DrJ CERTIFICATION

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Technical Evaluation Report

TER 1907-01

Big Timber® CTX Construction Lag Screw Properties

Western Builders Supply
DBA Big Timber

Product:

CTX Construction Lag Screws

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ICC MEMBER

COMPANY INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

1 PRODUCTS EVALUATED[1]

1.1 CTX Construction Lag 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*

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*

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[1] Building codes require data from valid *research reports* be obtained from *approved sources*. An *approved agency*, which is an *approved source*, is defined as "an established and recognized agency that is regularly engaged in…furnishing product certification where such agency has been approved…" Being *approved*, defined as "acceptable to the *building official*," is accomplished via accreditation using ISO/IEC 17065 evaluation procedures meeting code requirements of independence, adequate equipment, and experienced personnel. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation, DrJ certification can be used to obtain product approval in any country that is an IAF MLA Signatory and covered by an IAF MLA Evaluation per the Purpose of the MLA – "certified once, accepted everywhere." Manufacturers can go to *jurisdictions* in any IAF MLA Signatory Country and have their products readily approved by authorities having jurisdiction using DrJ's ANSI accreditation.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, see drjcertification.org.

[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. As required by code, where this TER is not approved, the *building official* shall respond in writing stating the reasons this TER was not *approved*. For any variations in state and local codes, see Section 8.

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

3 Performance Evaluation

3.1 Big Timber® CTX Construction Lag (CTX) Screws were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for allowable stress design (ASD). The following properties were evaluated:

3.1.1 Withdrawal strength in accordance with *ASTM D1761*.

3.1.2 Bending yield in accordance with *ASTM F1575*.

3.1.3 Tensile strength in accordance with *AISI S904*.

3.1.4 Shear strength in accordance with *AISI S904*.

3.1.5 Head pull-through in accordance with *ASTM D1037.*

3.1.6 Corrosion resistance of fasteners meeting or exceeding the protection afforded hot dipped galvanized fasteners in accordance with *ASTM A153, Class D*.

3.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.

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 CTX screws have a round washer head with a star drive and are partially threaded. The product evaluated in this TER is shown in Figure 1 and Figure 2.

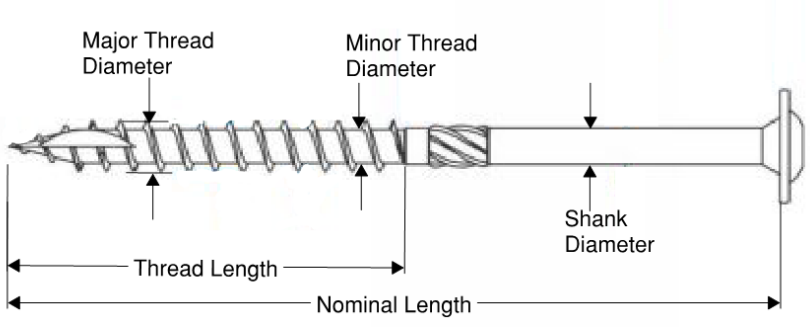

Figure 1. Big Timber® CTX Construction Lag Screw

Figure 2. Big Timber® CTX Construction Lag Screw Head Markings

4.2 CTX screws are manufactured using a standard cold-formed process followed by a heat-treating process.

4.3 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*.

4.4 Fasteners 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[4] and *IRC* Section R317.3.

4.4.1 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 2304.10.5[5] and *IRC* Section R317.3), allowing for its use in pressure treated wood.

4.4.2 Fasteners 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.

4.5 The fasteners evaluated in this TER are set forth in Table 1.

TABLE 1. 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 2½	0.531	Torx 25	2½	1½	0.168	0.146	0.242	355	141,300	930	725
	14 x 3			3	1½							
	14 x 4			4	2							
	14 x 5			5	3							
	14 x 6			6	3							
	15 x 3	0.620	Torx 30	3	1½	0.202	0.179	0.275	355	151,600	1,475	1,020
	15 x 3½			3½	2							
	15 x 4			4	2							
	15 x 5			5	3							
	15 x 6			6	3							
	17 x 7	0.675	Torx 40	7	3½	0.226	0.210	0.295	355	170,500	1,850	1,240
	17 x 8			8	4							
	17 x 10			10	4							
	17 x 12			12	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. Thread length includes tapered tip (see Figure 1).
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] 2012 *IBC* Section 2304.9

[5] 2012 *IBC* Section 2304.9.5

5 APPLICATIONS

5.1 *General*

5.1.1 CTX screws are used to attach wood framing members in conventional light-frame construction and provide resistance against withdrawal, head pull-through, axial, and shear loads. See Section 6 for installation requirements.

5.1.2 CTX screws are installed without lead holes, as prescribed in *NDS*.

5.2 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

5.3 *Design*

5.3.1 Design of CTX screws is governed by the applicable code and the provisions for dowel-type fasteners in *NDS*.

5.3.2 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.4 *CTX Reference Lateral Design Values (Z)*

5.4.1 Reference lateral design values (lbf) for shear load parallel and perpendicular to grain for CTX screws are specified in Table 2.

