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ESR-2328

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DIVISION: 03 00 00—CONCRETE
SECTION: 03 16 00—CONCRETE ANCHORS
DIVISION: 04 00 00—MASONRY
SECTION: 04 05 19.16—MASONRY ANCHORS
DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 05 23—WOOD, PLASTIC, AND COMPOSITE FASTENINGS

REPORT HOLDER:

FASTENING SPECIALISTS, INC.

726 CENTRAL FLORIDA PARKWAY
ORLANDO, FLORIDA 32824

EVALUATION SUBJECT:

TIE MAX ANCHOR BOLTS AND CONTINUOUS ROD TIE-DOWN RUN (CRTR)

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REPORT HOLDER:

FASTENING SPECIALISTS, INC.
726 CENTRAL FLORIDA PARKWAY
ORLANDO, FLORIDA 32824
(407) 888-9099
www.tiemax.com

EVALUATION SUBJECT:

TIE MAX ANCHOR BOLTS AND CONTINUOUS ROD TIE-DOWN RUN (CRTR)

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Properties evaluated:

Structural

2.0 USES

The TIE MAX anchor bolts and continuous rod tie-down runs (CRTRs), which include TIE MAX threaded rods, TIE MAX washers, TIE MAX hex nuts, and TIE MAX threaded rod couplers, are used to resist wind uplift loads applied at the top of wood light-frame walls. Each CRTR provides a continuous load path from the top of the CRTR to a TIE MAX anchor bolt, which transfers the wind uplift loads into a concrete or masonry foundation.

3.0 DESCRIPTION

3.1 General:

Specifications for each product are covered under TIE MAX's approved quality documentation. Each product is available with and without a zinc coating. The CRTRs include the following components: TIE MAX threaded rods, TIE MAX washers, TIE MAX hex nuts, and TIE MAX threaded rod couplers.

3.2 TIE MAX Anchor Bolts:

The TIE MAX anchor bolts have a nominal shank diameter of $^5/_8$ inch and a minimum length of $10^1/_2$ inches (267 mm). The threads start $3^1/_2$ inches (88.9 mm) beyond the underside of the head. TIE MAX Anchor Bolts used in interior walls have a head diameter of 2 inches (50.8 mm).

3.3 Continuous Rod Tie-down Run (CRTR) Components:

3.3.1 TIE MAX Threaded Rods: The TIE MAX threaded rods have nominal shank diameters of $^1/_2$ and $^5/_8$ inch.

3.3.2 TIE MAX Washers: See Table 3 for sizes.

3.3.3 TIE MAX Hex Nuts: The TIE MAX hex nuts have nominal diameters of $^1/_2$ and $^5/_8$ inch.

3.3.4 TIE MAX Couplers: The TIE MAX hex couplers have nominal diameters of $^1/_2$ and $^5/_8$ inch on each end. A coupler reducer is also available with $^1/_2$ inch (12.7 mm) on one end and $^5/_8$ inch (15.9 mm) on the other end.

4.0 DESIGN AND INSTALLATION

4.1 Installation:

The TIE MAX Anchor Bolts and CRTR must be installed in accordance with this evaluation report and the manufacturer's published installation instructions. For each installation, all products must either be zinc-coated or uncoated, due to TIE MAX nuts and TIE MAX couplers being tapped oversized for applications of zinc coatings. In the event of a conflict between this report and the manufacturer's published installation instructions, the more restrictive condition governs.

4.2 Design:

The allowable (ASD) design loads for the TIE MAX anchor bolts are given in Tables 1 and 2 for embedment in, respectively, concrete and reinforced masonry. The allowable (ASD) design loads for the CRTR are listed in Tables 3 and 4.

5.0 CONDITIONS OF USE

The TIE MAX anchors and CRTRs 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 contribution of wood shrinkage, wood deformation under load, and fastener slip, to the overall deflection of the wall in which the CRTRs are installed, must be analyzed by a registered design professional.

