



DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 05 23—Wood, Plastic and Composite Fastenings

REPORT HOLDER:

PRIMESOURCE BUILDING PRODUCTS, INC.

EVALUATION SUBJECT:

GRIP-RITE STRUCTURAL SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015 and 2012 *International Building Code*® (IBC)
- 2021, 2018, 2015 and 2012 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Corrosion resistance

2.0 USES

The Grip-Rite Structural Screws are used in wood-to-wood connections that are designed in accordance with the IBC. For structures regulated under the IRC, the fasteners may be used where an engineered design is submitted in accordance with IRC Section R301.1.3. The screws are intended for use in the Exposure Conditions shown in Table 6.

3.0 DESCRIPTION

3.1 Fasteners:

The Grip-Rite Structural Screws are partially-threaded, self-drilling screws with hex washer heads or flat heads which have a star shaped driving recess. The screws have a Type 17 point. Screws designated 1/4 inch, 5/16 inch and 3/8 inch have a reamer knurl between the screw thread and the smooth portion of the shank. The screws are formed from carbon steel wire, hardened after forming and then coated with a proprietary coating. See Table 1 and Figures 1 through 4 for fastener dimensions, descriptions and fastener strengths.

3.2 Coating:

The coating consists of a layer of zinc and an outer layer of a proprietary material which is black in color.

3.3 Wood Members:

For purposes of connection design, sawn lumber members must have an assigned specific gravity as indicated in the tables in this report. Assigned specific gravity for sawn lumber must be determined in accordance with Table 12.3.3A of the ANSI/AWC National Design Specification for Wood Construction (NDS) (Table 11.3.3A of the NDS for the 2012 IBC). Unless otherwise noted, sawn lumber members must have a moisture content of 19 percent or less.

For the purposes of connection design, structural glued laminated timber (GL) must have a Specific Gravity for Fastener Design (addressed in Tables 5A through 5D of the NDS Supplement), as indicated in the tables in this report. Unless otherwise noted, GL must have a moisture content of less than 16 percent.

When designing connections with screws installed into the face of cross-laminated timber (CLT) panels fabricated with sawn lumber laminations, all of the laminations must have a minimum assigned specific gravity in accordance with the NDS as indicated in the tables in this report. Moisture content must be less than 16 percent.

Use of the screws in engineered wood products (EWP) other than those addressed above is outside the scope of this report.

For wood-to-wood connections, the tabulated side member thickness is an absolute value (not a minimum or maximum value). The thickness of the wood main member must be equal to or greater than the screw length less the thickness of the side member.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The design values in this report are intended to aid the designer in meeting the requirements of IBC Section 1604.2. For connections not completely described in this report, determination of the suitability of the Grip-Rite Structural Screws for the specific application is the responsibility of the designer and is outside the scope of this report. The designer is responsible for determining the available strengths for the connection, considering all applicable limit states, and for considering serviceability issues.

4.1.1 Screw Strength: Allowable screw shear and tension strengths (ASD) and minimum specified bending yield strengths for the screws are shown in Table 1.

4.1.2 Governing Design Values: The allowable lateral load for a single-screw connection is the lesser of: (a) the reference lateral design value (Z) given in Table 4, adjusted by all applicable adjustment factors; and (b) the allowable screw shear strength given in Table 1. The allowable load for a single-screw connection in which the screw is subject to tension is the least of: (a) the reference withdrawal design value given in Table 2, multiplied by the embedded thread length, and adjusted by all applicable adjustment factors; (b) the allowable screw tension strength given in Table 1; and (c) the reference pull-through design value given in Table 3, adjusted by all applicable adjustment factors.

