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RESEARCH REPORT: RR 25864
(CSI # 04 05 19.16)

BASED UPON ICC EVALUATION SERVICE
REPORT NO. ESR-2966

REEVALUATION DUE

DATE: November 1, 2017
Issued Date: December 1, 2015
Code: 2014 LABC

GENERAL APPROVAL – Reevaluation - Powers Power-Stud + SD1 Anchors in Masonry.

DETAILS

The above assemblies and/or products are approved when in compliance with the use, description, design, installation, conditions of approval, and identification of Evaluation Report No. ESR- 2966, reissued December 1, 2015 of the ICC-ES Evaluation Services, LLC. The report, in its entirety, is attached and made part of this general approval.

The parts of Evaluation Report No ESR-2966 marked by the asterisks are deleted or revised by the Los Angeles Building Department from this approval.

The approval is subject to the following conditions:

1. The values shown in this report shall not be used in repair, retrofit and new construction of masonry buildings in connection with wood diaphragm (in tension).
2. A 25% reduction in all allowable loads specified in the research report shall be taken in hold-down devices per Section 2305.5 of the 2014 Los Angeles City Building Code.

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Powers Fasteners, Inc.

RE: Powers Power-Stud + SD1 Anchors in Masonry

3. The allowable and strength design values listed in the attached report and tables are for the fasteners only and do not include the supporting members. The supporting members shall be checked for structural adequacy.
4. Special inspection in accordance with Section 1704 of the 2014 Los Angeles City Building Code shall be provided for anchor installations.
5. The anchors shall not be used in cracked masonry.
6. Calculations demonstrating that the applied loads or factored loads are less than the allowable load values or design strength level values respectively, described in this report shall be submitted to the plan check Engineer at the time of permit application. The calculations shall be prepared by a Civil or Structural Engineer registered in the State of California.

EXCEPTION: Anchors used for the installation of mechanical, plumbing and electrical equipment may be designed and detailed on a plan prepared by an engineer licensed by the state of California.

7. The grout filled concrete masonry shall attain its minimum design strength prior to installation of the anchors.
8. The anchors shall be identified by labels on the packaging indicating the manufacturer's name and product designation.
9. The anchors shall be installed as per manufacturer's instructions except otherwise stated in this report. Copies of the installation instructions shall be available at each job site.

DISCUSSION

The report is in compliance with the 2014 City of Los Angeles Building Code.

The approval is based on load tests in accordance with ICC-ES Acceptance Criteria (AC01).

This general approval will remain effective provided the Evaluation Report is maintained valid and unrevised with the issuing organization. Any revisions to the report must be submitted to this Department, with appropriate fee, for review in order to continue the approval of the revised report.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

Powers Fasteners, Inc.
RE: Powers Power-Stud + SD1 Anchors in Masonry

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this approval have been met in the project in which it is to be used.

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EB
RR25864
R11/23/15
2107

Attachments: ICC ES Evaluation Report No. ESR-2966 (4 pages)

ICC-ES Evaluation Report

ESR-2966

Reissued December 2015

This report is subject to renewal December 2016.

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DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors
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EVALUATION SUBJECT:
**POWERS POWER-STUD+ SD1 EXPANSION ANCHORS
IN MASONRY**
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1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- * ■ 2012, 2009 and ~~2006~~ *International Residential Code*® (IRC)
- * ■ ~~2013 Abu Dhabi International Building Code (ADIBC)†~~

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Property evaluated:

Structural

2.0 USES

The Powers Power-Stud+ SD1 expansion anchors are used for anchoring building components and structural connections in predrilled holes to grout-filled uncracked concrete masonry units, to resist static, wind and seismic tension and shear loads. The anchors are alternatives to the cast-in-place anchors described in Section 2.1.4 of TMS 402/ ACI 530/ ASCE 5 as referenced in Section 2107 of the IBC. The anchors may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION
3.1 Power-Stud+ SD1:

Power-Stud+ SD1 anchors are torque-controlled, mechanical expansion anchors comprised of an anchor body, expansion wedge (clip), washer and hex nut. Product names for the report holder and for the additional listees are presented in Table 1 of this report. Available diameters recognized for use in masonry are $\frac{3}{8}$ inch, $\frac{1}{2}$ inch, and $\frac{5}{8}$ inch (9.5 mm, 12.7 mm and 15.9 mm). The anchor body and expansion clip are manufactured from medium carbon steel complying with requirements set forth in the approved quality documentation, and have minimum 0.0002-inch-thick (5 μ m) zinc plating in accordance with ASTM B633, SC1, Type III. The washers comply with ASTM F844. The hex nuts comply with ASTM A563, Grade A. The Power-Stud+ SD1 expansion anchor is illustrated in Figure 1.

