd}^{45°}$ [kN]	51.2	82.5	102.3	128.4	204.8	24.1	32.8	48.2	37.3	60.2
	V_{Rd} [kN]	70.4	140.8	140.8	257.3	281.6	23.6	31.5	47.2	31.5	47.2

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

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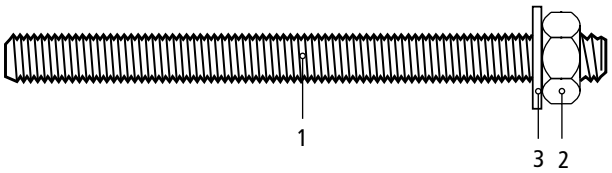
MATERIAL INFORMATION

MATERIAL SPECIFICATIONS - THREADED ROD



Part no.	Designation	Material
Carbon steel 4.8		
1	Anchor rod	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 4.8, R_m = 400 MPa; $R_{p\,0.2}$ = 320 MPa
2	Hexagon nut	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 4
3	Washer	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm
Carbon steel 5.8		
1	Anchor rod	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 5.8, R_m = 500 MPa; $R_{p\,0.2}$ = 400 MPa
2	Hexagon nut	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 5
3	Washer	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm
Stainless steel A4		
1	Anchor rod	Stainless steel 1.4401 / 1.4571; Strength class 70, R_m = 700 MPa; $R_{p\,0.2}$= 450 MPa
2	Hexagon nut	Stainless steel 1.4401 / 1.4571; Strength class 70
3	Washer	Stainless steel 1.4401 / 1.4571

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GENERAL INFORMATION

PV45-PRO / AC100e in Hammer/Rotary-Drilled Holes

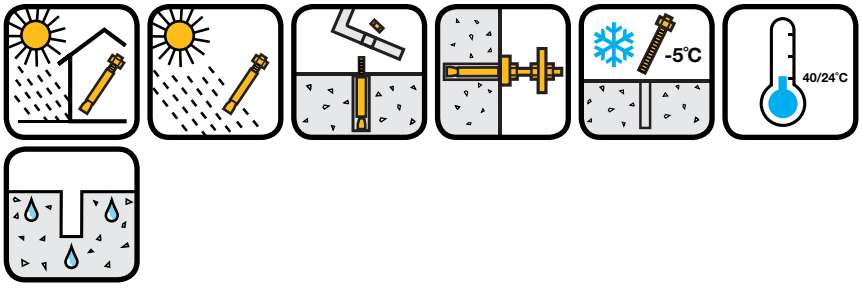
Polyester Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The PV45-PRO / AC100e is a two-component styrene-free polyester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The PV45-PRO / AC100e is a price competitive adhesive designed for common applications such as bonding threaded rods to masonry.




GENERAL APPLICATIONS AND USES



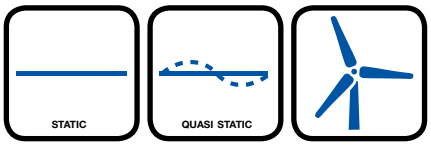
FEATURES AND BENEFITS

- Designed for use with standard threaded rods
- Simple and fast installation
- Versatile styrene-free formula with quick curing time
- Cartridge design allows multiple uses using extra mixing nozzle

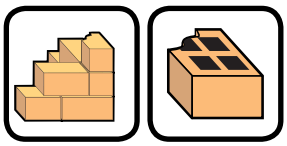
APPROVALS AND LISTINGS

ETAG 029

LOADING CONDITIONS



SUITABLE BASE MATERIALS



PV45-PRO Polyester / AC100e Polyester

Threaded Rod

Plastic Sleeve

GRADES

Carbon Steel 4.8
Carbon Steel 5.8
Stainless Steel A4

APPROVALS

- ETA-13/0063 (PV45-PRO)
- ETA-14/0150 (AC100e)

