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# ESR-1678

Reissued 03/2017  
This report is subject to renewal 03/2018.

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

**REPORT HOLDER:**

**DEWALT**

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

**EVALUATION SUBJECT:**

**WEDGE-BOLT+ SCREW ANCHORS IN MASONRY (DEWALT / POWERS)**



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# ICC-ES Evaluation Report

**ESR-1678**

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**Section: 04 05 19.16—Masonry Anchors**

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**EVALUATION SUBJECT:**

**WEDGE-BOLT+ SCREW ANCHORS IN MASONRY  
(DEWALT / POWERS)**

**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 Wedge-Bolt+ screw anchors are used to resist static, wind, and seismic tension and shear loads in fully grouted concrete masonry unit (CMU) masonry walls.

The screw anchors are alternatives to cast-in-place anchors described in Section 8.1.3 (2013 edition), or 2.1.4 (2011, 2008 or 2005 edition) of TMS 402/ACI 530/ ASCE 5 as referenced in Section 2107.1 of the IBC. The screw anchors may also be used under the IRC where an engineered design is submitted in accordance with Section R301.1.3.

**3.0 DESCRIPTION**

**3.1 Wedge-Bolt+ Screw Anchors:**

The screw anchors are manufactured from case-hardened, low-carbon steel with a minimum ultimate tensile strength of 100 ksi (990 N/mm<sup>2</sup>). The anchors are formed with a

dual lead thread and a chamfered tip, and have minimum 0.0002-inch (5 μm) zinc plating in accordance with ASTM B633, or mechanically galvanized in accordance with ASTM B695, Class 55. The Wedge-Bolt+ anchors are available in hex head styles. The anchors are available in nominal diameters of 1/4, 3/8, 1/2, 5/8 and 3/4 inch (6.4 mm, 9.5 mm, 12.7 mm, 15.9 mm and 19.1 mm), and in various lengths. Figure 2 illustrates Wedge-Bolt+ screw anchors.

**3.2 Fully grouted CMU Masonry:**

Fully grouted CMU masonry must comply with Chapter 21 of the IBC. 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 (CMUs):** Concrete Masonry Units must be minimum Grade N, Type II, concrete masonry units (CMUs) conforming to ASTM C90 (IBC). The minimum nominal size of the CMU's must be 6 inches (152 mm) wide by 8 inches (203 mm) high by 16 inches long (406 mm).

**3.2.2 Grout:** The masonry units must be fully grouted with grout complying with IBC Section 2103.3 (2015 IBC), 2103.13 (2012 IBC), IBC Section 2103.12 (2009 and 2006 IBC), or IRC Section R606 (2015 IRC), R609.1.1 (2012, 2009 or 2006), as applicable and having a minimum compressive strength in accordance with ACTM C1019 of 2,000 psi (13.8 MPa) at 28 days.

**3.2.3 Mortar:** Mortar must be Types M, S or N prepared in accordance with IBC Section 2103, or Section R606.2.11 (2015), R607.1 (2012, 2009 and 2006), as applicable.

**4.0 DESIGN AND INSTALLATION**

**4.1 Allowable Stress Design:**

**4.1.1 Design of Anchors Installed in Fully Grouted CMU Masonry:** 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 fully grouted CMU masonry are noted in Tables 2, 3 and 4.

The allowable loads for anchors installed in fully grouted CMU masonry subjected to combined tension and shear forces must be determined by the following equation:

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

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.

#### 4.1.2 Requirements for Minimum Spacing and Minimum Edge:

The minimum spacing between anchors must be 16 times the screw anchor diameter. The minimum edge distance between the anchor and the edge of the concrete masonry wall must be as set forth in Tables 2, 3 and 4, of this report. For anchor location details, see Figure 4. No load reduction factors are required for anchors installed at the minimum edge distance,  $c_{min}$ , or minimum spacing distance,  $s_{min}$ , as set forth in Tables 2, 3 and 4.

#### 4.2 Installation:

Anchors must be installed in accordance with this report and the manufacturer's printed installation instructions (MPII) depicted in Figure 3 of this report. In the event of a conflict between the instructions in this report and the manufacturer's instructions, this report governs. Anchor locations must comply with the approved plans and specifications. The anchors must not be installed until the base material has reached its minimum designated compressive strength. The hole must be drilled to the specified nominal embedment depth plus a minimum of  $\frac{1}{4}$  inch (6.35 mm). Dust and other deleterious matter must be removed using hand pump, compressed air or vacuum before anchor installation. The drill bit size (Wedge-bit), hole diameter, embedment depth, spacing, edge distance and base material must comply with the requirements of this report. Installation parameters must be in accordance with Tables 2, 3, and 4 and Figures 1 and 4.