4.1.3 Adjustments to Reference Design Values: The reference design values must be adjusted in accordance with the requirements for dowel-type fasteners in Section 11.3 of the NDS (Section 10.3 of the NDS for the 2012 IBC), including the wet service factor C_M , shown in Tables 2, 3 and 4, to determine allowable loads for use with ASD and/or design loads for use with LRFD. The reference design values must also be adjusted in accordance with Section 12.5 of the NDS (Section 11.5 of the NDS for the 2012 IBC), as applicable. When the capacity of a connection is controlled by the fastener strength, the allowable connection strength must not be increased by the adjustment factors specified in the NDS.

4.1.4 Connections with Multiple Screws: Connections made with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS (Sections 10.2.2 and 11.6 of the NDS for the 2012 IBC).

4.1.5 Combined Loading: When the screws are subjected to combined lateral and withdrawal loads, connections must be designed in accordance with Section 12.4.1 of the NDS (Section 11.4.1 of the NDS for the 2012 IBC).

4.1.6 Capacity Requirements for Wood Members: When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 11.1.2 of the NDS (Section 10.1.2 of the NDS for the 2012 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.

4.1.7 Reference Withdrawal and Pull-through Design Values: Reference withdrawal (W) design values in pounds per inch of thread penetration, for screws installed perpendicular to the face of the wood member are shown in Table 2. Reference pull-through (W_H) design values are addressed in Table 3.

4.1.8 Lateral Connections in Accordance with the NDS: The reference lateral design strength for connections of two or more wood members using the Grip-Rite Structural Screws may be designed in accordance with the NDS, subject to the following conditions:

1. The applicable specified bending yield strength from Table 1 must be used for design.
2. The minor thread diameter, D_r , must be used to determine R_d and K_D in accordance with Table 12.3.1B of the NDS, the dowel bearing strength in accordance with Table 12.3.3 of the NDS and the reference lateral design value based on Table 12.3.1A of the NDS (Tables 11.3.1B, 11.3.3 and 11.3.1A of the 2012 NDS for the 2015 and 2012 IBC).
3. The screw penetration into the main member must be a minimum of 6 times the major thread diameter.

4. Spacing, edge and end distance must be in accordance with Table 5, and as needed to prevent splitting of the wood.

4.1.9 Two-member Wood-to-wood Connections Based on Testing: For select connection configurations, testing has been conducted to determine reference lateral design values which exceed those determined in accordance with the NDS. Reference lateral (Z) design values for single shear, wood-to-wood connections loaded perpendicular and parallel to grain based on testing are shown in Table 4.

4.1.10 Corrosion Resistance: The screws may be used in preservative-treated and fire-retardant-treated lumber, as alternates to hot-dip galvanized fasteners prescribed in IBC Section 2304.10.6 (2018 and 2015 IBC Section 2304.10.5, 2012 IBC Section 2304.9.5), when used in the Exposure Conditions shown in Table 6. The screws have been evaluated for use in wood treated with ACQ-D preservatives with a maximum retention of 0.40 pcf (6.4kg/m³).

4.2 Installation:

Screws must be installed in accordance with the report holder's published installation instructions and this report. The screws must be installed perpendicular to the face of the wood side member. The underside of the screw head must bear against the surface of the wood side member. Screws must not be overdriven. Screws must be installed with the minimum spacing, end distances, and edge distances needed to prevent splitting of the wood, or as noted in Table 5, whichever is more restrictive. Installation may be performed without predrilling in wood species with assigned specific gravity of 0.55 or less. The screws must be installed by turning with star drive bits.

5.0 CONDITIONS OF USE

The Grip-Rite Structural 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 Installation must comply with this report, the report holder's published instructions and the applicable code. A copy of the report holder's published installation instructions must be available at the jobsite at all times during installation. In the event of a conflict between the published installation instructions and this report, this report governs.
- 5.2 Design loads for the screws must not exceed the available strengths described in Section 4.1.
- 5.3 Calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 When the capacity of the connection is controlled by the fastener steel strength, rather than wood strength, the steel strength must not be multiplied by the adjustment factors specified in the NDS.
- 5.5 The screws are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Dowel-type Threaded Fasteners Used in Wood (AC233), dated October 2020 (editorially revised December 2020).

