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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic and Composite Fastenings

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY, INC.
5956 WEST LAS POSITAS BOULEVARD
PLEASANTON, CALIFORNIA 94588
(800) 999-5099
www.simpsonanchors.com

EVALUATION SUBJECT:

POWER-DRIVEN FASTENERS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 *International Building Code*® (2009 IBC)
- 2009 *International Residential Code*® (2009 IRC)
- 2006 *International Building Code*® (2006 IBC)*
- 2006 *International Residential Code*® (2006 IRC)*
- 2003 *International Building Code*® (2003 IBC)*
- 2003 *International Residential Code*® (2003 IRC)*
- 1997 *Uniform Building Code*™ (UBC)*

*Codes indicated with an asterisk are addressed in Section 8.0.

Property evaluated:

Structural

2.0 USES

2.1 General:

The Simpson Strong-Tie Company power-driven fasteners are used to fasten building components, such as wood and steel, to normal-weight concrete, steel deck with structural lightweight concrete fill, structural steel, and hollow concrete masonry units (CMUs). The fasteners are alternatives to the cast-in-place anchors described in IBC Section 1911; the embedded anchors described in Section 2.1.4 of TMS 402/ACI 530/ASCE 5 (which is referenced in IBC Section 2107) for placement in grouted masonry; and the bolts used to attach materials to structural steel, described in IBC Section 2204.2. The fasteners may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

2.2 Headed Fasteners:

2.2.1 PDP Headed Fasteners: PDP headed fasteners are used to fasten building components to normal-weight concrete, steel, and hollow CMUs, including fastening of steel channels and angle clips to normal-weight concrete.

2.2.2 PDPH Headed Fasteners: PDPH headed fasteners are used to fasten building components to normal-weight concrete and structural steel.

2.2.3 PHN Headed Fasteners: PHN headed fasteners are used to fasten building components to normal-weight concrete and structural steel, and fastening of steel channels and angle clips to normal-weight concrete.

2.2.4 PDPA Headed Fasteners: PDPA headed fasteners are used to fasten building components to normal-weight concrete, structural steel, and steel deck with structural lightweight concrete fill.

2.3 Headed Fasteners with Washers:

PDPW, PDPWL, PDPWLS and PHNW headed fasteners with washers are used to fasten naturally durable wood sill plates to normal-weight concrete. PDPWL-300MG or PDPWLS-300MG fasteners and washers may be used to attach preservative-treated wood sill plates to concrete.

2.4 Headed Tophat Fasteners:

PDPT, PHNT and PDPAT headed tophat fasteners are used to fasten building components to steel deck with structural lightweight concrete fill, and to structural steel members.

2.5 Threaded Stud Fasteners:

2.5.1 PSLV3 Threaded Stud Fasteners: PSLV3 threaded stud fasteners are used to fasten building components to normal-weight concrete, structural steel, and steel deck with structural lightweight concrete fill.

2.5.2 PSLV4 Threaded Stud Fasteners: PSLV4 threaded stud fasteners are used to fasten building components to structural steel, and steel deck with structural lightweight concrete fill.

2.6 Preassembled Ceiling Clips:

PCLDP and PECLDP preassembled ceiling clips are used to fasten building components to steel deck with structural lightweight concrete fill.

2.7 Threaded Rod Hangers:

PTRH3 and PTRH4 threaded rod hangers are used to fasten building components to normal-weight concrete and steel deck with structural lightweight concrete fill.

***Revised July 2011**

3.0 DESCRIPTION

3.1 Fasteners:

3.1.1 General: The fasteners are manufactured from steel complying with ASTM A 510, Grades 1060 to 1065 or 10B60 to 10B65 and austempered to a Rockwell "C" core hardness of 51 to 56, except for PDPA headed fasteners. PDPA headed fasteners are manufactured from steel complying with ASTM A 510, Grade 1060, and austempered to a Rockwell "C" core hardness of 53 to 56. Unless otherwise noted in this report, the fasteners have a mechanically plated zinc finish complying with ASTM B 695, Type I, Class 5. When installed with the powder-actuated fastening tool recommended by Simpson Strong-Tie, the fasteners pierce the material being fastened and embed into the supporting concrete, structural steel or CMU substrate. See Figure 1 for fastener details.

3.1.2 Headed Fasteners:

3.1.2.1 PDP Headed Fasteners: PDP headed fasteners have a 0.145-inch-diameter (3.68 mm) smooth or knurled shank and a 0.30-inch-diameter (7.4 mm) head.

3.1.2.2 PDPH Headed Fasteners: PDPH headed fasteners have a 0.177-inch-diameter (4.50 mm) smooth or knurled shank and a 0.30-inch-diameter (7.4 mm) head.

3.1.2.3 PHN Headed Fasteners: PHN headed fasteners have a 0.145-inch-diameter (3.68 mm) smooth or knurled shank and an 8-millimeter-diameter (0.315 inch) head.

3.1.2.4 PDPA Headed Fasteners: PDPA headed fasteners have a 0.157-inch-diameter (4.0 mm) smooth or knurled shank and a 0.30-inch-diameter (7.4 mm) head.

