DrJ™ CERTIFICATION

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Technical Evaluation Report

TER 2104-04

Big Timber® CTX Construction Lag Screws Properties – Canada

Western Builders Supply DBA Big Timber®

Product:

CTX Construction Lag Screws

Issue Date:

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September 29, 2022

Subject to Renewal:

October 1, 2023

COMPANY INFORMATION:	ADDITIONAL LISTEES:
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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

1 Product Evaluated[1]

1.1 CTX Construction Lag Screws

2 Applicable Codes and Standards[2,3]

2.1 *Codes*

2.1.1 *NBC—10, 15, 20: National Building Code of Canada*

2.1.2 *O Reg. 332/12: Ontario Building Code (OBC)*[4]

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 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

2.2.3 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

2.2.4 *ASTM B117: Standard Test Methods for Mechanical Fasteners in Wood*

2.2.5 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*

2.2.6 *ASTM D2395: Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials*

2.2.7 *ASTM D2915: Standard Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products*

2.2.8 *ASTM D4442: Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials*

2.2.9 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

2.2.10 *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 2020 version of the *NBC*. This *alternative solution* is also approved for use with the 2010 and 2015 *NBC* and the standards referenced therein.

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

[4] References in this TER to the National Building Code of Canada (*NBC*) apply to the Ontario Building Code (*OBC*), unless noted otherwise.

2.2.11 *CSA O86: Engineering Design in Wood*

3 Performance Evaluation

3.1 Big Timber® CTX Construction Lag Screws were tested and evaluated to determine their structural resistance properties, which were used to develop design values for limit states design (LSD) in accordance with *CSA O86*. The following properties were evaluated:

3.1.1 Bending yield in accordance with *ASTM F1575*

3.1.2 Tensile strength in accordance with *AISI S904*

3.1.3 Shear strength in accordance with *AISI S904*

3.1.4 Lateral shear in accordance with *ASTM D1761* per *CSA O86* Clause 12.11.3[5]

3.1.5 Withdrawal strength in accordance with *ASTM D1761* per *CSA O86* Clause 12.11.4[6]

3.1.6 Head pull-through in accordance with *ASTM D1761* per *CSA O86* Clause 12.11.4.3[7]

3.1.7 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 TER.

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.

Figure 1. Big Timber® CTX Construction Lag Screw

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.

4.4 CTX screws approved for use in chemically-treated or untreated lumber where *ASTM A153, Class D* coatings are approved for use in accordance with *NBC* Subsection 5.9.1.[8]

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* (*NBC* Subsection 5.9.1[8]), allowing for its use in pressure treated wood.

4.5 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.

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

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[5] 2014 *CSA O86* Clause 12.11.4

