

# ICC-ES Evaluation Report

**ESR-1056**

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**DIVISION: 04—MASONRY**
**Section: 04081—Masonry Anchorage**
**REPORT HOLDER:**
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**EVALUATION SUBJECT:**
**TITEN HD SCREW ANCHORS**
**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

- 2009 *International Building Code*® (2009 IBC)
- 2009 *International Residential Code*® (2009 IRC)
- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 2000 *International Building Code*® (2000 IBC)
- 2000 *International Residential Code*® (2000 IRC)
- 1997 *Uniform Building Code*™ (UBC)

**Property evaluated:**

Structural

**2.0 USES**

The Titen HD screw anchor is for installation in predrilled holes in fully grouted concrete masonry wall construction.

The Titen HD screw anchors are alternatives to cast-in-place anchors described in Section 2107 of the IBC (TMS 402) and UBC Section 2107.1.5 for concrete masonry construction.

The anchors are permitted to be used in structures regulated by the IRC, provided an engineered design is submitted in accordance with IRC Section R301.1.3 (2009, 2006 and 2003 IRC) or Section R301.1.1.2 (2000 IRC).

**3.0 DESCRIPTION**
**3.1 Materials:**

**3.1.1 Titen HD Screw Anchor:** The Titen HD screw anchor is a carbon steel threaded anchor with a hex-washer head. The screw anchor is manufactured from heat-treated steel complying with SAE J403 Grade 10B21, and has either an electrodeposited coating of zinc in

accordance with ASTM B 633, Service Condition SC1, Type III; or a mechanically deposited coating of zinc in accordance with ASTM B 695, Class 55, Type I.

Titen HD screw anchors are available with nominally <sup>3</sup>/<sub>8</sub>-, <sup>1</sup>/<sub>2</sub>-, <sup>5</sup>/<sub>8</sub>-, and <sup>3</sup>/<sub>4</sub>-inch (9.5, 12.7, 15.9 and 19.1 mm) shank diameters, and with various lengths for multiple embedments as noted in the tables in this report. Refer to Figure 1 for an illustration of a typical screw anchor.

**3.1.2 Grout-filled Concrete Masonry:** When prism tests are required, the compressive strength of masonry,  $f'_m$ , at 28 days shall be a minimum of 1,500 psi (10.3 MPa). Fully grouted masonry walls shall be constructed from the following materials:

**3.1.2.1 Concrete Masonry Units (CMUs):** CMUs shall be minimum Grade N, Type II, lightweight, medium-weight, or normal-weight conforming to ASTM C 90 or UBC Standard 21-4. The minimum allowable nominal size of the CMU shall be 8 inches (203 mm) wide by 8 inches (203 mm) high by 16 inches (406 mm) long (i.e., 8x8x16).

**3.1.2.2 Grout:** Grout shall comply with IBC Section 2103.12 (2009 and 2006 IBC) or 2103.10 (2003 and 2000 IBC), IRC Section R609.1.1, or UBC Section 2103.4, as applicable. Alternatively, the grout shall have a minimum compressive strength when tested in accordance with ASTM C 1019 equal to its specified strength, but not less than 2,000 psi (13.8 MPa).

**3.1.2.3 Mortar:** Mortar shall be Type M or S in compliance with IBC Section 2103.8 (2009 and 2006 IBC) or 2103.7 (2003 and 2000 IBC), IRC Section R607, or UBC Section 2103.3 and UBC Standard 21-15, as applicable.

**3.2 Design:**

**3.2.1 General:** Anchors described in this report are assigned allowable tension and shear loads for designs based on allowable stress design (working stress design). Use of the anchors to resist vibratory and moving loads, such as those produced by reciprocating engines, cranes and vehicles, is beyond the scope of this report.

**3.2.2 Design of Anchors Installed in Fully Grouted CMU Masonry:** Allowable tension and shear loads for anchors installed in the face of fully grouted uncracked CMU masonry are noted in Table 1A for structures complying with the IBC or IRC, and Table 1B for structures complying with the UBC. The allowable tension and shear loads are for anchors installed in the grouted cells, the center web of CMU units, and horizontal mortared bed joints of fully grouted CMU masonry construction. Allowable loads for anchors installed in the vertical head joint or the end flanges of the CMU units are outside the scope of this report. Edge and end distances, and spacing requirements for anchors installed in the face of fully

grouted CMU masonry, as shown in Figure 2, are noted in Tables 1A and 1B. Allowable load reduction factors for anchors installed at reduced edge distances, and reduced spacing, are noted in Tables 2 and 3.

