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ESR-2966

Reissued 12/2016
This report is subject to renewal 12/2017.

DIVISION: 04 00 00—MASONRY
SECTION: 04 05 19.16—MASONRY ANCHORS

REPORT HOLDER:

DEWALT

**701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286**

EVALUATION SUBJECT:

POWER-STUD®+ SD1 EXPANSION ANCHORS IN MASONRY (DEWALT / POWERS)



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Section: 04 05 19.16—Masonry Anchors

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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2015, 2012, 2009 and 2006 *International Residential Code*® (IRC)

Property evaluated:

Structural

2.0 USES

The 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 8.1.3 (2013 edition) or Section 2.1.4 (2011, 2008, 2005 editions) of TMS 402/ACI 530/ASCE 5 as referenced in Section 2107.1 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 ³/₈ inch, ¹/₂ inch, and 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 μm) 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 2103.3 of the 2015 IBC; Section 2103.13 of the 2012 IBC; Section 2103.12 of the 2009 and 2006 IBC; or Section R606 of the 2015 IRC; Section R609.1.1 of the 2012, 2009 and 2006 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 of the IBC; or Section R606.2.11 of the 2015 IRC; Section R607.1 of the 2012, 2009 and 2006 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 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 33¹/₃ 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 2015 and 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 November 2015, for use in grout-filled uncracked concrete masonry; including optional seismic tests in tension and shear.

7.0 IDENTIFICATION

The 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
DEWALT	Power-Stud+ SD1
Powers Fasteners	Power-Stud+ SD1
Cooper B-Line	B-Line 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.

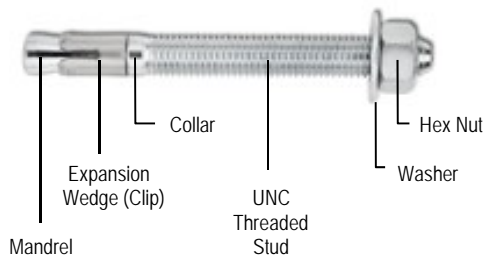


FIGURE 1—POWER-STUD+ SD1 ANCHOR ASSEMBLY

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
$1/2$	$2^{1/2}$	4	4	530	Any	560
		4	12	530	II to Edge	805 [14%] {0.88}
		12	4		II to End	
$5/8$	$3^{3/8}$	4	4	705	Any	685
		4	12	705	II to Edge	1,065 [14%] {0.88}
		12	4		II 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
					II 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	II to Edge	565
					Any	230
					⊥ to Edge	340
$5/8$	$6^{1/4}$	$2^{1/4}$	12	765	II 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 $33^{1/3}$ 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 2015 and 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.

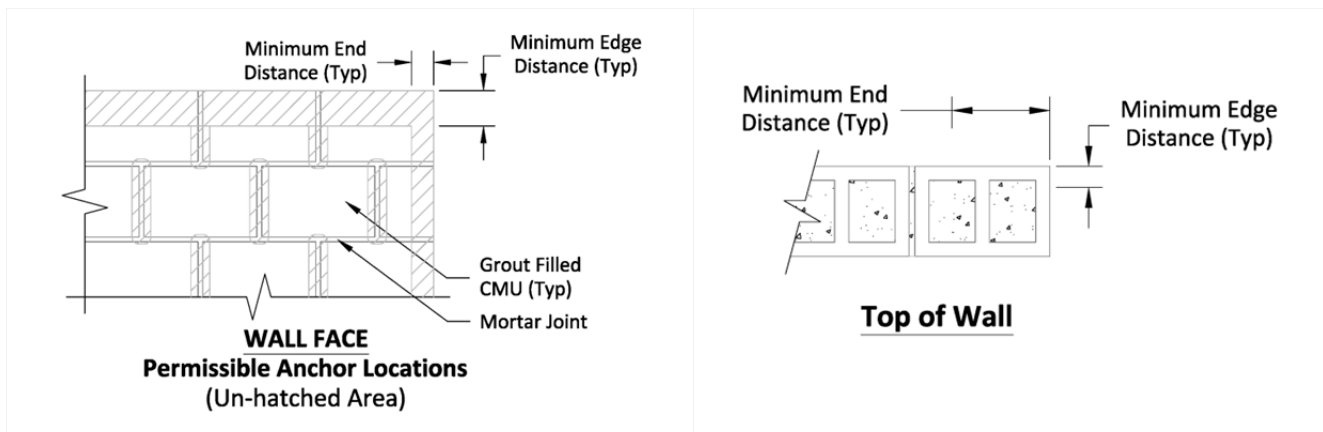


FIGURE 2—POWER-STUD+ SD1 EXPANSION ANCHORS INSTALLED INTO GROUT-FILLED CONCRETE MASONRY