ICC EVALUATION SERVICE

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ICC-ES Evaluation Report

Reissued July 2022

ESR-3587

This report is subject to renewal July 2024.

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

REPORT HOLDER:

COX INDUSTRIES, INC.

EVALUATION SUBJECT:

COX SHEAR CONNECTOR STUDS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, 2009 and 2006 *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 the Los Angeles Department of Building and Safety (LADBS), see ESR-3587 LABC Supplement.

Property evaluated:

Structural

2.0 USES

The Cox shear connector studs are intended for use in steel and concrete composite construction.

3.0 DESCRIPTION

The Cox shear connector studs are manufactured from ASTM A29, grades 1010 through 1020, cold-drawn steel. The studs conform to minimum physical properties as presented in Table 1. The shear connector studs are Type B studs conforming to requirements of the American Welding Society's Structural Welding Code—Steel, AWS D1.1, and Section A3.6 of the AISC Specification for Structural Steel Buildings (AISC 360). The shear connector studs are provided in $^3/_8$-, $^1/_2$-, $^5/_8$-, $^3/_4$-, $^7/_8$- and 1-inch (9.5, 12.7, 15.9, 19.1, 22 and 25.4 mm) diameters.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The nominal horizontal shear strengths of Cox shear connector studs [diameters from $^3/_8$ to $^3/_4$ inch (9.5 to 19.1 mm)] are given in Table 3-21 of the AISC Steel Construction Manual (13th, 14th and 15th editions), in accordance with AISC 360-16 for the 2018 IBC, AISC 360-10 for the 2015 and 2012 IBC and AISC 360-05 for the 2009 and 2006 IBC. Alternatively, the nominal shear strength of one steel headed stud anchor may be calculated in accordance with Section I8.2a of AISC 360-16 (2018 IBC), AISC 360-10 (2015 and 2012 IBC), or Sections I2.1g and I3.2d(3) of AISC 360-05 (2009 and 2006 IBC). The design of composite members with shear connectors must comply with the provisions of Sections 2203, 2204, and 2205 of the IBC and Chapter I of AISC 360.

For shear connector studs installed through steel deck, the steel deck material must be galvanized steel as specified in this report, unless field qualification tests in accordance with AWS D1.1 are conducted to the satisfaction of the code official. The following through-steel deck applications are recognized in this report:

1. Studs $^3/_4$ inch (19.1 mm) or smaller in diameter can be welded through one layer of No. 16 gauge [0.064 inch (1.61 mm)] base material thickness or thinner steel deck coated with a maximum galvanization of 0.90 ounce per square foot (275 g/m^2) complying with ASTM A525, class G90.
2. Studs $^3/_4$ inch (19.1 mm) or smaller in diameter can be welded through two layers of No. 16 gauge [0.064 inch (1.61 mm)] base material thickness or thinner steel deck coated with a maximum galvanization of 0.6 ounce per square foot (180 g/m^2) complying with ASTM A525, class G60.

4.2 Installation:

Cox shear connector studs are automatically end-welded with equipment and procedures as recommended by Cox Industries, Inc. All welding must comply with AISC 360, Section M2, item 4, and AWS D1.1. Prior to welding, steel deck surfaces and supporting beams must be clean, unpainted, and free of heavy rust and mill scale, dirt, sand, oil, water or other deleterious materials. The deck material must be tightly secured to the top flange of beams. No air gaps are permitted at weld areas. The ambient temperature must be above 0°F (-18°C). At ambient temperatures between 0°F and 32°F (-18°C and 0°C), special welding instructions in the Cox stud installation manual must be followed.

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4.3 Special Inspection:

The welding of the shear connector studs requires special inspection in accordance with Sections 1705.2 and 1705.3 of the 2018, 2015 and 2012 IBC or Sections 1704.3 and 1704.4 and Tables 1704.3 and 1704.4 of the 2009 and 2006 IBC, as applicable. The special inspector duties relate to identification of studs; concrete mix design; quality of concrete; stud clearances between edges, base and adjacent studs; stud size; concrete placement and testing; sampling of materials; verification of welder qualifications; weld-joint preparation; welding procedure and process; and tolerances.

5.0 CONDITIONS OF USE

The Cox shear connector studs 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 Installation complies with this report and the manufacturer's instructions. In the event of a conflict between this report and the manufacturer's installation instructions, this report governs.

5.2 Nominal shear strength of shear connector studs must be designed in accordance with references given in Section 4.1 of this report.

5.3 Designs of composite beams and concrete slabs on formed steel deck panels must comply with the provisions of Section 4.1 of this report.

5.4 Design of composite construction consisting of concrete slabs on formed steel deck panels connected to steel beams is limited to shear connectors $^{3}/_{4}$ inch (19 mm) or less in diameter.

5.5 Special inspection must take place in accordance with Section 4.3 of this report.

6.0 EVIDENCE SUBMITTED

Report of tests specified in AWS D1.1; manufacturer's product data; and quality documentation.

7.0 IDENTIFICATION

7.1 The Cox shear connector studs are identified by the letter "C" on the head of each stud (see Figure 1). The studs are shipped in containers with a label bearing the name and address of the manufacturer, stud size, part number, heat number, lot number and evaluation report number (ESR-3587).

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

COX INDUSTRIES, INC.
24700 WOOD COURT
MACOMB, MICHIGAN 48042
(586) 749-6650
www.cox-industries.com

TABLE 1—MINIMUM PHYSICAL PROPERTIES OF STUDS

PROPERTY	VALUE
Ultimate tensile strength	65,000 psi (450 MPa)
Yield strength—0.2% offset	51,000 psi (350 MPa)
Elongation in 2 inches (51 mm)	20 percent
Reduction of area	50 percent

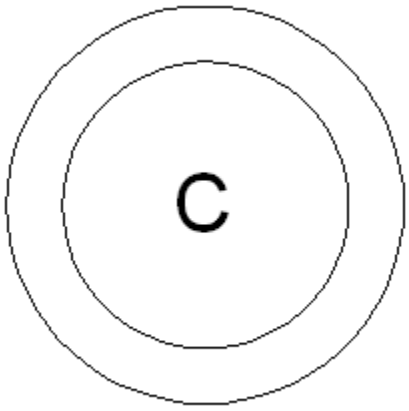

FIGURE 1—HEAD STAMP

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

REPORT HOLDER:

COX INDUSTRIES, INC.

EVALUATION SUBJECT:

COX SHEAR CONNECTOR STUDS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Cox Shear Connector Studs, described in ICC-ES evaluation report ESR-3587, have also been evaluated for compliance with the codes 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 Cox Shear Connector Studs, described in Sections 2.0 through 7.0 of the evaluation report ESR-3587, comply with the LABC Chapter 22, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Cox Shear Connector Studs described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-3587.
- The design, installation, conditions of use and identification of the Cox Shear Connector Studs are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-3587.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.

This supplement expires concurrently with the evaluation report, reissued July 2022.

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Cox Shear Connector Studs, described in ICC-ES evaluation report ESR-3587, have also been evaluated for compliance with the code noted below.

Applicable code edition:

2019 *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 Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

2.0 CONCLUSIONS

2.1 CBC:

The Cox Shear Connector Studs, described in Sections 2.0 through 7.0 of the evaluation report ESR-3587, comply with CBC Chapter 22, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16 and 17, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections of the CBC are beyond the scope of this supplement.

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