Allowable tension and shear loads for  $1/2$ -inch and  $5/8$ -inch (12.7 mm and 15.9 mm) anchors installed in the top of fully grouted concrete masonry (CMU grouted cores and CMU webs), are noted in Table 4A for anchors installed in structures complying with the IBC or IRC, and Table 4B for anchors installed in structures complying with the UBC.

Allowable loads for anchors installed in the face of fully grouted CMU masonry walls subjected to combined shear and tension forces shall be determined by the following equation:

$$\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right) \leq 1.0$$

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.

#### 4.0 INSTALLATION

##### 4.1 General:

Titen HD screw anchors shall be installed by drilling a pilot hole into the substrate using a handheld electro-pneumatic rotary hammer drill with a carbide-tipped drill bit conforming to ANSI B212.15-1994. The pilot hole shall have the same diameter as the nominal diameter of the anchor. The hole is drilled to the specified embedment depth plus  $1/2$  inch (12.7 mm). Dust and debris in the hole shall be removed by using oil-free compressed air. The Titen HD screw anchor shall be installed into the hole to the required embedment using a socket wrench or powered impact wrench.

##### 4.1.1 Installation in Fully Grouted CMU Masonry:

Anchors installed in the face of fully grouted CMU construction shall be limited to the face shell of the CMU unit (center web and grouted cores) and the horizontal mortared bed joints, as indicated by the shaded areas in Figure 2. Anchors installed in a T-joint, the mortared head joint, or the end webs of a CMU unit, as indicated in the non-shaded areas in Figure 2, are outside the scope of this report.

For anchors installed in the top of fully grouted concrete masonry (CMU grouted cores and CMU webs), anchor location shall comply with the minimum edge and end distances noted in Tables 4A and 4B and shown in Figure 3. Anchors installed in the mortared head joint are outside the scope of this report.

##### 4.2 Installation with Special Inspection (When Required):

Continuous special inspection shall be provided when required by the tables in this evaluation report. Special inspection under the IBC and IRC shall conform to IBC Section 1704; under the UBC, special inspection shall be in accordance with UBC Section 1701.

For fasteners installed with special inspection, the following items, as applicable, shall be inspected: fastener type and dimensions; masonry unit type and compliance with ASTM C 90; grout and mortar compressive strengths, and (when required) masonry prism compressive strength; drill bit size and compliance with ANSI B212.15-1994; and fastener embedment, spacing, and edge (and end)

distances. The special inspector shall inspect and verify that anchor installation complies with this evaluation report and Simpson Strong-Tie Company's published installation instructions.

#### 5.0 CONDITIONS OF USE

The Titen HD Screw Anchors described in this report comply with, or 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** Anchors are identified and installed in accordance with this report and the manufacturer's published installation instructions.
- 5.2** Anchors installed in the face or the top of fully grouted CMU masonry to resist dead, live, wind, and earthquake load applications shall be in accordance with Sections 3.2.1 and 3.2.2.
- 5.3 Grouted Masonry under IBC or IRC:** The anchors described in the evaluation report are capable of resisting seismic and wind loads. 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 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 multiplied by a factor of 0.75.
- 5.4 Grouted Masonry under the UBC:** When using the basic load combinations in accordance with UBC Section 1612.3.1, allowable loads are not permitted to be increased for wind or seismic loading. When using the alternative basic load combinations in UBC Section 1612.3.2 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.
- 5.5 Fatigue and Shock Loading:** Since an ICC-ES acceptance criteria is evaluating data to determine the performance of screw anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.
- 5.6 Fire-resistive Construction:** Where not otherwise prohibited by the applicable code, anchors are permitted for use with fire-resistance-rated construction provided that 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.
- 5.7 Cracked Masonry:** Since an ICC-ES acceptance criteria for evaluating the performance of screw anchors in cracked masonry is unavailable at this time, the use of anchors is limited to installation in uncracked masonry. Cracking occurs when  $f_t > f_r$  due to service loads or deformations.

