



CERTIFICATION



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Technical Evaluation Report

TER 1907-03

Big Timber® Screws for Use in Deck
Ledger Applications

**Western Builders Supply
DBA Big Timber**

Products:

Big Timber® CTX, BL, and GL Screws

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

SECTION: 06 11 00 - Wood Framing

SECTION: 06 15 00 - Wood Decking

1 PRODUCTS EVALUATED¹

1.1 Big Timber® CTX, BL, and GL Screws

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

2.1.1 *IBC—12, 15, 18: International Building Code®*

2.1.2 *IRC—12, 15, 18: International Residential Code®*

2.2 Standards and Referenced Documents

2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear Strength 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*

¹ Building codes require data from valid [research reports](#) be obtained from [approved sources](#). 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](#).

Through ANAB accreditation and the [IAF MLA](#), DrJ certification can be used to obtain product approval in any [jurisdiction](#) or country that has [IAF MLA Members & Signatories](#) to meet the [Purpose of the MLA](#) – “certified once, accepted everywhere.”

Building official approval of a licensed [registered design professional](#) (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant [jurisdiction](#). Therefore, the work of licensed RDPs is accepted by [building officials](#), except when plan (i.e., peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the [building official](#) responds in writing stating the reasons for [disapproval](#).

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjcertification.org or call us at 608-310-6748.

² Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., *ASCE 7, NDS, ASTM*). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

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



- 2.2.5 ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood
- 2.2.6 ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails

3 PERFORMANCE EVALUATION

- 3.1 The Big Timber® screws listed in Section 1 were evaluated to determine:
 - 3.1.1 Use for attachment of deck ledgers to the building structure. This application includes attachments to Spruce-Pine-Fir (SPF) band joists⁴ and oriented strand board (OSB) band joists.
 - 3.1.2 Lateral strength of ledger connections to wood-framed walls. This application includes zero, one, or two layers of ½" gypsum between the ledger and the wall studs.
- 3.2 For conventionally-framed buildings, the deck ledger is required to be attached to the band joist in accordance with IBC Section 1604.8.3 or IRC Section R507.9⁵ as applicable.
 - 3.2.1 Where a band joist is not used, as in some truss installations, an engineered design is required. See Appendix A for additional code requirements for ledger attachments.
- 3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.4 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 The products evaluated in this TER are shown in Figure 1, Figure 2, and Figure 3.



FIGURE 1. CTX CONSTRUCTION LAG SCREW



FIGURE 2. BL LOG, TIMBER & LANDSCAPING SCREW



FIGURE 3. GL GRAY STRUCTURAL SCREW

- 4.2 The Big Timber® screws evaluated in this TER are set forth in Table 1.

⁴ The term "band joist" is used throughout this report. Other regionally-used terms synonymous with band joist include rim board, band board, header board, and header joist.

⁵ 2015 IRC Section R507.2

TABLE 1. BIG TIMBER® FASTENER SPECIFICATIONS

Fastener Name	Designation	Head (in.)		Nominal Length ¹ (in.)	Thread Length ¹ (in.)	Shank Diameter ² (in.)	Thread Diameter (in.)		Specified Minimum Core Hardness ⁴ (HV 0.3)	Nominal Bending Yield, f _{yb} (psi)	Allowable Fastener Strength (lbf)	
		Diameter	Drive Type				Minor	Major			Tensile	Shear ³
CTX	14 x 4	0.531	Torx 25	4	2	0.168	0.146	0.242	355	141,300	930	725
	14 x 5			5	3							
	15 x 3½	0.620	Torx 30	3½	2½	0.202	0.179	0.275	355	151,600	1,475	1,020
	15 x 4			4	2½							
	15 x 5			5	3							
	15 x 6			6	3							
	17 x 4	0.675	Torx 40	4	2½	0.226	0.210	0.295	355	170,500	1,850	1,240
	17 x 5			5	3							
	17 x 6			5	3							
BL	14 x 4	0.487	Hex 5/16	4	2	0.189	0.171	0.258	355	177,700	1,085	725
	14 x 5			5	2							
	17 x 4	0.570	Hex 5/16	4	2	0.224	0.211	0.297	355	172,600	1,990	1,240
	17 x 5			5	3							
	17 x 6			6	3							
GL	17 x 4	0.570	Hex 5/16	4	2	0.224	0.211	0.297	355	172,600	1,990	1,240
	17 x 5			5	3							
	17 x 6			6	3							

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. Thread length includes tapered tip.
2. Shank diameter based on manufactured thickness. Finished dimensions are larger, due to the proprietary coatings added.
3. Shear determined at smooth shank diameter.
4. Based on a 300 gram load using the Vickers indenter.