5.2 The tabulated allowable loads noted in this report are obtained from calculations on the individual components making up the CRTR. Other variables that may further limit capacities, such as anchorage strength in tension or shear, and stresses within the wood or steel members of the wall in which the CRTR is installed, must be analyzed by the registered design professional.

5.3 When using the basic load combinations in accordance with IBC Section 1605.3.1, the tabulated allowable loads for the CRTR must not be increased for wind or seismic loading. When using the alternate basic load combinations in IBC Section 1605.3.2 that include wind or earthquake loads, the tabulated ASD loads for the CRTR must not be increased by $33^1/_3$ percent, nor shall the alternative basic load combinations be reduced by a factor of 0.75.

5.4 The tabulated allowable CRTR tension (uplift) loads and corresponding elongations are not intended to represent the capacity or deflection of the framing systems, or any other portion of the wall in which the CRTR is installed.

5.5 Design of the framing systems is the responsibility of the design professional and must be performed in accordance with the applicable code, taking into account all of the design considerations given in Section 4.1 of this report.

5.6 The design of framing and other elements within the load path is the responsibility of the design professional, and must be performed in accordance with the applicable code, considering loads, displacements, shrinkage, etc.

5.7 The design of wall top plates receiving uplift load and distributing it through the CRTR must take into account both deflection and strength limit states, including combined axial and flexural stress for cases where the wood top plate(s) also acts as a drag strut or collector, and must also take into account geometric compatibility.

5.8 A positive method to resist torsional rotation and cross-grain flexure of the top plates due to offsets between the point of load application (e.g., hurricane ties at the sides of the top plates) and load resistance (e.g., anchors at the center of the top plate), must be provided where such conditions exist; and calculations in accordance with principles of mechanics must be used to determine the demand on connections used to resist top plate torsion.

5.9 The use of the CRTRs in contact with chemically treated wood is subject to the approval of the code official, since the effects of corrosion of metal in contact with chemically treated wood, on the structural performance of the components, are outside the scope of the report.

5.10 Exterior use applications, such as use that allows exposure to moisture, are outside the scope of this report.

5.11 Installation of the CRTRs must be limited to dry interior locations.

5.12 No further increase in duration of load for wind loading is allowed for the use of the CRTR.

5.13 Drawings and design details verifying compliance with this report must be submitted to the code official for approval. Drawings and calculations must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Continuous Rod Tie-down Runs and Continuous Rod Tie-down Systems Used to Resist Wind Uplift (AC391), dated June 2010 (editorially revised March 2015).

6.2 Data in accordance with ACI 318 (for TIE MAX Anchors installed in concrete).

6.3 Data in accordance with ACI 530 (for TIE MAX Anchors installed in masonry).

7.0 IDENTIFICATION

The TIE MAX anchor bolts, steel nuts, threaded rods, and threaded rod couplers are identified by the name of the report holder (Fastening Specialists, Inc.), the product name, and the evaluation report number (ESR-2328).

TABLE 1—ALLOWABLE UPLIFT LOADS (ASD), TIE MAX ANCHOR IN CONCRETE[1-7]

$^5/_8$" TIE MAX ANCHOR BOLTS (CAST IN PLACE)	MINIMUM SPECIFIED CONCRETE COMPRESSIVE STRENGTH (psi)	MINIMUM EMBEDMENT (in.)	MINIMUM EDGE DISTANCE (in.)	ALLOWABLE UPLIFT LOAD (lbf)
	2,500	7	2	5,480
		7	7	6,140

For **SI:** 1 in. = 25.4 mm, 1 lbf = 4.5 N, 1 psi = 6.9 kPa.