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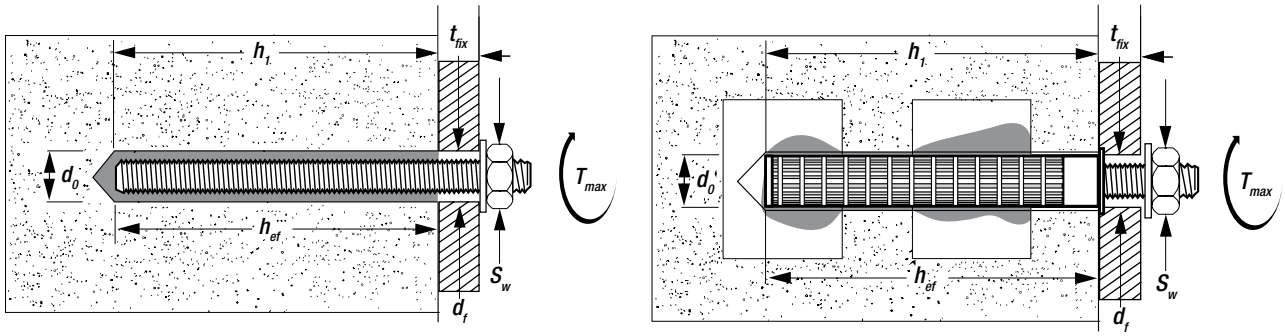
INSTALLATION INFORMATION

INSTALLATION DATA - THREADED ROD IN SOLID BRICKS, WITHOUT SLEEVES

	Notation	Unit	PV45-PRO / AC100e - Solid bricks, without sleeve			
			M8	M10	M12	M16
Anchor diameter	d	[mm]	8	10	12	16
Nominal drill bit diameter	d_0	[mm]	10	12	14	18
Diameter of hole clearance in fixture	d_f	[mm]	≤ 9	≤ 12	≤ 14	≤ 18
Minimum diameter of steel brush	d_b	[mm]	≥ 12	≥ 14	≥ 16	≥ 20
Embedment depth	h_{ef}	[mm]	80	90	100	100
Bore hole depth	h_1	[mm]	80	90	100	100
Minimum spacing for solid bricks*	$s_{min,II} = s_{cr,II}$ OR $s_{min,\perp} = s_{cr,\perp}$	[mm]	240	270	300	300
Minimum edge distance for solid bricks*	$c_{min} = c_{cr}$	[mm]	120	135	150	150
Maximum torque	T_{max}	[Nm]	2	2	2	2
Torque wrench socket size	S_w	[mm]	13	17	19	24
Minimum wall thickness	h_{min}	[mm]	h_{ef} + 30			

* The above spacing and edge distances are applicable for solid bricks of the description and sizes as given in ETA13-0063 and the table below.



INSTALLATION DATA - SOLID AND HOLLOW BRICKS, WITH SLEEVE

	Notation	Unit	Solid and hollow bricks, with sleeve				
			M8	M10		M12	M16
Sleeve type / size			SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Anchor diameter	d	[mm]	8	10	10	12	16
Nominal drill bit diameter	d_0	[mm]	12	16	16	20	20
Diameter of hole clearance in fixture	d_f	[mm]	≤ 9	≤ 12	≤ 12	≤ 14	≤ 18
Diameter of nylon brush	d_b	[mm]	≥ 14	≥ 18	≥ 18	≥ 22	≥ 22
Embedment depth	h_{ef}	[mm]	80	85	130	85	85
Embedment depth sleeve	ℓ_s	[mm]	80	85	130	85	85
Bore hole depth	h_1	[mm]	85	90	135	90	90
Minimum spacing for solid bricks 240 x 115 x 55 mm ($\rho \geq 1.8$ kg/dm³ $f_b \geq 28$ MPa) 240 x 115 x 71 mm ($\rho \geq 2.0$ kg/dm³ $f_b \geq 20$ MPa)	$s_{min,II} = s_{cr,II}$ OR $s_{min,\perp} = s_{cr,\perp}$	[mm]	240	240	255	-	-
Minimum spacing for hollow bricks 240 x 175 x 113 mm ($\rho \geq 1.4$ kg/dm³ $f_b \geq 12$ MPa)	$s_{min,II} = s_{cr,II}$ $s_{min,\perp} = s_{cr,\perp}$	[mm] [mm]	240 113	240 113	240 113	240 113	240 113
Minimum spacing for hollow bricks 497 x 240 x 238 mm ($\rho \geq 0.9$ kg/dm³ $f_b \geq 12$ MPa)	$s_{min,II} = s_{cr,II}$ $s_{min,\perp} = s_{cr,\perp}$	[mm] [mm]	497 238	497 238	497 238	497 238	497 238
Minimum spacing for hollow bricks 500 x 200 x 200 mm ($\rho \geq 1.0$ kg/dm³ $f_b \geq 4$ MPa)	$s_{min,II} = s_{cr,II}$ $s_{min,\perp} = s_{cr,\perp}$	[mm] [mm]	500 200	500 200	500 200	500 200	500 200
Minimum edge distance for solid brick of above sizes	$c_{min} = c_{cr}$	[mm]	120	128	195	-	-
Minimum edge distance for hollow brick of above sizes	$c_{min} = c_{cr}$	[mm]	100	100	100	120	120
Maximum torque	T_{max}	[Nm]	2	2	2	2	2
Torque wrench socket size	S_w	[mm]	13	17	17	19	19
Minimum wall thickness	h_{min}	[mm]	115	115	195	115	115

