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TITEN®2 SCREW ANCHORS FOR USE IN MASONRY

CSI Division:
04 00 00—MASONRY
CSI Section:
04 05 19.16—Masonry Anchors

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes & regulations:

- 2018, 2015, 2012, 2009 and 2006 International Building Code® (IBC)
- 2018, 2015, 2012, 2009 and 2006 International Residential Code® (IRC)

1.2 Evaluated in accordance with:

- ICC-ES Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry (AC106)

1.3 Properties assessed:

- Structural

2.0 PRODUCT USE

Simpson Strong-Tie® Titen®2 Screw Anchors are used to resist static tension and shear loads in grouted or ungrouted concrete masonry construction. The anchoring system is an alternative to cast-in-place anchors described in Section [2107.1](#) of the IBC and Section 8.1.3 of the [2016 TMS 402](#) or Section 8.1.3 of the [2013 TMS 402/ACI 530/ASCE 5](#) or Section 2.1.4 of the 2011, 2008 and 2005 [TMS 402/ACI 530/ASCE 5](#), as applicable. The anchors may also be used where an engineered design is submitted in accordance with Section [R301.1.3](#) of the IRC.

3.0 PRODUCT DESCRIPTION

3.1 Titen®2 Screw Anchors

The Titen®2 Screw Anchors are post-installed anchors that derive their holding strength from the mechanical interlock of the screw anchor threads with the grooves cut into the masonry by the screw anchor during installation. The screw anchors are manufactured from carbon steel that is given a supplementary hardening process. The screw anchors are available in nominal sizes of 3/16 inch and 1/4 inch (4.8 mm and 6.4 mm) diameters and in a variety of lengths.

The Titen®2 Screw Anchors are available with either a slotted hex head or a Philips flat head as shown in [Figure 1](#) of this report. All Titen®2 Screw Anchors are provided with a Ruspert coating.

3.2 Materials

3.2.1 Concrete Masonry Units (CMU's): CMU's shall be medium-weight or normal-weight conforming to ASTM C90. 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).

3.2.2 Grout: Grout shall comply with 2018 and 2015 IBC Section [2103.3](#), 2012 IBC Section [2103.13](#), 2009 and 2006 IBC Section [2103.12](#) or 2018 and 2015 IRC Section [R606](#), or 2012, 2009 and 2006 IRC Section [R609.1.1](#), as applicable. Alternatively, the grout shall have a minimum compressive strength when tested in accordance with [ASTM C1019](#) equal to its specified strength, f'_g , but not less than 2,000 psi (13.8 MPa).

3.2.3 Mortar: Mortar shall be minimum Type N in compliance with IBC Section [2103](#) or 2018 and 2015 IRC Sections [R606.2.8](#) and [R606.2.7](#), respectively, or [R607](#) (2012, 2009 and 2006 IRC), as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 General: Titen®2 Screw Anchor capabilities in this report are allowable load values for use in allowable stress design as set forth in Section [2107](#) of the IBC. For use under the IRC, an engineered design in accordance with Section R301.1.3 of the IRC shall be submitted to the code official for approval.

4.1.2 Design of Titen®2 Screw Anchors Installed in Concrete Masonry: Titen2 Screw Anchors are limited to installation in the face shell of the grouted or ungrouted concrete masonry units. Allowable tension and shear values, embedment depths, spacing requirements, end and edge distances for screw anchors installed in fully-grouted concrete masonry unit construction are noted in [Tables 3](#) and [4](#) of this report. Allowable tension and shear values, embedment depths, spacing requirements, end and edge distances for screw anchors installed in ungrouted concrete masonry unit construction are noted in [Tables 5](#) and [6](#) of this report.

Allowable loads for the Titen®2 Screw Anchors installed in the face shell of the grouted or ungrouted concrete masonry units subjected to combined tension and shear forces shall be determined by the following equation:

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.





$$(P_s/P_t) + (V_s/V_t) \leq 1.0$$

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.

4.2 Installation

Installation parameters are provided in [Table 2](#) and [Figure 2](#) of this report. The Titen[®]2 Screw Anchors shall be installed in accordance with the manufacturer's published instructions and this report. Screw anchor locations shall comply with this report and the plans and specifications approved by the code official. Screw anchors shall be installed in holes drilled using carbide-tipped drill bits conforming to [ANSI B212.15-1994](#) and [Table 2](#) of this report. The hole shall be drilled to the minimum depth noted in [Table 2](#) of this report, or completely through the face shell in the case of ungrouted masonry. Dust and debris in the hole shall be removed by using oil-free compressed air or a vacuum. The screw anchor shall be driven into the predrilled hole using a hammer drill set in the hammer and rotation mode with a Titen Screw Installation Tool and drive socket.

