

ICC-ES Evaluation Report

ESR-3046

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

REPORT HOLDER:

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EVALUATION SUBJECT:

SIMPSON STRONG-TIE® STRONG-DRIVE SD AND SDWF SERIES SCREWS

1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code*® (IBC)
- * ■ 2015, 2012, 2009 and ~~2006~~ *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Corrosion resistance

2.0 USES

The Simpson Strong-Tie® Strong-Drive SD series wood screws described in this report are used for steel-to-wood and wood-to-wood connections that are designed in accordance with the IBC and IRC.

The Simpson Strong-Tie® Strong-Drive SDWF series screws described in this report are used with the Simpson Take-Up Washer (TUW) for floor-to-floor connections within conventional wood platform construction, as depicted in the SDWF installation diagram shown in [Figure 1](#).

The Simpson Strong-Tie Strong-Drive SD series wood screws and SDWF series fasteners may be used where fasteners are required to exhibit corrosion resistance when exposed to adverse environmental conditions and/or in chemically treated wood (subject to the limitations of Sections 4.2.1, 5.2 and [Table 6](#)), and are alternates to hot-dip zinc galvanized fasteners with a coating weight in compliance with [ASTM A153](#), Class D. The screws have

been evaluated for use with wood chemically treated with waterborne alkaline copper quaternary, Type D (ACQ-D).

3.0 DESCRIPTION
3.1 General:

3.1.1 SD Series Wood Screws: The SD series wood screws are manufactured using a standard cold-forming process, and are heat-treated. The screws have rolled threads, spaced 8.5 threads per inch (0.335 thread per millimeter) for the SD9 screws and 10 threads per inch (0.393 thread per millimeter) for the SD10 screws. They have a plain (unslotted) 1/4-inch (6.35 mm) hex washer head, and a sharp point with serrated threads. The length of the threaded portion of the shank is approximately 1 inch (25.4 mm). [Table 1](#) provides a description of the SD series wood screws, and specifies the screws' dimensions, nominal bending yield strength and allowable tensile and shear loads.

3.1.2 SDWF Series Screws: The SDWF screws are manufactured using a standard cold-forming process, and are heat-treated. The screws have rolled 3/8"-24 threads near the head, and 5/16"-12 threads near the point. The length of threads near the point is approximately 5 inches (127 mm). The screws have a plain (unslotted) 5/16-inch (7.94 mm) hex washer head and Type 17 point. [Table 1](#) provides a description of the SDWF series screws, and specifies the screws' dimensions, and allowable tensile loads.

3.2 Materials:

3.2.1 SD Series Wood Screws: The SD series wood screws are manufactured from [ASTM A510](#), Grade 10B18, steel wire. The screws are mechanically galvanized per [ASTM B695](#), Type II, Class 55, except for the SD10112DBB screw which has a proprietary corrosion-resistant coating.

3.2.2 SDWF Series Screws: The SDWF series screws are manufactured from ASTM A510, Grade 10B21, steel wire. The screws are coated with a proprietary black electrocoat base coat.

3.2.3 Wood Members: Wood main members may be either solid-sawn lumber, or engineered wood (e.g. LVL, PSL, LSL). Wood side members must be either solid-sawn lumber or wood structural panel (OSB or plywood). Engineered wood must have a minimum *E* value of 0.8E for lateral loading and 1.55E for withdrawal loading. The engineered wood must be recognized in an ICC-ES evaluation report and must have a minimum equivalent specific gravity of 0.50. For the purposes of fastener design, wood members must have a minimum assigned

specific gravity as indicated in [Tables 2, 3 and 4](#). Assigned specific gravity for solid-sawn lumber and wood structural panels must be determined in accordance with Tables 12.3.3A and 12.3.3B, respectively, of the [2015 ANSI/AWC National Design Specification \(NDS\) for Wood Construction](#) (Tables 11.3.3A and 11.3.3B of [NDS-12](#) for the 2012 IBC, Tables 11.3.2A and 11.3.2B of [NDS-05](#) for the 2009 and 2006 IBC). For engineered wood, the moisture content at the time of screw installation and in service must be in accordance with the applicable ICC-ES evaluation report on the engineered wood product. For connections with SD screws, the thickness of the wood main member, t_m , must be equal to or greater than the screw length less the thickness of the side member.