The anchor body is comprised of a high-strength threaded rod at one end and a tapered mandrel at the other end. The tapered mandrel is enclosed by a three-section expansion clip that freely moves around the mandrel. The expansion clip movement is restrained by the mandrel taper and by a collar. The anchors are installed in a predrilled hole with a hammer. When torque is applied to the nut of the installed anchor on the threaded end of the anchor body, the mandrel at the other end of the anchor is drawn into the expansion clip, forcing it outward into the sides of the predrilled hole in the base material.

3.2 Grout-filled Concrete Masonry:

The compressive strength of masonry, f'_m , at 28 days must be a minimum of 1,500 psi (10.3 MPa). Grout-filled masonry must be constructed from the following materials:

3.2.1 Concrete Masonry Units: Grout-filled concrete masonry walls must be constructed from minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units (CMUs) conforming to ASTM C90

(IBC). The minimum allowable nominal size of the CMU must be 6 inches wide by 8 inches high by 16 inches long (i.e. 6x8x16).

3.2.2 Grout: The masonry units must be fully grouted with grout complying with Section 2103.13 of the 2012 IBC; Section 2103.12 of the 2009 and 2006 IBC; or Section R609.1.1 of the IRC and having a minimum compressive strength as indicated in these code sections at 28 days.

3.2.3 Mortar: Mortar must be Type N, S or M, prepared in accordance with Section 2103.9 of the 2012 IBC; Section 2103.8 of the 2009 and 2006 IBC; or Section R607 of the IRC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Allowable Stress Design (ASD):

The allowable load values for anchors described in this report are based on allowable stress design under the IBC. Allowable tension and shear loads for installation in uncracked grout-filled concrete masonry are noted in Table 4.

Allowable loads are given in Table 4 for anchors installed into grouted masonry wall faces at a critical spacing distance, s_{cr} , between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum spacing distance, s_{min} , of 8 times the anchor diameter provided the allowable tension loads are multiplied by a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.

The allowable loads for anchors installed in grout-filled concrete masonry subjected to combined tension and shear forces must be determined by the following equation:

$$\left(\frac{P_s}{P_t}\right)^{\frac{5}{3}} + \left(\frac{V_s}{V_t}\right)^{\frac{5}{3}} \leq 1 \quad (\text{Eq-1})$$

where:

P_s = Applied service tension load.

P_t = Allowable service tension load.

V_s = Applied service shear load.

V_t = Allowable service shear load.

4.2 Installation:

The Power-Stud+ SD1 expansion anchors must be installed in accordance with the manufacturer's published installation instructions and this report. Anchor locations must comply with this report and the plans and specifications approved by the code official. Installation parameters are provided in Table 2 and Figure 2. Anchors must be installed in holes drilled into the concrete using carbide-tipped masonry drill bits complying with ANSI B212.15-1994. The nominal drill bit diameter must be equal to that of the anchor. The dust and debris must be removed from the predrilled hole using a hand pump, compressed air or vacuum to remove loose particles left from drilling. The anchor must be hammered into the predrilled hole until the proper nominal embedment depth is achieved. The nut must be tightened against the washer until the torque values specified in Table 2 are achieved.

4.3 Special Inspection:

Special inspection under the IBC and IRC must be provided in accordance with Sections 1704 and 1705 of the IBC. The special inspector must make periodic inspections during anchor installation to verify anchor type,

anchor dimensions, drill bit size, masonry type, masonry thickness, mortar type, anchor location, anchor embedment and adherence to the manufacturer's printed installation instructions.

5.0 CONDITIONS OF USE

The Powers Power-Stud+ SD1 expansion anchors described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1** The anchors must be installed in accordance with the manufacturer's published installation instructions and this report. In case of conflict, this report governs.
- 5.2** Anchor sizes, dimensions, and minimum embedment depths are as set forth in this report.
- 5.3** Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4** Design of anchors installed in grout-filled uncracked concrete masonry to resist static, wind and seismic load applications must be in accordance with Section 4.1 of this report.
- 5.5** When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for wind or earthquake loading. When using the alternative basic load combinations in 2009 and 2006 IBC Section 1605.3.2 that include wind or seismic loads, the allowable shear and tension loads for anchors are permitted to be increased by $33\frac{1}{3}$ percent (unless noted by a percentage in brackets [%] in Table 4). Alternatively, the basic load combinations may be reduced by a factor of 0.75 (unless noted by a fraction in brackets {0.xx} in Table 4) when using IBC Section 1605.3.2. For the 2012 IBC, the allowable loads or load combinations may not be adjusted.
- 5.6** Since an ICC-ES acceptance criteria for evaluating data to determine the performance of expansion anchors subjected to fatigue and shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.
- 5.7** Where not otherwise prohibited by the code, anchors are permitted for installation in fire-resistance-rated construction provided at least one of the following conditions is fulfilled:
 - Anchors are used to resist wind or seismic forces only.
 - Anchors that support fire-resistance-rated construction or gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
 - Anchors are used to support nonstructural elements.
- 5.8** Since an ICC-ES acceptance criteria for evaluating data to determine the performance of expansion anchors in cracked masonry is unavailable at this

time, the use of anchors must be limited to installation in uncracked grout-filled concrete masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

