ICC-ES Legacy Report

9916B*

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The Subcommittee on Evaluation has reviewed the data submitted for compliance with the *Standard Building Code©, the SBCCI Standard for Hurricane Resistant Residential Construction© SSTD 10-99,* and the International One and Two Family Dwelling Code and submits to the Building Official or other authority having jurisdiction the following report. The Subcommittee on Evaluation, ICC-ES and its staff are not responsible for any errors or omissions to any documents, calculations, drawings, specifications, tests or summaries prepared and submitted by the design professional or preparer of record that are listed in the Substantiating Data Section of this report. Portions of this report were previously included in Evaluation Reports #9916 and #9916A.

REPORT NO.: 9916B

EXPIRES: See the current EVALUATION REPORT INDEX

CATEGORY: HANGERS AND SUPPORTS

SUBMITTED BY:

FASTENING SPECIALISTS, INC.
726 CENTRAL FLORIDA PARKWAY
ORLANDO, FLORIDA 32824

1. PRODUCT TRADE NAME

TIE MAX and TIE MAX STUD Anchors

2. SCOPE OF EVALUATION

Structural:

2.1 Wind Load Uplift
2.2 Wind Load Lateral

3. USES

TIE MAX and TIE MAX STUD Anchors are used to anchor wood stud walls and roof framing members to the foundation.

4. DESCRIPTION

4.1 General

TIE MAX and TIE MAX STUD are fabricated systems for anchoring roof and walls to foundations. The systems consist of 5/8 inch anchor bolts embedded in concrete with a 1/2 inch or 5/8 inch rod connected to the anchor bolt with a coupling nut. A coupling nut is attached to the top of the rod to allow the rod to project above the top plates. A steel plate and nut are used to anchor the top plate. Components of the system are listed in Section 4.2 Materials.

4.1.1 TIE MAX Cast in Concrete: In this system the TIE MAX anchor bolt is cast in the concrete. The TIE MAX anchor bolt is 5/8 inch diameter embedded a minimum of 7 inches into concrete. The TIE MAX Edge bolt's head diameter is 2 inches for placement within 7 inches of a free edge. The TIE MAX Field bolt's head diameter is at least 1-1/2 inches for placement at other locations.

4.1.2 TIE MAX STUD: In this system the TIE MAX STUD anchor bolt is a 5/8 inch threaded rod minimum 10-1/2 inches long which is set 7 inches into hardened concrete by drilling a hole and using epoxy.

4.1.3 TIE MAX Cast in Reinforced Masonry Bond Beam: In this system the TIE MAX anchor bolt is cast in the grout of a reinforced masonry bond beam. The TIE MAX anchor bolt is 5/8 inch diameter with a 2 inch diameter head embedded 7 inches into the grouted masonry bond beam.

4.2 Materials

4.2.1 TIE MAX: Cast in place anchor bolt 5/8 inch diameter shaft minimum 10-1/2 inches long. A 2 inch diameter head is formed on the Edge bolt and a 1-1/2 inch minimum head is formed on the Field bolt. A 5/8 - 11 thread is rolled into the upper 3-1/2 inches of the shaft. The anchor when set with the bottom of the threads at the top of the concrete will insure a 7 inch deep embedment. The anchor is manufactured from Grade 36MOD steel. The steel is Zinc Plated per ASTM B 633.

4.2.2 TIE MAX STUD: Epoxy set anchor rod minimum 10-1/2 inches long 5/8 inch diameter of Grade A36 MOD steel. The steel is Zinc plated per ASTM B 633. Epoxy is Power-Bond™ by Powers.

Fastening, Inc. (formerly Rawl, The Rawlplug Company, Inc.). The Power-Bond Epoxy Pump System consists of a self-contained pump style cartridge in which the adhesive components are mixed. The system is supplied in 10 fluid ounce cartridges. Each pump cartridge contains pre-measured amounts of epoxy resin and hardener which are separated by a set of engineered plastic barrier rings. As the pump is actuated, the barrier rings are pulled to the top of the cartridge allowing the components to flow together. As

the cartridge is pumped, the components are mixed together. Once the epoxy has been thoroughly mixed, the plunger handle is pulled up to extend the built-in mixing nozzle. The handle portion of the nozzle is removed and the cartridge is ready to use by inserting into a caulking gun.