3.2.4 Steel Members: For connections using the SD series wood screws, steel side members must have a minimum tensile strength, F_u , equal to 45 ksi (310.1 MPa), and design thickness (base-metal thickness exclusive of any coatings) ranging from 0.0352 inch to 0.1026 inch (0.894 mm to 2.606 mm), i.e., No. 20 gage to No. 12 gage. The hole in the steel side member for the SD screw must be predrilled or prepunched, and must have a standard round hole no greater than 0.156 inch (3.962 mm) in diameter for the SD9 screws, and no greater than 0.171 inch (4.343 mm) in diameter for the SD10 screws. Hole sizes may deviate from these limitations when the screws are recognized in a current evaluation report for use with a specific steel member with larger holes.

The SDWF series screws are limited to use with the Simpson Take-Up Washer (TUW), as described in [*^{*} ESR-2320](#). [LARR 25643](#)

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Reference lateral and withdrawal design values in the report are for allowable stress design, and must be multiplied by all applicable adjustment factors specified in the NDS as applicable to wood screws, including the wet service factor, C_M , where applicable, to determine adjusted design values. Design of connections using steel side plates must comply with Section 11.2.3 of NDS-15 (Section 10.2.3 of NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC). When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 11.1.2 of NDS-15 (Section 10.1.2 of NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC), and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group. Connections containing multiple screws must also be designed in accordance with Sections 11.2.2 and 12.6 of NDS-15 (Sections 10.2.2 and 11.6 of the NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC). Where the SD series wood screws are subjected to combined lateral and withdrawal loads, connections shall be designed in accordance with Section 12.4.1 of NDS-15 (Section 11.4.1 of NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC). The SDWF series screws must be limited to applications in which they will be loaded in direct axial withdrawal/tension only (within a tolerance of ± 2 degrees). Structural members forming the connection must be designed in accordance with the code.

4.1.2 Reference Lateral Design Values: Reference lateral (Z) design values for SD series wood screws for single shear steel-to-wood connections loaded perpendicular and parallel to grain are shown in [Table 2](#). Reference lateral (Z) design values for SD series wood screws for single shear wood-to-wood connections loaded perpendicular and parallel to grain are shown in [Table 3](#).

Minimum connection geometries must comply with [Table 5](#).

Since the SDWF series screws are intended only for use in direct axial withdrawal/tension, reference lateral design values for the SDWF screws are outside the scope of this report.

4.1.3 Reference Withdrawal Design Values and Pull-through Design Values: Design values for SD series wood screws that are loaded in tension are limited by the allowable withdrawal load, with the exception that design values for connections having nominally $1\frac{5}{32}$ -inch-thick plywood or OSB side members must not exceed the head pull-through design value of 130 pounds (578 N). Reference withdrawal (W) design values for SD series wood screws are shown in [Table 4](#), and are given in pounds per inch of thread penetration into the main member. Thread lengths for the SD series wood screws are shown in [Table 1](#).

Connections utilizing SDWF series screws have allowable tension design values that are limited by the lesser of: (a) the reference withdrawal design value given in [Table 4](#), multiplied by the length of thread penetration within the wall top plate and adjusted by all applicable adjustment factors; (b) the allowable load for the TUW, as given in [ESR-2320](#), and (c) the allowable screw tension strength given in [Table 1](#). **

4.2 Installation:

4.2.1 General: SD series wood screws are installed with a $\frac{1}{4}$ -inch (6.35 mm) hex head driver, and SDWF series screws are installed with a $\frac{5}{16}$ -inch (7.94 mm) hex head driver. Installation may be performed without predrilling wood members. Edge distances, end distances and spacing of the screws must be sufficient to prevent splitting of the wood, or as required by [Table 5](#) of this report, whichever is more restrictive. When use is in engineered wood products, the minimum fastener end and edge distances and spacing must be in accordance with Table 5 of this report or in accordance with the recommendations of the engineered wood product manufacturer, whichever is more restrictive.

The SD series wood screws and SDWF series screws have corrosion-resistant coatings that are recognized for use in wood treated with waterborne alkaline copper quaternary, Type D (ACQ-D), to a maximum retention level of 0.40 pcf (6.4 kg/m³), or in other treated wood products that have been demonstrated to have lower levels of corrosivity. These fasteners must be limited to use in the applications and limitations defined in [Table 6](#).

4.2.2 SD Series Wood Screws: When installing SD series wood screws, the bottom of the screw head must be flush to the surface of the member being connected. The screws must not be overdriven. SD screws must be installed such that the threaded portion of the shank is fully embedded within the main member.

