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# ICC-ES Evaluation Report

# ESR-2966

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**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)**

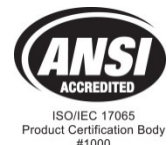


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**ESR-2966**

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**DIVISION: 04 00 00—MASONRY**  
**Section: 04 05 19.16—Masonry Anchors**

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**EVALUATION SUBJECT:**

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

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HIGHLAND, ILLINOIS 62249

**THE HILLMAN GROUP**  
10590 HAMILTON AVENUE  
CINCINNATI, OHIO 45231

**1.0 EVALUATION SCOPE**

**Compliance with the following codes:**

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

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see [ESR-2966 LABC and LARC Supplement](#).

**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 and 2008 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 the following table.

COMPANY NAME	PRODUCT NAME
DEWALT	Power-Stud+ SD1
Powers Fasteners	Power-Stud+ SD1
Cooper B-Line	B-Line Power-Stud+ SD1
The Hillman Group	Hillman Power-Stud+ SD1

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 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 2.

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 IBC; or Section R606 of the 2015 IRC; Section R609.1.1 of the 2012 and 2009 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 and 2009 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 3.

Allowable loads are given in Table 3 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 1 and Figure 3. 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 1 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 The grout and mortar shall have attained its minimum design strength prior to the installation of the anchors.
- 5.6 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 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 3). 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 3) when using IBC Section 1605.3.2. For the 2015 and 2012 IBC, the allowable loads or load combinations may not be adjusted.
- 5.7 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.
- 5.8 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.
- 5.9 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.
- 5.10 Use of carbon steel anchors is limited to dry, interior locations.
- 5.11 Special inspection must be provided in accordance with Section 4.3 of this report, where applicable.
- 5.12 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 2 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 Section 3.1 of this report, and the evaluation report number (ESR-2966).

DeWALT Dust Removal Drilling Systems with HEPA Dust Extractor Options		
Tool	Accessories and Shrouds	HEPA Dust Extractor
<b>SDS-Max Drills</b>		
 Cordless	 SDS-Max Hollow Drill Bit	 Dust Extractor
 Corded	 SDS-Max With Shroud	
<b>SDS-Plus Drills</b>		
 Cordless	 SDS-Plus Bit	 Cordless Dust Extractor
	 Corded	 SDS-Plus Hollow Drill Bit
 SDS-Plus With Telescope		
 SDS-Plus With Shroud		

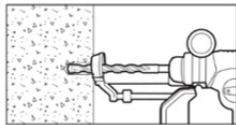
The DEWALT drilling systems shown above collect and remove dust with a HEPA dust extractor during the hole drilling operation in dry base materials using hammer-drills. See manufacturer's printed installation instructions.

**FIGURE A—EXAMPLES OF DEWALT DUST REMOVAL DRILLING SYSTEMS WITH HEPA DUST EXTRACTORS FOR ILLUSTRATION**

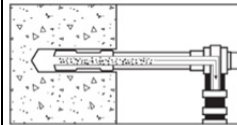
TABLE 1—POWER-STUD+ SD1 ANCHOR INSTALLATION SPECIFICATIONS IN GROUT-FILLED CONCRETE MASONRY

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter		
			<sup>3</sup> / <sub>8</sub> inch	<sup>1</sup> / <sub>2</sub> inch	<sup>5</sup> / <sub>8</sub> 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)	<sup>7</sup> / <sub>16</sub> (11.1)	<sup>9</sup> / <sub>16</sub> (14.3)	<sup>11</sup> / <sub>16</sub> (17.5)
Nominal drill bit diameter	$d_{bit}$	in.	<sup>3</sup> / <sub>8</sub> ANSI	<sup>1</sup> / <sub>2</sub> ANSI	<sup>5</sup> / <sub>8</sub> ANSI
Installation torque	$T_{inst}$	ft.-lbf. (N-m)	20 (27)	40 (54)	50 (68)
Torque wrench/socket size	-	in.	<sup>9</sup> / <sub>16</sub>	<sup>3</sup> / <sub>4</sub>	<sup>15</sup> / <sub>16</sub>
Nut height	-	In.	<sup>21</sup> / <sub>64</sub>	<sup>7</sup> / <sub>16</sub>	<sup>35</sup> / <sub>64</sub>

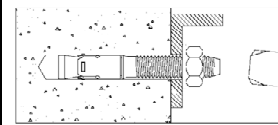
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.



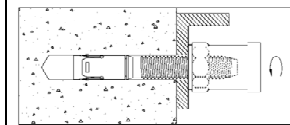
1.) Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



2.) Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



3.) Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth,  $h_{nom}$ .



4.) Tighten the anchor with a torque wrench by applying the required installation torque,  $T_{inst}$ . See Table 1. Note: The threaded stud draws up during the tightening of the nut; the expansion clip (wedge) remains in original position.

FIGURE 1—POWER-STUD+ SD1 INSTALLATION INSTRUCTIONS

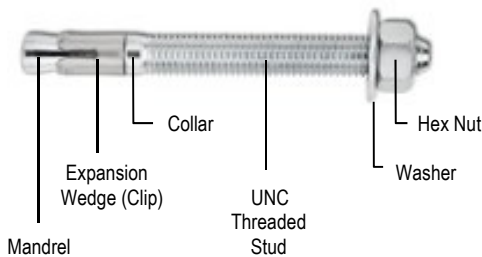


FIGURE 2—POWER-STUD+ SD1 ANCHOR ASSEMBLY

TABLE 2—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 <sup>1</sup> / <sub>2</sub>	2	2 <sup>1</sup> / <sub>2</sub>	3	3 <sup>1</sup> / <sub>2</sub>	4	4 <sup>1</sup> / <sub>2</sub>	5	5 <sup>1</sup> / <sub>2</sub>
	Up to but not including	2	2 <sup>1</sup> / <sub>2</sub>	3	3 <sup>1</sup> / <sub>2</sub>	4	4 <sup>1</sup> / <sub>2</sub>	5	5 <sup>1</sup> / <sub>2</sub>	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 <sup>1</sup> / <sub>2</sub>	7	7 <sup>1</sup> / <sub>2</sub>	8	8 <sup>1</sup> / <sub>2</sub>	9	9 <sup>1</sup> / <sub>2</sub>	10
	Up to but not including	6 <sup>1</sup> / <sub>2</sub>	7	7 <sup>1</sup> / <sub>2</sub>	8	8 <sup>1</sup> / <sub>2</sub>	9	9 <sup>1</sup> / <sub>2</sub>	10	11