- 5.8 Anchors are installed in substrates in holes predrilled with carbide-tipped masonry drill bits complying with ANSI B212.15-1994, and having the same diameter as the nominal diameter of the anchor.
- 5.9 Calculations demonstrating that the applied loads are less than the allowable loads described in this report, shall be submitted to the building official. The calculations shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.10 Special inspection, when required, shall be provided in accordance with Section 4.2.
- 5.11 Anchors are limited to dry, interior use.
- 5.12 The Titen HD screw anchors are manufactured by Simpson Strong-Tie Company under a quality control program with inspections by CEL Consulting (AA-639).

**6.0 EVIDENCE SUBMITTED**

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry (AC106), dated June 2006 (editorially revised December 2007), including the following optional tests:

6.1.1 Anchors installed in the face of fully grouted CMU masonry wall construction: Effects of edge distance on tension and shear performance (Test Series 4, 5, 13, and 14 of AC106), and seismic performance tests (Section 4.6 of AC106).

6.1.2 Anchors installed in the top of fully grouted CMU masonry wall construction with a minimum 1<sup>3</sup>/<sub>4</sub>-inch (44 mm) edge distance: Effects on tension and shear performance (Test Series 4 and 13 of AC106), and seismic performance tests (Section 4.6 of AC106).

**7.0 IDENTIFICATION**

Titen HD screw anchor packaging is marked with the Simpson Strong-Tie Company name; product name (Titen HD); anchor diameter and length; the name or logo of the inspection agency (CEL Consulting); and the evaluation report number (ESR-1056). In addition, the ≠ symbol and anchor length (in inches) is stamped on the head of each screw anchor.



FIGURE 1—TYPICAL TITEN HD SCREW ANCHOR

TABLE 1A—IBC AND IRC ALLOWABLE TENSION AND SHEAR LOADS FOR TITEN HD SCREW ANCHORS INSTALLED IN THE FACE OF FULLY GROUTED CMU MASONRY CONSTRUCTION<sup>1</sup>

ANCHOR DIA. <sup>2</sup> (in.)	DRILL BIT DIA. (in.)	MIN. EMBED. <sup>3</sup> (in.)	ANCHOR LOCATION <sup>4</sup> (in)				ALLOWABLE LOADS BASED ON ANCHORS INSTALLED AT DISTANCES ≥ CRITICAL EDGE DISTANCE, <i>c<sub>crit</sub></i> , AND SPACING, <i>s<sub>crit</sub></i> <sup>5,6,7</sup> (lbf)	
			Edge Distance		Spacing		Tension	Shear
			Critical, <i>c<sub>crit</sub></i>	Minimum, <i>c<sub>min</sub></i>	Critical, <i>s<sub>crit</sub></i>	Minimum, <i>s<sub>min</sub></i>		
3/8	3/8	2 <sup>3</sup> / <sub>4</sub>	12	4	6	3	480	870
1/2	1/2	3 <sup>1</sup> / <sub>2</sub>	12	4	8	4	690	1,385
5/8	5/8	4 <sup>1</sup> / <sub>2</sub>	12	4	10	5	1,060	2,085
3/4	3/4	5 <sup>1</sup> / <sub>2</sub>	12	4	12	6	1,600	3,000

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.48 N.

<sup>1</sup>Anchors shall be installed a minimum of 1<sup>1</sup>/<sub>4</sub> inches from vertical head joints and T-joints. Refer to Figure 2 for permitted and prohibited anchor installation locations.

<sup>2</sup>The drill bit diameter shall be equal to the nominal diameter of the anchor. Anchor installation shall comply with Section 4.0 of this report.