[6] 2014 *CSA O86* Clause 12.11.5

[7] 2014 *CSA O86* Clause 12.11.5.3

[8] *O Reg. 332/12 Subsection 5.10.1*

Table 1. Fastener Specifications

Fastener Name	Designation	Head in (mm)		Nominal Length[1] in (mm)	Thread Length[1] in (mm)	Shank Diameter[2] in (mm)	Thread Diameter in (mm)		Specified Minimum Core Hardness[4] (HV 0.3)	Nominal Bending Yield, f_{yb} psi (MPa)	Factored Fastener Strength lbf (kN)	
		Diameter	Drive Type				Minor	Major			Tensile	Shear[3]
CTX	14 x 1"	0.531 (13.5)	Torx 25	1 (25)	1 (25)	0.168 (4.3)	0.146 (3.7)	0.242 (6.2)	355	141,300 (975)	1,675 (7.4)	1,305 (5.8)
	14 x 1½"			1½ (38)	1½ (38)							
	14 x 2"			2 (51)	2 (51)							
	14 x 2½"			2½ (64)	2¼ (57)							
	14 x 3"			3 (76)	2 (51)							
	14 x 4"			4 (102)	2 (51)							
	14 x 5"			5 (127)	3 (76)							
	14 x 6"			6 (152)	3 (76)							
	15 x 2"	0.620 (15.7)	Torx 30	2 (51)	1½ (38)	0.202 (5.1)	0.179 (4.6)	0.275 (7.0)	355	151,600 (1,045)	2,655 (11.8)	1,835 (8.2)
	15 x 2½"			2½ (64)	1½ (38)							
	15 x 3"			3 (76.)	2 (51)							
	15 x 3½"			3½ (89)	2½ (64)							
	15 x 4"			4 (102)	2½ (64)							
	15 x 5"			5 (127)	3 (76)							
	15 x 6"			6 (152)	3 (76)							
	17 x 4"	0.675 (17.1)	Torx 40	4 (102)	2½ (64)	0.226 (5.7)	0.210 (5.3)	0.295 (7.5)	355	170,500 (1,175)	3,330 (14.8)	2,230 (9.9)
	17 x 5"			5 (127)	3 (76)							
	17 x 6"			6 (152)	3 (76)							
	17 x 7"			7 (178)	3½ (89)							
	17 x 8"			8 (203)	4 (102)							
	17 x 10"			10 (254)	4 (102)							
	17 x 12"			12 (305)	4 (102)							
	17 x 14"			14 (356)	5 (127)							
	17 x 16"			16 (406)	5 (127)							

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

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.

5 Applications

5.1 *General*

5.1.1 CTX screws are used to attached 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 *CSA O86* Article 12.11.2.1.

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

5.2 *Design*

5.2.1 Design of CTX screws is governed by the applicable code and the provisions for wood screws in *CSA O86*.

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

5.3 *CTX Factored Lateral Design Values (N_r)*

5.3.1 The factored lateral design values for shear load perpendicular to grain and parallel to grain for CTX screws in sawn lumber are specified in Table 2.

Table 2. CTX Screw Factored Lateral Design Values for Connections in Solid Sawn Lumber (N_r)

Fastener Name	Designation	Nominal Length in (mm)	Thread Length in (mm)	Minimum Side Member Thickness in (mm)	Minimum Main Member Penetration[4] in (mm)	Factored Lateral Design Values,[1,2] lbf (N)	
						Wood Species[3] (Relative Density)	
						HF/SPF (0.42)	
						$N_{r\perp}$	$N_{r\parallel}$
CTX	14 x 2"	2 (51)	2 (51)	¾ (19.1)	1¼ (32)	220 (985)	220 (985)
	14 x 2½"	2½ (64)	2¼ (57)	¾ (19.1)	1¾ (45)	365 (1,615)	365 (1,615)
	14 x 3"	3 (76)	2 (51)				
	14 x 4"	4 (102)	2 (51)	1¾ (45)	2¼ (57)	515 (2,280)	515 (2,280)
	14 x 5"	5 (127)	3 (76)				
	14 x 6"	6 (152)	3 (76)	3 (76)	3 (76)	585 (2,595)	720 (3,205)
	15 x 2½"	2½ (64)	1½ (38)	¾ (19.1)	1¼ (32)	310 (1,385)	310 (1,385)
	15 x 3"	3 (76)	2 (51)	¾ (19.1)	2¼ (57)	365 (1,630)	420 (1,875)
	15 x 3½"	3½ (89)	2½ (64)				
	15 x 4"	4 (102)	2½ (64)	1½ (38)	2½ (64)	915 (4,070)	870 (3,875)
	15 x 5"	5 (127)	3 (76)				
	15 x 6"	6 (152)	3 (76)	2 (51)	4 (102)	610 (2,720)	720 (3,210)
	17 x 4"	4 (102)	2½ (64)	1½ (38)	2½ (64)	1,065 (4,735)	770 (1,065)
	17 x 5"	5 (127)	3 (76)				
	17 x 6"	6 (152)	3 (76)				
	17 x 7"	7 (178)	3½ (89)	2¾ (70)	4¼ (108)	650 (2,895)	970 (4,315)
	17 x 8"	8 (203)	4 (102)				
	17 x 10"	10 (254)	4 (102)	3½ (89)	6½ (165)	710 (3,165)	1,190 (5,295)
	17 x 12"	12 (305)	4 (102)				
	17 x 14"	14 (356)	5 (127)				
	17 x 16"	16 (406)	5 (127)				