- 4.3 Big Timber® screws are manufactured using a standard cold-formed process followed by a heat-treating process.
- 4.4 CTX screws are coated with a proprietary coating, designated as Bronze Star, which exceeds the protections provided by hot-dipped galvanized coatings conforming to *ASTM A153*.
- 4.5 BL screws are coated with a proprietary coating, designated as Black Log, which exceeds the protections provided by hot-dipped galvanized coatings conforming to *ASTM A153*.
- 4.6 GL screws are coated with a proprietary coating, designated as Gray Log, which exceeds the protections provided by hot-dipped galvanized coatings conforming to *ASTM A153*.
- 4.7 Big Timber® screws are approved for use in chemically treated or untreated lumber where *ASTM A153, Class D* coatings are approved for use in accordance with *IBC Section 2304.10*⁶ and *IRC Section R317.3*.

⁶ 2012 *IBC Section 2304.9*

- 4.7.1 The proprietary coating has been tested and found to exceed the protection provided by code-approved, hot-dipped galvanized coatings meeting *ASTM A153, Class D (IBC Section 2304.10.5⁷ and IRC Section R317.3)*, allowing for its use in pressure-treated wood.
- 4.7.2 Big Timber® screws are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.

5 APPLICATIONS

- 5.1 Big Timber® CTX, BL, and GL screws are self-tapping fasteners used for attaching the deck ledger to the band joist of a building in accordance with *IBC Section 1604.8.3 and IRC Section R507.9⁸*. See Section 6 for installation requirements.
- 5.2 Big Timber® CTX, BL, and GL screws can be used for attaching ledger boards to wall studs with zero, one, or two layers of GWB between the ledger and the wall studs.
- 5.3 Big Timber® CTX, BL, and GL screws are installed without lead holes, as prescribed in *NDS*.
- 5.4 Design of Big Timber® CTX, BL, and GL screws are governed by the applicable code and the provisions for dowel-type fasteners in *NDS*.
- 5.5 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.
- 5.6 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
- 5.7 *Design Values for Deck Ledger*
 - 5.7.1 Big Timber® CTX, BL, and GL screws are designed for attaching the deck ledger to the band joist of a building in accordance with *IBC Section 1604.8.3 and IRC Section R507.9*. This connection is shown in Figure 4..

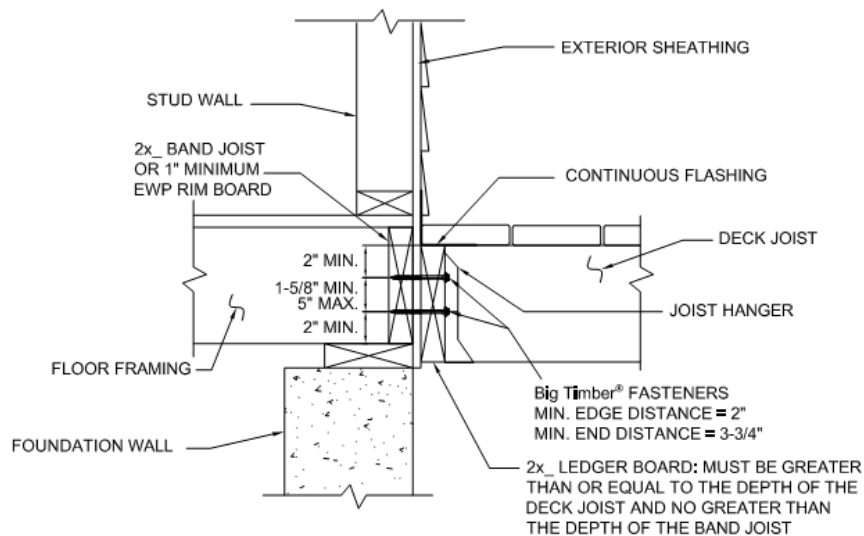


FIGURE 4. BIG TIMBER® DECK LEDGER CONNECTION

⁷ 2012 IBC Section 2304.9.5

⁸ 2015 IRC Section R507.2



- 5.7.1.1 Where a band joist is not used, an engineered design is required. See Appendix A for additional code requirements for ledger attachments.
- 5.7.2 The *IRC* provides prescriptive fastener spacing for the attachment of a deck ledger to a rim joist with ½" diameter lag screws or through bolts as shown in [IRC Table R507.9.1.3\(1\)](#)⁹.
- 5.7.2.1 Table 2 provides the Big Timber® CTX, BL, and GL screw spacing required to provide performance at least equivalent to the lag screws found in [IRC Table R507.9.1.3\(1\)](#) in accordance with [IBC Section 104.11](#) and [Section 1604.8.3](#), [IRC Section R104.11](#) and [Section R507.9](#), and in accordance with generally accepted engineering practice.
 - 5.7.2.1.1 Table 2 provides screw spacing for materials found in [IRC Table R507.9](#), as well as a wider range of materials commonly used for rim joists. Screw spacing values are provided for two loading conditions.
- 5.7.2.2 When installed in accordance with the spacing requirements of Table 2, Big Timber® CTX, BL, and GL screws provide equivalent performance to [IRC Table R507.9](#).