The TIE MAX STUD threaded rod is installed in a predrilled hole which has been drilled with a bit complying with ANSI B 94.14. The hole is drilled to a specified size 3/4 inch diameter and embedment depth 7 inches and cleaned using compressed air and a nylon brush. The injection gel epoxy is injected into the hole, starting at the bottom and gradually moved upward until the hole is approximately one-half full. The threaded rod is inserted, while turning, until epoxy flows out of the top of the hole, fully embedding the rod or bar. Bond strength is reduced at elevated temperatures, see manufacturer. The hardening and curing time at different temperatures for the epoxy is specified by the manufacturer (60° F slow set gel time is 20 minutes and curing time is 36 hours). The shelf life of the epoxy resin is one year minimum. Special Inspection is required for installing the Power-Bond Adhesive, see Section 5.5 of this report.

4.2.3 Threaded Rods: ASTM A 307 steel rods in either ½ inch diameter or 5/8 inch diameter, fully threaded. Available in lengths to accommodate various wall heights and location of couplers. The steel is Zinc Plated per ASTM B 633.

4.2.4 Couplers: Threaded rod couplers are Grade 2, SAE 1008 steel with a length of twice that required for full engagement. The couplers are available in three types, a 5/8 inch to 1/2 inch reducing coupler, a ½ inch to ½ inch coupler and a 5/8 inch to 5/8 inch coupler. The steel is Zinc Plated per ASTM B 633.

4.2.5 Square Washers: The washers are steel flat plate manufactured from SAE 1008-1025 Grade steel. The washers are available in four sizes, 2 inches x 2 inches x 1/8 inch, 2.5 inches x 2.5 inches x 3/16 inch, 3 inches x 3 inches x 1/4 inch and 3 inches x 3.5 inches x 1/4 inch.

4.2.6 Nuts: 1/2-13 inc, 5/8-11 hex Nuts, Type Grade 2, low or medium carbon steel, SAE J995.

4.3 Design Loads

Maximum allowable design loads for the anchors are given in Tables 1 through 3. Design loads on the building shall be determined in accordance with Chapter 16 of the *Standard Building Code*© and shall not exceed the loads shown in the tables.

The capacities noted in this report for the TIE MAX and TIE MAX Stud anchors are not intended to represent the capacity of framing systems or masonry walls connected to the TIE MAX and TIE MAX STUD anchors. The design of framing and other elements within the load path of the anchors is the responsibility of the design professional, and shall be performed in accordance with the applicable code, considering loads, displacements, shrinkage, etc. The design of wall top plates receiving uplift load and distributing it to the anchors shall consider 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 shall also consider geometric compatibility. 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) shall be provided where such conditions exist; and calculations in accordance with principles of mechanics shall be used to determine the demand on connections used to resist top plate torsion.

In addition to other design considerations set forth in the applicable code and this report, the lesser of the uplift loads in Table 1 and Table 3 for concrete, or Table 1 and Table 3 for grouted masonry, must be used to establish the strength of the systems.

5. INSTALLATION

5.1 General

TIE MAX and TIE MAX STUD Anchors are installed in accordance with the manufacturer's published installation instructions and this report.

The manufacturer's published installation instructions and this report shall be strictly adhered to and a copy of these instructions shall be available at all times on the job site during installation.

The instructions within this report govern if there are any conflicts between the manufacturer's instructions and this report.

5.2 Foundations

TIE MAX and TIE MAX STUD Anchor Bolts are embedded 7 inches into concrete foundations that are minimum 12 inches thick exterior to receive the Edge bolt and 10 inches interior to receive Field bolts, with a minimum compressive strength of 2,500 psi. The bolts shall have a minimum edge distance of 2 inches and shall be spaced as required to resist wind uplift load. The foundations shall be designed to resist the design loads determined in accordance with Chapter 16 of the *Code*.