#### 4.3 Special Inspections:

Special inspection must be in accordance with Section 1704 and 1705 of the IBC. For anchors installed under special inspection, the following items must be inspected: fastener type and dimensions, masonry type, masonry compressive strength, drill bit size, fastener spacing, edge distances and fastener embedment (as applicable). The special inspector must verify that anchor installation was in compliance with this evaluation report and in accordance with the manufacturer's published installation instructions. Installations in grout-filled concrete masonry without special inspection are not permitted under the IBC or the IRC. Under the IBC, the additional requirements as set forth in Section 1705 or 1706 must be observed.

### 5.0 CONDITIONS OF USE

The Wedge-Bolt+ Screw Anchors described in this report are suitable alternatives to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The anchors must be identified and installed in accordance with this report and the manufacturer's instructions. In the event of a conflict between the instructions in this report and the manufacturer's instructions, this report must govern.
- 5.2 Wedge-Bolt+ anchor sizes, dimensions, and allowable loads must be as set forth in this report.
- 5.3 Anchors may be used to resist short-term loading due to wind or seismic forces, subject to the conditions of this report. Anchors resisting dead, live, seismic or wind load in grout-filled concrete masonry must be designed in accordance with Section 4.1 of this report.
- 5.4 When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for seismic or wind loading. When using the alternative basic load combinations in 2009 and 2006 IBC Section 1605.3.2 that include seismic or wind loads, the allowable shear and tension

loads for anchors are permitted to be increased by  $33\frac{1}{3}$  percent, or the alternative basic load combinations may be reduced by a factor of 0.75. For the 2015 and 2012 IBC, the allowable loads or load combinations may not be adjusted.

- 5.5 Anchors must be installed in holes predrilled in substrates described in this report, using Wedge-bits complying with Table 1 of this report.
  - 5.6 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official for approval. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is being constructed.
  - 5.7 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of screw 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 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 the performance of screw anchors in cracked masonry is unavailable at this time, the use of screw anchors is limited to installation in uncracked masonry. Cracking occurs when  $f_t > f_r$  due to service loads or deformations.
  - 5.10 Special inspection, when required, must be provided in accordance with Section 4.3 of this report.
  - 5.11 Use of carbon steel anchors with zinc plating in accordance with ASTM B633 as described in Section 3.1 of this report is limited to dry, interior locations. Use of anchors in an interior damp environment must have mechanical zinc plating in accordance with ASTM B695, Class 55.
  - 5.12 Anchors in contact with preservative-treated and fire-retardant-treated wood must comply with ASTM B695, Class 55. Exception: Anchors with a diameter of  $\frac{1}{2}$  inch (12.7 mm) or greater under the IRC.
  - 5.13 The Wedge-Bolt+ anchors are manufactured under a quality control program with inspections by ICC-ES.
- ### 6.0 EVIDENCE SUBMITTED
- Data in accordance with the ICC-ES Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry (AC106), dated November 2015, including reports on optional seismic tests; and quality control documentation.
- ### 7.0 IDENTIFICATION
- The screw anchors must be identified in the field by labels on the packaging bearing the company name, the product name (Wedge-Bolt+), the anchor diameter and length, and the evaluation report number (ESR-1678). In addition, the anchor diameter and length identification is stamped on the head of each hex-head screw anchor.

TABLE 1—DRILL BIT SIZES AND MINIMUM FIXTURE CLEARANCE HOLE DIAMETERS

ANCHOR DIAMETER, $d_o$ (inch)	NOMINAL DRILL BIT DIAMETER, $d_{bit}$ (inch)	WEDGE-BOLT+ SCREW ANCHORS	
		Wedge-bit Tolerance Range (inch)	Minimum Clearance Hole Diameter <sup>1</sup> (inch)
1/4	1/4	0.255 – 0.259	5/16
3/8	3/8	0.385 – 0.389	7/16
1/2	1/2	0.490 – 0.495	9/16
5/8	5/8	0.600 – 0.605	11/16
3/4	3/4	0.720 – 0.725	13/16

For SI: 1 inch = 25.4 mm.

<sup>1</sup>Where applicable these dimensions are to be used for anchor installations through a steel or structural member.