4.2.3 SDWF Series Screws: The SDWF screw must be installed through the hole in the center of the TUW, normal to the plane of the TUW, through the sole plate and floor cavity, and into the top plate of the floor below, until the head of the SDWF screw pulls the TUW side tabs downward, thereby engaging the shank of the screw. The screws must not be overdriven. The go/no-go gage, supplied with the TUW, must be used in accordance with the manufacturer's installation instructions to ensure proper installation. See [Figure 1](#) for a typical installation detail of the SDWF.

5.0 CONDITIONS OF USE

The Simpson Strong-Drive SD and SDWF series screws 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 The SD and SDWF series screws must be installed in accordance with the manufacturer’s published installation instructions, this evaluation report and the applicable code. The most restrictive governs if there are any conflicts between the manufacturer’s published installation instructions and this report.
- 5.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 5.3 The SDWF series screws must be limited to use in dry conditions, with wood having a moisture content of 19 percent or less, both at the time of screw installation and in service.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners

(AC233), dated April 2015 (editorially revised August 2015).

- 6.2 Data in accordance with the ICC-ES Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effects of Wood Treatment Chemicals (AC257), dated October 2009 (editorially revised May 2015).

7.0 IDENTIFICATION

The packaging is labeled with the fastener series designation, the Simpson Strong-Tie Company name and address, the fastener size, and the ICC-ES evaluation report number (ESR-3046). Each screw head is marked with the not-equal-to symbol (\neq), and numbers designating the screw size and length, as shown in [Table 1](#). The SDWF screw is packaged with the Take-Up Washer (TUV) and a go/no-go gage for use in installation.

TABLE 1—SCREW SPECIFICATIONS, NOMINAL BENDING YIELD STRENGTH, AND FASTENER ALLOWABLE STEEL STRENGTH

FASTENER DESIGNATION	HEAD MARKING	SCREW SPECIFICATIONS (inches)				NOMINAL BENDING YIELD STRENGTH ³ , F_{yb} (psi)	FASTENER ALLOWABLE STEEL STRENGTH ⁴ (lbf)	
		Screw Length, L	Thread Length ¹ , T	Unthreaded Shank Length, $L - T$	Minor Thread (root) Diameter ² , D_r		Tension	Shear
SD9112	915	1.5	1.0	0.5	0.109	188,000	510	425
SD9212	925	2.5		1.5				
SD10112/SD10112DBB	1015	1.5		0.5	0.122		555	445
SD10212	1025	2.5		1.5				
SDWF2716	16	16.0	5.0	11.0	0.240	NA ⁵	2685	NA ⁵
SDWF2720	20	20.0		15.0				
SDWF2724	24	24.0		19.0				
SDWF2726	26	26.0		21.0				

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

¹Length of thread includes tip. See [Figure 1](#).

²Minor thread diameter shown in the table is the minimum minor diameter.

³Bending yield strength determined in accordance with [ASTM F1575](#) using the minor thread (root) diameter, D_r .

⁴Allowable fastener loads are based on steel properties of the screw. Refer to [Tables 2](#) and [3](#) for reference lateral (Z) design values for steel-to-wood and wood-to-wood connections, respectively. Refer to [Table 4](#) for reference withdrawal (W) design values.

⁵SDWF series screws have not been evaluated for use in lateral loading applications.