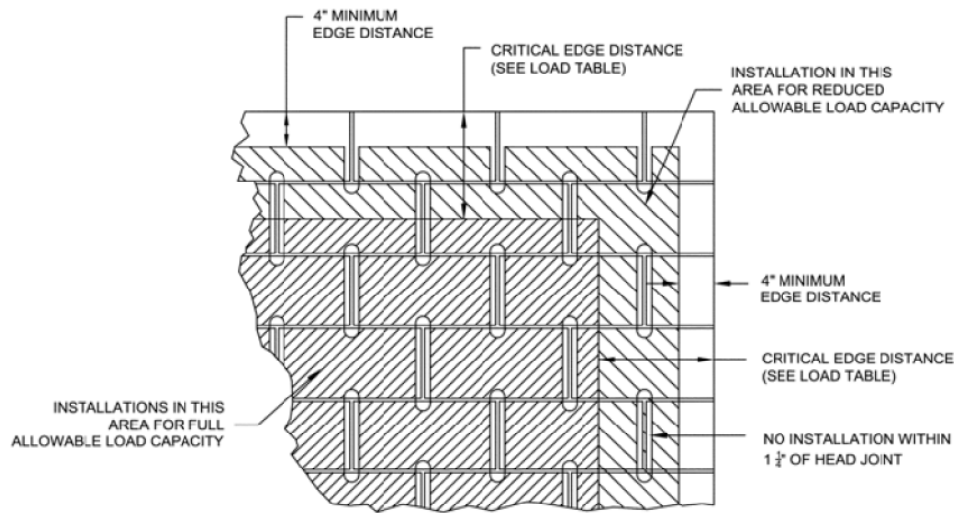
<sup>3</sup>Embedment depth is measured from the outside face of the masonry.

<sup>4</sup>Critical and minimum edge distances, *c<sub>crit</sub>* and *c<sub>min</sub>*, respectively, shall comply with this table. Refer to Figure 2. Critical and minimum spacing, *s<sub>crit</sub>* and *s<sub>min</sub>*, respectively, shall comply with this table. Critical and minimum edge and spacing distances are valid for anchors resisting tension or shear loads. Refer to Table 2 for allowable tension and shear load reduction factors for anchors installed between critical and minimum edge distances, and to Table 3 for anchors installed between critical and minimum spacing.

<sup>5</sup>Tabulated loads are for anchors installed in fully grouted masonry wall construction, consisting of Grade N, Type II, lightweight, medium-weight, or normal-weight, closed-end, concrete masonry units (CMUs) conforming to ASTM C 90. Masonry shall be fully grouted with coarse grout having a minimum compressive strength of 2,000 psi, and complying with IBC Section 2103.12 (2009 and 2006 IBC) or 2103.10 (2003 and 2000 IBC) or IRC Section R609.1.1 as applicable. Mortar shall be Type M or S in compliance with IBC Section 2103.8 (2009 and 2006 IBC or 2103.7 (2003 and 2000 IBC) or IRC Section R607, as applicable. The specified compressive strength of masonry, *f<sub>m</sub>*, at 28 days shall be a minimum of 1,500 psi.

<sup>6</sup>Tabulated allowable loads are based on a safety factor of 5.0 and are based on special inspection being provided during anchor installation. Special inspection requirements shall comply with Section 4.2 of this report.

<sup>7</sup>For wind or earthquake loading conditions, allowable loads may be adjusted in accordance with Section 5.3.



**FIGURE 2—TITEN HD SCREW ANCHOR INSTALLED IN THE FACE OF GROUT-FILLED CMU (CONCRETE MASONRY UNIT) WALL CONSTRUCTION (Refer to Tables 1, 2, and 3)**

**TABLE 1B—UBC ALLOWABLE TENSION AND SHEAR LOADS FOR TITEN HD SCREW ANCHORS INSTALLED IN THE FACE OF FULLY GROUTED CMU MASONRY CONSTRUCTION<sup>1</sup>**

