

ICC-ES Evaluation Report

ESR-3317*

Issued July 1, 2013

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DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories
Section: 03 21 00—Reinforcing Steel

REPORT HOLDER:

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EVALUATION SUBJECT:

**THE CONCO COMPANIES HEADED SHEAR STUD
(PSR) REINFORCEMENT ASSEMBLIES**

1.0 EVALUATION SCOPE
Compliance with the following codes:

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

Property evaluated

Structural

2.0 USES

The Conco Companies Headed Shear Stud (PSR) Reinforcement Assemblies are used as shear reinforcement in flat concrete slabs and footings to replace or supplement stirrups, drop panels or column capitals in increasing the punching shear resistance of the flat slabs and footings.

3.0 DESCRIPTION
3.1 General:

The Conco Companies Headed Shear Stud (PSR) Reinforcement Assemblies are formed by welding large-headed shear studs to steel flat bars (base rails). The stud dimensions are given in Table 1, and base rail dimensions are given in Table 2. The Conco Companies PSR reinforcement assembly, and its installation, are shown in Figure 1.

The Conco Companies PSR reinforcement assemblies comply with the provisions of ASTM A1044 and Section 3.5.5 of ACI 318-11 and ACI 318-08.

3.2 Materials:

3.2.1 Studs: The shear studs used in the Conco Companies PSR reinforcement assemblies are $\frac{3}{8}$ -, $\frac{1}{2}$ -,

$\frac{5}{8}$ - and $\frac{3}{4}$ -inch-diameter (9.5, 12.7, 15.9 and 19.1 mm) Nelson Punching Shear Resistor (PSR) studs recognized in ICC-ES evaluation report ESR-1170. The studs meet the material requirements and specifications of ASTM A1044. The studs are produced from ASTM A29 Grades 1010 through 1020 steel and conform to the following physical and mechanical requirements prescribed in Table 1 of ASTM A1044.

Tensile strength, min, psi (MPa):	65,000 (450)
Yield strength, min, psi (MPa):	51,000 (350)
Elongation in 2 in. (50 mm), min, %:	20
Reduction of area, min, %:	50

3.2.2 Base Rails: The base rails are produced from ASTM A36 steel plates and must conform to the following physical and mechanical requirements in accordance with the prescribed values in Table 2 of ASTM A1044:

Tensile strength, min, psi (MPa):	65,000 (450)
Yield strength, min, psi (MPa):	44,000 (300)
Elongation in 8 in. (200 mm), min, %:	20

3.3 Stud Welding:

The PSR studs are factory-welded by the Conco Companies to the flat steel rails in accordance with the approved Conco Companies quality documentation. All welding complies with ASTM A1044 and AWS D1.1 requirements.

4.0 DESIGN AND INSTALLATION
4.1 Design:

4.1.1 General: Structural design and installation of the Conco Companies PSR reinforcement assemblies used as punching shear reinforcement in reinforced concrete slabs or footings must comply with the applicable provisions of ACI 318-11 for the 2012 IBC (ACI 318-08 for the 2009 IBC). Under the 2006 IBC, structural design and installation of the Conco Companies PSR reinforcement assemblies used as punching shear reinforcement in reinforced concrete slabs or footings must comply with ACI 318-05, including Sections 3.5.5, 7.7.5, and 11.11.5 of ACI 318-08. The specified yield strength of transverse reinforcement, f_{yt} , must not exceed the specified yield strength of the shear studs defined in Section 3.2.1.

4.1.2 Design Considerations: The structural design must specify the following items, based on design requirements in this report.

*Corrected August 2013

- The number of studs per rail
- Stud spacing (S)
- Shear rail assembly overall height (OAH)
- Stud shank diameter
- Distance between column face and first peripheral line of studs (S_o)
- Base rail length
- Arrangement of headed shear stud reinforcement

4.1.3 Earthquake Loads: The stud rail reinforcement may be used at slab-to-column connections of structures where a flat slab is used together with the primary seismic force-resisting systems in Seismic Categories C, D, E and F, such as concrete shear walls, under the following conditions:

4.1.3.1 General: Lateral force-resisting elements of the structure are designed in accordance with the IBC.

4.1.3.2 Shear Strength: The nominal shear strength provided by the concrete in the presence of the shear studs, referenced in Section 11.11.5 of ACI 318-11 (ACI 318-08 for the 2009 and 2006 IBC), must be revised as follows,

$$V_c = 1.5 \lambda \sqrt{f'_c} (b_o d)$$

This revision requires revisions to the nominal shear strength, V_n , and the maximum shear stress, v_n .