5.3 Wall Construction

Wood framed walls shall be constructed of either Southern Pine, No. 2 Grade, G = 0.55 or Spruce Pine Fir, No. 2 Grade, G = 0.42, minimum 2 inch nominal thickness. All walls shall have double top plates.

5.4 Masonry Bond Beams

TIE MAX anchor bolts are embedded 7 inches into reinforced masonry lintels or bond beams with a minimum 1 #5 steel reinforcing bar complying with ACI 318. The lintel or bond beam is filled with grout complying with ASTM C 476 with a minimum compressive strength of 2000 psi. The bolts shall have a minimum edge distance of 2 inches.

TIE MAX anchors may also be installed in formed concrete lintels or bond beams used as part of a masonry wall. The concrete lintels or bond beams shall have a minimum compressive strength of 2,500 psi. Design loads, minimum embedment and edge distances for the anchors shall be as noted in this report for installation in concrete.

5.5 Special Inspection

Special Inspection is required for use of Power-Bond adhesive. The construction shall be inspected by a registered engineer or architect, preferably the one responsible for the design, or by a competent representative responsible to the registered engineer.

Such inspection shall be of a nature as to determine that the construction and quality of work are in accordance with the contract drawings and specifications and the manufacturer's installation instructions.

Items to be verified by the special inspector include hole diameter, cleanliness of hole and anchor rod, adhesive type, adhesive application, rod diameter, rod embedment, grade of steel, and other requirements specified in this report and the manufacturer's instructions.

6. SUBSTANTIATING DATA

6.1 Manufacturer's descriptive literature, specifications, mil order certificates, and installation instructions.

6.2 Test report on load testing under ASTM E 488, Applied Research Laboratories, Test Report 29858, 10/01/98, signed by Lawrence E. Jollioffe, Jr., Alan B. Suket, and signed and sealed by Christopher A. Hammon, P.E.

6.3 Engineering calculations, Bowen Engineering Corporation, November 23, 1998, Revised January 20, 1999, signed by David Horne, E.I., and signed and sealed by Fred J. Bowen, P.E. Supplemental calculations for bolt modifications, May 5, 1999.

6.4 Test report on tension testing of adhesive anchor PROSTUD in grouted masonry under ASTM E 488 and E 1512, C E L Consulting, Report No. 8R57, October 12, 1998, signed and sealed by Lee Mattis, P.E.

6.5 Test report on shear and tension loads in concrete and grouted masonry under ASTM E 488, Applied Research Laboratories, Lab No. 29905, 02/01/99, signed by Lawrence E. Jolliffe, Jr., Christopher A. Hammon, P.E., and Alan B. Sukert.

7. CODE REFERENCES

Standard Building Code - 1999 Edition

Section 103.7	Alternate Materials and Methods
Section 1606	Wind Loads
Section 1609	Load Combinations
Chapter 17	Structural Tests and Inspections
Chapter 19	Concrete
Section 1914	Headed Bolts and Headed Stud Anchors in Concrete
Chapter 22	Steel
Section 2301.2	Wood Construction - Design
Section 2306.2	Other Fastenings
Section 2307	Floor Framing
Section 2308	Vertical Framing
Section 2309	Roof and Ceiling Framing

SBCCI Standard for Hurricane Resistant Residential Construction© SSTD 10-99

Section 101.4	Alternate Materials and Methods
Section 101.6.2	Design Concepts - Exterior Walls
Section 104	Design Criteria
Chapter 3	Buildings With Wood-Framed Exterior Walls
Section 302.1	Fasteners and Connectors
Section 303.2.3	Sill Plate to Foundation Anchorage
Section 303.3.2	Wall to Foundation Anchorage - Monolithic Slab-On-Grade Foundations
Section 305.3	Connections for Exterior Wall Framing
Section 305.7	Holddown Connectors
Section 307	Roof Systems
Section 307.1.5	Connections - Rafter-Joist Systems
Section 307.2.6	Connections - Truss Framing Systems
Chapter 4	Combined Concrete, Masonry or ICF And Wood Exterior Wall Construction