- 5.9 Use of carbon steel anchors is limited to dry, interior locations.
- 5.10 Special inspection must be provided in accordance with Section 4.3 of this report, where applicable.
- 5.11 Anchors are manufactured under an approved quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Expansion Anchors in Masonry Elements (AC01), dated May 2012, for use in grout-filled uncracked concrete masonry; including optional seismic tests in tension and shear.

6.2 Quality control documentation.

7.0 IDENTIFICATION

The Powers Power-Stud+ SD1 expansion anchors are identified by dimensional characteristics and packaging. A length letter code, visible after installation, is stamped on each anchor on the exposed threaded stud end along with the number “1”. Table 3 summarizes the length code identification system. A plus sign (+) is also marked with the number “1” on all anchors recognized in this report. Packages are identified with the product name, type and size, the company name as set forth in Table 1 of this report, and the evaluation report number (ICC-ES ESR-2966).

TABLE 1—CROSS REFERENCE OF COMPANY NAMES TO PRODUCT NAMES

COMPANY NAME	PRODUCT NAME
Powers Fasteners, Inc.	Power-Stud+ SD1
Cooper B-Line	B-Line Power-Stud+ SD1
DEWALT (Stanley Black and Decker)	Power-Stud+ SD1
L. H. Dottie Co.	Dottie Wedge SD1
The Hillman Group	Hillman Power-Stud+ SD1

TABLE 2—POWER-STUD+ SD1 ANCHOR INSTALLATION SPECIFICATIONS IN GROUT-FILLED CONCRETE MASONRY

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter		
			³ / ₈ inch	¹ / ₂ inch	⁵ / ₈ inch
Anchor diameter	d_o	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	⁷ / ₁₆ (11.1)	⁹ / ₁₆ (14.3)	¹¹ / ₁₆ (17.5)
Nominal drill bit diameter	d_{bit}	in.	³ / ₈ ANSI	¹ / ₂ ANSI	⁵ / ₈ ANSI
Installation torque	T_{inst}	ft.-lbf. (N-m)	20 (27)	40 (54)	50 (68)
Torque wrench/socket size	-	in.	⁹ / ₁₆	³ / ₄	¹⁵ / ₁₆
Nut height	-	ln.	²¹ / ₆₄	⁷ / ₁₆	³⁵ / ₆₄

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

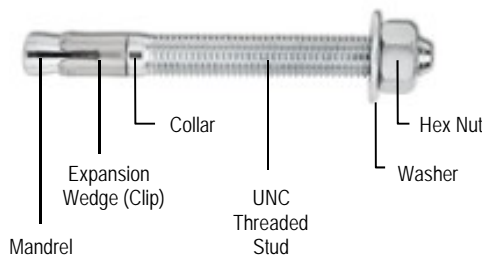


FIGURE 1—POWER-STUD+ SD1 ANCHOR ASSEMBLY

TABLE 3—POWER-STUD+ SD1 ANCHOR LENGTH CODE IDENTIFICATION SYSTEM

Length ID marking on threaded stud head		A	B	C	D	E	F	G	H	I
Overall anchor length, (inches)	From	1 ¹ / ₂	2	2 ¹ / ₂	3	3 ¹ / ₂	4	4 ¹ / ₂	5	5 ¹ / ₂
	Up to but not including	2	2 ¹ / ₂	3	3 ¹ / ₂	4	4 ¹ / ₂	5	5 ¹ / ₂	6
Length ID marking on threaded stud head (cont.)		J	K	L	M	N	O	P	Q	R
Overall anchor length, (inches)	From	6	6 ¹ / ₂	7	7 ¹ / ₂	8	8 ¹ / ₂	9	9 ¹ / ₂	10
	Up to but not including	6 ¹ / ₂	7	7 ¹ / ₂	8	8 ¹ / ₂	9	9 ¹ / ₂	10	11

TABLE 4—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR POWER-STUD+ SD1 EXPANSION ANCHORS INSTALLED IN GROUT-FILLED CONCRETE MASONRY^{1,2,3,6}