⁹ [2015 IRC Section R507.2.1](#)



TABLE 2. SCREW SPACING FOR ITEMS IN *IRC* TABLE 507.9.1.3(1)⁹ AND OTHER MATERIALS AND LOADING CONDITIONS¹

Fastener Designation ^{2,8} (in.)	Loading Condition (LL + DL)	2x Nominal Ledger Species ^{3,4,5}	Band Joist Material ^{6,7}	Maximum On-center Spacing of Fasteners (in.)						
				Maximum Deck Joist Spans (ft.)						
				Up to 6'	Up to 8'	Up to 10'	Up to 12'	Up to 14'	Up to 16'	Up to 18'
CTX 15 x 4 CTX 15 x 5 CTX 15 x 6 CTX 17 x 4 CTX 17 x 5 CTX 17 x 6	40 + 10	HF	2x Sawn Lumber	18	13	10	8	7	6	5
			1 1/8" OSB	24	18	12	10	9	8	7
		SP	2x Sawn Lumber	22	16	12	10	8	7	6
			1 1/8" OSB	23	17	13	11	9	8	7
	60 + 10	HF	2x Sawn Lumber	12	9	7	6	5	4	4
			1 1/8" OSB	17	11	9	7	6	5	5
		SP	2x Sawn Lumber	14	11	8	7	6	5	4
			1 1/8" OSB	16	12	9	8	6	6	5
BL 17 x 4 BL 17 x 5 BL 17 x 6 GL 17 x 4 GL 17 x 5 GL 17 x 6	40 + 10	HF	2x Sawn Lumber	22	17	12	10	8	7	6
			1 1/8" OSB	23	17	11	9	8	7	6
		SP	2x Sawn Lumber	24	18	12	10	8	7	6
			1 1/8" OSB	26	20	16	13	11	10	9
	60 + 10	HF	2x Sawn Lumber	16	10	8	7	6	5	4
			1 1/8" OSB	16	10	8	6	5	5	4
		SP	2x Sawn Lumber	17	11	8	7	6	5	4
			1 1/8" OSB	19	14	11	9	8	7	6

SI: 1 in. = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Based on load duration of 1.0. Spacing may be adjusted by the applicable load duration as specified in *NDS*.
2. Fasteners are required to have full thread penetration into the main member. Excess fastener length extending beyond the main member is not reflected in the table above.
3. Solid-sawn ledgers shall be HF or SP species (specific gravity of 0.43 and 0.55, respectively), designed by others.
4. Minimum ledger board requirements: 1 1/2" thickness and 7 1/2" depth
5. Ledger materials tested in the wet service condition.
6. A maximum 1/2" structural sheathing may be installed between the ledger and band joist. Up to 1/2" thickness of stacked washers shall be permitted to substitute for up to 1/2" on allowable sheathing thickness where combined with wood structural panel or lumber sheathing.
7. Minimum band joist requirements: SPF (specific gravity of 0.42) solid-sawn lumber 1 1/2" thick and 7 1/2" depth; OSB 1 1/8" thick and 7 1/4" depth
8. Fasteners shall be installed per Section 6 of this TER.
9. In the 2015 IRC, this is Table R507.2

5.8 Reference Lateral Design Values for Ledger to Stud Attachment With or Without Gypsum Interlayer

- 5.8.1 Installation details for ledger to stud connections without gypsum wallboard for 2"x6", 2"x8", and 2"x10" ledgers are shown in Figure 5, Figure 6, and Figure 7, respectively.
- 5.8.2 Installation details for ledger to stud connections with a single layer of gypsum wallboard for 2"x6", 2"x8", and 2"x10" ledgers are shown in Figure 8, Figure 9, and Figure 10, respectively.
- 5.8.3 Installation details for ledger to stud connections with a double layer of gypsum wallboard for 2"x6", 2"x8", and 2"x10" ledgers are shown in Figure 11, Figure 12, and Figure 13, respectively.