International One and Two Family Dwelling Code - 1998 Edition

Section 108	Alternate Materials and Systems
Section 301	Design Criteria
Section 403	Footings
Chapter 5	Floors
Chapter 6	Wall Construction
Table 602.3a	Fastener Schedule for Structural Members
Chapter 8	Roof-Ceiling Construction

8. COMMITTEE FINDINGS

The Subcommittee on Evaluation in review of the data submitted finds that, in their opinion, the TIE MAX and TIE MAX STUD Anchors as described in this report conform with or are suitable alternates to that specified in the *Standard Building Code©, the SBCCI Standard for Hurricane Resistant Residential Construction© SSTD 10-99,* and the International One and Two Family Dwelling Code or Supplements thereto.

9. LIMITATIONS

9.1 This Legacy Evaluation Report and the installation instructions, when required by the building official, shall be submitted at the time of permit application.

9.2 Design loads on the TIE MAX and TIE MAX STUD Anchors shall be determined in accordance with Chapter 16 of the *Standard Building Code*©.

9.3 Design of the framing systems (wood and/or masonry) is the responsibility of the design professional, and must be performed in accordance with the applicable code, considering all of the design considerations given in Section 4.3 of this report.

9.4 When using SSTD 10-99, the design loads listed in the standard shall not exceed those recommended by the manufacturer as shown in Section 4.3.

9.5 Each package of TIE MAX and TIE MAX STUD Anchors components shall contain the manufacturer’s installation instructions.

9.6 TIE MAX and TIE MAX STUD Anchors that are exposed directly to weather or subject to salt corrosion in coastal areas, as determined by the local building official, shall be galvanized in accordance with 302.1.3 of SSTD 10-99.

9.7 Installation of TIE MAX and TIE MAX STUD Anchors in masonry lintels and bond beams is covered under Section 5.4 of this report.

9.8 Installations using Power-Bond adhesive require special inspecting, see Section 5.5 of this report.

10. IDENTIFICATION

Each package of TIE MAX and TIE MAX STUD Anchors covered by this report shall be labeled with the manufacturer's name and/or trademark, the SBCCI Public Safety Testing and Evaluation Services Inc. Seal or initials (SBCCI PST & ESI), and the number of this report for field identification.

11. PERIOD OF ISSUANCE

SEE THE CURRENT EVALUATION REPORT INDEX FOR STATUS OF THIS LEGACY EVALUATION REPORT.

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TABLE 1—ALLOWABLE DESIGN LOADS (POUNDS)
TIE MAX AND TIE MAX STUD IN CONCRETE

Model	Minimum Embedment (in)	Minimum Edge Distance (in)	Threaded Rod Diameter (in)	Allowable Uplift Load (lbs)	Allowable Shear Load (lbs)
5/8 inch TIE MAX (cast in place)	7	2	½	5585	5343
	7	7	½	6023	5343
	7	7	5/8	8377	5343
5/8 inch TIE MAX STUD (epoxy set)	7	2	½	3349	3468
	7	7	½	4943	3468

Notes:
1. Allowable uplift loads shown in the table are for pullout from concrete. The design may be limited by washer bearing capacity (see Table 3 below) or other design considerations (see Section 4.3 above).
2. Allowable Shear loads shown in the table are at the bottom wood plate with a washer and nut in place, minimum 2 x4 plate Southern Pine No. 2 Grade, G =0.55.
3. The allowable design load shall not be increased for duration of load.
4. Minimum concrete compressive strength is F'_c = 2500 psi.
5. Epoxy is Power-Bond ™ by Powers Fastening Inc., see section 4.2.2 above. Special Inspection is required for installation of Power-Bond epoxy, see section 5.5 above.
6. SI Units conversion: 1 in. = 25.4 mm, 1 lbf = 4.5 N., 1 psi = 6.9 kPa.