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effects of Wood Treatments (AC257), dated October 2009 (editorially revised January 2021).

7.0 IDENTIFICATION

7.1 Packages of screws are identified with the report holder name (PrimeSource Building Products) and address, the brand name (Grip-Rite), the product name (Structural Screws), the nominal fastener size and length, the head style, lot number and the evaluation report number (ESR-3933).

7.2 The report holder's contact information is the following:

PRIMESOURCE BUILDING PRODUCTS, INC.
1321 GREENWAY DRIVE
IRVING, TEXAS 75038
(972) 999-8500
www.primesourcebp.com/us/en

TABLE 1—FASTENER SPECIFICATIONS

FASTENER DESIGNATION	OVERALL LENGTH ¹ (inches)	THREAD LENGTH ² (inches)	HEAD STYLE	HEAD DIAMETER (inch) (DRIVE SIZE)	ROOT DIAMETER (inch)	SHANK DIAMETER (inch)	OUTSIDE THREAD DIAMETER (inch)	SPECIFIED BENDING YIELD STRENGTH ³ F _y (psi)	ALLOWABLE STEEL STRENGTH	
									Tensile (lbf)	Shear (lbf)
#9 x 1½"	1½	1¾	Hex Washer	0.382 (T-20)	0.108	0.150	0.178	200,000	1,800	1,925
#9 x 2½"	2½	1¾								
#9 x 1½"	1½	1¾	Flat	0.472 (T-25)	0.130	0.163	0.192	200,000	2,590	1,925
#9 x 2½"	2½	1¾								
#10 x 1½"	1½	1⅛	Hex Washer	0.382 (T-20)	0.130	0.163	0.192	200,000	2,590	1,925
#10 x 2½"	2½	1⅛								
#10 x 3"	3	1½	Flat	0.533 (T-25)	0.148	0.166	0.234	220,000	3,460	1,925
#10 x 1½"	1½	1⅛								
#10 x 2½"	2½	1⅛	Flat	0.533 (T-25)	0.179	0.202	0.281	230,000	5,910	3,205
#10 x 3½"	3	1½								
¼ x 3"	3	1½	Hex Washer	0.415 (T-20)	0.148	0.166	0.234	220,000	3,460	1,925
¼ x 4"	4	2								
¼ x 4½"	4½	2¼	Flat	0.533 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
¼ x 5"	5	2¼								
¼ x 6"	6	3¼	Hex Washer	0.415 (T-20)	0.179	0.202	0.281	230,000	5,910	3,205
¼ x 2½"	2½	1½								
¼ x 3"	3	1½	Flat	0.533 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
¼ x 4"	4	2								
¼ x 4½"	4½	2¼	Hex Washer	0.415 (T-20)	0.196	0.220	0.311	230,000	6,315	3,255
¼ x 5"	5	2¼								
¼ x 6"	6	3¼	Flat	0.533 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
¼ x 2½"	2½	1½								
5/16 x 3"	3	1½	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 3½"	3½	1½								
5/16 x 4"	4	2	Flat	0.610 (T-30)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 5"	5	2¼								
5/16 x 6"	6	3¼	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 8"	8	3¼								
5/16 x 10"	10	3⅞	Flat	0.610 (T-30)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 2½"	2½	1½								
5/16 x 3"	3	1½	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 3½"	3½	1½								
5/16 x 4"	4	2	Flat	0.610 (T-30)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 5"	5	2¼								
5/16 x 6"	6	3¼	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 8"	8	3¼								
5/16 x 10"	10	3⅞	Flat	0.610 (T-30)	0.196	0.220	0.311	230,000	6,315	3,255
5/16 x 2½"	2½	1½								
3/8 x 3"	3	1½	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 3½"	3½	2								
3/8 x 4"	4	2	Flat	0.728 (T-40)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 6"	6	3¼								
3/8 x 8"	8	3¼	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 10"	10	3⅞								
3/8 x 12"	12	3⅞	Flat	0.728 (T-40)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 3"	3	1½								
3/8 x 3½"	3½	2	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 4"	4	2								
3/8 x 6"	6	3¼	Flat	0.728 (T-40)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 8"	8	3¼								
3/8 x 10"	10	3⅞	Hex Washer	0.571 (T-25)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 12"	12	3⅞								
3/8 x 14"	14	3⅞	Flat	0.728 (T-40)	0.196	0.220	0.311	230,000	6,315	3,255
3/8 x 16"	16	3⅞								