The icons of bricks shown in the above table represent hollow or solid brick. These icons do not represent the actual profile / type of the bricks.
Please refer to ETA13-0063 for type, size, strength and other description of bricks.

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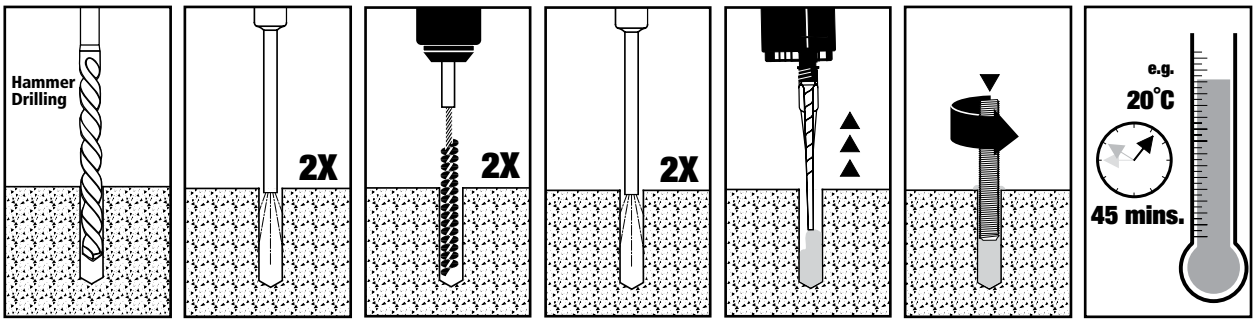
INSTALLATION INSTRUCTIONS - SOLID BRICK WITHOUT SLEEVE



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

2.) *Blow the hole clean using a hand pump or compressed air 2 times minimum.*

3.) *Brush the hole with the proper wire brush 2 times minimum.*

4.) *Blow the hole clean using a hand pump or compressed air 2 times minimum.*

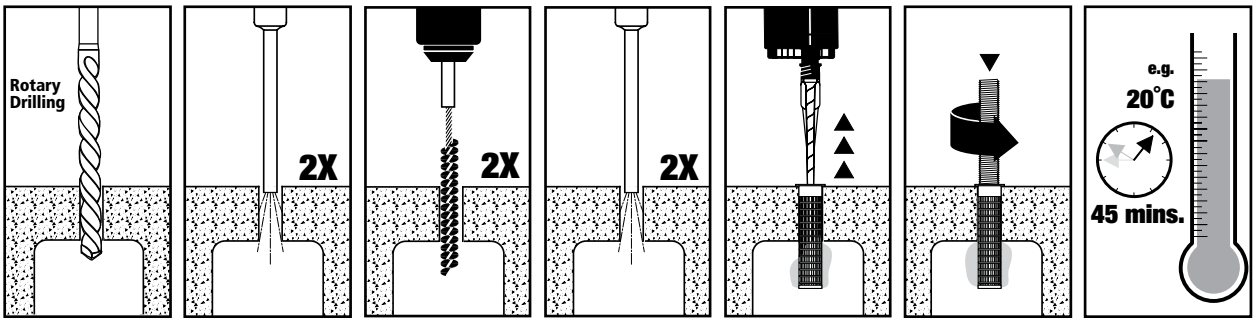
5.) *Squeeze out separately and discard a minimum of 3 full strokes until the mortar is uniformly mixed and shows consistent colour. Fill the hole upto approximately 2/3 with uniformly mixed adhesive.*

6.) *Push the steel element into the hole while turning slightly.*

7.) *Allow the adhesive to cure for the time specified for the actual concrete temperature.*

For complete installation instructions, see technical approval.