**TABLE 3—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR POWER-STUD+ SD1 EXPANSION ANCHORS INSTALLED IN GROUT-FILLED CONCRETE MASONRY<sup>1,2,3,6</sup>**

ANCHOR INSTALLED INTO GROUTED MASONRY WALL FACES <sup>4</sup>						
ANCHOR DIAMETER $d_a$ (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	
		4	4	705	Any	
$5/8$	$3^{3/8}$	4	12	705	∥ to Edge	1,065 [14%] {0.88}
		12	4		∥ to End	
		4	4	705	Any	
ANCHOR INSTALLED INTO TOPS OF GROUTED MASONRY WALLS <sup>5</sup>						
ANCHOR DIAMETER $d_a$ (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
					∥ to Edge	565
$5/8$	$3^{3/8}$	$2^{1/4}$	12	765	Any	230
	$6^{1/4}$	$2^{1/4}$	12	765	⊥ to Edge	340
					∥ to Edge	705

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

<sup>1</sup>Tabulated 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 3 for permitted anchor locations.

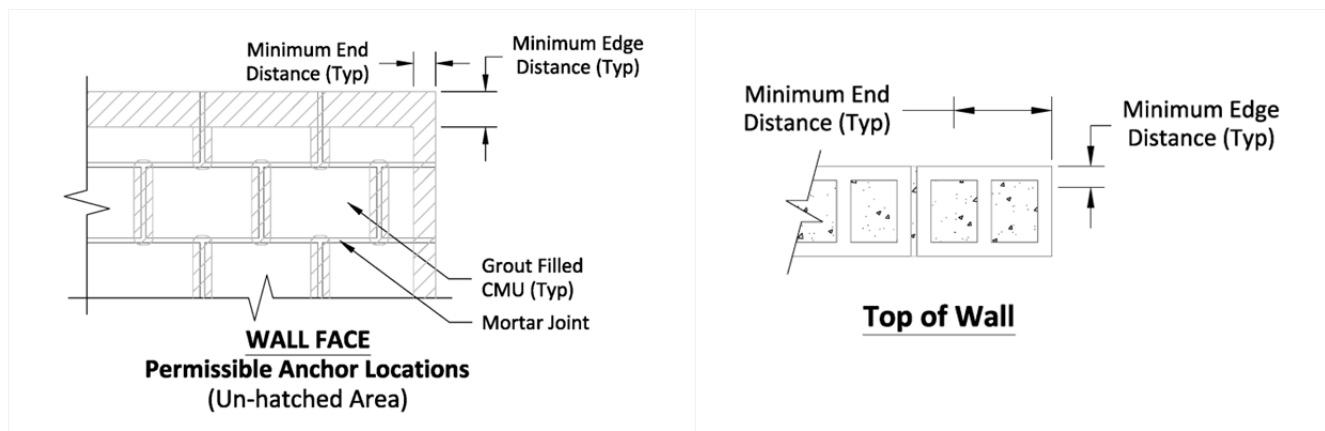
<sup>2</sup>The embedment depth,  $h_{nom}$ , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor prior to tightening.

<sup>3</sup>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 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 2015 and 2012 IBC, the allowable loads or load combinations may not be adjusted.

<sup>4</sup>The 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.

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

<sup>6</sup>Anchors 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 3—POWER-STUD+ SD1 EXPANSION ANCHORS INSTALLED INTO GROUT-FILLED CONCRETE MASONRY**

## ICC-ES Evaluation Report

## ESR-2966 LABC and LARC Supplement

Issued January 2018

This report is subject to renewal December 2018.

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Section: 04 05 19.16—Masonry Anchors

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### EVALUATION SUBJECT:

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

### 1.0 REPORT PURPOSE AND SCOPE

#### Purpose:

The purpose of this evaluation report supplement is to indicate that the Power-Stud+ SD1 Expansion Anchors in fully grouted concrete masonry, described in ICC-ES master evaluation report [ESR-2966](#), have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

#### Applicable code editions:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

### 2.0 CONCLUSIONS

The Power-Stud+ SD1 Expansion Anchors in fully grouted concrete masonry, described in Sections 2.0 through 7.0 of the master evaluation report [ESR-2966](#), comply with the LABC Chapter 21, and the LARC, and are subjected to the conditions of use described in this report.

### 3.0 CONDITIONS OF USE

The Power-Stud+ SD1 Expansion Anchors described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the master evaluation report [ESR-2966](#).
- The design, installation, conditions of use and identification of the anchors are in accordance with the 2015 *International Building Code*® (2015 IBC) provisions noted in the master evaluation report [ESR-2966](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable design values listed in the master evaluation report and tables are for the connection of the anchors to the masonry. The connection between the anchors and the connected members shall be checked for capacity (which may govern).
- Use of the anchors as out-of-plane wall anchorage for horizontal flexible diaphragm to resist tension loads is beyond the scope of this LABC and LARC Supplement.

This supplement expires concurrently with the master report, reissued December 2017 and revised January 2018.