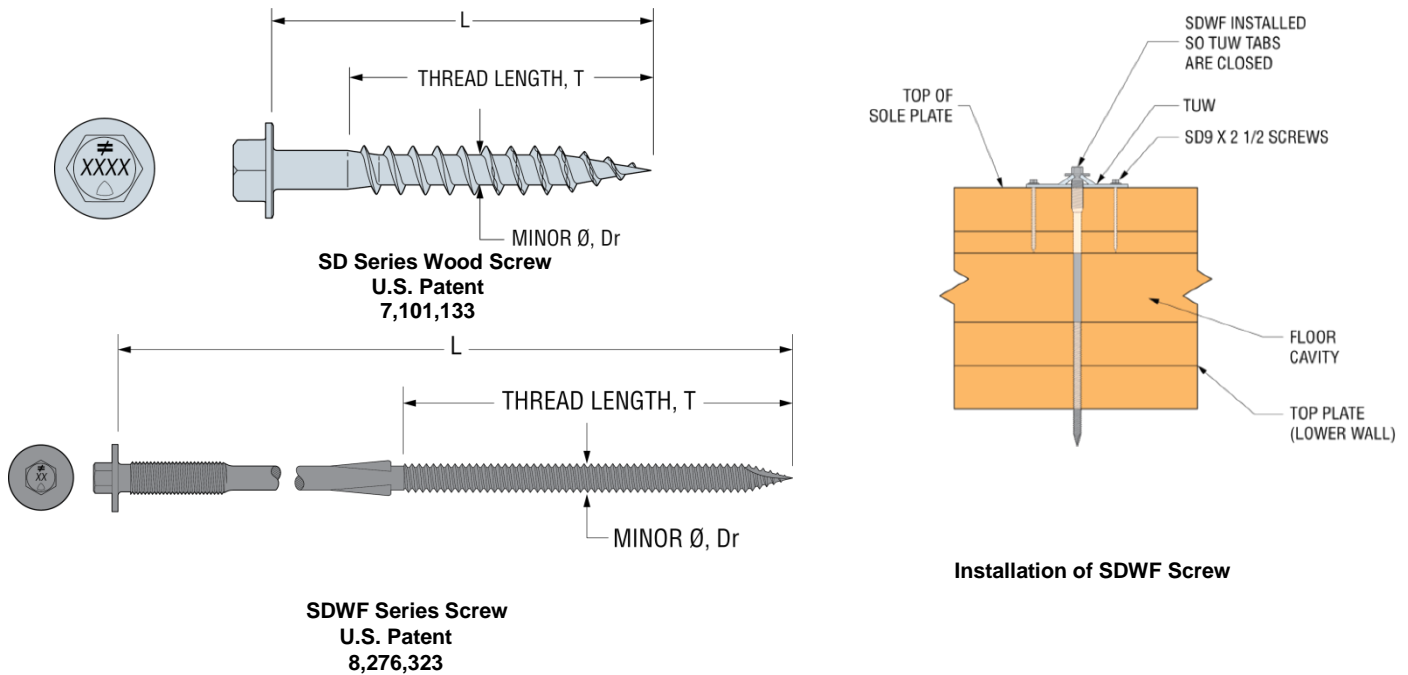


FIGURE 1—SD AND SDWF SCREWS

TABLE 2—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR STEEL-TO-WOOD CONNECTIONS WITH SD SERIES WOOD SCREWS (lbf)^{1,2,3,4,5,6,7,8}

FASTENER DESIGNATION	REFERENCE LATERAL DESIGN VALUE (Z)	
	0.42 ≤ SG < 0.50 ⁽²⁾	SG ≥ 0.50 ⁽²⁾
SD9112	112	171
SD9212	112	200
SD10112/SD10112DBB	138	173
SD10212	165	215

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹The side member must consist of steel having a minimum tensile strength (F_u) of 45 ksi, and must have a design thickness (t_s) no less than 0.0352 inches (No. 20 gage) and no greater than 0.1026 inches (No. 12 gage).

²The main member must be solid-sawn lumber. Main members must have a minimum assigned specific gravity (SG) of either 0.42 or 0.50, as indicated in the table above. Values for $SG \geq 0.50$ are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.3.

³The uncoated minimum steel thickness of the cold-formed product delivered to the jobsite must not be less than 95 percent of the design thickness, t_s .

⁴Holes in the steel side member must be predrilled or pre-punched. Hole diameter must comply with Section 3.2.4 of this report.

⁵Tabulated lateral design values (Z) must be multiplied by all applicable adjustment factors, including the load duration factor, C_D , from the NDS as referenced in the IBC or IRC.

⁶Screws must be installed straight into the side grain of the wood main member with the screw axis at a 90-degree angle to the wood fibers.

⁷Minimum fastener penetration must be equal to the screw length less the thickness of the metal side plate.

⁸Tabulated reference lateral design values apply to both parallel- and perpendicular-to-grain loading.

TABLE 3—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR WOOD-TO-WOOD CONNECTIONS WITH SD SERIES WOOD SCREWS (lbf)^{1,2,3,4,5,6,7}

FASTENER DESIGNATION	REFERENCE LATERAL DESIGN VALUE (Z)					
	0.42 ≤ SG < 0.50 ^(1,2)			SG ≥ 0.50 ^(1,2)		
	15/32" Side Member	23/32" Side Member	1 1/2" Side Member	15/32" Side Member	23/32" Side Member	1 1/2" Side Member
SD9112	93	—	—	105	—	—
SD9212	99	94	109	118	133	130
SD10112/SD10112DBB	102	—	—	127	—	—
SD10212	106	126	123	147	168	152

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹The nominal 15/32- and 23/32-inch-thick side members must be plywood or OSB with minimum equivalent specific gravities (SG) of either 0.42 or 0.50, as indicated in the table above.

