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ESR-2236

Reissued 01/2018

This report is subject to renewal 01/2019.

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**

EVALUATION SUBJECT:

SIMPSON STRONG-DRIVE SDS WOOD SCREWS



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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-DRIVE SDS WOOD 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-Drive SDS 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. Screws having the proprietary Double Barrier Coating (i.e., those with a four-cut point) 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, 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. Screws having the proprietary Double Barrier Coating have been evaluated for use with wood chemically treated with waterborne alkaline copper quaternary, Type D (ACQ-D).

3.0 DESCRIPTION

3.1 General:

The SDS wood screws are manufactured using a standard cold-forming process, and consist of either heat-treated

carbon steel or type 316L stainless steel. The screws have rolled threads, spaced 10 threads per inch (0.393 thread per millimeter), a plain (unslotted) hex washer head, and either a Type 17 drill (fluted) point or a proprietary four-cut (square-shank) point. The length of threads is approximately equal to two-thirds of the nominal screw length. The screws' major and minor diameters are 0.250 inch and 0.185 inch (6.4 mm and 4.7 mm), respectively, and the unthreaded shank diameter is 0.242 inch (6.1 mm). [Table 1](#) provides a description of screws recognized in this report, and specifies the screws' nominal bending yield strength and allowable tensile and shear loads. See [Figure 1](#) for a diagram of the SDS wood screw.

3.2 Materials:

3.2.1 SDS Wood Screws: The SDS wood screws are manufactured from [SAE J403](#) low-carbon steel wire, grade 1022; SAE J403 low-carbon-alloy steel wire, grade 10B21, or from type 316L stainless steel complying with [ASTM A493](#). The carbon steel screws with the type 17 point are supplied with a yellow zinc dichromate finish. The carbon steel screws with the four-cut point have a proprietary coating that is identified as a Double Barrier Coating. The screws can be supplied with a hot-dipped galvanized (HDG) coating having a minimum average zinc coating thickness of 0.0021 inch (0.053 mm) and a minimum individual zinc coating thickness of 0.0017 inch (0.043 mm) in accordance with ASTM A153, Class D.

3.2.2 Wood Members: Wood members may be either solid-sawn lumber having an assigned specific gravity of 0.50 or greater, or engineered wood (e.g. LVL, PSL, LSL) having 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. 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). Sawn lumber members must have a moisture content of less than 19 percent both at time of screw installation, and in service. 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. 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. For wood-to-wood connections, the

actual thickness of the wood side member, t_s , must be either $1\frac{1}{2}$ or $1\frac{3}{4}$ inches (38.1 or 44.5 mm), as specified in [Table 3](#). The wood side member thickness is an actual value, and is not a minimum or maximum value.

3.2.3 Steel Members: Steel side members must have a minimum tensile strength, F_u , equal to 45 ksi (310.1 MPa) when the steel member design thickness (base-metal thickness exclusive of any coatings) is from 0.0584 inch to 0.1795 inch (1.5 to 4.5 mm), i.e., Nos. 16 gage to 7 gage, and a minimum F_u equal to 52 ksi (358.3 MPa) when the steel member design thickness is 0.2405 inch (6.1 mm), i.e., No. 3 gage. The hole in the steel side member for the SDS screw must be predrilled or prepunched, and must have a standard round hole diameter no greater than 0.273 inch (6.9 mm) in diameter when the steel member thickness is from 0.0584 to 0.1795 inch (1.48 to 4.56 mm), and no greater than 0.305 inch (7.6 mm) in diameter when the steel member thickness is 0.2405 inch (6.1 mm). 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.

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, as applicable to wood screws, in accordance with the NDS to determine adjusted design values. 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 NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC). Where the screws are subjected to combined lateral and withdrawal loads, connections must 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). Design of connections having steel side members 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). 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 SDS wood screws for single shear steel-to-wood and wood-to-wood connections loaded perpendicular and parallel to grain are shown in [Table 2](#) and [Table 3](#), respectively. Minimum connection geometries must comply with [Table 4](#).

4.1.3 Reference Withdrawal Design Values: Reference withdrawal (W) design values for SDS wood screws must be derived according to provisions for wood screws in the NDS. For purposes of determining NDS tabulated withdrawal design values, the SDS screws are classified as a No. 14 wood screw. The thread lengths for the SDS screws are provided in [Table 1](#) of this report. The withdrawal design value in pounds per inch of thread penetration into the side grain of the main member of wood or engineered wood having a minimum specific gravity of 0.50 is shown in [Table 5](#) of this report.

4.1.4 Pull-through Design Values: Pull-through (pull-over) design values are outside the scope of this report.

4.2 Installation:

SDS wood screws are installed with a $\frac{3}{8}$ -inch (9.5 mm) hex head driver and a low-speed drill. 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 4](#) 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 4 of this report or in accordance with the recommendations of the engineered wood product manufacturer, whichever is more restrictive. The bottom of the screw head must be installed flush to the surface of the member being connected. The screws must not be overdriven.

