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SUREBUILT STUD RAIL DOUBLE-HEADED STUD ANCHOR (DSA) REINFORCEMENT SYSTEM

CSI Section:
03 21 00 Reinforcing Steel

1.0 RECOGNITION

The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System recognized in this report has been evaluated for use in headed shear stud reinforcement assemblies in flat concrete slab and footing locations. The structural properties of the SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System were evaluated for compliance with the following code and editions:

- 2018, 2015, 2012 and 2009 International Building Code® (IBC)
- 2017 City of Los Angeles Building Code (LABC) – attached supplement

2.0 LIMITATIONS

Use of the SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System recognized in this report is subject to the following limitations:

2.1 The Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System shall be designed, manufactured and installed in accordance with this report, the approved plans, and the manufacturer's instructions. In the event of a conflict, the more restrictive governs.

2.2 Drawings and design details showing compliance with the design requirements of Section 3.1 of this report shall be submitted to the code official for approval. The drawings and calculations shall be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

2.3 Special inspections shall be provided in accordance with Section 3.3 of this report.

2.4 The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement Systems are manufactured in Bellwood, Illinois.

3.0 PRODUCT USE

The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement Systems comply with the IBC Chapter 19 and ACI 318-14 Section 20.5.1 (ACI 318-11 and -08 Section 3.5.5.1) as headed shear stud reinforcement assemblies in flat concrete slab and footing locations.

3.1 Design

3.1.1 General: Design for shear strength shall comply with Chapters 8 and 22 of ACI 318-14 (Chapter 11 of ACI 318-11 and -08), including specific provisions for headed shear stud reinforcement in slabs and footings in Sections 8.7.7. and 22.6.8 of ACI 318-14 (Section 11.11.5 of ACI 318-11 and -08). The following information shall be determined on a case-by-case basis in accordance with the applicable provisions in Section 8.7.7.1 of ACI 318-14: number of studs per stud rail assembly; stud diameter; stud spacing; stud rail assembly height and length; and distance between column face and first line of studs.

3.1.2 Earthquake Loads: In Seismic Design Categories C, D, E, and F, the headed shear stud reinforcement assemblies at slab-to-column connections shall conform to the following conditions:

1. Lateral force-resisting elements of the structure shall be designed in accordance with the IBC, ACI 318, and other referenced standards.
2. The nominal shear strength provided by concrete in the presence of shear studs, determined in accordance with Section 3.1.1 of this report, shall be calculated by (Eq - 1):

$$V_c = 1.5 \lambda \sqrt{f'_c} b_o d \quad (\text{Eq.-1})$$

This value replaces the concrete shear strength determination in Section 22.6.6.1 and Table 22.6.6.1 of ACI 318-14 (Section 11.11.5.1 of ACI 318-11 and -08) and shall be used to determine the nominal shear strength, V_n , and the maximum shear strength, v_n as set forth in ACI 318.

3. The design of two-way slabs without beams, designated as part of the seismic force-resisting system, shall comply with Section 18.4.5.8 of ACI 318-14 (Section 21.3.6.8 of ACI 318-11 and -08), with the following exception:
 - a. V_c shall be calculated by (Eq-1) of this report.
4. The design of two-way slabs without beams, which are not designated as part of the seismic force-resisting system, shall comply with the provisions in Section 18.14.5.1 of ACI 318-14 (Section 21.13.6 of ACI 318-11 and -08), with the following exceptions:



- a. V_c shall be calculated by (Eq-1) of this report.
- b. design story drift ratio shall be the lesser of the design story drift ratio given in Table 12.12-1 of ASCE/SEI 7 and design story drift ratio set forth in Section 18.14.5.1 of ACI 318-14 (Section 21.13.6(b) of ACI 318-11 and -08).

3.2 Installation: The Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System shall be installed in accordance with the approved plans, the IBC, ACI 318, and the manufacturer's instructions. The approved plans shall be available on the jobsite at all times during installation. Surface conditions of the assemblies shall comply with Section 26.6.1.2 of ACI 318-14 (2015 IBC); Section 7.4 of ACI 318-11 (2012 IBC) or 1907.4 of the 2009 IBC. The headed shear stud reinforcement assemblies shall be installed in the positions specified in the approved plans. DSA plastic chairs shall be used where required to maintain proper positioning and concrete cover. Plastic chairs are available in four sizes. After the DSA Reinforcement System rails are in place, the reinforcing bars, post-tensioning tendons, conduit and other embedded items shall be placed in accordance with the approved plans. The Stud Anchor location and spacing shall comply with ACI 318-14 Section 8.7.7.1.2 and Table 8.7.7.1.2 (ACI 318-11 and -08 Section 11.11.5). The placement shall comply with Section 26.6.2 of ACI 318-14 (2015 IBC); Section 7.5 of ACI 318-11 (2012 IBC) or Section 1907.5 of the 2009 IBC. Concrete cover shall comply with Section 20.6.1.3.5 of ACI 318-14; Section 7.7 of ACI 318-11 (2012 IBC) or 2009 IBC Section 1907.7. Figure 2 of this report provides typical installation details.

