ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ESR-2907

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

Reissued 12/2017
This report is subject to renewal 12/2018.

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

REPORT HOLDER:

NELSON STUD WELDING, INC.

7900 WEST RIDGE ROAD
ELYRIA, OHIO 44036

EVALUATION SUBJECT:

NELSON D2L DEFORMED BAR ANCHOR STUDS

Look for the trusted marks of Conformity!

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of ICC INTERNATIONAL CODE COUNCIL

ICC-ES Evaluation Report

ESR-2907

Reissued December 2017

This report is subject to renewal December 2018.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

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

REPORT HOLDER:

NELSON STUD WELDING, INC.
7900 WEST RIDGE ROAD
ELYRIA, OHIO 44036

EVALUATION SUBJECT:

NELSON D2L DEFORMED BAR ANCHOR 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-2907 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

The deformed bar anchor studs are used to resist static tension and shear loads in uncracked normalweight concrete. The anchors are alternatives to cast-in-place anchors described in Section 1901.3 of the 2015 IBC, Section 1908 of the 2012 IBC, and Section 1911 of the 2009 and 2006 IBC.

3.0 DESCRIPTION

3.1 General:

The Nelson D2L Deformed Bar Anchor Studs are deformed steel wire. Diameters include $^3/_8$ inch, $^1/_2$ inch, $^5/_8$ inch and $^3/_4$ inch (9.5, 12.7, 15.9 and 19.1 mm). Nelson anchors may be used for concrete connections such as shear keys, bearing plates, column-base plates, beam-to-column connections, panel connections, angles, and column-to-column connections. The use of these anchors is limited to installation in uncracked normalweight concrete.

3.2 Material:

3.2.1 Deformed Bar Anchors: The anchors are produced from steel deformed wire complying with ASTM A496 and requirements for type C studs in accordance with the American Welding Society D1.1-2010 (2015 and 2012 IBC), -2004 (2009 and 2006 IBC) (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 Plate: Steel embedment plate material for 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, such as ASTM A36. Length and width depends on specification requirements. The minimum plate thickness must be 0.5 times the stud diameter. The use of base plate material of lesser thicknesses must be application-qualified according to Section 7.6 of AWS D1.1, to determine application acceptability.

4.0 DESIGN AND INSTALLATION

4.1 Allowable Loads:

Allowable loads are shown in Tables 3 and 4. For single or grouped deformed bar anchors subject to combined tension and shear loading, that meet tension development length criteria in Table 1 and installation dimensions in Table 2, the following interactive equation applies:

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

where:

P_s = Applied tension load.

P_t = Table 3 allowable tension load.

V_s = Applied shear load.

V_t = Table 4 allowable shear load.

4.2 Installation:

The anchors must be factory-welded to the plates according to Chapter 7 of AWS D1.1, using a stud welding gun. Typical installation requirements are indicated in Tables 1 through 4. The anchor must be placed in position before the concrete is cast, to fully embed these anchors. Surface conditions must comply with Section 26.6.1.2 (d) of ACI 318-14, or Section 7.4 of ACI 318 (2011, 2008 and 2005).

4.3 Special Inspection:

Special inspection during installation is required in accordance with Sections 1705.2 and 1705.3 of the 2015 and 2012 IBC, or Sections 1704.3 and 1704.4 of the 2009 and 2006 IBC. Inspectors' responsibilities include verifying:

1. Identification of anchors.
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 Nelson D2L Deformed Bar Anchor 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 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 are as set forth in this report.

5.2 Calculations justifying that the applied loads do not exceed the anchor allowable capacities described in this report are 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 anchors are 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 Anchors are limited to non-fire-resistive construction.

5.6 Special inspection is provided in accordance with Section 4.3.

5.7 When used in exterior moist locations, the deformed bar anchors must be shown to comply with Sections 26.6.1.1(i) or 26.7.1(k) or 26.8.1(d) of ACI 318-14, or Section 7.7.7 of ACI 318-11 and -08, or Section 7.7.6 of ACI 318-05 to the satisfaction of the code official.

5.8 When using the basic load combinations in accordance with 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.

5.9 When using the alternative basic load combinations in accordance with 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.

5.10 Use of the anchors to resist seismic loads is beyond the scope of this report.

6.0 EVIDENCE SUBMITTED

6.1 Reports of tests in accordance with ASTM E488.

6.2 Data in accordance with AWS D1.1-2010, or -2004 and ASTM A496.

6.3 A quality control manual.

7.0 IDENTIFICATION

Nelson D2L Deformed Bar Anchor Studs are shipped in containers bearing the Nelson name, deformed bar diameter and length, the evaluation report number (ESR-2907), heat number, part number, lot number and number of pieces enclosed. In addition, the manufacturer's symbol "N" is marked along the length of each deformed bar anchor for identification.