For **SI**: 1 inch = 25.4 mm; 1 psi = 6.9 kPa.

¹Overall length of fastener is measured from the underside of the head to the tip.

²Length of thread includes tip.

³Bending yield strength determined in accordance with ASTM F1575 using the root diameter.

TABLE 2—REFERENCE WITHDRAWAL DESIGN VALUES (*W*) FOR INSTALLATION INTO THE FACE OF THE WOOD MEMBER^{1,2,3}

FASTENER DESIGNATION	MINIMUM EMBEDDED THREAD LENGTH ⁴ (inches)	<i>W</i> (lbf/in.) FOR SPECIFIC GRAVITIES (SG) OF:		<i>C_M</i>
		SG ≥ 0.42	SG ≥ 0.55	
#9	1 ³ / ₁₆	85	127	0.46
#10	1 ¹ / ₈	86	127	
1 ¹ / ₄	1 ¹ / ₂	97	169	
5 ⁵ / ₁₆	1 ¹ / ₂	119	168	
3 ³ / ₈	1 ¹ / ₂	122	203	

For **SI**: 1 inch = 25.4 mm; 1 lbf/in = 175 N/m.

¹ Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

² Tabulated reference withdrawal design values (*W*) are in pounds per inch of thread penetration into the main member.

³ Values must be multiplied by applicable all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD and/or design loads for use with LRFD, and must be multiplied by the length of thread penetration in the main member, including tip.

⁴ Embedded thread length is that portion of the screw held in the main member including the screw tip.

TABLE 3—REFERENCE PULL-THROUGH DESIGN VALUES (W_H)^{1,2}

FASTENER DESIGNATION	HEAD STYLE	MINIMUM SIDE MEMBER THICKNESS (inch)	W_H (lbf) FOR SPECIFIC GRAVITIES (SG) OF:		C_M
			SG ≥ 0.42	SG ≥ 0.55	
#9, #10, 1/4	Hex Washer	Determine in accordance with Section 12.2.5 of the 2018 NDS			Per Section 11.3.3 of the 2018 NDS
5/16		3/4	178	296	0.46
3/8					
#9	Flat Head	Determine in accordance with Section 12.2.5 of the 2018 NDS			Per Section 11.3.3 of the 2018 NDS
#10		3/4	168	242	0.46
1/4					
5/16					
3/8					

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

¹Values must be multiplied by all applicable adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD and/or design loads for use with LRFD. ²Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

TABLE 4—REFERENCE LATERAL DESIGN VALUES (Z) FOR WOOD-TO-WOOD CONNECTIONS¹

FASTENER DESIGNATION	SIDE MEMBER THICKNESS (inch)	MINIMUM MAIN MEMBER PENETRATION (inches)	Z (lbf) FOR SPECIFIC GRAVITIES (SG) OF:				C_M
			SG ≥ 0.42		SG ≥ 0.55		
			Parallel to Grain, $Z_{ }$	Perpendicular to Grain, Z_{\perp}	Parallel to Grain, $Z_{ }$	Perpendicular to Grain, Z_{\perp}	
#9	3/4	3/4	74	59	71	85	0.51
#10	3/4	3/4	65	—	64	97	
1/4	3/4	1 5/8	—	79	—	—	
5/16	3/4	1 5/8	—	99	-	-	
	1 1/2	2 3/8	191	155	206	225	
	2	3 7/8	246	156	241	268	
3/8	3/4	2 3/8	—	132	—	202	
	1 1/2	1 1/2	156	173	202	220	
	2	3 7/8	213	303	207	294	
	2 3/4	4 1/4	161	-	-	-	

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

¹Values must be multiplied by applicable adjustment factors, in accordance with the NDS.