TABLE 2—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR WEDGE-BOLT+ SCREW ANCHORS INSTALLED THROUGH FACE SHELL INTO GROUT-FILLED CONCRETE MASONRY CELL<sup>1,2,3,4,5,6,8</sup>

ANCHOR INSTALLED THROUGH FACE SHELL INTO GROUTED CELL <sup>9</sup>					
ANCHOR DIAMETER, $d_o$ (inch)	MINIMUM EMBED., $h_{nom}$ (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM END DISTANCE (inches)	TENSION LOAD (pounds)	SHEAR LOAD (pounds)
				IBC/IRC <sup>4</sup>	IBC/IRC <sup>4</sup>
1/4	1	3 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub>	80	150
	2	1 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	230 <sup>7</sup>	165 <sup>7</sup>
	2	3 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub>	340	310
3/8	1 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>	12	210	400
	2 <sup>1</sup> / <sub>2</sub>	1 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub>	295 <sup>7</sup>	210 <sup>7</sup>
		12	12	615 <sup>7</sup>	910 <sup>7</sup>
3 <sup>1</sup> / <sub>2</sub>				1,290	910
1/2	2	3 <sup>3</sup> / <sub>4</sub>	12	335	720
	3 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub>	590 <sup>7</sup>	405 <sup>7</sup>
	4	12	12	1,525	1,085
5/8	2 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>	12	455	1,005
	4	12		1,310	1,085
	5			1,940	1,255
3/4	3	3 <sup>3</sup> / <sub>4</sub>	12	615	750
		12			1,455
	4	12		1,680	
5					
ANCHOR INSTALLED THROUGH FACE SHELL INTO CELL WEB					
ANCHOR DIAMETER, $d_o$ (inch)	MINIMUM EMBED., $h_{nom}$ (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM END DISTANCE (inches)	TENSION LOAD (pounds)	
				IBC/IRC <sup>4</sup>	
1/4	2	1 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	230 <sup>7</sup>	
3/8	2 <sup>1</sup> / <sub>2</sub>	1 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub>	295 <sup>7</sup>	
		12	12	615 <sup>7</sup>	
1/2	3 <sup>1</sup> / <sub>2</sub>	16	16	870	
	4			590 <sup>7</sup>	
5/8	4			1,110	
3/4	4			1,205	
				1,310	

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. See Figure 4 for permitted anchor locations.

<sup>2</sup>Refer to Sections 5.3 and 5.4 of this report for modifying allowable loads of anchors to resist short-term loads.

<sup>3</sup>The tabulated values are applicable for screw anchors installed at a minimum spacing between screw anchors of 16 times the screw anchor diameter.

<sup>4</sup>These tension and shear load values are applicable only when the anchors are installed with special inspection as set forth in Section 4.3.

<sup>5</sup>Embedment depth is measured from the outside surface of the concrete masonry unit.

<sup>6</sup>Allowable shear loads for 1/4-inch- and 3/8-inch-diameter anchor installations into the face shell of a masonry cell may be applied in any direction. Allowable shear loads for 1/2-, 5/8- and 3/4-inch diameter anchor installations into the face shell may be applied in any direction provided the location is a minimum of 12 inches from the edge and end of the wall. For anchors with diameters of 1/2 inch and greater installed with an edge distance less than 12 inches, the allowable shear loads may be applied in any direction except upward vertically.

<sup>7</sup>For concrete masonry with  $f_m$  greater than or equal to 2,000 psi, values may be increased by 15 percent.

<sup>8</sup>Anchors must be installed no closer than 1<sup>3</sup>/<sub>8</sub> inches from head joints. Minimum edge and end distances must also be maintained.

<sup>9</sup>The tabulated values for installations through the face shell are applicable for screw anchors in the ends of grout-filled concrete masonry units where minimum edge and end distances are maintained.

