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ICC-ES Evaluation Report

ESR-2823

Reissued December 2022

Revised January 2023

This report is subject to renewal December 2024.

DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories

REPORT HOLDER:

TRU-WELD DIVISION, TFP CORPORATION

EVALUATION SUBJECT:

DEFORMED BAR ANCHORS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see [ESR-2823 LABC Supplement](#).

Property evaluated:

Structural

2.0 USES

The deformed bar anchors are used to resist static tension and shear loads in uncracked normal-weight concrete. The anchors are alternatives to cast-in-place anchors described in Section 1901.3 of the IBC (Section 1908 of the 2012 IBC and Section 1911 of the 2009 IBC). Deformed bar anchors may be used for concrete connections such as shear keys, bearing plates, base plates, beam-to-column connections, panel connections, angles, and column-to-column connections.

3.0 DESCRIPTION

3.1 General:

The deformed bar anchor studs are produced from deformed steel wire. Embedded lengths range from 15 to 96 inches (381 to 2438 mm), with diameters including 3/8 inch, 1/2 inch, 5/8 inch and 3/4 inch (9.5 mm, 12.7 mm, 15.9 mm and 19.1 mm).

3.2 Material:

3.2.1 Deformed Bar Anchors: The anchors are produced from deformed steel wire conforming to ASTM A496 and the requirements for Type C studs in accordance with American Welding Society D1.1 (AWS D1.1). The minimum yield strength is 70,000 psi (485 MPa) and the minimum tensile strength is 80,000 psi (550 MPa).

3.2.2 Steel Member: Steel plate material for deformed bar anchor stud welding must comply with one of the prequalified Group 1 or Group 2 base metals specified in Table 3.1 of AWS D1.1. The length and width of the steel plate may vary depending on specification requirements. The minimum thickness must be 0.5 times the deformed bar anchor diameter.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The allowable tension and shear load values shown in Tables 1 and 2, respectively, are to be used in allowable stress design (ASD). Allowable loads for deformed bar anchors subjected to combined shear and tension forces can be determined by the following equation:

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

where:

- P_s = Applied service tension load.
- P_t = Table 1 allowable tension load.
- V_s = Applied service tension load.
- V_t = Table 1 allowable shear load.

4.2 Installation:

The anchor locations must comply with the approved plans and specifications. The anchors must be welded to the plates in accordance with Chapter 7 of AWS D1.1, using a stud welding gun. Typical installation parameters are noted in Table 1. Pre-weld preparation of the anchor and supporting member must be in accordance with Section 5.14 of AWS D1.1. The anchors must be placed in position

before the concrete is cast, to fully embed the anchors, and must be adequately secured to prevent displacement during concrete placement. The welding of the deformed bar anchor to the steel plate must be done prior to concrete placement.

4.3 Special Inspection:

Continuous special inspection is required during installation in accordance with Sections 1705.2 and 1705.3 of the IBC (Sections 1704.3 and 1704.4 of the 2009 IBC). Inspectors' responsibilities include verifying:

1. Identification of anchors, and cleanliness
2. Concrete mix design
3. Quality of concrete
4. Anchor tying and bracing
5. Anchor clearances between edges, base and adjacent anchors
6. Anchor size
7. Concrete placement
8. Concrete testing
9. Sampling materials
10. Welder qualifications
11. Weld joint preparation
12. Weld procedure and process
13. Tolerances

5.0 CONDITIONS OF USE

The deformed bar anchors described in this report comply with, or are suitable alternatives to what is specified in, the code listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Anchors are produced and installed in accordance with this report and the manufacturer's instructions. In case of conflict between this report and the installation instructions, this report governs. Allowable loads must be as set forth in this report.
- 5.2 Calculations and details justifying that the applied loads comply with this report must be submitted to the code official for approval. The calculations and details must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3 The use of the anchors subjected to fatigue, shock, or vibratory loads, such as those generated by reciprocating engines and crane loads, and moving loads due to vehicles, is outside the scope of this report.
- 5.4 The use of the anchors is limited to installation in uncracked concrete. The use of the anchors in cracked concrete applications is outside the scope of this report. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.5 Use of the anchors to resist seismic loads is beyond the scope of this report.
- 5.6 When using the allowable stress design load combinations in accordance with 2021 IBC Section 1605.1 (2018, 2015, 2012 and 2009 IBC Section 1605.3.1.1), allowable tension and shear loads shown in Table 1 of this report are not permitted to be increased for wind loading.

5.7 When using the alternative allowable stress design load combinations in accordance with 2021 IBC Section 1605.2 (2018, 2015, 2012 and 2009 IBC Section 1605.3.2), that include wind loads, allowable tension and shear loads shown in Table 1 of this report are not permitted to be increased.

5.8 Anchors are limited to non-fire-resistive construction unless appropriate data, demonstrating acceptable anchor performance in fire-resistive situations, is submitted to the code official for approval.