ANCHOR DIA. <sup>2</sup> (in.)	DRILL BIT DIA. (in.)	MIN. EMBED. <sup>3</sup> (in.)	ANCHOR LOCATION <sup>4</sup> (in)				ALLOWABLE LOADS BASED ON ANCHORS INSTALLED AT DISTANCES $\geq$ CRITICAL EDGE DISTANCE, $c_{crit}$ , AND SPACING, $s_{crit}$ <sup>5,6,7</sup> (lbf)		
			Edge Distance		Spacing		Tension		Shear <sup>9</sup>
			Critical, $c_{crit}$	Minimum, $c_{min}$	Critical, $s_{crit}$	Minimum, $s_{min}$	Installed with Special Inspection <sup>7</sup>	Installed without Special Inspection <sup>8</sup>	
$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{3}{4}$	12	4	6	3	600	300	1,085
$\frac{1}{2}$	$\frac{1}{2}$	$3\frac{1}{2}$	12	4	8	4	860	430	1,730
$\frac{5}{8}$	$\frac{5}{8}$	$4\frac{1}{2}$	12	4	10	5	1,325	665	2,605
$\frac{3}{4}$	$\frac{3}{4}$	$5\frac{1}{2}$	12	4	12	6	2,000	1,000	3,750

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.48 N.

<sup>1</sup>Anchors shall be installed a minimum of  $1\frac{1}{4}$  inches from vertical head joints and T-joints. Refer to Figure 2 for permitted and prohibited anchor installation locations.

<sup>2</sup>The drill bit diameter shall be equal to the nominal diameter of the anchor. Anchor installation shall comply with Section 4.0 of this report.

<sup>3</sup>Embedment depth is measured from the outside face of the masonry.

<sup>4</sup>Critical and minimum edge distances,  $c_{crit}$  and  $c_{min}$ , respectively, shall comply with this table. Refer to Figure 2. Critical and minimum spacing,  $s_{crit}$  and  $s_{min}$ , respectively, shall comply with this table. Critical and minimum edge and spacing distances are valid for anchors resisting tension or shear loads. Refer to Table 2 for allowable tension and shear load reduction factors for anchors installed between critical and minimum edge distances, and to Table 3 for anchors installed between critical and minimum spacing.

<sup>5</sup>Tabulated loads are for anchors installed in fully grouted masonry wall construction, consisting of Grade N, Type II, lightweight, medium-weight, or normal-weight, closed-end, concrete masonry units (CMUs) conforming to UBC Standard 21-4. Masonry shall be fully grouted with coarse grout having a minimum compressive strength of 2,000 psi, and complying with UBC Section 2103.4. Mortar shall be Type M or S in compliance with UBC Section 2103.3 and UBC Standard 21-15. The specified compressive strength of masonry,  $f_m$ , at 28 days shall be a minimum of 1,500 psi.

<sup>6</sup>For wind or earthquake loading conditions, allowable loads may be adjusted in accordance with Section 5.4.

<sup>7</sup>These allowable tension loads are based on a factor of safety of 4.0 and special inspection being provided during anchor installation. Special inspection requirements shall comply with Section 4.2 of this report.

<sup>8</sup>These reduced allowable tension loads are applicable for anchors installed without special inspection and are based on a factor of safety of 8.0.

<sup>9</sup>These allowable shear loads are based on a factor of safety of 4.0 and anchor installation with or without special inspection.

**TABLE 2—LOAD REDUCTION FACTORS FOR TITEN HD SCREW ANCHORS INSTALLED BETWEEN CRITICAL AND MINIMUM EDGE DISTANCES (Anchors Installed in the Face of Grout-filled CMU Masonry)<sup>1,2,3</sup>**

ANCHOR DIAMETER (in)	MINIMUM EMBEDMENT DEPTH (in)	LOAD REDUCTION FACTORS FOR ANCHORS INSTALLED AT:				
		Critical Edge Distance, $C_{crit}$		Minimum Edge Distance, $C_{min}$		
		Tension or Shear Load	Tension Load	Shear Load Acting:		
				Towards an Edge	Away from an Edge	Parallel to an Edge
$\frac{3}{8}$	$2\frac{3}{4}$	1.0	1.0	0.58	0.89	0.77
$\frac{1}{2}$	$3\frac{1}{2}$	1.0	1.0	0.38	0.79	0.48
$\frac{5}{8}$	$4\frac{1}{2}$	1.0	0.83	0.30	0.58	0.46
$\frac{3}{4}$	$5\frac{1}{2}$	1.0	0.66	0.21	0.38	0.44

For SI: 1 inch = 25.4 mm.

<sup>1</sup>The load reduction factors in this table are applicable to the allowable loads shown in Tables 1A and 1B.