TABLE 2—ALLOWABLE DESIGN LOADS (POUNDS)
TIE MAX IN REINFORCED MASONRY BOND BEAM

Model	Minimum Embedment (Inches)	Minimum Edge Distance (Inches)	Threaded Rod Diameter (Inches)	Allowable Uplift Load (lbs)
5/8 inch TIE MAX	7	2	½	1998

Notes:
1. Allowable uplift loads are for pullout from grouted reinforced masonry bond beams, reinforced with minimum #5 reinforcing bar, and minimum grout strength of 2000 psi. The design may be limited based on washer bearing capacity (see Table 3 below) or other design considerations (see Section 4.3, above).
2. The allowable loads shall not be increased for duration of load.
3. SI Units conversion: 1 in = 25.4 mm, 1 lbf = 4.5 N, 1 psi = 6.9 kPa.

TABLE 3—ALLOWABLE LOADS
TOP PLATE WASHERS

Top Plate Washer	Southern Pine G = 0.55 Allowable Uplift Loads (Lbs)	Spruce Pine Fir G = 0.42 Allowable Uplift Loads (Lbs)
2 in. x 2 in. x 1/8 in.	2260	1513
2.5 in. x 2.5 in. x 3/16 in.	3930	2330
3 in. x 3 in. x 1/4 in.	5595	3315
3 in. x 3.5 in. x 1/4 in	6545	3880

Notes:
1. Allowable uplift loads are for wood bearing. The design may be limited based on concrete pullout capacity (see Table 1 above), grout pullout capacity (see Table 2, above), and other design considerations (see Section 4.3, above).
2. The allowable design load shall not be increased for duration of load.
3. Double top plates are required, either Southern Pine No. 2 Grade with a F'_c = 565 psi or Spruce Pine Fir No. 2 Grade with an F'_c = 335 psi, perpendicular to grain.
4. SI Units conversion: 1 in. = 25.4 mm, 1 lbf = 4.5 N., 1 psi = 6.9 kPa.

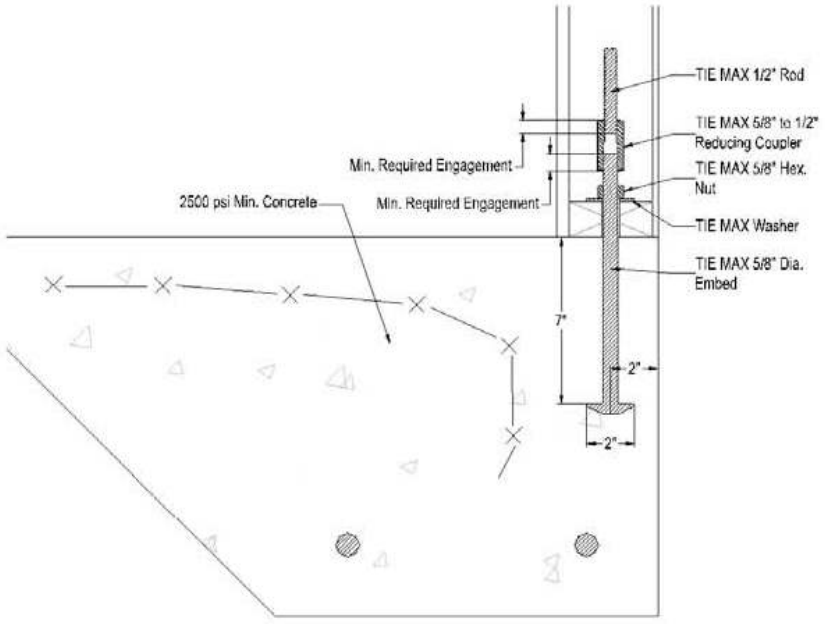
TIE MAX 1/2" Rod
TIE MAX 5/8" to 1/2" Reducing Coupler
TIE MAX 5/8" Hex. Nut
TIE MAX Washer
TIE MAX 5/8" Dia. Embed
Min. Required Engagement
Min. Required Engagement
2500 psi Min. Concrete
7"
2"
2"

FIGURE 1