TABLE 1—TENSION DEVELOPMENT LENGTH FOR NELSON DEFORMED BAR ANCHOR STUDS

NORMAL-WEIGHT CONCRETE COMPRESSIVE STRENGTH[1], f'_c (psi)	MINIMUM EMBEDMENT LENGTH FOR FULL ANCHOR CAPACITY DEVELOPMENT, AFTER WELDING (inch)			
	Bar Diameter, d_b (inches)			
	$^3/_8$ inch	$^1/_2$ inch	$^5/_8$ inch	$^3/_4$ inch
2,500	16	22	27	33
3,000	15	20	25	30
3,500	14	18	23	28
4,000	13	17	22	26

For **SI:** 1 psi = 6.894 kPa, 1 inch = 25.4 mm.
[1] Minimum Compressive Strength of 24 MPa is required under ADIBC Appendix L, Section 5.1.1.

TABLE 2—INSTALLATION PARAMETERS[1]

PARAMETER	TENSION LOADS	SHEAR LOADS
Critical edge distance	$10d_b$[1]	$15d_b$[1]
Critical spacing	$7.5d_b$[1]	$20d_b$[1]
Minimum cover at anchor base	ACI 318-14, Section 20.6.1.1 ACI 318-11, -08 and -05 Section 7.7.1	ACI 318-14, Section 20.6.1.1 ACI 318-11, -08 and -05 Section 7.7.1

[1] d_b = bar diameter.

TABLE 3—ALLOWABLE TENSION CAPACITY FOR NELSON D2L DEFORMED BAR ANCHORS WITH MINIMUM DEVELOPMENT LENGTHS AS SHOWN IN TABLE 1

BAR DIAMETER (inch)	STRESS AREA, A_1 (inch^2)	ALLOWABLE TENSION CAPACITY(lbs)	
		Based on Steel Yield Strength	Based on Steel Ultimate Strength
$^3/_8$	0.11	1,925	2,200
$^1/_2$	0.19	3,325	3,800
$^5/_8$	0.29	5,075	5,800
$^3/_4$	0.41	7,175	8,200

For **SI:** 1 inch = 25.4 mm, 1 inch^2 = 645.16 mm^2, 1 lbf = 4.44822 N.

TABLE 4—ALLOWABLE SHEAR CAPACITY FOR NELSON DEFORMED BAR ANCHOR STUDS WITH $15d_b$ MINIMUM EMBEDMENT LENGTH [1]

NOMINAL BAR DIAMETER (inch)	Area (inch^2)	ALLOWABLE SHEAR CAPACITY—NORMAL-WEIGHT CONCRETE			
		2,500 psi	3,000 psi	3,500 psi	4,000 psi
$^3/_8$	0.11	1,400	1,600	1,700	1,800
$^1/_2$	0.19	-	2,900	3,100	3,200
$^5/_8$	0.29	-	4,300	4,500	4,700
$^3/_4$	0.41	-	5,300	5,900	6,500

For **SI:** 1 inch = 25.4 mm, 1 inch^2 = 645.16 mm^2, 1 psi = 6.894 kPa.

[1] d_b = bar diameter

ICC-ES Evaluation Report

ESR-2907 LABC and LARC Supplement

Issued December 2017
This report is subject to renewal December 2018.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

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

REPORT HOLDER:

NELSON STUD WELDING, INC.
7900 WEST RIDGE ROAD
ELYRIA, OHIO 44036

EVALUATION SUBJECT:

NELSON D2L DEFORMED BAR ANCHOR STUDS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Nelson D2L Deformed Bar Anchor Studs, described in ICC-ES master evaluation report ESR-2907, 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 Nelson D2L Deformed Bar Anchor Studs, described in Sections 2.0 through 7.0 of the master evaluation report ESR-2907, comply with LABC Chapter 19, and LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Nelson D2L Deformed Bar Anchor Studs described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the master evaluation report ESR-2907.
- The design, installation, conditions of use and identification of the Nelson D2L Deformed Bar Anchor Studs are in accordance with the 2015 *International Building Code®* (2015 IBC) provisions noted in the master evaluation report ESR-2907.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, and 19, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable design values listed in the master evaluation report and tables are for the connection of the anchor studs to concrete. The connection between the anchor studs and the connected members shall be checked for capacity (which may govern).

This supplement expires concurrently with the master report, reissued December 2017.