²The main member and 1 1/2-inch-thick side member must be solid-sawn lumber with a minimum assigned specific gravity or equivalent specific gravity (SG) of either 0.42 or 0.50, as indicated in the table above. Values for SG ≥ 0.50 are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.3.

³When the assigned specific gravities or equivalent specific gravity (SG) of the main and side members are different, the design values of the wood with the lowest specific gravity (SG) must be used.

⁴Tabulated lateral design values (Z) must be multiplied by all applicable adjustment factors, including the load duration factor, C_D, from the NDS as referenced in the IBC or IRC.

⁵Screws must be installed straight into the side grain of the wood members with the screw axis at a 90-degree angle to the wood fibers.

⁶Minimum fastener penetration must be equal to the screw length less the thickness of the wood side member.

⁷Tabulated reference lateral design values apply to both parallel- and perpendicular-to-grain loading.

TABLE 4—REFERENCE WITHDRAWAL DESIGN VALUES (W) FOR SCREWS INSTALLED IN THE SIDE GRAIN OF A WOOD MAIN MEMBER

FASTENER DESIGNATION	SCREW LENGTH, L	THREAD LENGTH, T	REFERENCE WITHDRAWAL DESIGN VALUE, W (lbf/inch) ^{1,2,3}		
			0.42 ≤ SG < 0.50 ⁽⁴⁾	0.50 ≤ SG < 0.55 ⁽⁴⁾	SG ≥ 0.55 ⁽⁴⁾
SD9112	1.5	1.0	122	173	173
SD9212	2.5				
SD10112/SD10112DBB	1.5				
SD10212	2.5				
SDWF2716	16.0	5.0	180	250	295
SDWF2720	20.0				
SDWF2724	24.0				
SDWF2726	26.0				

For **SI**: 1 inch = 25.4 mm, 1 lbf/inch = 4.44 kPa.

¹The tabulated reference withdrawal design value, W, is in pounds per inch of the thread penetration into the side grain (or face grain) of the main member. Thread penetration is the portion of the threaded length held in the main member, including the screw tip. SD screws must be installed such that the threaded portion of the shank is fully embedded within the main member. SDWF screws must be installed such that the threaded length embedded within the wall top plate is at least 3 inches.

²The tabulated reference withdrawal design value, W, must be multiplied by all applicable adjustment factors from the NDS as referenced in the IBC or IRC.

³For SD screw connections with nominal 15/32-inch-thick plywood or OSB side members, reference withdrawal design values, W, must be limited by the head pull-through design value of 130 pounds.

⁴Wood main members must have a minimum assigned specific gravity or equivalent specific gravity (SG) as indicated in the table above. Values for SG ≥ 0.55 are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.3.

TABLE 5—CONNECTION GEOMETRY

SCREW SERIES	CONDITION ¹		MINIMUM DISTANCE OR SPACING (in.)	
			Main Member	Wood Side Member
SD	Edge distance	Perpendicular to grain loading (Loaded or unloaded edge)	1	1
		Parallel to grain loading	1/2	1/2
	End distance	Perpendicular to grain loading	2	2 ⁷ / ₁₆
		Parallel to grain loading (Loading toward or away from end)	2	2 ⁷ / ₁₆
	Spacing (Loading parallel or perpendicular to grain)	Between fasteners in a row	2	2 ⁷ / ₁₆
		Between rows	1/2	1 ³ / ₁₆
Between staggered rows		1/2	1/2	
SDWF	Edge distance	Withdrawal loading	1	NA ²
	End distance	Withdrawal loading	4	NA ²
	Spacing	Between fasteners in a row	8	NA ²

For SI: 1 inch = 25.4 mm.

¹Edge distances, end distances and spacing of the screws must be sufficient to prevent splitting of the wood, or as required by this table, whichever is the more restrictive.

²The SDWF series screws must be used with the Take-Up Washer (TUV), as described in [ESR-2320](#).

TABLE 6—RECOGNIZED EXPOSURE CONDITIONS FOR SIMPSON STRONG-TIE SD AND SDWF FASTENERS

EXPOSURE CONDITION	TYPICAL APPLICATIONS	RECOGNITION LIMITATIONS
1	Treated wood in dry use applications	Limited to use where equilibrium moisture content of the chemically treated wood meets the dry services condition as described in the NDS
3	General construction	Limited to freshwater and chemically treated wood exposure, e.g., no saltwater exposure