3.1.3 Headed Fasteners with Washers:

3.1.3.1 PDPW-300 Headed Fasteners with Washers: PDPW-300 headed fasteners with washers consist of 0.145-inch-diameter (3.68 mm), 3-inch-long (76 mm), smooth shank PDP fasteners described in Section 3.1.2.1 of this report, with $^3/_4$-inch-diameter (19 mm), 0.070-inch-thick (1.78 mm) washers premounted near the pointed end. The washer is manufactured from steel complying with ASTM A 1011, CS Type A, and has an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.3.2 PDPWL-300, PDPWL-300MG and PDPWLS-300MG Headed Fasteners with Washers: PDPWL-300 headed fasteners with washers consist of 0.145-inch-diameter (3.68 mm), minimum 3-inch-long (76 mm), smooth shank PDP fasteners described in Section 3.1.2.1 of this report, with 1-inch-diameter (25 mm), 0.070-inch-thick (1.78 mm) washers premounted near the pointed end. The washer is manufactured from steel complying with ASTM A 1011, CS Type A, and has an electroplated zinc finish complying with ASTM B 633, SC1, Type I. The PDPWL-300MG is identical to the PDPWL-300, except that the PDPWL-300MG fasteners and washers have a mechanically plated zinc finish complying with ASTM B 695, Type I, minimum Class 55. The PDPWLS-300MG is identical to the PDPWL-300, except that the PDPWLS-300MG has a 1-inch (25 mm) square washer premounted near the pointed end.

3.1.3.3 PHNW-72 Headed Fasteners with Washers: PHNW-72 headed fasteners with washers consist of 0.145-inch-diameter (3.68 mm), $2^7/_8$-inch-long (73 mm), smooth shank PHN fasteners described in Section 3.1.2.3 of this report, with 1-inch-diameter (25 mm), 0.070-inch-thick (1.78 mm) washers premounted near the pointed end. The washer is manufactured from steel complying with ASTM A 1011, CS Type A, and has an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.4 Headed Tophat Fasteners:

3.1.4.1 PDPT Headed Tophat Fasteners: The PDPT headed tophat fasteners consist of the PDP headed fasteners described in Section 3.1.2.1 of this report, and a "tophat" that is manufactured from steel complying with ASTM A 1011, CS Type A, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.4.2 PHNT Headed Tophat Fasteners: The PHNT headed tophat fastener consists of a PHN headed fastener described in Section 3.1.2.3 of this report, and a "tophat" that is manufactured from steel complying with ASTM A 1011, CS Type A, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I

3.1.4.3 The PDPAT headed tophat fastener consists of a PDPA headed fastener described in Section 3.1.2.4 of this report, and a "tophat" that is manufactured from steel complying with ASTM A 1011, CS Type A with an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.5 Threaded Stud Fasteners:

3.1.5.1 PSLV3 Threaded Stud Fasteners: PSLV3 threaded stud fasteners consist of a 0.205-inch-diameter (5.2 mm), smooth or knurled shank portion, and a $1^1/_4$-inch-long (32 mm), 3/8-16 (9.5 mm - 6.30 threads/cm) threaded portion. The fasteners are supplied as PSLV3-12575K, with a $^3/_4$-inch-long (19 mm) knurled shank portion; as PSLV3-125100, with a 1-inch-long (25 mm) smooth shank portion; and as PSLV3-125125, with a $1^1/_4$-inch-long (32 mm) smooth shank portion.

3.1.5.2 PSLV4 Threaded Stud Fasteners: PSLV4 threaded stud fasteners consist of a 0.150-inch-diameter (3.81 mm) smooth shank portion and a $^1/_4$-20 (6.4 mm - 7.87 threads/cm) threaded portion. The fasteners are supplied with various combinations of smooth shank and threaded portion lengths, each from $^1/_2$ to $1^1/_4$ inches (13 and 32 mm).

3.1.6 Preassembled Ceiling Clips:

3.1.6.1 PCLDP Preassembled Ceiling Clips: PCLDP preassembled ceiling clips consist of a 0.145-inch-diameter (3.68 mm), smooth-shank, PDPT headed tophat fastener described in Section 3.1.4.1 of this report, and a 0.075-inch-thick (1.91 mm), 90-degree angle clip that is premounted near the pointed end. The clip is manufactured from structural grade steel complying with the manufacturer's approved quality documentation, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I. The PCLDP preassembled ceiling clips are supplied as PCLDP-100, with a 1-inch-long (25 mm) fastener, and as PCLDP-125, with a $1^1/_4$-inch-long (32 mm) fastener.

3.1.6.2 PECLDP-125 Preassembled Ceiling Clips: PECLDP-125 preassembled ceiling clips consist of a 0.145-inch-diameter (3.68 mm), $1^1/_4$-inch-long (32 mm), smooth-shank, PDP headed fastener described in Section 3.1.2.1 of this report, and a 0.075-inch-thick (1.91 mm), 45-degree angle clip that is premounted near the pointed end. The clip is manufactured from structural grade steel complying with the manufacturer's approved quality documentation, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.7 Threaded Rod Hangers:

3.1.7.1 PTRH3-HN32 Threaded Rod Hangers: PTRH3 threaded rod hangers consist of a 0.145-inch-diameter (3.68 mm), $1^1/_4$-inch-long (32 mm), smooth-shank, PHN headed fastener described in Section 3.1.2.3 of this report,

and a premounted, embossed, 0.075-inch-thick (1.91 mm) clip that has two bends, one having a 45-degree angle and the other having a 30-degree angle. The 90-degree angle portion of the clip has a $^{3}/_{8}$-16 (9.5 mm - 6.30 threads/cm) threaded eyelet. The clip is manufactured from structural grade steel complying with the manufacturer's approved quality documentation, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.1.7.2 PTRH4-HN32 Threaded Rod Hangers: PTRH4 threaded rod hangers consist of a 0.145-inch-diameter (3.68 mm), $1^{1}/_{4}$-inch-long (32 mm), smooth-shank, PHN headed fastener described in Section 3.1.2.3 of this report, and a premounted, embossed, 0.075-inch-thick (1.91 mm) clip that has one bend having a 30-degree angle and another bend having a 90-degree angle. The 90-degree angle portion of the clip has a $^{1}/_{4}$-20 (6.4 mm - 7.87 threads/cm) threaded portion threaded eyelet. The clip is manufactured from structural grade steel complying with the manufacturer's approved quality documentation, with an electroplated zinc finish complying with ASTM B 633, SC1, Type I.

3.2 Materials:

3.2.1 Normal-weight Concrete: Normal-weight concrete must be stone-aggregate and comply with Chapter 19 of the IBC or Section R402.2 of the IRC, as applicable.

3.2.2 Structural Lightweight Concrete: Structural lightweight concrete must be sand-lightweight and must comply with Chapter 19 of the IBC or Section R402.2 of the IRC, as applicable.

3.2.3 Concrete Masonry Units: Concrete masonry units (CMUs) must be minimum 8-inch-thick (203 mm) lightweight blocks complying with ASTM C 90.

3.2.4 Structural Steel: Structural steel substrates must comply with the minimum requirements of ASTM A 36 or ASTM A 572, Grade 50, or ASTM A 992, and have a thickness as noted in Table 2 of this report.

3.2.5 Steel Deck: Where fasteners are placed through a steel deck into structural sand-lightweight concrete in accordance with Table 5 and Figure 2 of this report, the steel deck must comply with the applicable reference standard, have a minimum yield strength of 38 ksi (262 MPa), have a minimum No. 20 gage thickness [0.0359 inch (0.091 mm) base-steel thickness] and have a depth of 3 inches (76 mm).

3.2.6 Sill Plates: Sill plates must be nominal 2-inch-thick naturally durable wood complying with IBC Section 2302 or IRC Section R202, as applicable, or wood that has been preservative-treated in accordance with IBC Section 2303.1.8 or IRC Section R317.1, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Allowable shear and tension (pullout) values in the tables of this report are for use in allowable stress design, and are for fasteners driven into the materials specified in the tables. The stress increases and load reductions described in IBC Section 1605.3 are not allowed for wind loads acting alone or combined with vertical loads. No adjustments are allowed for vertical loads acting alone.

Allowable loads for fasteners subjected to combined shear and tension loads may be calculated by the following equation:

$$(p/P_a) + (v/V_a) \leq 1.0$$

where:

p = Actual tension load on fastener, lbf (N).

P_a = Allowable tension load on fastener, lbf (N).

v = Actual shear load on fastener, lbf (N).

V_a = Allowable shear load on fastener, lbf (N).

Members fastened to the substrates specified in this report must be designed in accordance with the applicable code and design criteria.

4.1.2 Wood-to-Concrete Connections: Lateral design values for nails with diameters equal to or less than the diameter of the Simpson Strong-Tie fasteners and penetration into the main member of 10 fastener diameters, determined in accordance with Part 11 and/or Table 11N of the ANSI/AF&PA NDS are applicable to the Simpson Strong-Tie fasteners. The wood element is the side member. The fastener bending yield strength must be limited to the value noted in the footnotes to Table 11N of ANSI/AF&PA NDS, based on the shank diameter of the Simpson Strong-Tie fasteners.

4.1.3 Sill Plate to Foundation Connections:

4.1.3.1 General: The headed fasteners with washers described in Section 3.1.3 of this report may be used to attach wood sill plates to the concrete foundation in areas classified as Seismic Design Category A or B under the following conditions:

1. No cold joint exists, between the slab and foundation, below the sill plate.
2. The sill plate is not installed on slabs supported by masonry foundation walls.

4.1.3.2 Design: Table 4A specifies the allowable fastener shear and tension loads for attachment of wood sill plates to concrete foundations. Bearing area and thickness of the washers, are also given in Table 4A. For shear loads, spacing of fasteners must be determined considering the lesser of allowable shear load from Table 4A and allowable load on the wood sill plate, determined in accordance with the NDS, with a fastener bending yield strength, F_{yb} = 90,000 psi (621 MPa) and a concrete dowel bearing strength, F_e = 7,500 psi (52 MPa). For tension loads, spacing of fasteners must be determined considering the lesser of allowable tension load from Table 4A and pull through capacity of the wood sill plate, based on Section 3.10 of the NDS, using the washer bearing area from Table 4A.

4.2 Installation:

The installation of fasteners requires a powder-actuated fastening tool, recommended by Simpson Strong-Tie, used in accordance with the manufacturer's published installation instructions. Installation is limited to dry, interior environments. The fastener size, minimum penetration, minimum spacing, and edge distances must comply with Tables 1 through 7 of this report, as applicable. For fasteners installed into concrete, the fasteners must not be driven until the concrete has reached the designated compressive strength. Unless otherwise noted, the concrete must have a thickness of at least three times the fastener penetration.

5.0 CONDITIONS OF USE

The Simpson Strong-Tie power-driven fasteners 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 Fasteners must be installed in accordance with this report and Simpson Strong-Tie published installation instructions. In the event of a conflict between this report and the Simpson Strong-Tie published installation instructions, this report governs.