<sup>2</sup>Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge distance are calculated separately and multiplied.

<sup>3</sup>Load reduction factors for anchors loaded in tension or shear with edge distances between critical and minimum are obtained by linear interpolation.

**TABLE 3—LOAD REDUCTION FACTORS FOR TITEN HD SCREW ANCHORS INSTALLED BETWEEN CRITICAL AND MINIMUM SPACING (Anchors Installed in the Face of Grout-filled CMU Masonry)<sup>1,2,3</sup>**

ANCHOR DIAMETER (in)	MINIMUM EMBEDMENT DEPTH (in)	LOAD REDUCTION FACTORS FOR ANCHORS INSTALLED AT:		
		Critical Spacing, $S_{crit}$	Minimum Spacing, $S_{min}$	
		Tension or Shear Load	Tension Load	Shear Load
$\frac{3}{8}$	$2\frac{3}{4}$	1.0	0.87	0.62
$\frac{1}{2}$	$3\frac{1}{2}$	1.0	0.69	0.62
$\frac{5}{8}$	$4\frac{1}{2}$	1.0	0.59	0.62
$\frac{3}{4}$	$5\frac{1}{2}$	1.0	0.50	0.62

For SI: 1 inch = 25.4 mm.

<sup>1</sup>The load reduction factors in this table are applicable to the allowable loads shown in Tables 1A and 1B.

<sup>2</sup>Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge distance are calculated separately and multiplied.

<sup>3</sup>Load reduction factors for anchors loaded in tension or shear with spacing between critical and minimum are obtained by linear interpolation.

**TABLE 4A—IBC AND IRC ALLOWABLE TENSION AND SHEAR LOADS FOR TITEN HD SCREW ANCHORS INSTALLED IN TOP OF GROUT-FILLED CMU MASONRY<sup>1</sup>**

ANCHOR DIA. (in)	DRILL BIT DIA. (in)	MINIMUM EMBEDMENT DEPTH (in)	ANCHOR LOCATION <sup>2</sup> (in)			IBC AND IRC ALLOWABLE LOADS <sup>3,4,5</sup> (lbf)		
			Minimum Edge Distance	Minimum End Distance	Minimum Spacing	Tension	Shear	
							Parallel to Edge of Masonry Wall	Perpendicular to Edge of Masonry Wall
$\frac{1}{2}$	$\frac{1}{2}$	$4\frac{1}{2}$	$1\frac{3}{4}$	8	8	570	585	160
$\frac{5}{8}$	$\frac{5}{8}$	$4\frac{1}{2}$	$1\frac{3}{4}$	10	10	570	675	160

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

<sup>1</sup>The allowable tension and shear loads in Table 4A are applicable when anchors are installed in structures regulated by the IRC or IBC.

<sup>2</sup>Minimum edge and end distances are measured from the anchor centerline to the edge and end of the CMU masonry wall, respectively.

Refer to Figure 3. Minimum spacing is measured from center-to-center of two anchors. Anchors installed in the mortared head joint are outside the scope of this report.

<sup>3</sup>The allowable loads in Table 4A are for anchors resisting dead, live, wind, and earthquake load applications. For short-term loading due to wind and earthquake forces, the allowable loads may be adjusted in accordance with Section 5.3.

<sup>4</sup>Tabulated loads are for anchors installed in fully grouted masonry wall construction consisting of Grade N, Type II, lightweight, medium-weight, or normal-weight concrete masonry units (CMUs) conforming to ASTM C 90. Allowable minimum nominal dimensions of the CMU shall be 8 inches wide by 8 inches high by 16 inches long (8"x8"x16"). Masonry wall construction shall be fully grouted with coarse grout having a minimum compressive strength of 2,000 psi, and complying with IBC Section 2103.12 (2009 and 2006 IBC) or 2103.10 (2003 and 2000 IBC) or IRC Section R609.1.1, as applicable. Mortar shall be Type M or S in compliance with IBC Section 2103.8 (2009 or 2006 IBC) or 2103.7 (2003 and 2000 IBC) or IRC Section R607.1, as applicable, and have a minimum compressive strength of 1,500 psi. The specified compressive strength of masonry,  $f_m$ , at 28 days shall be a minimum of 1,500 psi.