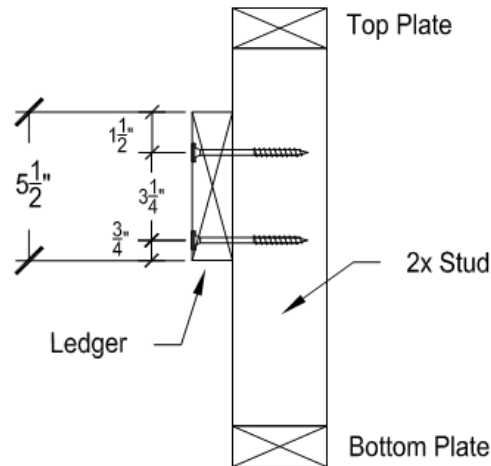


FIGURE 5. 2"x6" LEDGER DIRECTLY ATTACHED TO STUD

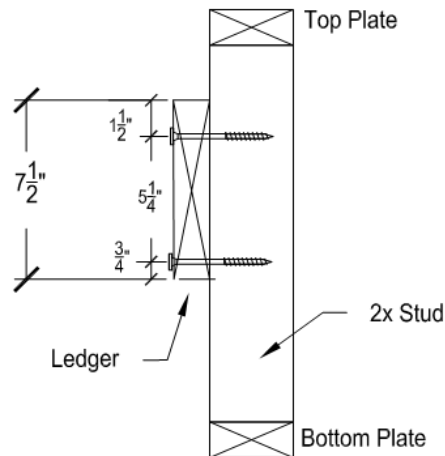


FIGURE 6. 2"x8" LEDGER DIRECTLY ATTACHED TO STUD

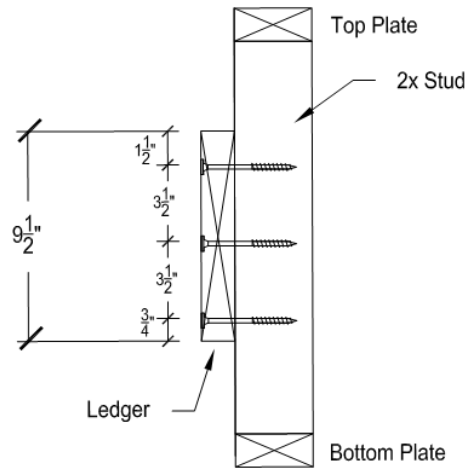


FIGURE 7. 2"x10" LEDGER DIRECTLY ATTACHED TO STUD

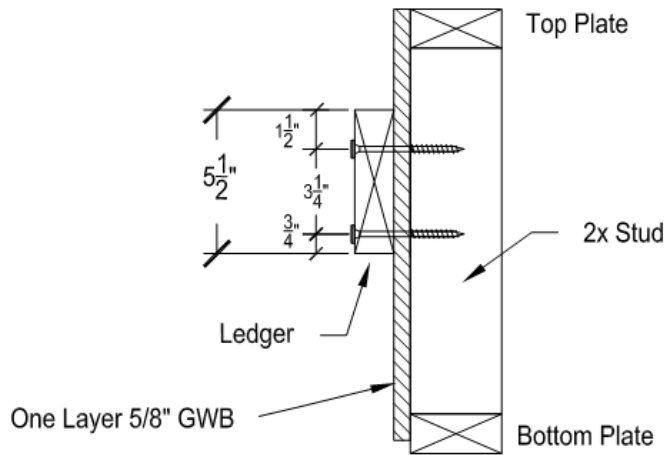


FIGURE 8. 2"x6" LEDGER ATTACHED TO STUD THROUGH ONE LAYER OF GWB

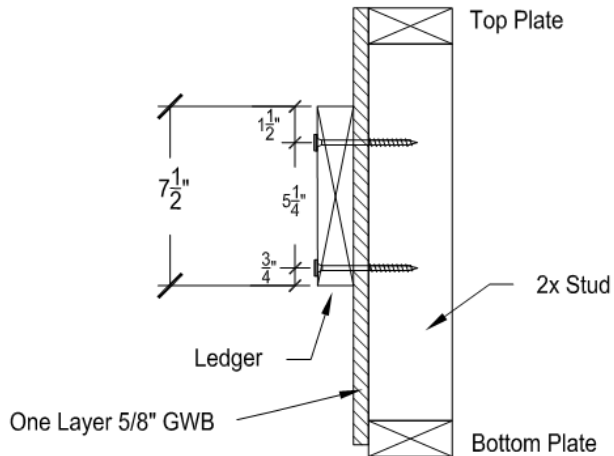


FIGURE 9. 2"x8" LEDGER ATTACHED TO STUD THROUGH ONE LAYER OF GWB

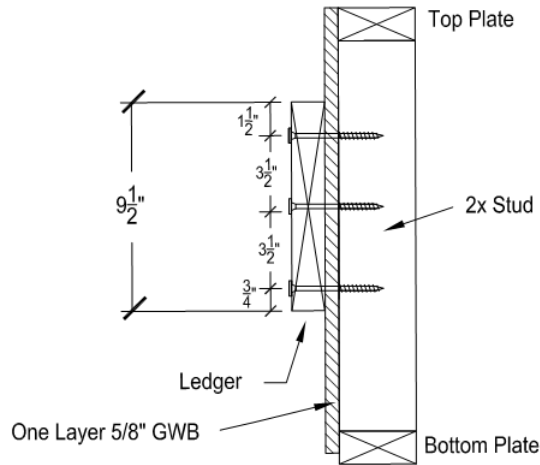


FIGURE 10. 2"x10" LEDGER ATTACHED TO STUD THROUGH ONE LAYER OF GWB

