



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 2204-03

Truss/Rafter/Joist to Wall Top Plate
Connections with Grip-Rite Structural
Screws

**PrimeSource Building Products,
Inc.**

Product:

1/4" Grip-Rite Structural Screws

Issue Date:

August 5, 2022

Revision Date:

August 5, 2022

Subject to Renewal:

October 1, 2023



COMPANY
INFORMATION:

PrimeSource Building Products, Inc.
1321 Greenway Drive
Irving, TX 75038-2504

Phone: 972-999-8500

Fax: 562-404-5450

gattos@primesourcebp.com

primesourcebp.com

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 00 90 - Wood and Plastic Fastenings

SECTION: 06 05 23 - Wood, Plastic, and Composite Fastenings

1 PRODUCT EVALUATED¹

- 1.1 ¼" Grip-Rite Structural Screws

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—15, 18, 21: International Building Code®*
- 2.1.2 *IRC—15, 18, 21: International Residential Code®*

2.2 Standards and Referenced Documents

- 2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear of Screws*
- 2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 2.2.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*
- 2.2.6 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.7 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*
- 2.2.8 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

¹ For more information, visit drjcertification.org or call us at 608-310-6748.

² Unless otherwise noted, all references in this TER are from the 2021 version of the codes and the standards referenced therein. This material, design, or method of construction also complies with the 2000-2018 versions of the referenced codes and the standards referenced therein.

³ All terms defined in the applicable building codes are italicized.

3 PERFORMANCE EVALUATION

- 3.1 1/4" Grip-Rite Structural Screws were evaluated as an alternate means of attaching metal plate connected wood trusses, rafters, or floor joists to the tops of walls to provide uplift and lateral load resistance. The fasteners were evaluated under the following conditions:
 - 3.1.1 Shear strength for use as an alternate to toenail connections, hurricane and seismic clip/straps, or nails in shear (lateral) load applications either parallel or perpendicular to wood grain.
 - 3.1.2 Withdrawal strength for use as an alternative to toenail connections, metal hurricane and seismic clip/straps, or nails in tension (uplift) load applications.
 - 3.1.3 Head pull-through strength for use as an alternative to toenail connections, hurricane and seismic clips/straps, or nails in tension (uplift) load application.
- 3.2 Connections other than those addressed in Section 3 are outside the scope of this TER.
- 3.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.
- 3.4 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.5 Any engineering evaluation conducted for this TER was performed within DrJ's ANAB accredited ICS code scope and/or the defined professional engineering scope of work on the dates provided herein.

4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 The products evaluated in this TER is shown in Figure 1.

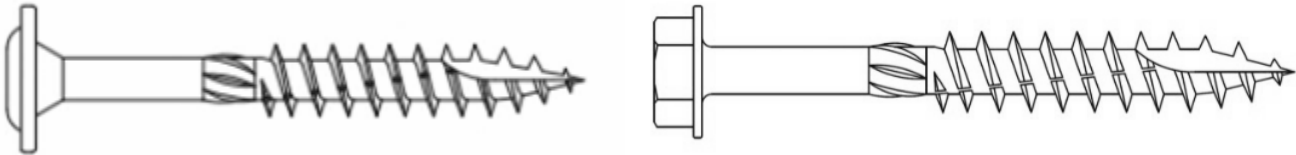


FIGURE 1. 1/4" GRIP-RITE STRUCTURAL SCREW WITH FLAT HEAD (LEFT) AND HEX HEAD (RIGHT)

- 4.2 1/4" Grip-Rite Structural Screws are partially-threaded, self-drilling screws with flat heads with a star shaped driving recess or hex-washer heads. The screws have a Type 17 point. The screws have a reamer knurl between the screw thread and the smooth portion of the shank. For this application, 4" and 6" lengths are evaluated.
- 4.3 1/4" Grip-Rite Structural Screws are formed from carbon steel wire, hardened after forming and then coated with a proprietary coating.
 - 4.3.1 The coating consists of a layer of zinc and a proprietary black outer coating.
- 4.4 *Treated Wood Applications*
 - 4.4.1 1/4" Grip-Rite Structural Screws may be used in preservative-treated and fire-resistant-treated lumber as alternatives to hot-dip galvanized fasteners prescribed in IBC Section 2304.10.6⁴. 1/4" Grip-Rite Structural Screws have been evaluated for use in wood treated with ACQ-D preservatives with a maximum retention of 0.40 pcf.
 - 4.4.2 Corrosion resistance applications are limited to the following:
 - 4.4.2.1 Where equilibrium moisture content of the chemically treated wood meets the dry service conditions as described in *NDS*.
 - 4.4.2.2 Exposure is freshwater and chemically treated wood (no saltwater exposure).
 - 4.4.3 Fastener design values for preservative-treated and fire-resistant-treated lumber must be reduced as stated by the manufacturer of the lumber treatment.