Notes:
1. The minimum concrete thickness must be 10 inches.
2. Installations involving Seismic Design Categories C, D, E, and F listed in ACI 318 Section D.3.3 are beyond the scope of this report.
3. Allowable design loads calculated for use in regions of concrete members where analysis indicates no cracking at service loads according to ACI 318 Section D.5.2.6.
4. The distance from the center of the anchor to all other edges must be a minimum of 10.5 inches.
5. Minimum spacing between anchors must be 21 inches to act as a single fastener according to ACI318 Section D.1.
6. The allowable uplift values are based on calculations in accordance with Appendix D of AC318 divided by a factor of 1.6 in order to take into account the 1.6W load combination. The design wind load (W) must be less than the tabulated values.
7. The anchors must not be torqued (finger tightened).

TABLE 2—ALLOWABLE DESIGN LOADS (ASD), TIE MAX ANCHOR IN REINFORCED MASONRY[1-3]

$^5/_8$" TIE MAX ANCHOR BOLTS (CAST IN PLACE)	MINIMUM EMBEDMENT (in)	MINIMUM EDGE DISTANCE (in.)	MINIMUM END DISTANCE (in.)	ALLOWABLE UPLIFT LOAD (lbf)
	7	4	12	2,210

For **SI:** 1 in. = 25.4 mm, 1 lbf = 4.5 N, 1 psi = 6.9 kPa.

Notes:
1. Allowable uplift loads are for pullout from grouted reinforced masonry with minimum specified compressive strength of 2,000 psi.
2. Masonry units must have a minimum width of 8 inches.
3. Per ACI 530 Section 2.1.4.2.2.1, the projected areas of adjacent bolts must not overlap.

TABLE 3—ALLOWABLE DESIGN LOADS (ASD), TIE MAX WASHER BEARING CAPACITIES[1-3]

TIE MAX WASHERS	ALLOWABLE UPLIFT LOADS (lbf) SOUTHERN PINE (SYP) G = 0.55	ALLOWABLE UPLIFT LOADS (lbf) SPRUCE-PINE-FIR (SPF) G = 0.42
2 in. x 2 in. x $^1/_8$ in.	1,960	1,800
2.5 in. x 2.5 in. x $^3/_{16}$ in.	3,520	2,840
3 in. x 3 in. x $^1/_4$ in.	5,440	4,090
3 in. x 3.5 in. x $^1/_4$ in.	6,370	4,730

For **SI:** 1 in. = 25.4 mm, 1 lbf = 4.5 N, 1 psi = 6.9 kPa.

Notes:
1. Allowable uplift loads are the lesser of wood bearing perpendicular to grain capacity or washer bending capacity.
2. Double top plates are required, either Southern Pine No. 2 Grade with $F_c' = 565$ psi or Spruce-Pine-Fir No. 2 Grade with $F_c' = 425$ psi, per the NDS.
3. Reference compression design values perpendicular to grain are adjusted using Bearing Area Factor C_b, per the NDS. Wet Service Factor (CM) and Temperature Factor (Ct) are taken to equal 1.

TABLE 4—ALLOWABLE DESIGN LOADS (ASD), TIE MAX THREADED ROD

MODEL	GROSS DIAMETER (in)	GROSS AREA (in^2)	THREADS PER INCH, *n*	NET AREA, A_n (in^2)	MAXIMUM ALLOWABLE TENSION (lbf)[1]	ALLOWABLE TENSION (lbs) FOR ROD LENGTH LIMIT OF 0.18 inch ELONGATION			
						10 ft	15 ft	20 ft	25 ft
TIE MAX Threaded Rod	$^1/_2$	0.196	13	0.142	4,420	4,420	4,120	3,090	2,470
	$^5/_8$	0.307	11	0.226	6,900	6,900	6,550	4,920	3,930

For **SI:** 1 in. = 25.4 mm, 1 lbf = 4.5 N, 1 psi = 6.9 kPa.

Notes:
1. Maximum allowable tension based on AISC 360 Section J3.