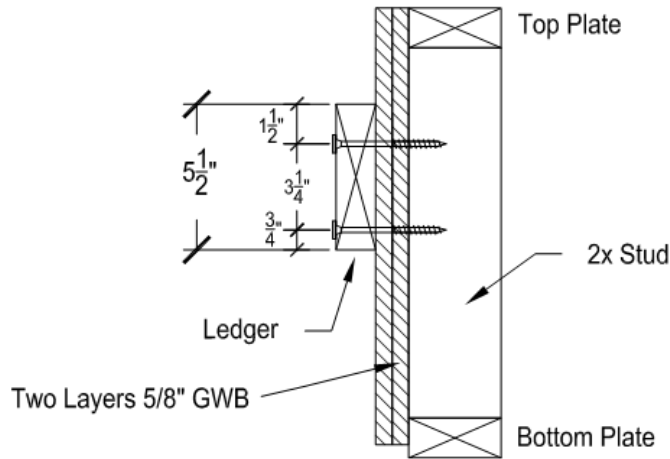


FIGURE 11. 2"x6" LEDGER ATTACHED TO STUD THROUGH TWO LAYERS OF GWB

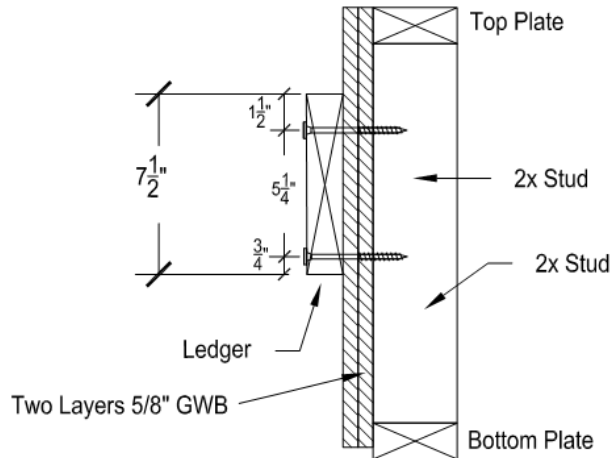


FIGURE 12. 2"x8" LEDGER ATTACHED TO STUD THROUGH TWO LAYERS OF GWB

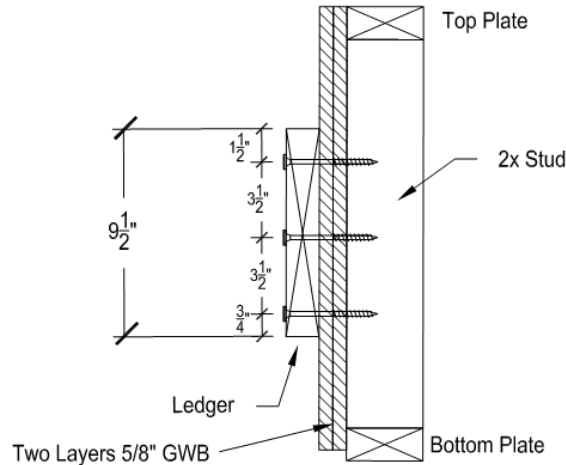


FIGURE 13. 2"x10" LEDGER ATTACHED TO STUD THROUGH TWO LAYERS OF GWB

5.9 Reference lateral design values for the ledger to stud connections detailed in Figure 5 through Figure 13 are provided in Table 3 and Table 4. The values in Table 3 and Table 4 apply where the ledger is applied either directly over the studs or with up to two layers of 5/8" gypsum between the ledger and studs.