**TABLE 3—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR WEDGE-BOLT+ SCREW ANCHORS INSTALLED INTO THE JOINTS IN THE FACE OF GROUT-FILLED CONCRETE MASONRY<sup>1,2,3,4,5</sup>**

ANCHOR INSTALLED IN T-JOINT AND BED JOINT <sup>7</sup>							
ANCHOR DIAMETER, <i>d</i> (inch)	MINIMUM EMBED., <i>h<sub>nom</sub></i> (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM END DISTANCE (inches)	TENSION LOAD (Pounds)		SHEAR LOAD (Pounds)	
				IBC/IRC <sup>4</sup>		IBC/IRC <sup>4</sup>	
1/4	2	1 1/2	2 3/4	230 <sup>8</sup>		165 <sup>8</sup>	
3/8	1 1/2	16	8	—		510 <sup>6</sup>	
	2 1/2	1 3/4	3 3/4	295 <sup>8</sup>		210 <sup>8</sup>	
		12	12	615 <sup>8</sup>		910 <sup>8</sup>	
1/2	3 1/2	16	8	830		510 <sup>6</sup>	
	4	16	8	590 <sup>8</sup>		405 <sup>8</sup>	
5/8	4			1,090		635 <sup>6</sup>	
3/4	2 1/2	16	8	840		1,225 <sup>6</sup>	
	4			—			
				890			

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. See Figure 4 for permitted anchor locations.

<sup>2</sup>Refer to Sections 5.3 and 5.4 of this report for modifying allowable loads of anchors to resist short-term loads.

<sup>3</sup>The tabulated values are applicable for screw anchors installed at a minimum spacing between screw anchors of 16 times the screw anchor diameter.

<sup>4</sup>Tension and shear load values are applicable only when the anchors are installed with special inspection as set forth in Section 4.3.

<sup>5</sup>Embedment depth is measured from the outside surface of the concrete masonry unit.

<sup>6</sup>Allowable shear loads for anchor installations into the mortar bed joint may be applied in any direction provided the anchor location is a minimum of 16 inches from the edge of the wall. For anchor installations with an edge distance of less than 16 inches, the allowable shear loads may be applied in any direction except upward vertically.

<sup>7</sup>Allowable tension load values apply to installations in T-joints. For anchors installed into a horizontal mortar joint (bed joint), allowable tension loads may be increased by 35 percent.

<sup>8</sup>For concrete masonry with *f<sub>m</sub>* greater than or equal to 2,000 psi, values may be increased by 15 percent.

<sup>9</sup>The tabulated values for installations through the face shell are applicable for screw anchors in the ends of grout-filled concrete masonry units where minimum edge and end distances are maintained.

**TABLE 4—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR WEDGE-BOLT+ SCREW ANCHORS INSTALLED INTO THE TOP OF GROUT-FILLED CONCRETE MASONRY<sup>1,2,3,4,5,6</sup>**

ANCHOR INSTALLED IN TOP OF WALL <sup>6</sup>							
ANCHOR DIAMETER, <i>d</i> (inch)	MINIMUM EMBED., <i>h<sub>nom</sub></i> (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM END DISTANCE (inches)	TENSION LOAD (pounds)		SHEAR LOAD (pounds)	
				IBC/IRC <sup>4</sup>	Direction of Loading	IBC/IRC <sup>4</sup>	
3/8	2 1/2	1 1/2	3	310	Shear to Edge	140	
					Shear to End	250	
1/2	3 1/2	1 3/4	3	535	Shear to Edge	260	
					Shear to End	235	
	4 1/2	1 3/4	3	745	Shear to Edge	260	
					Shear to End	235	
5/8	4 1/2	1 3/4	9	835	Shear to Edge	250	
					Shear to End	570	
	5 1/2	2 3/4	9	1,005	Shear to Edge	420	
					Shear to End	250	
	7 1/2	2 3/4	9	1,215	Shear to Edge	250	
					Shear to End	570	

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. See Figure 4 for permitted anchor locations.

<sup>2</sup>Refer to Sections 5.3 and 5.4 of this report for modifying allowable loads of anchors to resist short-term loads.

<sup>3</sup>The tabulated values are applicable for screw anchors installed at a minimum spacing between screw anchors of 16 times the screw anchor diameter.

<sup>4</sup>These tension and shear load values are applicable only when the anchors are installed with special inspection as set forth in Section 4.3.

<sup>5</sup>Embedment depth is measured from the outside surface of the concrete masonry unit.

<sup>6</sup>For concrete masonry with *f<sub>m</sub>* greater than or equal to 2,000 psi, values may be increased by 15 percent.