TABLE 5—CONNECTION GEOMETRY REQUIREMENTS^{1,2,3}

CONDITION		MINIMUM DISTANCE OR SPACING		
		SG ≥ 0.42	SG ≥ 0.50	
End distance	Tension loading parallel to grain (fastener bearing toward end)		15D	20D
	Compression loading parallel to grain (fastener bearing away from end)		10D	15D
	Loading perpendicular to grain		10D	15D
	Axial loading (fastener withdrawal or pull-through)		10D	10D
Edge distance	Loading parallel to grain		5D	7D
	Loading perpendicular to grain	Load toward edge	10D	12D
		Load away from edge	5D	7D
	Axial Loading		4D	4D
Spacing between fasteners in a row (parallel to grain of main member)	Loading parallel to grain		15D	15D
	Loading perpendicular to grain		12D	15D
	Axial loading		7D	7D
Spacing between rows (perpendicular to grain of main member)	Lateral loading	In-line rows	5D	7D
		Staggered rows ⁴	2.5D	3D
	Axial loading		4D	4D

For **SI**: 1 inch = 25.4 mm.

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

²Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

³D refers to the outside thread diameter.

⁴Values for spacing between staggered rows apply where fasteners in adjacent rows are offset by half of the spacing between fasteners in a row.

TABLE 6—APPLICABLE EXPOSURE CONDITIONS FOR GRIPRITE STRUCTURAL SCREWS

EXPOSURE CONDITION	TYPICAL APPLICATIONS	LIMITATIONS
Corrosion Resistance of Fasteners		
1	Treated wood in dry use applications	Limited to use where equilibrium moisture content of the chemically treated wood meets the dry service conditions as described in the NDS.
3	General construction	Limited to freshwater and chemically treated wood exposure, i.e., no saltwater exposure.

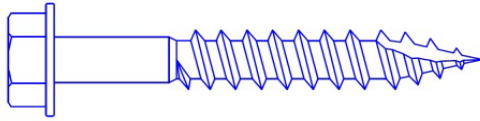


FIGURE 1—#9 AND #10 GRIPRITE STRUCTURAL SCREWS WITH HEX WASHER HEAD

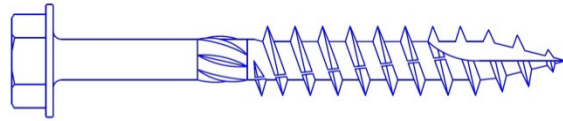


FIGURE 2— $\frac{1}{4}$, $\frac{5}{16}$ AND $\frac{3}{8}$ INCH GRIPRITE STRUCTURAL SCREWS WITH HEX WASHER HEAD

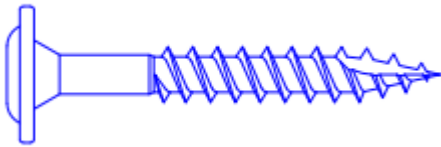


FIGURE 3—#9 AND #10 GRIPRITE STRUCTURAL SCREWS WITH FLAT HEAD

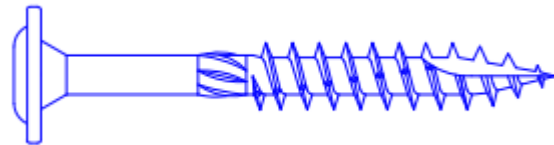


FIGURE 4— $\frac{1}{4}$, $\frac{5}{16}$ AND $\frac{3}{8}$ INCH GRIPRITE STRUCTURAL SCREWS WITH FLAT HEAD