5.9 Special inspection is provided according to Section 4.3.

5.10 When used in exterior moist locations, the deformed bar anchors must be shown to comply with ACI 318-19 Section 20.5.1.4, ACI 318-14 Section 20.6.1.4 ACI 318-11 Section 7.7.6 and ACI 318-08, Section 7.7.6 as referenced by IBC Section 1901.2, as applicable, to the satisfaction of the code official.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with applicable sections of the ICC-ES Acceptance Criteria for Fiber-reinforced Composite Connectors Anchored in Concrete (AC320), dated October 2015 and editorially revised May 2021, including ASTM E488 tests and analysis.

6.2 Data in accordance with applicable sections of the ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193), dated October 2017 and editorially revised December 2020.

6.3 Data in accordance with AWS D1.1 and ASTM A496.

6.4 Quality documentation.

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-2823) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.

7.2 In addition, Deformed Bar Anchor Studs manufactured by Tru-Weld Division, TFP Corporation, are shipped in containers bearing the name of the report holder (Tru-Weld Division, TFP Corporation), the deformed bar diameter and length, and the heat number, part number, lot number and number of pieces enclosed. In addition, each deformed bar is marked with the Tru-Weld logo (see Figure 1).

7.3 The report holder's contact information is the following:

TRU-WELD DIVISION, TFP CORPORATION

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TABLE 1—ALLOWABLE TENSION LOADS AND INSTALLATION DIMENSIONS FOR DEFORMED BAR ANCHORS IN NORMAL-WEIGHT CONCRETE

PARAMETER	VALUE			
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Anchor diameter (inch)	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Minimum embedment (inches)	15	21	26	30
Minimum anchor spacing (inches)	3	$3\frac{1}{4}$	$3\frac{5}{8}$	3
Minimum edge distance (inches)	$2\frac{1}{8}$	4	4	4
Allowable tension load (lbf)	2210 ¹	3415 ¹	6135 ²	7915 ²

For **SI**: 1 inch = 25.4 mm; 1lbf = 48.93 N; 1 psi = 6.89 kPa.

¹Allowable tension values based on deformed bar anchor cast in concrete having a minimum compressive strength of 3000 psi [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

²Allowable tension values based on deformed bar anchor cast in concrete having a minimum compressive strength of 5000 psi.

TABLE 2—ALLOWABLE SHEAR LOADS AND INSTALLATION DIMENSIONS FOR DEFORMED BAR ANCHORS IN NORMAL WEIGHT CONCRETE^{1,2}

PARAMETER	VALUE			
	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Anchor diameter (inch)	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Minimum embedment (inches)	15	21	26	30
Minimum anchor spacing (inches)	9	$12\frac{3}{4}$	$9\frac{1}{2}$	$17\frac{3}{4}$
Minimum edge distance (inches)	4	$6\frac{1}{4}$	$1\frac{3}{4}$	8
Allowable shear load (lbf)	755 ¹	605 ¹	645 ²	830 ²

For **SI**: 1 inch = 25.4 mm; 1lbf = 48.93 N; 1 psi = 6.89 kPa.

¹Allowable shear values based on deformed bar anchor cast in concrete having a minimum compressive strength of 3000 psi [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

²Allowable shear values based on deformed bar anchor cast in concrete having a minimum compressive strength of 5000 psi.

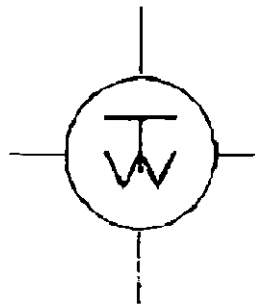


FIGURE 1—TRU-WELD LOGO

DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories

REPORT HOLDER:

TRU-WELD DIVISION, TFP CORPORATION

EVALUATION SUBJECT:

DEFORMED BAR ANCHORS

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that Deformed Bar Anchors, described in ICC-ES evaluation report [ESR-2823](#), have also been evaluated for compliance with the code noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code edition:2020 *City of Los Angeles Building Code* (LABC)**2.0 CONCLUSIONS**

The Deformed Bar Anchors, described in Sections 2.0 through 7.0 of the evaluation report [ESR-2823](#), comply with the LABC Chapter 19 and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Deformed Bar Anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report [ESR-2823](#).
- The design, installation, conditions of use and identification of the Deformed Bar Anchors are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report [ESR-2823](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- The allowable strength and design strength values listed in the evaluation report and tables are for the connection of the anchors to the concrete. The connection between the anchors and the connected members shall be checked for capacity (which may govern).

This supplement expires concurrently with the evaluation report, reissued December 2022 and revised January 2023.

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TRU-WELD DIVISION, TFP CORPORATION

EVALUATION SUBJECT:

DEFORMED BAR ANCHORS

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that the deformed bar anchors, described in ICC-ES evaluation report ESR-2823, have also been evaluated for compliance with the code noted below.

Applicable code edition(s):

- 2022 California Building Code (CBC)

For evaluation of applicable Chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

2.0 CONCLUSIONS**2.1 CBC:**

The deformed bar anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-2823, comply with CBC Chapter 19, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 19, as applicable.

2.1.1 OSHPD: The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA: The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued December 2022 and revised January 2023.