The SDS wood screws with a proprietary Double Barrier Coating (i.e., those with a four-cut point) 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](#).

5.0 CONDITIONS OF USE

The Simpson Strong-Drive SDS wood 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** When the capacity of a connection is controlled by fastener or side plate metal strength, rather than wood strength, the allowable strength of the connection is not permitted to be multiplied by the adjustment factors specified in the NDS.
- 5.2** Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.

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.
- 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

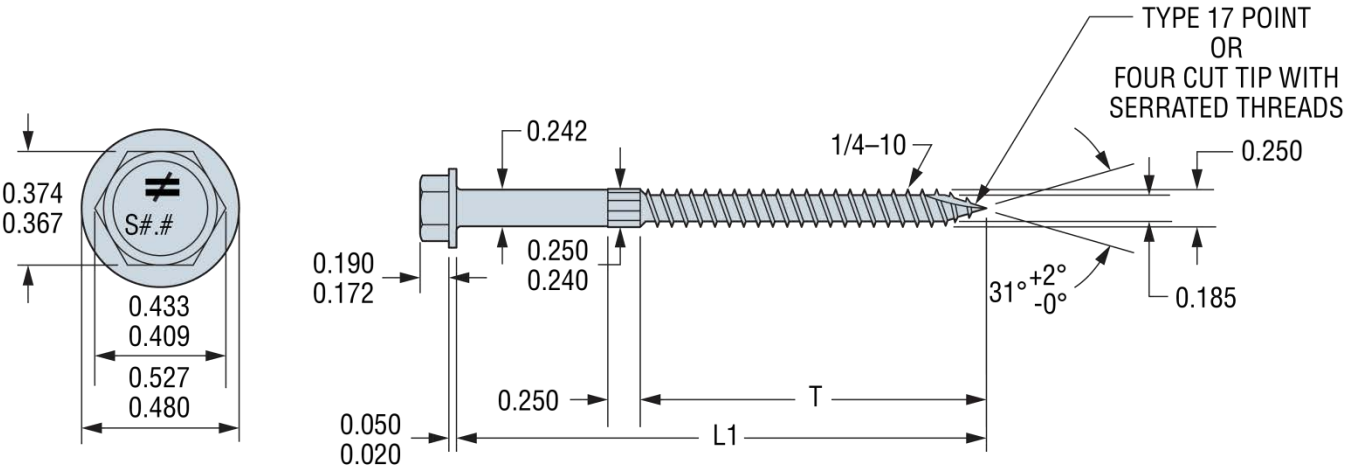
The packaging for the SDS wood screws is labeled with the designation "Simpson Strong-Drive SDS," the Simpson Strong-Tie Co. name and address, the fastener size, point type (four-cut or type 17), and the ICC-ES evaluation report number (ESR-2236). Each screw head is marked with the not-equal-to symbol (\neq), and the letter S followed by a number designating the screw length, as shown in [Table 1](#).

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

FASTENER DESIGNATION (based on point geometry)			HEAD MARKING	SCREW SPECIFICATIONS (inches)				SPECIFIED BENDING YIELD STRENGTH ³ , <i>F_{yb}</i> (psi)	FASTENER ALLOWABLE STEEL STRENGTH ⁴ (lbf)	
Carbon Steel		Stainless Steel		Screw Length, <i>L</i> 1	Thread Length ¹ , <i>T</i>	Unthreaded Shank Length, <i>L</i> 1 ! <i>T</i>	Minor Thread (root) Diameter ² , <i>D_r</i>		Tension	Shear
Type 17 Point	Four-Cut Point	Type 17 or Four-Cut Point								
SDS 1/4×1 1/2	SDS25112	SDS25112SS	S1.5	1 1/2	1	1/2	0.185	164,000	1,430	800
SDS 1/4×1 3/4	SDS25134	—	S1.75	1 3/4	1 1/4	1/2				
SDS 1/4×2	SDS25200	SDS25200SS	S2	2	1 1/4	3/4				
SDS 1/4×2 1/2	SDS25212	SDS25212SS	S2.5	2 1/2	1 1/2	1				
SDS 1/4×3	SDS25300	SDS25300SS	S3	3	2	1				
SDS 1/4×3 1/2	SDS25312	SDS25312SS	S3.5	3 1/2	2 1/4	1 1/4				
SDS 1/4×4 1/2	SDS25412	—	S4.5	4 1/2	2 3/4	1 3/4				
SDS 1/4×5	SDS25500	—	S5	5	2 3/4	2 1/4				
SDS 1/4×6	SDS25600	—	S6	6	3 1/4	2 3/4				
SDS 1/4×8	SDS25800	—	S8	8	3 1/4	4 3/4				

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 nominal diameter with manufacturing tolerances from a minimum of 0.183 inch to a maximum of 0.193 inch.
³Bending yield strength determined in accordance with [ASTM F1575](#) using the minor thread (root) diameter, *D_r*.
⁴Allowable fastener strengths are based on steel properties of the screw. Refer to [Tables 2](#) and [3](#) for allowable reference lateral (*Z*) design values for steel-to-wood and wood-to-wood connections, respectively.