5.2 Fasteners must not be used in preservative-treated wood or fire-retardant-treated wood, except when the PDPWL-300MG and PDPWLS-300MG fasteners and washers, described in Section 3.1.3.2 of this report, are used to attach preservative-treated wood to concrete.

5.3 Installation is limited to dry, interior environments.

5.4 Except for fasteners used with architectural, electrical and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, and fasteners used as described in Section 4.1.3, use of fasteners to resist earthquake loads is outside the scope of this report.

5.5 Allowable loads must comply with Section 4.1. Calculations demonstrating that the applied loads are less than the maximum allowable loads described in this report must be submitted to the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.6 For fasteners installed into concrete, the minimum concrete thickness must be three times the fastener embedment in concrete, except where noted otherwise in this report.

5.7 Use in concrete is limited to uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70), dated February 2010.

7.0 IDENTIFICATION

Containers of the fasteners are labeled with the Simpson Strong-Tie Company, Inc., name and address; the fastener product size and type; the evaluation report number (ESR-2138); and the manufacturing date and lot number. In addition, the fastener heads are identified with the following marking:

8.0 OTHER CODES

8.1 Scope:

In addition to the 2009 IBC and IRC, the products in this report were evaluated for compliance with the requirements of the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 1997 *Uniform Building Code*™ (UBC)

8.2 Uses:

Simpson Strong-Tie® power-driven fasteners are used for general fastening of building components as described in Section 2.0. The fasteners are alternates to the cast-in-place anchors described in 2006 IBC Sections 1911 and 1912, 2003 IBC Sections 1912 and 1913 and UBC Section 1923.1 for placement in concrete; the embedded anchors described in Section 2.1.4 of ACI 530 (which is referenced in 2006 and 2003 IBC Section 2107) and UBC Section 2107.1.5 for placement in grouted masonry; and the bolts used to attach materials to structural steel, described in 2006 and 2003 IBC Section 2204.2 and UBC Section 2205.11. The fasteners may be used where an engineered design is submitted in accordance with 2006 and 2003 IRC Section R301.1.3.

8.3 Description:

8.3.1 Fasteners: See Section 3.1.

8.3.2 Materials:

8.3.2.1 Concrete: See Sections 3.2.1 and 3.2.2. Concrete must conform to UBC Chapter 19, as applicable.

8.3.2.2 CMUs: CMUs must be minimum 8-inch-thick (203 mm) Grade N, Type II, lightweight blocks complying with UBC Standard 21-4.

8.3.2.3 Structural Steel: See Section 3.2.4.

8.3.2.4 Steel Deck Panels: See Section 3.2.5.

8.3.2.5 Sill Plates: Sill plates must be nominal 2-inch-thick naturally durable wood complying with 2006 IBC Section 2302, 2003 IBC Section 2302, or 2006 IRC Section R202; decay-resistant wood complying with 2003 IRC Section R319.1; or untreated wood complying with UBC Section 2302, as applicable, or wood that has been preservative-treated in accordance with 2006 and 2003 IBC Section 2303.1.8, 2006 and 2003 IRC Section R319.1, or UBC Section 2303 Item 3, as applicable. See the footnotes to Table 4B for specific gravity requirements.

8.4 Design and Installation:

8.4.1 Design:

8.4.1.1 General: See Section 4.1. The stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC), and fasteners used as described in Section 8.4.1.3, use of fasteners to resist earthquake loads is outside the scope of this report.

8.4.1.2 Wood to Steel, Concrete, or Masonry: For 2006 IBC, 2006 IRC, 2003 IBC and 2003 IRC, see Section 4.1.2, For UBC, design values for nails with diameters equal to or less than the diameter of the Simpson Strong-Tie® fasteners, determined in accordance with Section 2318.3 of the UBC, are applicable to Simpson Strong-Tie® fasteners. The wood element is the side member. The fastener bending yield strength must be limited to the value noted in the footnotes to UBC Tables 23-III-C-1 and 23-III-C-2, based on the diameter of the Simpson Strong-Tie® fasteners

8.4.1.3 Sill Plate to Foundation Connections: See Section 4.1.3.1 for general requirements. Table 4B specifies the allowable fastener spacing for attachment of wood sill plates to concrete foundations in areas classified as Seismic Design Category A or B (IBC and IRC), or Seismic Zones 0, 1, 2 and 3 (UBC), and in areas assigned basic wind speeds up to 100 mph (161 km/h) (3-second-gust, IBC & IRC) or 85 mph (137 km/h) (fastest mile, UBC). For sill plate connections in Seismic Design Categories A or B or Seismic Zones 0, 1, 2 and 3 in areas assigned basic wind speeds of 105 mph (169 km/h) (3-second-gust) or 90 mph (145 km/h) (fastest mile) or greater, an

engineered design using allowable loads described in Table 4A must be provided to the code official for approval. **Exception:** These seismic and wind limitations may be waived for interior non-shear walls.

8.4.2 Installation: See Section 4.2.

8.5 Conditions of Use:

See Section 5.0, and the following:

8.5.1 Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC), and fasteners used as described in Section 8.4.1.3, use of fasteners to resist earthquake loads is outside the scope of this report.

8.6 Evidence Submitted:

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70), dated October 2006.

8.7 Identification:

See Section 7.0.