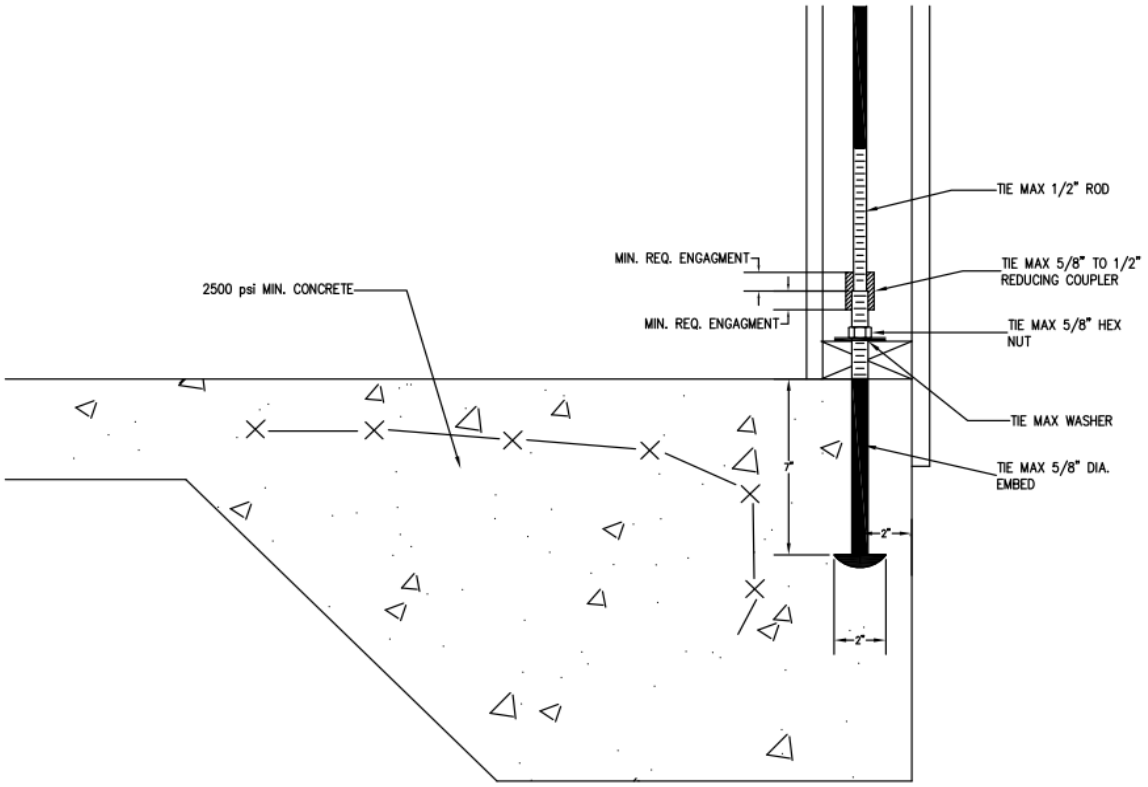
TIE MAX 1/2" ROD
MIN. REQ. ENGAGMENT
TIE MAX 5/8" TO 1/2" REDUCING COUPLER
2500 psi MIN. CONCRETE
MIN. REQ. ENGAGMENT
TIE MAX 5/8" HEX NUT
TIE MAX WASHER
TIE MAX 5/8" DIA. EMBED
7"
2"
2"

FIGURE 1

ICC-ES Evaluation Report

ESR-2328 FBC Supplement

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EVALUATION SUBJECT:

TIE MAX ANCHOR BOLTS AND CONTINUOUS ROD TIE-DOWN RUN (CRTR)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Tie Max anchor bolts and continuous rod tie-down runs (CRTRs), recognized in ICC-ES master evaluation report ESR-2328, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2014 *Florida Building Code—Building*
- 2014 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Tie Max anchor bolts and CRTRs, described in Sections 2.0 through 7.0 of the master evaluation report ESR-2328, comply with the *Florida Building Code—Building*, and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2012 *International Building Code®* (IBC) provisions noted in the master report.

Use of the Tie Max anchor bolts and CRTRs for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building*, and the *Florida Building Code—Residential*, has not been evaluated, and is outside the scope of this supplemental report.

For products falling under Florida Rule 9N-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report, reissued October 2016.