TABLE 2. CTX SCREW REFERENCE LATERAL DESIGN VALUES (Z), LBF

CTX Screw Designation	Nominal Length (in)	Thread Length (in)	Minimum Side Member Thickness (in)	Minimum Main Member Penetration (in)	Wood Species (Specific Gravity)			
					HF/SPF (0.42)		SP (0.55)	
					$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$
14 x 2½	2½	1½	¾	1¾	155	155	170	215
14 x 3	3	1½		2¼				
14 x 4	4	2	1¾	2¼	225	220	240	245
14 x 5	5	3		3¼				
14 x 6	6	3	3	3	255	300	250	415
15 x 3	3	1½	¾	2¼	160	185	225	285
15 x 3½	3½	2		2¾				
15 x 4	4	2	1½	2½	265	260	290	300
15 x 5	5	3		3½				
15 x 6	6	3	2	4	265	310	250	340
17 x 7	7	3½	2¾	4¼	280	420	300	485
17 x 8	8	4		5¼				
17 x 10	10	4	3½	6½	310	475	315	630
17 x 12	12	4		8½				

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/in = 0.175 kN/m

1. Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
2. For wood species with a specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42.
3. Tabulated lateral design values (Z) shall be adjusted by all applicable adjustment factors per *NDS*.
4. $Z_\perp$ = Lateral Design Values Perpendicular to Grain, $Z_\parallel$ = Lateral Design Values Parallel to Grain.

5.5 *CTX Reference Withdrawal Design Values (W) in Side Grain Applications*

5.5.1 Reference withdrawal design values (lbf/in) for CTX screws are specified in Table 3.

TABLE 3. CTX SCREW REFERENCE WITHDRAWAL DESIGN VALUES (W) – SIDE GRAIN APPLICATIONS, LBF/IN

CTX Screw Designation	Nominal Length (in)	Thread Length (in)	Wood Species (Specific Gravity)	
			HF/SPF (0.42)	SP (0.55)
14 x 2½	2½	1½	195	215
14 x 3	3	1½		
14 x 4	4	2		
14 x 5	5	3		
14 x 6	6	3		
15 x 3	3	1½	165	215
15 x 3½	3½	2	175	230
15 x 4	4	2		
15 x 5	5	3		
15 x 6	6	3		
17 x 7	7	3½	180	235
17 x 8	8	4		
17 x 10	10	4		
17 x 12	12	4		

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/in = 0.175 kN/m

1. Tabulated withdrawal values (W) shall be adjusted by all applicable adjustment factors per *NDS*, Table 11.3.1.
2. Fastener penetration is the threaded length embedded in the main member, including the tip.
3. For wood species with a specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42.
4. The full design withdrawal value is equal to the reference withdrawal value multiplied by the length of the threaded portion of the fastener embedded in the main member.

5.6 *CTX Reference Head Pull-Through Design Values (P)*

5.6.1 Reference design values for head pull-through (lbf) for CTX screws are specified in Table 4.

TABLE 4. CTX SCREW REFERENCE HEAD PULL-THROUGH DESIGN VALUES (P), LBF

CTX Screw Designation	Nominal Length (in)	Thread Length (in)	Wood Species (Specific Gravity)	
			HF/SPF (0.42)	SP (0.55)
14 x 2½	2½	1½	345	405
14 x 3	3	1½		
14 x 4	4	2		
14 x 5	5	3		
14 x 6	6	3		
15 x 3	3	1½	340	485
15 x 3½	3½	2		
15 x 4	4	2		
15 x 5	5	3		
15 x 6	6	3		
17 x 7	7	3½	440	460
17 x 8	8	4		
17 x 10	10	4		
17 x 12	12	4		

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/in = 0.175 kN/m

1. Tabulated pull through values (P) shall be adjusted by all applicable adjustment factors per *NDS*, Table 11.3.1.
2. Fastener penetration is the threaded length embedded in the main member, including the tip.
3. For wood species with a specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42.
4. Pull-through design values apply to connections having a minimum wood side member thickness of at least ¾ inch.

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 Minimum penetration is 1", unless otherwise stated in this TER. Install fasteners with head flush to the surface of the wood member.

6.3 Lead holes are not required.

6.4 Screws shall be installed with the appropriate rotating powered driver.

6.5 Minimum requirements for screw spacing, edge distance, and end distance shall be in accordance with Table 5.

TABLE 5. CTX SCREW SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS[1], INCH

Connection Geometry	CTX 14	CTX 15	CTX 17
Edge Distance – Load in any direction	1⅜	1⅝	1⅞
End Distance – Load parallel to grain, towards end	2½	3	3⅜
End Distance – Load parallel to grain, away from end	1⅝	2	2¼
End Distance – Load perpendicular to grain	1⅝	2	2¼
Spacing between Fasteners in a Row – Parallel to grain	2½	3	3⅜
Spacing between Fasteners in a Row – Perpendicular to grain	1⅝	2	2¼
Spacing between Rows of Fasteners – In-line	⅞	1	1⅛
Spacing between Rows of Fasteners – Staggered	½	½	⅝

SI: 1 in = 25.4 mm

1. 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.
2. Values for "Spacing between Rows of Fasteners-Staggered" apply where the screws in adjacent rows are offset by one half of the "Spacing between Fasteners in a Row"

7 TEST ENGINEERING SUBSTANTIATING DATA

7.1 Testing for withdrawal by Element, in accordance with *ASTM D1761*.

7.2 Testing for lateral strength by Element, in accordance with *ASTM D1761*.

7.3 Testing for head pull-through by Element, in accordance with *ASTM D1037.*

7.4 Testing for bending yield by Element, in accordance with *ASTM F1575*.

7.5 Testing for tensile strength by Element, in accordance with *AISI S904*.

7.6 Testing for shear strength by Element, in accordance with *AISI S904*.

7.7 Testing for corrosion resistance by Element.

7.8 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.

7.9 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 have the reference design value properties defined herein and are approved for use in accordance with the applicable code.

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 evaluation, they are listed here.

8.3.1 No known variations

9 Conditions of Use

9.1 Wood main and side members must have a moisture content of less than 19 percent.

9.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.

9.3 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.

9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.

9.5 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*).

9.6 At a minimum, this product shall be installed per Section 6 of this TER.

9.7 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.

9.8 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.

9.9 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.