TABLE 3. CTX SCREW DESIGN VALUES FOR LEDGER TO STUD ATTACHMENT

Fastener	Minimum Fastener Length ⁴ (in.)	Layers of GWB ⁵	Ledger Size (in.)	Fasteners Per Stud ^{6,7}	Allowable Load per Stud Connection ^{1,2,3} (lb.)		
					Lumber Species (Specific Gravity)		
					SPF (0.42)	DF (0.50)	SYP (0.55)
CTX 14	4	0	2x6	2	245	285	315
		1	2x8		140	155	160
	5	2	2x10	3	135	140	145
CTX 15	3 1/2	0	2x6	2	340	430	470
		1	2x8		205	260	270
	5	2	2x10	3	245	255	260

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

1. Allowable loads shall be limited to parallel-to-grain loaded solid sawn main members (minimum 2" nominal). Wood side members shall be loaded perpendicular to grain.
2. Allowable loads are shown at the wood load duration factor of $C_D = 1.00$. Loads may be increased for load duration as permitted by the building code up to a $C_D = 1.60$. All adjustment factors shall be applied per *NDS*. For in-service moisture content greater than 19%, use $C_M = 0.70$.
3. For LRFD values, the reference connection design values shall be adjusted in accordance with the *NDS* Section 11.3.
4. Required minimum fastener penetration is $6D$ into the main member, where D is the root minor diameter of the thread.
5. Gypsum board must be attached as required per the building code.
6. Fasteners shall be centered in the stud and spaced as shown in Figure 5 through Figure 13. Minimum end distances shall be per *NDS*.
7. Additional fasteners are prohibited.

TABLE 4. BL & GL SCREW DESIGN VALUES FOR LEDGER TO STUD ATTACHMENT

Fastener	Minimum Fastener Length ⁴ (in.)	Layers of GWB ⁵	Ledger Size (in.)	Fasteners Per Stud ^{6,7}	Allowable Load per Stud Connection ^{1,2,3} (lb.)		
					Lumber Species (Specific Gravity)		
					SPF (0.42)	SPF (0.42)	SPF (0.42)
BL 14	4	0	2x6	2	345	440	480
		1	2x8		245	270	280
	5	2	2x10	3	255	270	275
GL 17	4	0	2x6	2	395	500	575
		1	2x8		275	360	390
	5	2	2x10	3	335	390	400

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

1. Allowable loads shall be limited to parallel-to-grain loaded solid sawn main members (minimum 2" nominal). Wood side members shall be loaded perpendicular to grain.
2. Allowable loads are shown at the wood load duration factor of $C_D = 1.00$. Loads may be increased for load duration as permitted by the building code up to a $C_D = 1.60$. All adjustment factors shall be applied per *NDS*. For in-service moisture content greater than 19%, use $C_M = 0.70$.
3. For LRFD values, the reference connection design values shall be adjusted in accordance with the *NDS* Section 11.3.
4. Required minimum fastener penetration is 6D into the main member, where D is the root minor diameter of the thread.
5. Gypsum board must be attached as required per the building code.
6. Fasteners shall be centered in the stud and spaced as shown in Figure 5 through Figure 13. Minimum end distances shall be per *NDS*.
7. Additional fasteners are prohibited.

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 Lead holes are not required but may be used where lumber is prone to splitting.
- 6.3 Big Timber® screws shall be installed with the appropriate rotating powered driver. Do not overdrive.
- 6.4 Install Big Timber® screws such that the threads fully engage the band joist material and the fastener tip extends beyond the back face of the band joist material when fully seated against the installed ledger.
- 6.5 For deck ledger connections, stagger the Big Timber® screws from the top to the bottom along the length of the ledger while maintaining the required edge and end distances.
 - 6.5.1 Figure 4 provides a deck ledger installation detail, including minimum required spacing, end, and edge distances.
- 6.6 For applications outside the scope of this TER, an engineered design is required.

7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 Properties for Big Timber® CTX Construction Lag Screws from DrJ [TER 1907-01](#)
- 7.2 Properties for Big Timber® BL Log, Timber & Landscape Screws and GL Gray Structural Screws from DrJ [TER 1907-02](#)
- 7.3 Deck ledger assembly testing in accordance with *ASTM D1761* by Structural Building Components Research Institute (SBCRI)
- 7.4 Connection design value calculations by DrJ Engineering, LLC in accordance with *NDS* and accepted engineering practice



- 7.5 Some information contained herein is the result of testing and/or data analysis by other sources which conform to IBC Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.
- 7.6 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC*, *IRC*, *NDS®*, and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