ANCHOR INSTALLED INTO GROUTED MASONRY WALL FACES ⁴						
ANCHOR DIAMETER d_o (inch)	MIN. EMBED. h_{nom} (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DIST. (inches)	TENSION LOAD (pounds)	SHEAR LOAD (pounds)	
				IBC / IRC	Direction of Loading	IBC / IRC
$3/8$	$2^{3/8}$	4	4	445	Any	595
		4	4	530	Any	560
$1/2$	$2^{1/2}$	4	12	530	to Edge	805 [14%] {0.88}
		12	4		to End	
$5/8$	$3^{3/8}$	4	4	705	Any	1,065 [14%] {0.88}
		4	12	705	to Edge	
		12	4		to End	
ANCHOR INSTALLED INTO TOPS OF GROUTED MASONRY WALLS ⁵						
ANCHOR DIAMETER d_o (inch)	MIN. EMBED. h_{nom} (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DIST. (inches)	TENSION LOAD (pounds)	SHEAR LOAD (pounds)	
				IBC / IRC	Direction of Loading	IBC / IRC
$3/8$	$2^{3/8}$	$1^{3/4}$	12	295	⊥ to Edge	230
					to Edge	485
$1/2$	$2^{1/2}$	$2^{1/4}$	12	445	Any	230
	5	$2^{1/4}$	12	685	⊥ to Edge	280
$5/8$	$3^{3/8}$	$2^{1/4}$	12	765	to Edge	565
	$6^{1/4}$	$2^{1/4}$	12	765	Any	230
					⊥ to Edge	340
					to Edge	705

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

¹Tabulated load values are for anchors installed in minimum 6-inch-wide (152 mm) grout-filled concrete masonry units described in Section 3.2 of this report. If the specified compressive strength of the masonry, f'_m , is minimum 2,000 psi (13.8 MPa) the tabulated values may be increased by 20 percent. See Figure 2 for permitted anchor locations.

²The embedment depth, h_{nom} , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor prior to tightening.

³When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for wind or earthquake loading. When using the alternative basic load combinations in 2009 and 2006 IBC Section 1605.3.2 that include wind or seismic loads, the allowable shear and tension loads for anchors are permitted to be increased by 33 $\frac{1}{3}$ percent (unless noted by a percentage in brackets [%] in the table). Alternatively, the basic load combinations may be reduced by a factor of 0.75 (unless noted by a fraction in brackets {0.xx} in the table) when using IBC Section 1605.3.2. For the 2012 IBC, the allowable loads or load combinations may not be adjusted.

⁴The tabulated values are applicable for anchors installed into grouted masonry wall faces at a critical spacing distance, s_{cr} , between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum distance, s_{min} , of 8 times the anchor diameter but provided the allowable tension loads are multiplied by a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.

⁵Anchor installations into tops of grouted masonry walls are limited to one per masonry cell.

⁶Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than $1^{3/8}$ inches from head joints. The minimum edge and end distances must also be maintained.

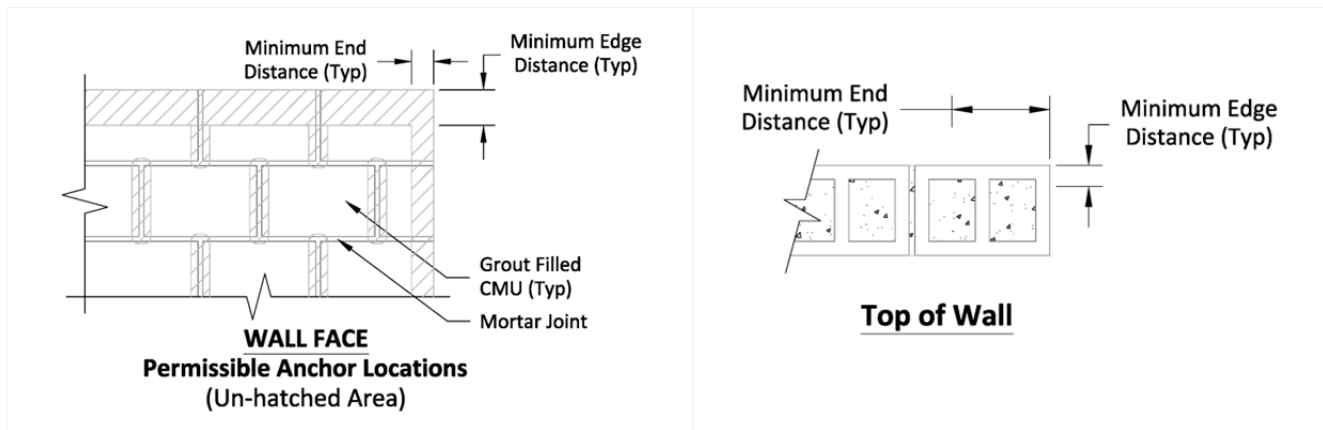


FIGURE 2—POWER-STUD+ SD1 EXPANSION ANCHORS INSTALLED INTO GROUT-FILLED CONCRETE MASONRY