U.S. Patent 6,109,850;
5,897,280; 7,101,133

FIGURE 1—SDS SCREW

TABLE 2—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR STEEL-TO-WOOD CONNECTIONS WITH SDS WOOD SCREWS^{1,2}

SCREW LENGTH (inches)	STEEL SIDE MEMBER DESIGN THICKNESS ^{3,4} , t_s (inches)					
	0.0584 (No. 16 gage)	0.0721 (No. 14 gage)	0.1026 (No. 12 gage)	0.1342 (No. 10 gage)	0.1795 (No. 7 gage)	0.2405 (No. 3 gage)
	Lateral Design Value (Z) ^{5,6,7} (lbf)					
1½	250	250	250	250	250	250
1¾	250	250	250	250	250	250
2	250	290	290	290	290	290
2½	250	390	390	420	420	420
3	250	420	420	420	420	420
3½	250	420	420	420	420	420
4½	250	420	420	420	420	420
5	250	420	420	420	420	420
6	250	420	420	420	420	420
8	250	420	420	420	420	420

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

¹The side member must be steel having a minimum tensile strength (F_u) equal to 45 ksi when the steel member design thickness is from 0.0584 inch to 0.1795 inch, and a minimum F_u equal to 52 ksi when the steel member design thickness is 0.2405 inch.

²The main member must be wood having a minimum assigned specific gravity of 0.50, such as Douglas fir–larch, and must be sufficiently sized to accommodate the screw length less the thickness of the side member. Values are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.2.

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

⁴Holes in the steel side member must be predrilled or prepunched. Hole diameter must comply with Section 3.2.3 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 into the side grain of the wood main member with the screw axis perpendicular to wood fibers.

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

TABLE 3—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR WOOD-TO-WOOD CONNECTIONS WITH SDS WOOD SCREWS

SCREW LENGTH (inches)	WOOD SIDE MEMBER ACTUAL THICKNESS ¹ , t_s (inches)	
	1½	1¾
	Lateral Design Value (Z) ^{2,3,4,5} (lbf)	
2½	190	—
3	280	—
3½	340	340
4½	350	340
5	350	340
6	350	340
8	350	340

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

¹The actual thickness of the wood side member, t_s , must be either 1½ or 1¾ inches, as specified in the table. The wood side member thickness is an absolute value, and is not a minimum or maximum value.

²The tabulated lateral design values (Z) are based on wood members having a minimum assigned specific gravity of 0.50, such as Douglas fir–larch. Values are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.2.

³The wood main member must be equal to or greater than the screw length less the thickness of the wood side member.

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 into the side grain of the wood members with the screw axis perpendicular to wood fibers.

TABLE 4—CONNECTION GEOMETRY

CONDITION ¹		MINIMUM DISTANCE OR SPACING (in.)
Edge distance	Perpendicular to grain loading (Loaded or unloaded edge)	1½
	Parallel to grain loading	1
End distance	Perpendicular to grain loading	4
	Parallel to grain loading (Loading toward or away from end)	3
Spacing (Loading parallel or perpendicular to grain)	Between fasteners in a row	3
	Between rows	3
	Between staggered rows	1½

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.

²Values for spacing between staggered rows apply where screws in adjacent rows are offset by half of the spacing between screws in a row.

TABLE 5—REFERENCE WITHDRAWAL DESIGN VALUE FOR SDS WOOD SCREWS INSTALLED IN THE SIDE GRAIN OF A WOOD MAIN MEMBER

SDS WOOD SCREW DIMENSIONS (in.)		REFERENCE WITHDRAWAL DESIGN VALUE ^{2,3,4} , <i>W</i> (lbs/inch)
Screw Length, <i>L</i> 1	Thread Length ¹ , <i>T</i>	
1½	1	172
1¾	1¼	
2	1¼	
2½	1½	
3	2	
3½	2¼	
4½	2¾	
5	2¾	
6	3¼	
8	3¼	

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

¹The tabulated reference withdrawal design value (*W* = 172 lbs/inch) is in pounds per inch of the thread penetration into the side grain of the main member.

²Tabulated reference withdrawal design values (*W* = 172 lbs/inch) must be multiplied by all applicable adjustment factors from the NDS as referenced in the IBC or IRC.

³Embedded thread length is that portion held in the main member including the screw tip.

⁴The tabulated withdrawal design value (*W*) is based on wood members having a minimum assigned specific gravity of 0.50, such as Douglas fir–larch. Values are also applicable for fasteners installed into the face of engineered wood described in Section 3.2.2.

TABLE 6—RECOGNIZED EXPOSURE CONDITIONS FOR SIMPSON STRONG-TIE SDS 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