⁴ 2018 IBC Section 2304.10.5

4.5 Wood Material

4.5.1 Wood main and side members must be solid-sawn lumber or boards having an assigned specific gravity as given in the respective tables of this TER.

4.6 The 1/4" Grip-Rite Structural Screws evaluated in this TER are set forth in Table 1.

TABLE 1. 1/4" GRIP-RITE STRUCTURAL SCREW PROPERTIES

Fastener Designation	Head			Length (in)		Diameter (in)			Bending Yield Strength ³ , f_{yb} , (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Fastener ¹	Thread ²	Shank	Minor	Major		Tensile	Shear
1/4" x 4"	Hex Washer	T-20	0.415	4	2	0.166	0.148	0.234	220,000	1,155	645
1/4" x 6"				6	3 1/4						
1/4" x 4"	Flat	T-25	0.533	4	2	0.166	0.148	0.234	220,000	1,155	645
1/4" x 6"				6	3 1/4						

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa
 1. Fastener length is measured from the underside of the head to the tip.
 2. Thread length includes tapered tip.
 3. Bending yield strength, F_{yb} , is determined in accordance with *ASTM F1575* using minor thread diameter.

5 APPLICATIONS

5.1 The 1/4" Grip-Rite Structural Screws in this TER are used in construction of walls that meet the requirements of IBC Section 2308 or IRC Section R602 for the following applications:

- 5.1.1 To attach minimum 1 1/2"-thick wood trusses, rafters, or floor joists to wood walls.
- 5.1.2 To attach minimum 1 1/2"-thick wood gable end trusses to wood walls.

5.2 Allowable design loads are applicable to fasteners installed in accordance with Section 6.

5.3 Walls shall consist, at a minimum, of a single or double top plate installed in accordance with IBC Section 2308.5.3.2 or IRC Section R602.3.2.

5.4 The 1/4" Grip-Rite Structural Screws in this TER are used in buildings requiring design in accordance with IBC Section 1609 or wind analysis in accordance with IRC Section R301.2.1.

5.5 The 1/4" Grip-Rite Structural Screws in this TER are used in buildings requiring design in accordance with IBC Section 1613 or wind analysis in accordance with IRC Section R301.2.2.

5.6 To maintain a continuous uplift load path, connections in the same area must be stacked on the same side of the wall (e.g., rafter to top plate connection and top plate to stud connection).

5.7 Allowable design loads for uplift and lateral resistance for truss, rafter, and joist to top plate connections are provided in Table 2.

5.8 Loads parallel to the wall are labeled F1 and loads perpendicular to the wall are labeled F2. See Figure 2 for load directions.

5.9 Allowable design loads are applicable to fasteners installed in accordance with Section 6 in top plate applications.

TABLE 2. ALLOWABLE UPLIFT & LATERAL LOADS FOR FASTENERS IN TRUSS/RAFTER/JOIST TO WALL TOP PLATE CONNECTIONS

Fastener Designation	Main Member ^{1,2}	Min. Main Member Penetration (in)	Top Plate	Fastener Angle to Vertical	Allowable Loads ³ (lb)		
					Wood Species ⁴ (Specific Gravity)		
					SPF (0.42)		
					Uplift	F1	F2
1/4" x 4"	Truss/Rafter/Joist ⁵	2 1/4	Single	22.5°	420	390	400
				0°	595	390	455
1/4" x 6"		2 3/4	Double	22.5°	495	390	560
				0°	635	390	575
1/4" x 4"	Gable End Truss	2 1/2	Single	0°	595	455	390
1/4" x 6"		3	Double	0°	635	575	390

SI: 1 in. = 25.4 mm, 1 lb. = 4.45 N

- Gable end truss, truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of gable truss, truss, rafter, or floor joist is by others.
- See Figure 2 for truss, rafter, or floor joist load directions and Figure 3 for gable end truss load directions. See Figure 3, Figure 4, Figure 5, and Figure 6 for installation details.
- Includes 1.6 duration of load increase for wind and seismic. No further duration of load increases permitted. Reduce design values for other load durations as applicable.
- Equivalent specific gravity of structural composite lumber (SCL) shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
- Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal) or 0° (See Figure 4 and Figure 5). For installation between 20° and 30°, design values for 22.5° may be used.