Two-way slabs without beams, which are not designated as part of the seismic force-resisting system, must comply with the provisions in Section 21.13.6 of ACI 318-11 (ACI 318-08 for the 2009 and 2006 IBC), except that V_c must be limited as set forth in Section 4.1.3.2 of this report and the design story drift ratio specified in Section 21.13.6(b) ACI 318-11 (ACI 318-08 for the 2009 and 2006 IBC) must not exceed the drift ratio referenced in Table 12.12-1 of ASCE/SEI 7-10 (ASCE/SEI 7-05 for the 2009 and 2006 IBC).

4.2 Installation:

Installation of the Conco Companies PSR reinforcement assemblies must comply with the applicable provisions of the 2012, 2009 and 2006 IBC and the approved engineering plans. The Conco Companies PSR reinforcement assemblies must be positioned correctly around columns and set in accordance with the IBC and the approved engineering plans and details. Concrete cover must comply with ACI 318-11 Section 7.7 for the 2012 IBC (Section 1907.7 for the 2009 and 2006 IBC). See Figure 1 for typical installation details.

4.3 Special Inspection:

Special inspection of shear rail reinforcement and its installation at the jobsite must comply with Section 1705.3 for the 2012 IBC (Section 1704.4 for the 2009 and 2006 IBC). The special inspector is responsible for verifying identification of the shear rail assembly per Section 7.0 of this report, along with its condition, location, positioning, clearances and concrete cover.

5.0 CONDITIONS OF USE

The Conco Companies PSR reinforcement assemblies described in this report comply with, or are suitable alternatives to what is specified in, those codes noted in Section 1.0 of this report, subject to the following conditions:

- 5.1** The Conco Companies PSR reinforcement assemblies must be designed, manufactured, and installed in accordance with this report and the approved plans. In the event of a conflict between this report and the approved plans, the more restrictive governs.
- 5.2** Design details and drawings must be in compliance with the design requirements of Section 4.1 of this report and must be approved by the code official. The calculations and drawings must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be built.
- 5.3** Special inspections must be provided in accordance with Section 4.3 of this report.
- 5.4** The Conco Companies PSR reinforcement assemblies are manufactured at the Conco Companies facility in Benicia, California, under a quality control program with third-party inspections by CEL Consulting (AA-639).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Headed Shear Stud Reinforcement Assemblies for Concrete Slabs or Footings (AC395), dated October 2008 (editorially revised February 2012).

7.0 IDENTIFICATION

The Conco Companies PSR reinforcement assemblies are identified on the packaging with the product model, product name, product size, manufacturer's name (Gonsalves & Santucci, Inc., dba The Conco Companies) and address, the evaluation report number (ICC-ES ESR-3317), and the name or logo of the inspection agency (CEL Consulting).

TABLE 1—PSR STUD DIMENSIONS

SHANK DIAMETER, D [in. (mm)]	HEAD DIAMETER, H [in. (mm)]	H/D RATIO	SHANK AREA, S _A [in. ² (mm ²)]	HEAD AREA, H _A [in. ² (mm ²)]	H _A /S _A RATIO	HEAD THICKNESS, T [in. (mm)]
³ / ₈ (9.5)	1.19 (30.1)	3.17	0.110 (71)	1.112 (712)	10.1	0.24 (6.1)
¹ / ₂ (12.7)	1.58 (40.2)	3.16	0.196 (127)	1.961 (1269)	10.0	0.33 (8.4)
⁵ / ₈ (15.9)	1.98 (50.2)	3.17	0.307 (199)	3.079 (1979)	10.0	0.40 (10.2)
³ / ₄ (19.1)	2.37 (60.2)	3.16	0.442 (287)	4.412 (2846)	10.0	0.47 (12.0)