- 8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product(s) listed in Section 1.1 are approved for the following:
- 8.1.1 Big Timber® screws provide an equivalent connection as that required by the IBC Section 1604.8.3 and IRC Section R507.9.
- 8.2 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.9 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, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in 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*.
- 8.3 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this TER, they are listed here.
- 8.3.1 No known variations

9 CONDITIONS OF USE

- 9.1 Big Timber® screws covered by this TER shall be installed in accordance with this report and the manufacturer's installation instruction.
- 9.2 Big Timber® screw spacing shall not exceed those listed in Table 3 and Table 4.
- 9.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 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 *registered design professional*).
- 9.7 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.8 This product is manufactured under a third-party quality control program in accordance with IBC Section 104.4 and 110.4 and IRC Section R104.4 and 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. Therefore, the TER shall be reviewed for code compliance by the *building official* for acceptance.
- 9.10 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the *building official's* inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 IDENTIFICATION

- 10.1 The product(s) 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 bigtimberfasteners.com.

11 REVIEW SCHEDULE

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

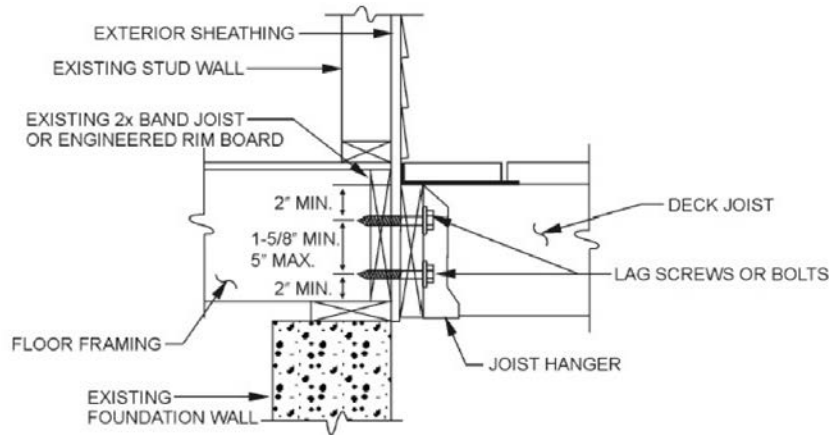


APPENDIX A: CODE REQUIREMENTS FOR LEDGER ATTACHMENTS

For guidance on designing the connection of the deck ledger to trusses where a band joist is not used, see SBCA's Tech Note, [Attachment of Residential Deck Ledger to Metal Plate Connected Wood Truss Floor System.](#)

- 1) [IRC Section R507.8](#)¹⁰ contains the following code requirements ([IBC Section 1604.8.3](#) is similar):
 - a) Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads.
 - i) Attachment shall not be accomplished by the use of toenails or nails subject to withdrawal.
- 2) [IRC Section R507.9.1](#) details how vertical loads shall be transferred to band joists with ledgers:
 - a) [IRC Section R507.9.1.1](#)
 Deck ledgers shall be a minimum 2-inch by 8-inch (51 mm by 203 mm) nominal, pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, or approved, naturally durable, No. 2 grade or better lumber...
 - b) [IRC Section R507.9.1.2](#)
 Band joists supporting a ledger shall be a minimum 2-inch-nominal (51 mm), spruce-pine-fir or better lumber or a minimum 1-inch by 9½-inch (25 mm x 241 mm) dimensional, Douglas fir or better, laminated veneer lumber. Band joists shall bear fully on the primary structure capable of supporting all required loads.
 - c) [IRC Section R507.9.1.3](#)¹¹

Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and Figures R507.9.1.3(1) and R507.9.1.3(2).



For SI: 1 inch = 25.4 mm.

FIGURE 14. PLACEMENT OF LAG SCREWS AND BOLTS IN BAND JOISTS, [IRC FIGURE R507.9.1.3\(2\)](#)

- d) [Tables R507.9.1.3\(1\) and R507.9.1.3\(2\)](#)¹² cover the placement of lag screws or bolts in deck ledgers:
 The tip of the lag screw shall fully extend beyond the inside face of the band joist.

¹⁰ [2012 IRC Section R507.1, 2015 IRC Section R507.1](#)

¹¹ [2012 IRC Section R507.2, 2015 IRC Section R507.2](#)

¹² [2012 IRC Section R507.2.1, 2015 IRC Section R507.2.1](#)

Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).

The minimum distance from bottom row of lag screws or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).