INSTALLATION INSTRUCTIONS - SOLID AND HOLLOW BRICKS, WITH SLEEVE



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

2.) *Blow the hole clean using a hand pump or compressed air 2 times minimum.*

3.) *Brush the hole with the proper wire brush 2 times minimum.*

4.) *Blow the hole clean using a hand pump or compressed air 2 times minimum.*

5.) *Insert the sleeve, required for hollow masonry, into the hole. Squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive. Fill the sleeve up completely with uniformly mixed adhesive.*

6.) *Push the steel element into the hole while turning slightly.*

7.) *Allow the adhesive to cure for the time specified for the actual concrete temperature.*

For complete installation instructions, see technical approval.

Base material temperature	Working time	Minimum curing time
- 5°C to -1°C	90 min	6 h
0°C to + 4°C	45 min	3 h
+ 5°C to + 9°C	25 min	2 h
+ 10°C to + 14°C	20 min	100 min
+ 15°C to + 19°C	15 min	80 min
+ 20°C to + 29°C	6 min	45 min
+ 30°C to + 34°C	4 min	25 min
+ 35°C to + 39°C	2 min	20 min
Cartridge Temperature	+ 5°C to + 40°C	

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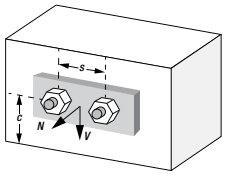
DESIGN INFORMATION

- 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 following tables are valid for specific brick types defined in the technical approval.
- The values in the table below are characteristic values for the anchor resistance.
- For further details and background information please see the introduction of this manual.



ULTIMATE TENSION LOAD CAPACITIES - PARAMETERS FOR CALCULATION OF DESIGN STRENGTH

According to ETAG 029 Annex C Method A.

Brick type, density and compressive strength		Notation	Unit	PV45-PRO - Anchor rod				
				M8	M10		M12	M16
Failure of metal part / Pullout failure of anchor / Brick breakout failure / Pullout of one brick								
Solid sand-lime brick $\rho \geq 2.0$ kg/dm³ $f_b \geq 20$ MPa	Characteristic resistance without sleeve Hammer Drilling	N_{Rk} [1]	[kN]	6.0	6.0		7.0	6.0
	Characteristic resistance with sleeve of indicated sizes Hammer Drilling	N_{Rk} [1]	[kN]	5.0	5.0	5.0	-	-
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Solid clay brick $\rho \geq 1.8$ kg/dm³ $f_b \geq 28$ MPa	Characteristic resistance without sleeve Hammer Drilling	N_{Rk} [1]	[kN]	3.0	3.0		2.5	4.5
	Characteristic resistance with sleeve of indicated sizes Hammer Drilling	N_{Rk} [1]	[kN]	3.5	3.5	5.0	-	-
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow sand-lime brick $\rho \geq 1.4$ kg/dm³ $f_b \geq 12$ MPa	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	N_{Rk} [1]	[kN]	3.5	3.0	4.5	3.0	3.0
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow clay brick $\rho \geq 0.9$ kg/dm³ $f_b \geq 12$ MPa	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	N_{Rk} [1]	[kN]	1.5	2.0	3.0	3.5	3.5
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow brick $\rho \geq 1.0$ kg/dm³ $f_b \geq 4$ MPa	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	N_{Rk} [1]	[kN]	0.4	0.4	2.0	0.9	0.75
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Partial safety factor		γ_M [2]	[-]	2.5				
Reduction factor in case of unfilled or not visible vertical joints		α_i	[-]	0.75				

1) $N_{Rk,p} = N_{Rk,b} = N_{Rk,s} = N_{Rk}$; $N_{Rk,pb}$ according to ETAG029, Annex C

2) In absence of other national regulations

Notes: • **Refer to ETA or page 18 for spacing and edge distances (characteristic and minimum) requirements.**
• **The design capacities shall be derived by dividing the above given characteristic resistances by the above given partial safety factor.**
• The icons of bricks shown in the above table represent hollow or solid brick. These icons do not represent the actual profile / type of the bricks.
• Please refer to ETA13-0063 for type, size, strength and other description of bricks.

PDA 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

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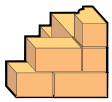
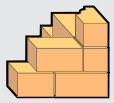
ULTIMATE SHEAR LOAD CAPACITIES - PARAMETERS FOR CALCULATION OF DESIGN STRENGTH

According to ETAG 029 Annex C Method A.

