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ESR-1094

Reissued 04/2017
This report is subject to renewal 04/2018.

DIVISION: 03 00 00—CONCRETE
SECTION: 03 15 00—CONCRETE ACCESSORIES

REPORT HOLDER:

STUD WELDING ASSOCIATES, INC.

41515 SCHADDEN ROAD
ELYRIA, OHIO 44035

EVALUATION SUBJECT:

SHEAR CONNECTOR STUDS

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Reissued April 2017
Revised November 2017
This report is subject to renewal April 2018.

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

REPORT HOLDER:

STUD WELDING ASSOCIATES, INC.
41515 SCHADDEN ROAD
ELYRIA, OHIO 44035
(800) 365-9353
www.studwelding.com

EVALUATION SUBJECT:

SHEAR CONNECTOR STUDS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 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-1094 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

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

3.0 DESCRIPTION

3.1 Shear Connector Studs:

The shear connector studs are designed for shear transfer between steel and concrete in composite construction. The studs are available in $^1/_2$-, $^5/_8$-, $^3/_4$-, and $^7/_8$-inch (12.7, 15.9, 19.1, and 22 mm) diameters, and comply with the dimensional specifications of American Welding Society (AWS) D1.1-2010. 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 D1.1-10, and Sections A3.6 and I8 of the 2010 AISC Specification for Structural Steel Buildings (AISC 360-10). Shear connector studs are manufactured from ASTM A-29 Grades 1010 through 1020 (inclusive) cold-drawn steel and conform to requirements of AWS D1.1.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The nominal horizontal shear strengths of shear stud connectors are given in Table 3-21 of the AISC Steel Construction Manual (14th edition), in accordance with AISC 360. Alternatively, the nominal shear strength of one stud shear connector may be calculated in accordance with AISC 360-10 Section I8.2 for the 2015 and 2012 IBC (Sections I2.1g and I3.2d(3) of AISC 360-05 for the 2009 and 2006 IBC). The design of composite members with shear connectors must comply with the provisions of Sections 2203, 2204, 2205 and 2206 of the 2015 and 2012 IBC (Sections 2203, 2204, and 2205 of the 2009 and 2006 IBC) and Chapter I of AISC 360.

For 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 D1.1-2010 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 gage [0.064 inch (1.61 mm)] base material thickness or thinner steel deck coated with a maximum galvanization of 1.25 ounces per square foot (0.04 kg/m^2).
2. Studs $^3/_4$ inch (19.1 mm) or smaller in diameter can be welded through two layers of minimum No. 20 gage [0.035 inch (0.89 mm)] base material thickness or thinner deck coated with a maximum galvanization of 0.6 ounce per square foot (0.02 kg/m^2) per layer of deck.

4.2 Installation:

4.2.1 General: Studs must be automatically end-welded with equipment and procedures as recommended by Stud Welding Associates. All welding must comply with AISC 360, Section M2, item 4, and AWS D1.1-2010. Shear connector studs must be shop- or field-welded in the flat (down-hand) position to a planar or horizontal surface. Installation of studs applied to nonplanar surfaces or to a planar surface in the vertical or overhead position is outside the scope of this report.

4.2.2 Composite Beams with Steel Deck: When welding through steel deck, the stud diameter must be no greater than $2^1/_2$ times the thickness of the flange to which the studs are welded, unless the weld is located over the web, or $^3/_4$ inch (19.1 mm), whichever is less. In no case are studs allowed to be welded through more than two plies of metal deck.

Prior to welding, studs and the surface to which they are to be welded must be free from rust, scale, oil, moisture, and other deleterious substances. These areas may be cleaned by brushing, scaling or grinding. The stud base must not be painted, galvanized or plated prior to welding. No air gaps are permitted within welded areas. Ambient temperature should be above 32°F (0°C), and welding is not permitted at temperatures below 0°F (–18°C). Detailed welding instructions in the Stud Welding Associates manual dated January 1997 must be followed for welding at temperatures between 0°F and 32°F (–18°C and 0°C).

4.3 Special Inspection:

The welding of the shear connectors requires special inspection in accordance with 2015 and 2012 IBC Sections 1705.2 and 1705.3, Tables 1705.2.2 and 1705.3, and Chapter N of AISC 360-10 (Sections 1704.3 and 1704.4 and Tables 1704.3 and 1704.4 of the 2009 and 2006 IBC). 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 Stud Welding Associates 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 conflict between this report and the manufacturer's installation instructions, this report governs.

5.2 Nominal shear strength of shear connectors must be determined in accordance with references given in Section 4.1 of this report.

5.3 Design 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 Use of the anchors or studs in fire-resistance-rated assemblies is outside the scope of this report.

5.6 Special inspection must be in compliance 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

Containers for the connector studs carry a label bearing the company name (Stud Welding Associates) and address; part number; type according to AWS D1.1-2010 (Type B); the ICC-ES evaluation report number (ESR-1094); the lot number; and the quantity. The Stud Welding Associates shear connector studs are identified by the letter "X" on the head of each stud.

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

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ESR-1094 LABC AND LARC Supplement

Issued November 2017

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REPORT HOLDER:

STUD WELDING ASSOCIATES, INC.
41515 SCHADDEN ROAD
ELYRIA, OHIO 44035
(800) 365-9353
www.studwelding.com

EVALUATION SUBJECT:

SHEAR CONNECTOR STUDS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Shear Connector Studs, described in ICC-ES master evaluation report ESR-1094, 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 editions:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Shear Connector Studs, described in Sections 2.0 through 7.0 of the master evaluation report ESR-1094, comply with the LABC Chapter 22, and the LARC, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

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

- All applicable sections in the master evaluation report ESR-1094.
- The design, installation, conditions of use and identification of the Shear Connector Studs are in accordance with the 2015 *International Building Code®* (2015 IBC) provisions noted in the master evaluation report ESR-1094.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the master report, reissued April 2017 and revised November 2017.