CONNECTION DETAILS	JOIST SPAN						
	6' and less	6'1" to 8'	8'1" to 10'	10'1" to 12'	12'1" to 14'	14'1" to 16'	16'1" to 18'
	On-center spacing of fasteners						
1/2-inch diameter lag screw with 1/2-inch maximum sheathing ^{c, d}	30	23	18	15	13	11	10
1/2-inch diameter bolt with 1/2-inch maximum sheathing ^d	36	36	34	29	24	21	19
1/2-inch diameter bolt with 1-inch maximum sheathing ^e	36	36	29	24	21	18	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
- b. Snow load shall not be assumed to act concurrently with live load.
- c. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
- d. Sheathing shall be wood structural panel or solid sawn lumber.
- e. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

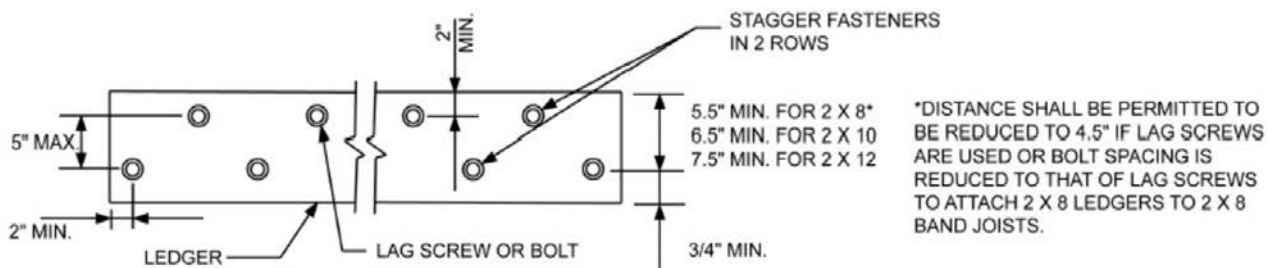
FIGURE 15. DECK LEDGER CONNECTION TO BAND JOIST^{A,B}, TABLE R507.9.1.3(1)
(DECK LIVE LOAD = 40 PSF, DECK DEAD LOAD = 10 PSF, SNOW LOAD ≤40 PSF)

MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	BOTTOM EDGE	ENDS	ROW SPACING
Ledger ^a	2 inches ^d	3/4 inch	2 inches ^b	1 5/8 inches ^b
Band Joist ^c	3/4 inch	2 inches	2 inches ^b	1 5/8 inches ^b

For SI: 1 inch = 25.4 mm.

- a. Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).
- b. Maximum 5 inches.
- c. For engineered rim joists, the manufacturer's recommendations shall govern.
- d. The minimum distance from bottom row of lag screws or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).

FIGURE 16. PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS, TABLE R507.9.1.3(2)



For SI: 1 inch = 25.4 mm.

FIGURE 17. PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS, FIGURE R507.9.1.3(1)

APPENDIX B: TESTING PROCEDURE AND METHODOLOGY

To determine the strength and load-deflection performance of the fasteners in a ledger connection, a two-joint assembly with connection of a ledger to a rim board was created. Load was applied to the joists, which transferred load to the ledger via hangers. String potentiometers were placed along the bottom of the ledger to measure vertical deflection during the test, while a load cell attached to an actuator measured load applied. The rim board was fixed to prevent deflection and rotation during the test. Immediately after testing, a section was cut near each fastener location to determine the moisture content and oven-dry specific gravity of each piece of lumber. The performance of the code defined ½" diameter lag screw connection was then compared to the performance of the Big Timber® CTX, BL, and GL screws in the ledger application built per the code requirements. Both single fastener and three fastener installations shown in Figure 18 were tested.

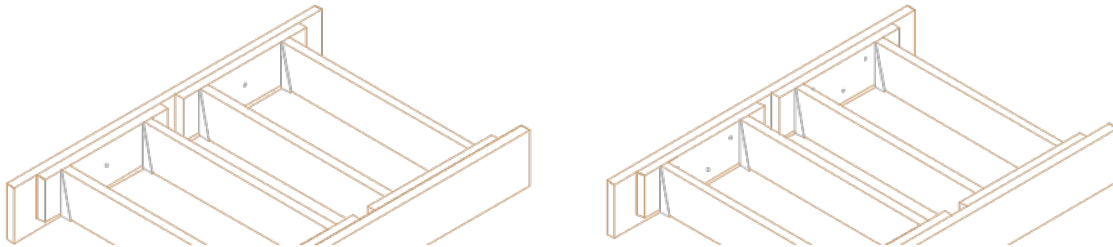


FIGURE 18. SINGLE & THREE-FASTENER SETUPS

The testing and resulting analysis define comparative performance and the design parameters required for the Big Timber® CTX, BL, and GL screws to be considered an equivalent alternative to the specified fasteners required by the building code in accordance with the provisions of IBC Section 104.11 and IRC Section R104.11.