Brick type, density and compressive strength		Notation	Unit	PV45-PRO - Anchor rod				
				M8	M10		M12	M16
Failure of metal part / Local brick failure								
Solid sand-lime brick $\rho \geq 2.0$ kg/dm³ $f_b \geq 20$ MPa 	Characteristic resistance without sleeve Hammer Drilling	V_{Rk} 1)	[kN]	4.0	3.5		5.0	5.0
	Characteristic resistance with sleeve of indicated sizes Hammer Drilling	V_{Rk} 1)	[kN]	5.0	4.0	5.0	-	-
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Solid clay brick $\rho \geq 1.8$ kg/dm³ $f_b \geq 28$ MPa 	Characteristic resistance without sleeve Hammer Drilling	V_{Rk} 1)	[kN]	3.0	3.0		2.5	4.5
	Characteristic resistance with sleeve of indicated sizes Hammer Drilling	V_{Rk} 1)	[kN]	3.5	3.5	4.0	-	-
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow sand-lime brick $\rho \geq 1.4$ kg/dm³ $f_b \geq 12$ MPa 	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	V_{Rk} 1)	[kN]	2.5	2.5	2.5	2.5	2.5
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow clay brick $\rho \geq 0.9$ kg/dm³ $f_b \geq 12$ MPa 	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	V_{Rk} 1)	[kN]	1.5	2.0	2.5	2.5	2.5
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Hollow brick $\rho \geq 1.0$ kg/dm³ $f_b \geq 4$ MPa 	Characteristic resistance with sleeve of indicated sizes Rotary Drilling	V_{Rk} 1)	[kN]	0.4	0.4	2.0	0.9	0.75
		Sleeve Type / Size		SH 12x80	SH 16x85	SH 16x130	SH 20x85	SH 20x85
Partial safety factor		γ_M 2)	[-]	2.5				

Notes:
- **Refer to ETA or page 18 for spacing and edge distances (characteristic and minimum) requirements.**
- **The design capacities shall be derived by dividing the above given characteristic resistances by the above given partial safety factor.**
- The icons of bricks shown in the above table represent hollow or solid brick. These icons do not represent the actual profile / type of the bricks.
- Please refer to ETA13-0063 for type, size, strength and other description of bricks.

Failure of metal part, shear load with lever arm						
			M8	M10	M12	M16
Carbon steel, Characteristic resistance, strength class 4.8	$M^0_{Rk,s}$	[Nm]	15	30	52	133
	γ_{Ms} 4)	-	1.25			
Carbon steel, Characteristic resistance, strength class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	66	166
	γ_{Ms} 4)	-	1.25			
Stainless steel, Characteristic resistance, strength class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233
	γ_{Ms} 4)	-	1.56			

1) $V_{Rk,b} = V_{Rk,s} = V_{Rk}$
2) $V_{Rk,c}$; according to ETAG029, Annex C for solid masonry
3) $V_{Rk,c} = V_{Rk}$ according to ETAG029, Annex C for hollow masonry
4) In absence of other national regulations

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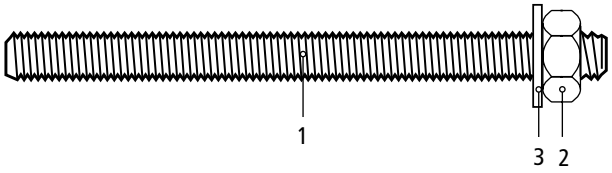
MATERIAL INFORMATION

MATERIAL SPECIFICATIONS - THREADED ROD



Part no.	Designation	Material
Carbon steel 4.8		
1	Anchor rod	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 4.8, R_m = 400 MPa; $R_{p\,0.2}$ = 320 MPa
2	Hexagon nut	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 4
3	Washer	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm
Carbon steel 5.8		
1	Anchor rod	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 5.8, R_m = 500 MPa; $R_{p\,0.2}$ = 400 MPa
2	Hexagon nut	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm; Strength class 5
3	Washer	Steel zinc plated ≥ 5 µm or hot-dip galvanized ≥ 40 µm
Stainless steel A4		
1	Anchor rod	Stainless steel 1.4401 / 1.4571; Strength class 70, R_m = 700 MPa; $R_{p\,0.2}$= 450 MPa
2	Hexagon nut	Stainless steel 1.4401 / 1.4571; Strength class 70
3	Washer	Stainless steel 1.4401 / 1.4571