TABLE 1—ALLOWABLE LOADS IN NORMAL-WEIGHT CONCRETE (lbf) [1,2,3,4]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM PENETRATION (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM SPACING (inches)	CONCRETE COMPRESSIVE STRENGTH							
					2,000 psi		3,000 psi		4,000 psi		6,000 psi	
					Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
PDP-XX[6]	0.145	1	3	4	45	120	100	165	150	205	150	205
		$1^1/_4$	3	4	140	265	255	265	370	265	370	265
PHN-XX[5]	0.145	1	3	4	45	120	100	165	150	205	150	205
		$1^1/_4$	3	4	140	265	255	265	370	265	370	265
PDPA-XX[6] PDPAT-XX[6]	0.157	$^3/_4$	3.5	5	-	-	-	-	30	135	70	130
		1	3.5	5	-	-	-	-	310	310	160	350
		$1^1/_4$	3.5	5	-	-	-	-	380	420	365	390
PDPH-XX[6]	0.177	$^3/_4$	3.5	5	30	50	30	80	30	110	115	195
		$1^1/_4$	3.5	5	130	265	195	240	260	220	190	105

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength, or the minimum compressive strength specified in the applicable code, whichever is greater. Concrete aggregate must comply with ASTM C 33. Minimum concrete thickness must be three times the fastener embedment into the concrete.

[2]The allowable shear and tension values are only for the fasteners in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.

[3]The stress increases and load reductions described in IBC Section 1605.3, and the stress increases described in UBC Section 1612.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

[4]Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.4.1.1 of this report.

[5]The XX designation in the model number is replaced with the length of the fastener expressed in millimeters. The fastener must be long enough to provide for the minimum penetration.

[6]The XX designation in the model number is replaced with the length of the fastener expressed in inches. The fastener must be long enough to provide for the minimum penetration.

TABLE 2—ALLOWABLE LOADS IN STEEL (lbf) [1,2,4,5]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM EDGE DISTANCE (inch)	MINIMUM SPACING (inches)	STEEL THICKNESS (inches)									
				$^3/_{16}$		$^1/_4$		$^3/_8$		$^1/_2$		$^3/_4$	
				Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
FASTENERS IN A36 STEEL[3]													
PDP - XX[7]	0.145	0.5	1.0	155	395	—	—	-	-	-	-	-	-
PHN - XX[6]	0.145	0.5	1.0	155	395	—	—	-	-	-	-	-	-
PDPT - XX[7]	0.145	0.5	1.0	290	660	340	700	-	-	-	-	-	-
PHNT - XX[6]	0.145	0.5	1.0	50	620	250	620	-	-	-	-	-	-
PDPA-XX[7] PDPAT-XX[7]	0.157	0.5	1.0	260	410	370	365	380[15]	385[15]	530[15]	385[15]	195[12]	325[12]
PDPH - XX[7]	0.177	0.5	1.0	340	790	520	870	-	-	-	-	-	-
FASTENERS IN A572 OR A992 STEEL[11]													
PDPA-XX[7] PDPAT-XX[7]	0.157	0.5	1.0	305	420	335	365	355[15]	290[15]	485[13]	275[13]	170[14]	275[14]
THREADED STUDS IN A36 STEEL[3,8]													
PSLV3-XXYY[9]	0.205	1.0	1.5	270	770	680	1120	-	-	-	-	-	-
PSLV3 -12575 K[10]	0.205	1.0	1.5	270	930	870	1130	-	-	-	-	-	-
PSLV4 - XXYY[9]	0.150	0.5	1.0	200	630	420	690	-	-	-	-	-	-

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The entire pointed portion of the fastener must penetrate through the steel to obtain the tabulated values, unless otherwise noted by footnote 12, 13, 14 or 15.

Notes to Table 2 (Continued):

[2]The allowable tension and shear values are for the fastener only. Members connected to the steel must be investigated separately in accordance with accepted design criteria.
[3]Steel must conform to ASTM A 36 specifications, with *Fy* = 36,000 psi, minimum.
[4]The stress increases and load reductions described in IBC Section 1605.3, and the stress increases described in UBC Section 1612.3, are not allowed for wind loads acting alone or combined with other loads. No adjustment is allowed for vertical loads acting alone.
[5]Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.4.1.1 of this report.
[6]The XX designation in the model number is replaced with the length of the fastener expressed in millimeters. The fastener must be long enough to provide for the minimum penetration.
[7]The XX designation in the model number is replaced with the length of the fastener expressed in inches. The fastener must be long enough to provide for the minimum penetration.
[8]The shank diameters are of the smooth or knurled shank portion of the threaded fastener.
[9]The XX and YY designations in the model number are replaced with the lengths, expressed in inches, of the threaded shank and smooth shank portions, respectively. The smooth shank portion must be long enough to provide for the minimum penetration.
[10]The K designation in the model number denotes a knurled shank.
[11]Steel must conform to ASTM A 572, Grade 50 specifications, with *Fy* = 50,000 psi, minimum or ASTM A992 specifications with Fy = 50,000 psi minimum.
[12]Based upon a minimum penetration depth of 0.46 inch (11.7 mm).
[13]Based upon a minimum penetration depth of 0.58 inch (14.7 mm), which can be achieved due to deformation of the steel base material.
[14]Based upon a minimum penetration depth of 0.36 inch (9.1 mm).
[15]The fastener must be driven to where the point of the fastener penetrates through the steel.