TABLE 2—RECTANGULAR SHEAR REINFORCEMENT PLATE (SHEAR RAIL) DIMENSIONS

SHANK DIAMETER, D [in. (mm)]	PLATE WIDTH, W [in. (mm)]	PLATE THICKNESS, TH [in. (mm)]	PLATE LENGTH
$\frac{3}{8}$ (9.5)	1.00 (25.4)	$\frac{3}{16}$ (4.8)	Determined by the registered design professional
$\frac{1}{2}$ (12.7)	1.25 (31.8)	$\frac{1}{4}$ (6.5)	
$\frac{5}{8}$ (15.9)	2.00 (50.8)	$\frac{5}{16}$ (7.9)	
$\frac{3}{4}$ (19.1)	2.00 (50.8)	$\frac{3}{8}$ (9.5)	

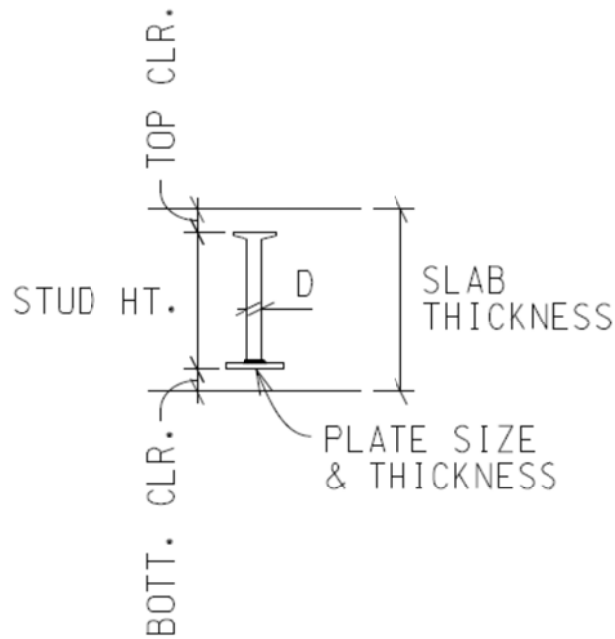
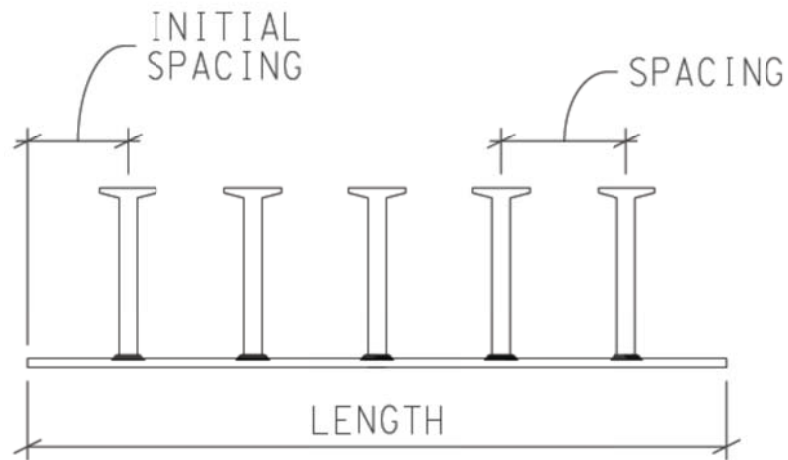


FIGURE 1—THE CONCO COMPANIES HEADED SHEAR STUD REINFORCEMENT ASSEMBLY AND INSTALLATION

ICC-ES Evaluation Report**ESR-3317 CBC Supplement**

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EVALUATION SUBJECT:**THE CONCO COMPANIES HEADED SHEAR STUD (PSR) REINFORCEMENT ASSEMBLIES****1.0 REPORT PURPOSE AND SCOPE**

The purpose of this evaluation report supplement is to indicate that The Conco Companies Headed Shear Stud (PSR) Reinforcement Assemblies, recognized in ICC-ES master report ESR-3317, have also been evaluated for compliance with the 2010 *California Building Code* (CBC), Chapters 19 and 19A.

2.0 CONCLUSIONS

The Conco Companies Headed Shear Stud (PSR) Reinforcement Assemblies, described in Sections 2.0 through 7.0 of the master evaluation report ESR-3317, comply with CBC Chapters 19 and 19A, provided the design and installation are in accordance with the *International Building Code*® provisions noted in the master report and the additional requirements of CBC Chapters 19 and 19A, as applicable.

This supplement expires concurrently with the master report, issued July 1, 2013, corrected August 2013.