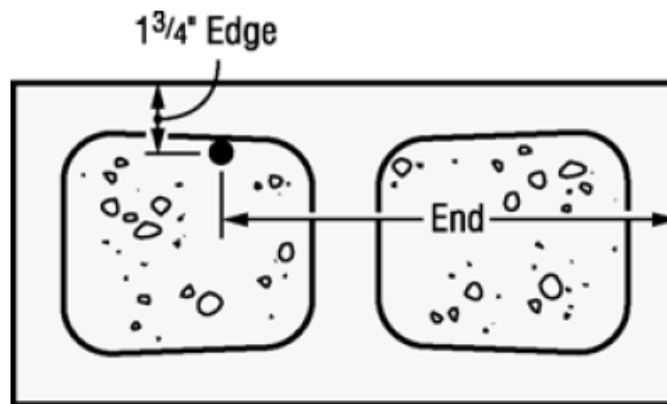
<sup>5</sup>Allowable tension and shear loads are based on a safety factor of 5.0, and are based on anchor installations with special inspection. Refer to Section 4.2 of this report for special inspection requirements.

**TABLE 4B—UBC ALLOWABLE TENSION AND SHEAR LOADS FOR TITEN HD SCREW ANCHORS  
INSTALLED IN TOP OF GROUT-FILLED CMU MASONRY<sup>1</sup>**

ANCHOR DIA. (in)	DRILL BIT DIA. (in)	MIN. EMBED. (in)	ANCHOR LOCATION <sup>2</sup> (in)			UBC ALLOWABLE LOADS <sup>3,4</sup> (lbf)			
			Minimum Edge Distance	Minimum End Distance	Minimum Spacing	Tension		Shear <sup>5</sup>	
						Installed with Special Inspection <sup>6</sup>	Installed without Special Inspection <sup>7</sup>	Parallel to Edge of Masonry	Perpendicular to Edge of Masonry
1/2	1/2	4 1/2	1 3/4	8	8	715	355	730	200
5/8	5/8	4 1/2	1 3/4	10	10	715	355	845	200

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

<sup>1</sup>The allowable tension and shear loads in Table 4B are applicable for anchors installed in structures regulated by the UBC.  
<sup>2</sup>Minimum edge and end distances are measured from the anchor centerline to the edge and end of the CMU masonry wall, respectively. Refer to Figure 3. Minimum spacing is measured from center-to-center of two anchors. Anchors installed in the mortared head joint are outside the scope of this report.  
<sup>3</sup>The allowable loads in Table 4B are for anchors resisting dead, live, wind, and earthquake load applications. For short-term loading due to wind and earthquake forces, the allowable loads may be adjusted in accordance with Section 5.4.  
<sup>4</sup>Tabulated loads are for anchors installed in fully grouted masonry wall construction consisting of Grade N, Type II, lightweight, medium-weight, or normal-weight concrete masonry units (CMUs) conforming to UBC Standard 21-4. Allowable minimum nominal dimensions of the CMU shall be 8 inches wide by 8 inches high by 16 inches long (8"x8"x16"). Masonry shall be fully grouted with coarse grout having a minimum compressive strength of 2,000 psi, and complying with UBC Section 2103.4. Mortar shall be Type M or S in compliance with UBC Section 2103.3 and UBC Standard 21-15. The specified compressive strength of masonry,  $f_m$ , at 28 days shall be a minimum of 1,500 psi.  
<sup>5</sup>Allowable shear loads are based on a safety factor of 4.0. Special inspection for anchor installation is not required.  
<sup>6</sup>Allowable tension loads in the column entitled "Installed with Special Inspection" are based on a safety factor of 4.0. Special inspection shall be provided during anchor installation, and shall comply with the requirements described in Section 4.2 of this report.  
<sup>7</sup>Allowable tension loads in the column entitled "Installed without Special Inspection" are based on a safety factor of 8.0. Special inspection for anchor installation is not required for anchors assigned these reduced allowable tension loads.



**FIGURE 3—EDGE AND END DISTANCES FOR THE TITEN HD ANCHOR  
INSTALLED IN THE TOP OF CMU MASONRY WALL CONSTRUCTION**