TABLE 3—ALLOWABLE LOADS WHEN ATTACHING STEEL ANGLES AND CHANNELS TO NORMAL-WEIGHT CONCRETE (lbf)[1,2,3]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	PENETRATION (inches)	ATTACHED ITEM	CONCRETE COMPRESSIVE STRENGTH (psi)	TYPE OF LOAD	ALLOWABLE LOAD (pounds)
PDP-125	0.145	$1^1/_8$	Angle clip[4]	2,000	Tension	25
PHN-32	0.145	$1^1/_8$	Angle clip[4]	2,000	Tension	25
PDP-150	0.145	$1^1/_4$	Angle clip[4]	2,000	Tension	85
PHN-32	0.145	$1^1/_4$	Angle clip[4]	2,000	Tension	85
PDP-100	0.145	$^7/_8$	No. 20 gage[5] steel channel	2,000	Shear	160
PHN-22	0.145	$^7/_8$	No. 20 gage[5] steel channel	2,000	Shear	160
PDP-100	0.145	$^7/_8$	No. 18 gage[5] steel channel	2,000	Shear	135
PHN-22	0.145	$^7/_8$	No. 18 gage[5] steel channel	2,000	Shear	135

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength, or the minimum compressive strength specified in the applicable code, whichever is greater. Concrete aggregate must comply with ASTM C 33. Minimum concrete thickness must be three times the fastener embedment into the concrete.
[2]The stress increases and load reductions described in IBC Section 1605.3, and the stress increases described in UBC Section 1612.3, are not allowed for wind loads acting alone or combined with other loads. No adjustment is allowed for vertical loads acting alone.
[3]Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.4.1.1 of this report.
[4]The angle clip is used to attach wire to the supporting concrete. The angle clip must be formed from steel having a minimum base metal thickness of 0.080 inch, and must have a dimension from the center of the hole through which the fastener is installed to the outstanding leg of the angle of 1 inch or less. Values in the table are for the fastener only. Capacity of the angle clip is outside the scope of this report.
[5]The Nos. 18 and 20 gage steel channels (drywall tracks) must have minimum base-metal thicknesses of 0.0478 and 0.0377 inch, respectively, and must be formed from steel having a minimum specified yield stress of 33 ksi. Values in the table are for the fastener installed in concrete only. Capacity of the channels is outside the scope of this report.

TABLE 4A—ALLOWABLE LOADS ON FASTENERS USED TO ATTACH WOOD SILL PLATES TO NORMAL-WEIGHT CONCRETE (2009 IBC & IRC) [1, 2, 3, 5]

FASTENER MODEL NUMBER	OVERALL LENGTH (inches)	HEAD DIAMETER (inch)	SHANK DIAMETER (inch)	WASHER THICKNESS (inch)	WASHER BEARING AREA (in^2)	ALLOWABLE LOAD (lbf)	
						Tension	Shear
PHNW-72	$2^7/_8$	0.315	0.145	0.070	0.770	125	150
PDPW-300	3	0.300	0.145	0.070	0.426	100	100
PDPWL-300, PDPWL-300MG[4]	3	0.300	0.145	0.070	0.770	100	100
PDPWLS-300MG[4]	3	0.300	0.145	0.055	0.970	100	100

For **SI:** 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lbf = 445 N.

[1]The fasteners must not be driven until the concrete has reached a minimum compressive strength of 2,000 psi (13.8 MPa), or the minimum compressive strength specified in the applicable code, whichever is greater.
[2]Minimum edge distance is $1^3/_4$ inches (44 mm).
[3]Wood members connected to the substrate must be investigated for compliance with the applicable code in accordance with referenced design criteria, for both lateral resistance and fastener pull-through.
[4]Only PDPWL-300MG or PDPWLS-300MG fasteners may be used to attach preservative-treated wood to concrete. Preservative-treated wood must be as described in IBC Section 2303.1.8 or IRC Section R317.1, as applicable.
[5]Fasteners may be used to resist earthquake loads as described in Section 5.4 of this report.

TABLE 4B—ALLOWABLE FASTENER SPACING FOR ATTACHMENT OF WOOD PLATE TO CONCRETE FOOTING OR SLAB (2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC, UBC)[1,2,3,4,5]

FASTENER MODEL NUMBER	OVERALL LENGTH (inches)	HEAD DIAMETER (inch)	SHANK DIAMETER (inch)	MAXIMUM SPACING (feet)		
				Interior Shear Walls[6]	Interior Nonshear Walls[7]	Exterior Shear Walls[6]
PHNW-72	$2^7/_8$	0.315	0.145	1.5	3.0	1.5
PDPW-300, PDPWL-300, PDPWL-300MG or PDPWLS-300MG[8,9]	3	0.300	0.145	1.0	2.0	1.0

For **SI:** 1 inch = 25.4 mm, 1 foot = 305 mm, 1 psi = 6.89 kPa, 1 plf = 0.0146 N/m.