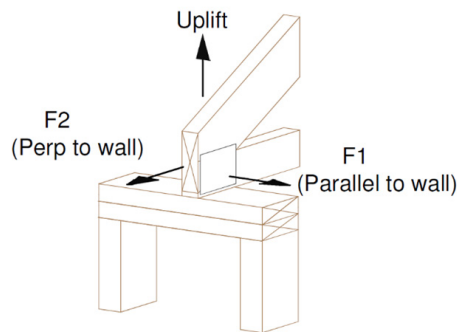


FIGURE 2. UPLIFT AND LATERAL LOAD ORIENTATIONS FOR TRUSS, RAFTER, AND JOIST

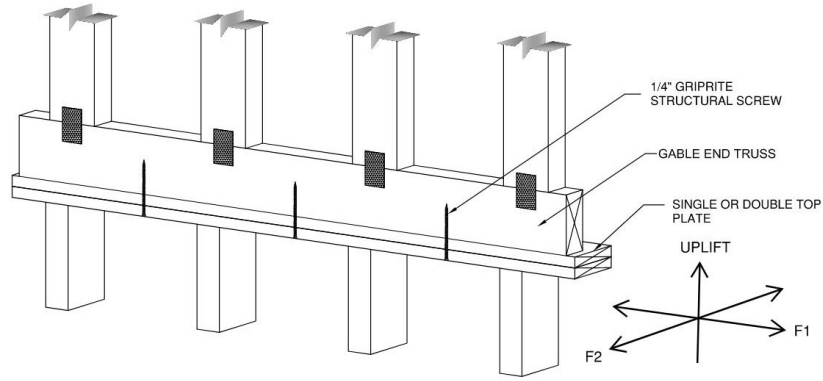


FIGURE 3. GABLE END TRUSS TO TOP PLATE - UPLIFT AND LATERAL LOAD (F1 AND F2) DIRECTIONS

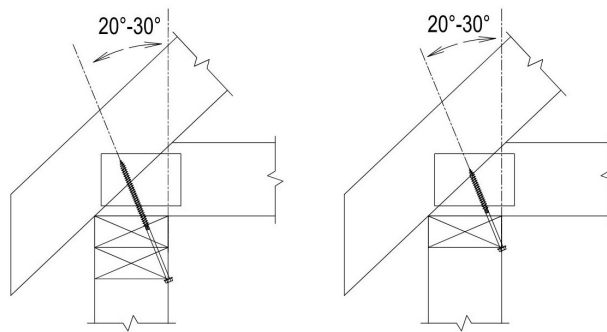


FIGURE 4. INSTALLATION OF FASTENERS AT AN ANGLE IN DOUBLE TOP PLATE TO TRUSS/RAFTER/JOIST APPLICATIONS

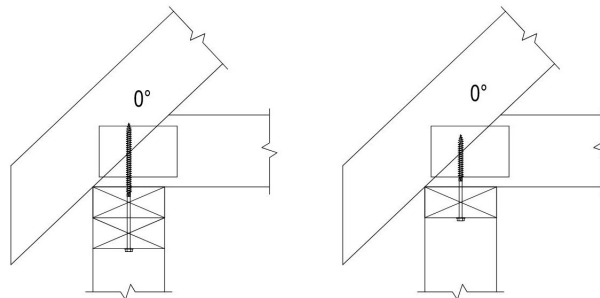


FIGURE 5. INSTALLATION OF FASTENERS IN TOP PLATE PERPENDICULAR TO TRUSS/RAFTER/JOIST APPLICATIONS

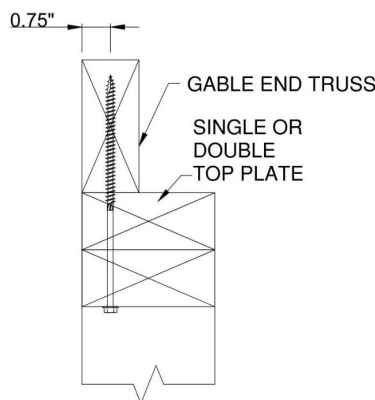


FIGURE 6. GABLE END TRUSS TO TOP PLATE INSTALLATION CONFIGURATION

6 INSTALLATION

- 6.1 Installation shall comply with the manufacturer’s installation instructions and this TER. In the event of a conflict between the manufacturer’s installation instructions and this TER, the more restrictive shall govern.
- 6.2 *Truss/Rafter/Joist to Top Plate Installation*
- 6.2.1 Install ¼" Grip-Rite Structural Screws upward into the center of the truss, rafter, or joist through the wall top plates or wood structural framing member at the bottom corner of the top plate(s). The fastener should be installed at an upward angle from the vertical of 20° to 30° (Figure 4) and should penetrate the truss, rafter, or joist within ¼" of the centerline. Fasteners located between studs may be installed perpendicular to the face of the top plate (Figure 5).
- 6.2.1.1 If the truss, rafter, or floor joist is located directly over a top plate splice, offset the fastener ¼" to one side of the splice.
- 6.2.2 Minimum penetration into truss/gable truss/rafter/joist using a single top plate connections is 2.5".
- 6.2.3 Minimum penetration into truss/gable truss/rafter/joist using a double top plate connections is 3".
- 6.3 *Gable End Truss to Top Plate Installation*
- 6.3.1 Install ¼" Grip-Rite Structural Screws upward into the center of the gable end truss through the wall top plates or wood structural framing member. The fastener should be installed perpendicular to the face of the top plate between studs (Figure 3) and should penetrate the gable end truss within ¼" of the centerline.
- 6.3.1.1 If the screw location for the gable end truss is located directly over a top plate splice or at a bottom chord splice joint, offset the fastener 1¾" to one side of the splice.
- 6.3.2 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with Table 3.

TABLE 3. SCREW SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS^{1,2,3}

Connection Geometry		Minimum Spacing (in)		
		0.42	0.50	
End Distance	Load in Any Direction	1 ¾	1 ¾	
Edge Distance	Load in Any Direction	¾	¾	
Spacing Between Fasteners in a Row (Parallel to Grain Spacing)	Loading Parallel to Grain	3 ⅝	3 ⅝	
	Loading Perpendicular to Grain	2 ⅞	3 ⅝	
	Axial Loading	1 ¾	1 ¾	
Spacing Between Rows (Perpendicular to Grain Spacing)	Lateral Loading	In-line rows	1 ¼	1 ¾
		Staggered rows ⁴	⅝	¾
	Axial Loading	1	1	

SI: 1 in = 25.4 mm

- Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive.
- Wood 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.
- Values for "Spacing between Rows or Fasteners-Staggered" apply where the screws in adjacent rows are offset by one-half of the "Spacing between Fasteners in a Row".

7 SUBSTANTIATING DATA

- 7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:
- 7.1.1 Assembly testing in accordance with *ASTM D1761*