3.3 Special Inspection: Special inspection of the Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System and installation shall comply with the 2018, 2015 and 2012 IBC Section 1705.3 or 2009 IBC Section 1704.4; and ACI 318-14 Section 26.13 (2018, 2015 IBC). The special inspector is responsible for verifying identification of the stud rail assembly in accordance with Section 5.0 of this report, condition of the assembly, placement, positioning, clearances and concrete cover.

4.0 PRODUCT DESCRIPTION

4.1 Product information: The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System complies with the specification of ASTM A1044-16 Type 2 in accordance with Section 20.5.1 of ACI 318-14 (Section 3.5.5.1 of ACI 318-11 and -08). The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System consists of Double-Headed Stud Anchors (DSA), in 3/8, 1/2, 5/8, and 3/4 inch diameters, tack-welded to a steel base rail (flat steel shape). The rail and the welding are not part of this report. Stud dimensions are given in Tables 1 of this report. Figures 1 and 2 of this report illustrate the SureBuilt Stud Rail Double-Headed Stud Anchor (DSA)

Reinforcement System. The number of studs per rail, stud spacing, stud rail assembly height and length, and distance from the end of the plate to the first stud shall be determined by the project-specific structural design.

4.2 Material information

4.2.1 Headed Studs: The headed studs are formed from steel bars conforming to ASTM A29 Grades 1010 through 1020 and satisfy the tensile requirements in ASTM A1044. The headed stud steel materials possess the following physical and mechanical requirements and comply with ASTM A1044-16 Type 2:

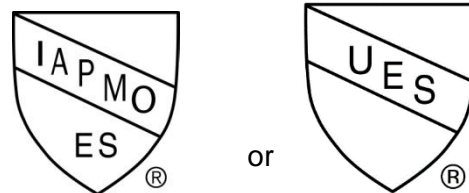
- Yield strength: minimum 51,000 psi (350 MPa),
- Tensile strength: minimum 65,000 psi (450 MPa),
- Elongation: minimum 20 percent in 2 inches (51 mm)
- Reduction in area: minimum 50 percent

4.2.2 Steel shapes: The steel shapes comprising the base rail are cut from steel plates conforming to ASTM A36. These are non-structural component of the DSA stud rail assembly and intended for alignment and positioning of the double headed stud.

5.0 IDENTIFICATION

The Double-Headed Stud Anchors (DSA) used in an assembly are marked on the head of the stud. The marking of the stud includes an "S" for the manufacturer (Surebuilt), two digits representing the shaft diameter in fraction (e.g. 12 for 1/2") and an additional "S" for smooth bar. The assembly is labeled with a tag showing the product name DSA Shear Reinforcement, project specific information, the manufacturer's name (Surebuilt), website and phone number, the Uniform Evaluation Report Number (ER-614), and one of the IAPMO UES marks shown below.

Either of the following Marks of Conformity may be used:



IAPMO UES ER-614



6.0 SUBSTANTIATING DATA

Data in accordance with the ICC-ES Acceptance Criteria for Headed Shear Stud Reinforcement Assemblies for Concrete Slabs or Footings (AC308) — Approved June 2017, editorially revised November 2017.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research carried out by IAPMO Uniform Evaluation Service on SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System to assess conformance to the code shown in Section 1.0 of this report and serves as documentation of the product certification. The system is produced at locations noted in Section 2.4 of this report under a quality control program with periodic inspections under the supervision of IAPMO UES.

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Vice President, Technical Operations
Uniform Evaluation Service

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Table 1—Shear Stud Dimensions (DSA)^{1) 2) 3)}

Shank diameter (dA) in [mm]	Shank Area in ² (mm ²)	Head diameter (dK) in [mm]	Head Area in ² (mm ²)	Head Thickness (hK) in [mm]	Radius at connection of shank and head (R) in [mm]
0.375 (9.5)	0.110 (71)	1.19 (30.1)	1.112 (712)	0.21 (5.3)	0.25 (6.4)
0.500 (12.7)	0.196 (127)	1.58 (40.1)	1.96 (1269)	0.28 (7.1)	0.25 (6.4)
0.625 (15.9)	0.307 (199)	1.98 (50.2)	3.08 (1979)	0.35 (8.9)	0.25 (6.4)
0.750 (19.1)	0.442 (287)	2.37 (60.2)	4.412 (2846)	0.42 (10.7)	0.375 (9.5)

¹⁾ Height (H), as shown in Figure 1, will vary based on the customer order.

²⁾ The Ratio of head diameter to shank diameter is 3.16.

³⁾ The Ratio of head area to shank area is 10.

