

ICC-ES Evaluation Report

ESR-2856

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DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories
REPORT HOLDER:
NELSON STUD WELDING, INC.

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EVALUATION SUBJECT:
NELSON SHEAR CONNECTOR STUDS
1.0 EVALUATION SCOPE
Compliance with the following codes:

2012, 2009 and 2006 *International Building Code*® (IBC)

Property evaluated:

Structural

2.0 USES

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

3.0 DESCRIPTION

The Nelson shear connector studs are intended for use in steel and concrete composite construction and are manufactured from ASTM A29-12, 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 -10 and Section A3.6 of the AISC Specification for Structural Steel Buildings (AISC 360-10 for the 2012 IBC, or -05 for the 2009 and 2006 IBC). 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 strength of Nelson stud shear connectors [diameters from $\frac{3}{8}$ to $\frac{3}{4}$ inch (9.5 to 19.1 mm)] is given in Table 3-21 of the AISC Steel Construction Manual (13th and 14th editions), in accordance with Specification for Structural Steel Buildings (AISC 360). Alternatively, the nominal shear strength of one stud shear

connector may be calculated in accordance with Sections I2.1g and I3.2d(3) of AISC 360-05 (2009 and 2006 IBC), or Section I8.2a of AISC 360-10 (2012 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 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 D1.1-10 are conducted to the satisfaction of the code official. The following through-steel deck applications are recognized in this report:

1. Three-quarter-inch-diameter (19.1 mm) stud through one layer of No. 16 gage or thinner deck with a maximum 1.25-ounce-per-square-foot (381 g/m²) galvanization complying with ASTM A525, Class G90.
2. Three-quarter-inch-diameter (19.1 mm) stud through two layers of No. 20 gage or thinner deck with a maximum 0.6-ounce-per-square-foot (183 g/m²) galvanization on each deck layer complying with ASTM A525, Class G60.

4.2 Installation:

Nelson shear connector studs are automatically end-welded with equipment and procedures recommended by Nelson Stud Welding, Inc. All welding must comply with AISC 360 Section M2, item 4, and AWS D1.1-10. 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 welded areas. The ambient temperature must be above 0°F (−18°C). Between 0°F and 32°F (−18°C and 0°C), special welding instructions in the Nelson stud installation manual must be followed.

4.3 Special Inspection:

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

5.0 CONDITIONS OF USE

The Nelson 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 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

The Nelson shear connector studs are identified by the letter "N" on the head of each stud. The studs are shipped in containers with a label bearing the name and address of the manufacturer, stud size, part number, heat number, manufacturer's code and evaluation report number (ESR-2856).

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