4.3 Special Inspection

Periodic special inspection is required in accordance with 2018 and 2015 IBC Section [1705.4](#), 2012 IBC Section [1705.3](#), 2009 IBC Section [1704.15](#) or 2006 IBC Section [1704.13](#), provided the masonry construction has quality assurance requirements as specified in [Tables 3](#) and [4](#) of TMS 602-16 Section 1.6 (2018 IBC), Section 3.1 of TMS 402-13 (2015 IBC) or Section 1.19 of TMS 402-11 (2012 IBC, Level 1 or Level 2 under Section [1704.5](#) of the 2009 IBC or Section [1704.5](#) of the 2006 IBC. The special inspector shall be present as often as required in accordance with the "statement of inspection." The special inspector shall make periodic inspections during anchor installation to verify anchor type, anchor dimensions, masonry unit type and compliance with [ASTM C90](#), grout and mortar compressive strengths, hole dimensions, hole cleaning procedures, drill bit size, anchor spacing, edge and end distances, anchor embedment and adherence to the installation instructions contained in this report. Additional requirements as set forth in Section [1704](#), [1705](#), [1706](#) and [1707](#) of the IBC shall be observed, where applicable.

5.0 LIMITATIONS

The Simpson Strong-Tie Titen[®]2 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 limitations:

5.1 Titen[®]2 Screw Anchors shall be installed in accordance with the manufacturer's published installation instructions and this report as shown in [Figure 2](#) of this report. Where conflicts between this report and the published instructions occur, the more restrictive shall prevail.

5.2 Screw anchor sizes, dimensions and minimum embedment depths are as set forth in this report.

5.3 Screw anchors shall be installed in holes predrilled with carbide-tipped drill bits complying with ANSI B212.15-1994 in accordance with the installation details shown in [Table 2](#) of this report.

5.4 Under the IBC and IRC, use of the screw anchors to resist wind or seismic loads is beyond the scope of this report. The allowable loads or load combinations for the screw anchors shall not be adjusted for screw anchors subjected to wind or seismic loads.

5.5 Prior to installation, calculations and details demonstrating compliance with this report shall be submitted to the building official. The calculations and details shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.6 Since an evaluation criteria for evaluating data to determine the performance of anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under such conditions is beyond the scope of this report.

5.7 Where not otherwise prohibited in the IBC or IRC, Titen[®]2 Screw Anchors are permitted for installation in fire-resistive construction provided at least one of the following conditions are met.

- Anchors that support gravity load-bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.8 Use of screw anchors is limited to dry, interior locations.

5.9 Since acceptance criteria for evaluating the performance of screw anchors in cracked masonry are not available at this time, the use of screw anchors is limited to installation in uncracked masonry. Cracking occurs when $f_t > f_t$ due to service loads or deformations.

5.10 Special inspection shall be provided in accordance with Section 4.3 of this report.



5.11 Titen[®]2 Screw Anchors are manufactured under an approved quality control program with quality control inspections by CEL Consulting (AA-639).

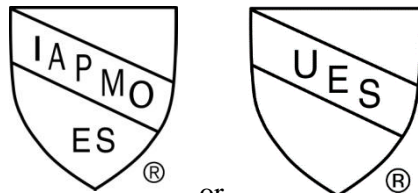
6.0 SUBSTANTIATING DATA

Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Predrilled Fasteners (AC106), approved March 2018. Test results are from laboratories in compliance with [ISO/IEC 17025](https://www.iso.org/standard/68549.html).

7.0 IDENTIFICATION

7.1 Titen[®]2 Screw Anchors are identified in the field by labels on the packaging, bearing the company name (Simpson Strong-Tie Company, Inc.), product name (Titen2), the anchor diameter and length, catalog number, either IAPMO ES Mark of Conformity as shown below, and the evaluation report number (ER-466). In addition, the ≠ symbol and a length identification code letter are stamped on the head of each screw anchor.

This evaluation report is subject to re-examination in one year.



or
IAPMO ER-466

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For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org



TABLE 1
LENGTH IDENTIFICATION HEAD MARKS ON TITEN®2 SCREW ANCHORS
(CORRESPONDS TO ANCHOR LENGTH IN INCHES)

Length ID marking on head		-	A	B	C	D	E	F	G	H	I	J
Length of anchor (inch)	From	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Up to, but not including	1½	2	2½	3	3½	4	4½	5	5½	6	6½

For SI: 1 inch = 25.4 mm

TABLE 2
TITEN®2 SCREW ANCHOR INSTALLATION INFORMATION¹

CHARACTERISTIC	NOMINAL SCREW ANCHOR DIAMETER (inch)	
	3/16	1/4
Nominal Outside Diameter (shank)	0.149	0.180
Drill Bit Diameter	5/32	3/16
Minimum Embedment depth - Grouted CMU	2	2
Minimum Hole Depth - Grouted CMU	2½	2½
Embedment depth - UngROUTED CMU	1¼	1¼

For SI: 1 inch = 25.4 mm

¹ Embedment is measured from the masonry surface to the embedded end of the screw anchor.