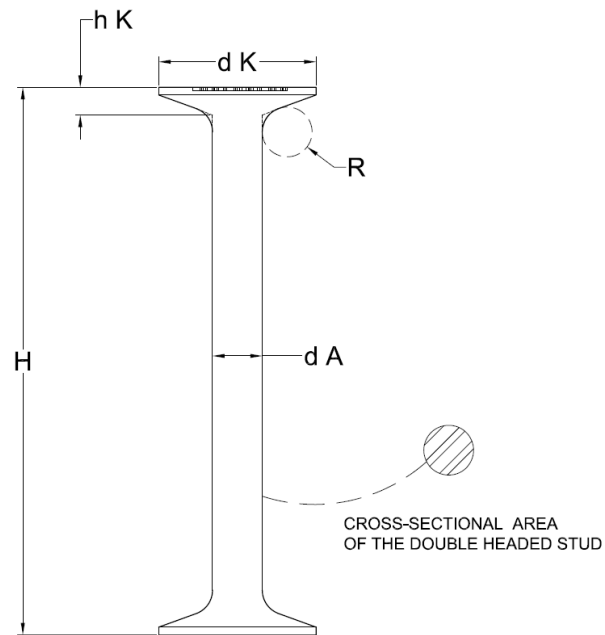


FIGURE 1—DSA double headed shear stud

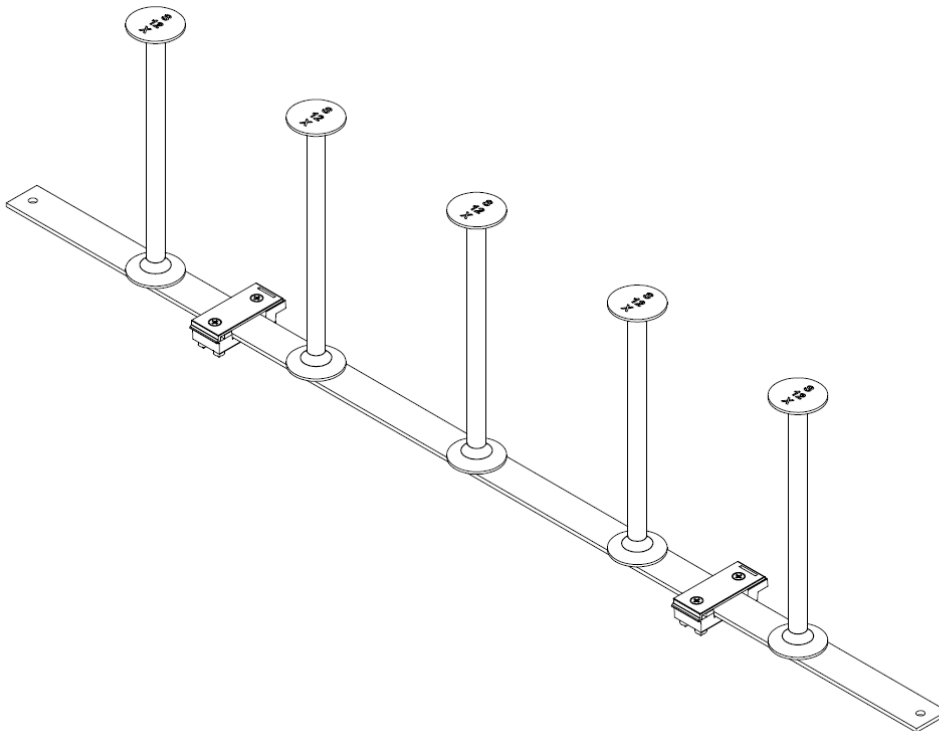


FIGURE 2—DSA double headed shear stud with steel rail and plastic chairs



CITY OF LOS ANGELES SUPPLEMENT

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1.0 RECOGNITION

The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System described in ER-614 and this supplemental report have been evaluated for use as a headed shear stud reinforcement assembly in flat concrete slab and footing locations. The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System has been evaluated for structural performance properties, subject to the requirements in ER-614 and this supplemental report. The SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System was evaluated for compliance with the following code:

- 2017 City of Los Angeles Building Code (LABC)

2.0 LIMITATIONS

Use of the SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System recognized in this supplement is subject to the following limitations:

2.1 Complete design specifications and calculations of the SureBuilt Stud Rail Double-Headed Stud Anchor (DSA) Reinforcement System demonstrating compliance with ER-614 shall be submitted to the structural plan check division for review and approval. The calculations shall be prepared by a Registered Civil or Structural Engineer licensed in the State of California.

2.2 Continuous special inspections of the stud rail reinforcement during installation shall be provided by Registered Deputy Inspectors as required by Section 1705 of the 2017 LABC, as applicable. The Registered Deputy Inspector shall verify the following for field welding: verifying identification of the stud reinforcement and its condition, positioning clearances and concrete cover in accordance with the specifications and the applicable code; and the installation procedures comply with the

specifications and the manufacturer's published installation instructions.

2.3 Fabrication of the stud rails used within the City shall be performed in the shop of a City of Los Angeles Building Department licensed fabricator.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org