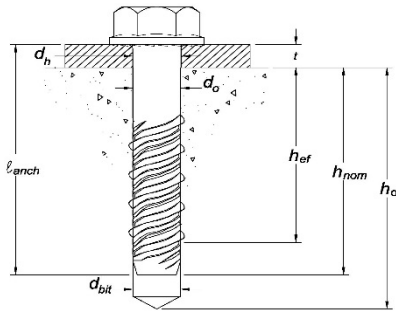


FIGURE 1—WEDGE-BOLT+ ANCHOR DETAIL

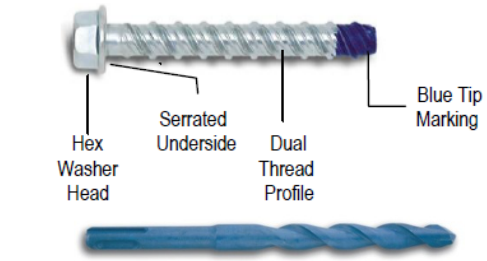
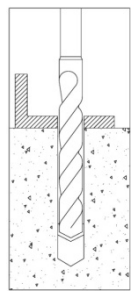
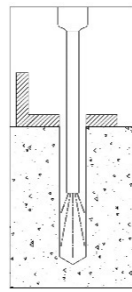


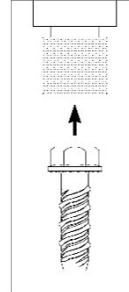
FIGURE 2—WEDGE-BOLT+ ANCHOR (ZINC PLATED OR MECHANICALLY GALVANIZED) AND WEDGE-BIT



1.) Using the proper Wedge-bit drill bit size, drill a hole into the base material to the required depth. The hole must be drilled to the specified nominal embedment depth plus a minimum of 1/4 inch (6.35 mm). The tolerances of the carbide Wedge-bit used must meet the requirements of the published Wedge-bit range in Table 1.



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



3.) Attach an appropriate sized hex socket to the wrench and mount the screw anchor head into the socket.



4.) Drive the anchor with a wrench through the fixture and into the hole until the head of the anchor comes into contact with the fixture. The anchor must be snug after installation. Do not spin the hex socket off the anchor to disengage.

FIGURE 3—WEDGE-BOLT+ INSTALLATION INSTRUCTIONS

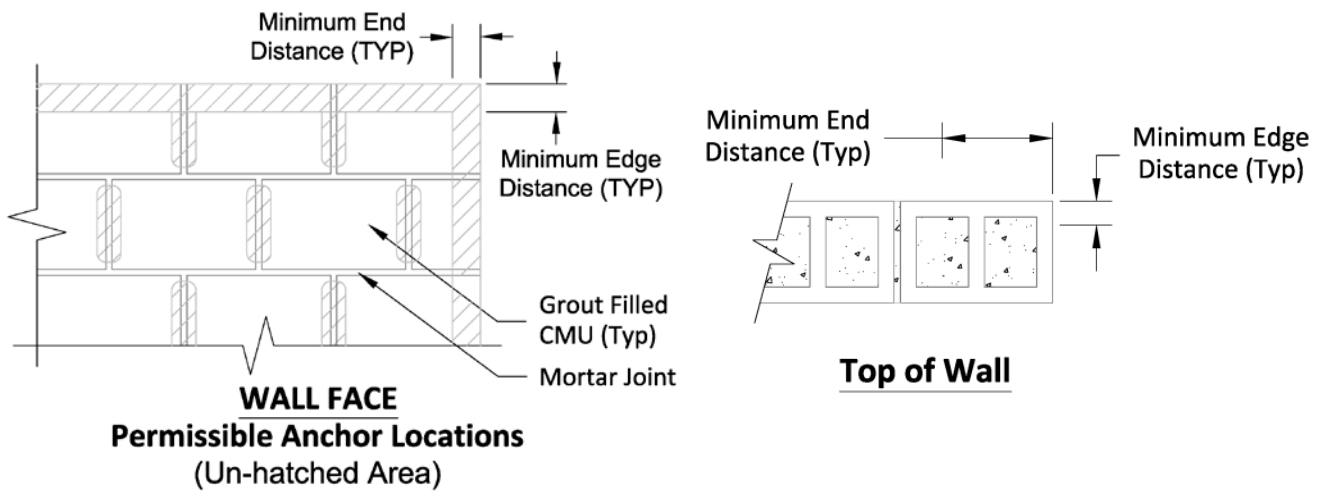


FIGURE 4—WEDGE-BOLT+ SCREW ANCHORS INSTALLED INTO GROUT-FILLED CONCRETE MASONRY<sup>1,2</sup>

<sup>1</sup>In the wall face anchors must be installed no closer than 1 3/8 inches from head joints. Minimum edge and end distances must also be maintained.

<sup>2</sup>The tabulated values for installations through the face shell are applicable for screw anchors in the ends of grout-filled concrete masonry units where minimum edge and end distances are maintained.