ORDERING INFORMATION

AC100e and PV45-PRO adhesive

Part no.	Type	Box qty.	Carton qty.
AC100-E-PWR	300ML POLYESTER INJECTION SYSTEM	1	10
PV45PRO-PWR	410ML POLYESTER INJECTION SYSTEM	1	10

PV45-PRO CARTRIDGE

AC100e CARTRIDGE

Mixing nozzles

Part no.	Type	Box qty.
8482-PWR	Adhesive Nozzles for PV45PRO / AC100e / AC100PRO	10
MNEXT-PWR	Mixer Nozzle Extensions (200mm)	10
AEXTN-PWR	Adhesive Extension Nozzle 1.0mt	10


8482-PWR

MNEXT-PWR

Cartridge guns

Part no.	Type	Box qty.	Carton Qty.
CG150SF-PWR	Dispensing Tool for 285/300ml cartridge	1	-
CG380KF2-PWR	Cartridge Gun For 420ml co-axial 10:1 Cartridge	1	10
CGPRO-PWR	4 In 1 Injection Tool	1	10
CGPRO-4-PWR	4-in-1 Multi Pro cartridge Injection Gun	1	10
CGB-420-PWR	Battery Tool For 420ml Cartridge	1	10


CG150SF-PWR


CG380KF2-PWR


CGPRO-PWR


CGPRO-4-PWR


CGB-420-PWR

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Accessories

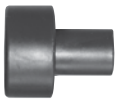
Part no.	Type	Box Qty.
BLOWPUMP-PWR	Blow Pump	1
AWBM16-PWR	SDS-Plus Adhesive Wire Brush 20mm	1
AWBR16-PWR	SDS-Plus Adhesive Wire Brush 22mm	1
AWBM20M24-PWR	SDS-Plus Adhesive Wire Brush 26mm	1
AWBM30-PWR	SDS-Plus Adhesive Wire Brush 34mm	1
AWBM36-PWR	SDS-Plus Adhesive Wire Brush 40mm	1
AWBEXT-PWR	Extension for SDS Adhesive Brush 300mm	1
AWBSDSPLUS-PWR	SDS-Plus Adhesive Brush Adaptor	1
APP18-PWR	Adhesive Piston Plug for 18mm Hole	1
APP20-PWR	Adhesive Piston Plug for 20mm Hole	1
APP24-PWR	Adhesive Piston Plug for 24mm Hole	1
APP28-PWR	Adhesive Piston Plug for 28mm Hole	10
APP35-PWR	Adhesive Piston Plug for 35mm Hole	10
APP40-PWR	Adhesive Piston Plug for 40mm Hole	10

BLOW PUMP

SDS CONNECTION

EXTENSION FOR SDS+ ADHESIVE BRUSH

STEEL BRUSH



PISTON PLUG

Sleeves

Part no.	Type	Hole Dia.	Box qty.
AAS1280-PWR	Plastic Sleeves 12mm x 80mm for M8 Studs	12	
AAS1685-PWR	Plastic Sleeves 16mm x 85mm for M10 Studs	16	
AAS16130-PWR	Plastic Sleeves 16mm x 130mm for M10 Studs	16	
AAS2085-PWR	Plastic Sleeves 20mm x 85mm for M12 and M16 Studs	20	
MS121000-PWR	Steel Mesh Sleeves 11mm x 1000mm for M8 Studs*	12	
MS161000-PWR	Steel Mesh Sleeves 15mm x 1000mm for M10 and M12 Studs*	16	

* ETA listing does not cover these sleeves

PLASTIC SLEEVE

MESH SLEEVE*

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CONTACT INFORMATION

TECHNICAL SUPPORT CONTACT INFORMATION

Australia

Stanley Black & Decker, Inc. ANZ
Level 2, 810 Whitehorse Road, Box Hill, VIC 3128, Australia
T: (03) 8669 5200
F: 1800 080 898

New Zealand

Stanley Black & Decker, Inc. ANZ
39 Business Parade North, East Tamaki, Auckland 2013
T: (09) 265 6714
F: (09) 273 3392

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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.

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Stanley Black & Decker, Inc. ANZ
Level 2, 810 Whitehorse Road
Box Hill, VIC 3128
Australia

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