[1]Spacings are based upon the attachment through the center of nominally 2-inch-thick wood sill plates, with specific gravity of 0.50 or greater, to concrete floor slabs or footings in accordance with 2006 or 2003 IBC Section 2308.6, 2006 or 2003 IRC Section R403.1.6 (for maximum two-story buildings), or UBC Sections 1806.6 and 2320.6 (for maximum two-story buildings), as applicable. For other species of lumber, the required spacings of fasteners require special calculations complying with 2006 or 2003 IBC Section 2306 and UBC Chapter 23, as applicable.
[2]Fasteners must not be driven until the concrete has reached a minimum concrete compressive strength of 2,000 psi, or the minimum compressive strength specified in the applicable code, whichever is greater. Minimum edge distance is $1^3/_4$ inches.
[3]Wall panels must be braced in accordance with 2006 or 2003 IBC Section 2308.9.3, 2006 or 2003 IRC Section R602.10, or UBC Section 2320.11.3, as applicable. Interior and nonbearing wall panels are not assumed to be braced.
[4]Fasteners must not be used to attach shear walls having a unit shear exceeding 100 pounds per foot.
[5]See Section 8.4.1.3 of this report for additional design and installation requirements.
[6]Walls must have two fasteners placed 6 inches and 10 inches, respectively, from each end of sill plates, with maximum spacing as noted in this table.
[7]Walls must have fasteners placed at 6 inches from ends of sill plates, with maximum spacing as noted in this table.
[8]Fasteners indicated must have four fasteners placed at each end of sill plates with a length greater than 30 inches. The fasteners must be placed 3, 6, 9 and 12 inches, respectively, from the interior face of the end of studs. The spacing may be adjusted to avoid interference with intervening studs.
[9]Only the PDPWL-300MG or PDPWLS-300MG fasteners and washers may be used to attach preservative-treated wood to concrete. Preservative-treated wood must be as described in Section 8.3.2.5.

TABLE 5—ALLOWABLE LOADS IN MINIMUM 3,000 psi STRUCTURAL LIGHTWEIGHT CONCRETE FILLED STEEL DECK[1,2,3,4,5]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inches)	INSTALLED DIRECTLY INTO CONCRETE		INSTALLED THROUGH LOWER FLUTE OF STEEL DECK INTO CONCRETE		
			Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Oblique (lbf)
PDPA-XX[6] PDPAT-XX[6]	0.157	$^3/_4$	85	105	105	280	—
		1	150	225	145	280	—
		$1^1/_4$	320	420	170	320	—
PDPT-XX[6]	0.145	$^7/_8$	85	250	40	275	—
PHNT-XX[7]	0.145	$^7/_8$	185	275	165	400	—
PTRH3 - HN32	0.145	1	—	—	140	—	—
PTRH4 - HN32	0.145	1	—	—	140	—	—
PCLDP -100; PCLDP-125	0.145	$^7/_8$	—	—	55	—	85
PCLDP -125	0.145	1	—	—	55	—	85
PECLDP -125	0.145	1	—	—	55	—	85
PSLV4 - XXYY[8]	0.150	1	—	—	80	—	—
PSLV3 -125125	0.205	$1^1/_4$	—	—	225	—	—

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

[1]The tabulated allowable load values are for the fasteners only. Members connected to the concrete receiving elements must be designed in accordance with the applicable code and accepted design criteria.
[2]The steel deck must be 3 inches deep, and have a minimum thickness of 20 gage (0.0359-inch-thick base-steel thickness) and a minimum yield strength of 38,000 psi.
[3]The fasteners must be installed through the steel deck and into the concrete at the upper or lower flute as designated in the table. The fastener must be a minimum of $1^1/_2$ inches from the edge of the deck web and 4 inches from the end of the deck. The minimum fastener spacing is 4 inches.
[4]Structural sand-lightweight concrete fill above top of steel deck profiles must be a minimum of $3^1/_4$ inches thick. Figure 2 shows nominal flute dimensions, fastener locations, and load orientations for both floor deck profiles.
[5]The stress increases and load reductions described in IBC Section 1605.3, and the stress increases described in UBC Section 1612.3, are not allowed for wind loads acting alone or combined with other loads. No adjustment is allowed for vertical loads acting alone.
[6]The XX designation in the model number is replaced with the length of the fastener expressed in inches. The fastener must be long enough to provide for the minimum embedment.
[7]The XX designation in the model number is replaced with the length of the fastener expressed in millimeters. The fastener must be long enough to provide for the minimum embedment.
[8]The XX and YY designations in the model number are replaced with the lengths, expressed in inches, of the threaded shank and smooth shank portions, respectively. The smooth shank portion must be long enough to provide for the minimum embedment.

TABLE 6—ALLOWABLE LOADS IN HOLLOW CONCRETE MASONRY UNITS (CMUs)[1,2,3,4,5]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM CMU FACE SHELL THICKNESS (inches)	HOLLOW CMU	
			Face Shell	
			Tension (lbf)	Shear (lbf)
PDP - XX[6]	0.145	$1^1/_4$	110	200

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm.

[1]The tabulated allowable load values are for the fasteners only. Members connected to the CMU receiving elements shall be designed in accordance with the applicable code and accepted design criteria.
[2]The tabulated allowable load values are for fasteners installed in hollow lightweight CMUs conforming to ASTM C 90. The minimum allowable nominal size of the CMU must be 8 inches high by 8 inches wide by 16 inches long, with a minimum,$1^1/_4$-inch-thick face shell thickness.
[3]The tabulated allowable load values are for fasteners installed in the center of a hollow CMU face shell. Allowable loads for fasteners installed in mortar head and bed joints, or into the web of the CMU, are outside the scope of this report.
[4]The entire pointed portion of the fastener must penetrate through the thickness of the face shell to obtain the tabulated values.
[5]No more than one fastener may be installed in an individual hollow CMU cell.
[6]The XX designation in the model number is replaced with the length of the fastener expressed in inches. The fastener must be long enough to provide for the minimum penetration.