- 7.2 Information contained herein is the result of testing and/or data analysis by sources which conform to IBC Section 1703 and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.
- 7.3 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through state or local adoption of codes and standards. The providers of the codes and standards are legally responsible for their content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes a products as being equivalent to that prescribed in this code in quality, strength, effectiveness, fire resistance, durability, and safety. Where the accuracy of the provisions provided herein is reliant upon the published properties of materials, DrJ relies upon the grade mark, grade stamp, mill certificate, and/or test data provided by material suppliers to be minimum properties. DrJ analysis relies upon these properties to be accurate.

8 FINDINGS

- 8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the products listed in Section 1.1 is approved for the following:
- 8.1.1 An acceptable alternative means of attaching metal plate connected wood trusses, gable end trusses, or floor joists to the tops of walls to provide uplift and lateral load resistance due to wind and seismic forces as provided in Table 2.
- 8.2 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
- 8.2.1 Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.
- 8.3 Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the building official. DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs RDPs.
- 8.4 Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain products approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – “certified once, accepted everywhere.”
- 8.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10⁵ are similar) states:

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code...Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

⁵ 2018 IFC Section 104.9



9 CONDITIONS OF USE

- 9.1 For conditions not covered in this TER, connections shall be designed in accordance with accepted engineering practice.
- 9.2 Connected wood members must have a moisture content of less than or equal to 19 percent.
- 9.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.
- 9.4 Where required by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.
- 9.5 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.6 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (e.g., owner or RDP).
- 9.7 At a minimum, this products shall be installed per Section 6 of this TER.
- 9.8 This products has an internal quality control program and a third-party quality assurance program in accordance with IBC Section 104.4 and Section 110.4 and IRC Section R104.4 and Section R109.2.
- 9.9 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent.
- 9.10 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.11 The implementation of this TER for this products is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections required by IBC Section 110.3, and any other code or regulatory requirements that may apply.

10 IDENTIFICATION

- 10.1 The products listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at primesourcebp.com.

11 REVIEW SCHEDULE

- 11.1 This TER is subject to periodic review and revision. For the most recent version, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.