TABLE 3
ALLOWABLE TENSION LOADS FOR TITEN®2 SCREW ANCHORS INSTALLED IN GROUTED CMU WALL FACES^{1,2,3}

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Allowable Load (lbf.)
		Spacing (in.)	Edge (in.)	End (in.)	
3/16	2	3	3 ⁷ / ₈	3 ⁷ / ₈	346
3/16	2	3	1½	3 ⁷ / ₈	315
1/4	2	4	3 ⁷ / ₈	3 ⁷ / ₈	277
1/4	2	4	1½	3 ⁷ / ₈	272

For SI: 1 inch = 25.4 mm, 1 lbf. = 4.448 N, 1 psi = 6.895 kPa

¹ The tabulated values are for screw anchors installed in minimum 8 inch wide grouted concrete masonry walls having reached a minimum f'_m of 1,500 psi at time of installation.

² Embedment is measured from the masonry surface to the embedded end of the screw anchor.

³ Screw anchors shall be installed in grouted cell. The minimum edge and end distances shall be maintained.



TABLE 4
ALLOWABLE SHEAR LOADS FOR TITEN®2 SCREW ANCHORS INSTALLED IN GROUTED CMU WALL FACES^{1,2,3}

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Direction of Loading	Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)		
3/16	2	3	3 ⁷ / ₈	3 ⁷ / ₈	Toward edge, parallel to wall end	224
3/16	2	3	1 ¹ / ₂	3 ⁷ / ₈	Toward wall end, parallel to wall edge	238
1/4	2	4	3 ⁷ / ₈	3 ⁷ / ₈	Toward edge, parallel to wall end	309
1/4	2	4	1 ¹ / ₂	3 ⁷ / ₈	Toward wall end, parallel to wall edge	277

For SI: 1 inch = 25.4 mm, 1 lbf. = 4.448 N, 1 psi = 6.895 kPa

¹ The tabulated values are for screw anchors installed in minimum 8 inch wide grouted concrete masonry walls having reached a minimum f_m of 1,500 psi at time of installation.

² Embedment is measured from the masonry surface to the embedded end of the screw anchor.

³ Screw anchors shall be installed in grouted cell. The minimum edge and end distances shall be maintained.

TABLE 5
ALLOWABLE TENSION LOADS FOR TITEN®2 SCREW ANCHORS INSTALLED IN UNGROUTED CMU WALL FACES^{1,2,3}

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)	
3/16	1 ¹ / ₄	3	3 ⁷ / ₈	3 ⁷ / ₈	151
1/4	1 ¹ / ₄	4	3 ⁷ / ₈	3 ⁷ / ₈	153

For SI: 1 inch = 25.4 mm, 1 lbf. = 4.448 N, 1 psi = 6.895 kPa

¹ The tabulated values are for screw anchors installed in minimum 8 inch wide ungrouted concrete masonry walls having reached a minimum f_m of 1,500 psi at time of installation.

² Embedment is measured from the masonry surface to the embedded end of the screw anchor.

³ Screw anchors may be installed at any location in the wall face provided the minimum edge and end distances are maintained.



TABLE 6
ALLOWABLE SHEAR LOADS FOR TITEN®2 SCREW ANCHORS INSTALLED IN
UNGROUTED CMU WALL FACES^{1,2,3}

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Direction of Loading	Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)		
3/16	1 1/4	3	3 7/8	3 7/8	Toward edge, parallel to wall end	168
1/4	1 1/4	4	3 7/8	3 7/8	Toward edge, parallel to wall end	163

For **SI**: 1 inch = 25.4 mm, 1 lbf. = 4.448 N, 1 psi = 6.895 kPa

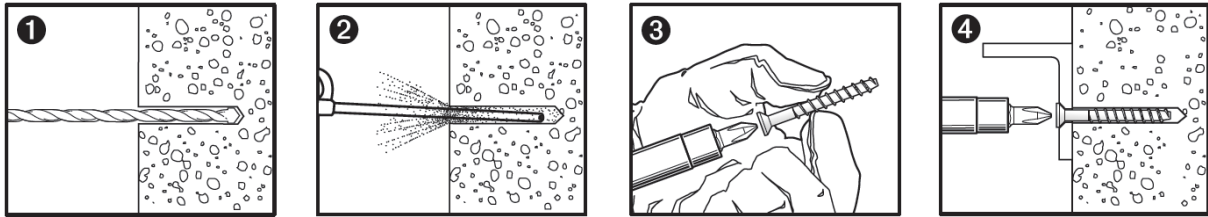
¹ The tabulated values are for screw anchors installed in minimum 8 inch wide ungrouted concrete masonry walls having reached a minimum f'_m of 1,500 psi at time of installation.

² Embedment is measured from the masonry surface to the embedded end of the screw anchor.

³ Screw anchors may be installed at any location in the wall face provided the minimum edge and end distances are maintained.



Figure 1 – Titen®2 Screw Anchors



- Step 1** – Drill a hole in the base material using the proper diameter carbide drill bit to a depth that is 1/2" deeper than the specified embedment depth.
- Step 2** – Clean the hole of excess drill fines with compressed air.
- Step 3** – Assemble the Titen Installation Tool sleeve and drive socket over the drill bit, and position the anchor in the drive socket.
- Step 4** – Drive the anchor through the fixture and into the predrilled hole. The drive socket will automatically disengage from the anchor when the anchor is flush with the fixture.

Figure 2 – Installation Instructions for Titen®2 Screw Anchors