TABLE 7—ALLOWABLE LOADS IN MINIMUM 2500 psi NORMAL-WEIGHT CONCRETE (pounds)[1,2,3]

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM PENETRATION (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM SPACING (inches)	ALLOWABLE TENSION LOAD (pounds)
THREADED ROD HANGERS					
PTRH3 - HN32	0.145	1	3.0	4.0	155
PTRH4 - HN32	0.145	1	3.0	4.0	150
THREADED STUDS					
PSLV3 -125125	0.205	$1^1/_4$	4.0	6.0	260

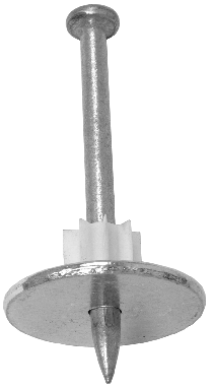
For **SI:** 1 inch = 25.4 mm, 1 psi = kPa, 1 lbf = 4.45 N.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength, or the minimum compressive strength specified in the applicable code, whichever is greater. Concrete aggregate must comply with ASTM C 33. Minimum concrete thickness must be three times the fastener embedment into the concrete.
[2]The stress increases and load reductions described in IBC Section 1605.3, and the stress increases described in UBC Section 1612.3, are not allowed for wind loads acting alone or combined with other loads. No adjustment is allowed for vertical loads acting alone.
[3]Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.4.1.1 of this report.

PDP **PDPH** **PHN**

FIGURE 1—FASTENERS

PDPW



PDPWL

PNHW

PDPT

PHNT

PDPA

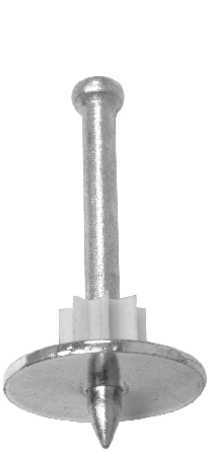
PDPAT

PDPH

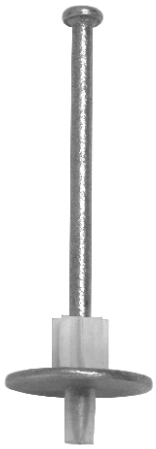
PDPHMG

PSLV3

FIGURE 1—FASTENERS (Continued)

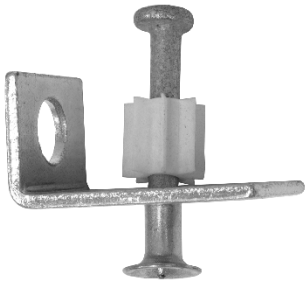


PDPHWL

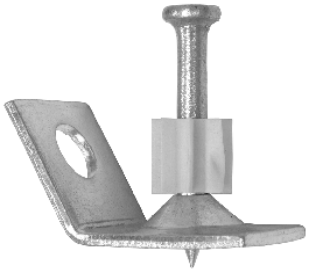


PDPWLMG

PSLV4



PCLDP



PECLDP

PTRH3

FIGURE 1—FASTENERS (Continued)

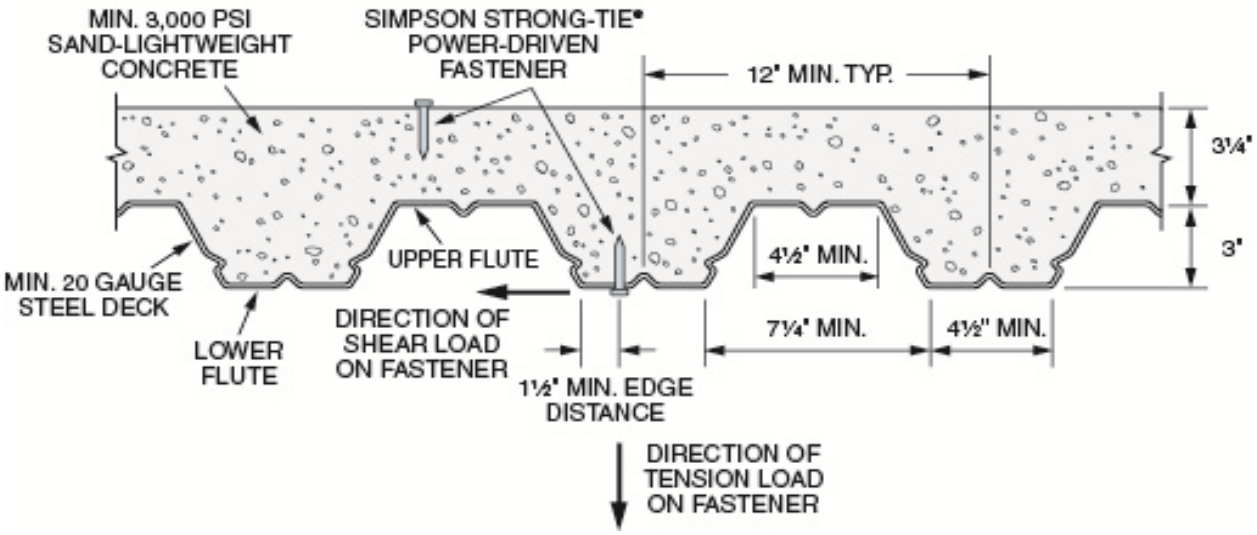


FIGURE 2—INSTALLATION IN CONCRETE FILL OVER STEEL DECK