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. $N_{r\perp}$ = Lateral Design Values Perpendicular to Grain, $N_{r\parallel}$ = Lateral Design Values Parallel to Grain.
2. Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per *CSA O86*.
3. Factored lateral design values apply to two-member single shear connections where both members are of the same relative density, and the fastener is oriented perpendicular to grain. Where the members are of different relative densities, use the lower of the two.
4. Fastener main member penetration is the length embedded in the main member, including the tip.

5.4 *CTX Factored Withdrawal Design Values (P_{rw}) in Side Grain Applications*

5.4.1 The design provisions for withdrawal noted in *CSA O86* Subsection 12.11.4[9] apply to CTX screws, unless otherwise noted in this TER. Factored withdrawal design values per millimeter of threaded shank penetration for CTX screws are specified in Table 3.

[9] 2014 *CSA O86* Clause 12.11.5

Table 3. CTX Screw Factored Withdrawal Design Values (P_{rw}) – Side Grain Applications

Fastener Name	Designation	Nominal Length in (mm)	Thread Length in (mm)	Factored Withdrawal Design Values,[1,2,3] lbf/in (N/mm)
				Wood Species (Relative Density)
				HF/SPF (0.42)
CTX	14 x 1"	1 (25)	1 (25)	200 (35)
	14 x 1½"	1½ (38)	1½ (38)	
	14 x 2"	2 (51)	2 (51)	
	14 x 2½"	2½ (64)	2¼ (57)	370 (65)
	14 x 3"	3 (76)	2 (51)	
	14 x 4"	4 (102)	2 (51)	
	14 x 5"	5 (127)	3 (76)	
	14 x 6"	6 (152)	3 (76)	
	15 x 2"	2 (51)	1½ (38)	230 (40)
	15 x 2½"	2½ (64)	1½ (38)	
	15 x 3"	3 (76)	2 (51)	
	15 x 3½"	3½ (89)	2½ (64)	315 (55)
	15 x 4"	4 (102)	2½ (64)	
	15 x 5"	5 (127)	3 (76)	
	15 x 6"	6 (152)	3 (76)	
	17 x 4"	4 (102)	2½ (64)	230 (40)
	17 x 5"	5 (127)	3 (76)	
	17 x 6"	6 (152)	3 (76)	
	17 x 7"	7 (178)	3½ (89)	315 (55)
	17 x 8"	8 (203)	4 (102)	
	17 x 10"	10 (254)	4 (102)	
	17 x 12"	12 (305)	4 (102)	
	17 x 14"	14 (356)	5 (127)	
	17 x 16"	16 (406)	5 (127)	

SI: 25.4 mm = 1 in, 1 kN/m = 737.6 lb/ft

1. Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per *CSA O86* for wood screws.
2. Minimum fastener penetration into main member of 1" (25.4 mm) is required. Fastener penetration is the threaded length embedded in the main member, excluding the tip.
3. The full factored design withdrawal value is equal to the tabulated withdrawal value multiplied by the length of the threaded portion of the fastener embedded in the main member.

5.5 *CTX Factored Head Pull-Through Design Values (P_{pt})*

5.5.1 The factored design values for head pull-through for CTX screws are specified in Table 4.

Table 4. CTX Screw Factored Head Pull-Through Design Values (P_{pt})

Fastener Name	Designation	Nominal Length in (mm)	Thread Length in (mm)	Factored Head Pull-Through Design Value,[1,2] lbf (N)
				Wood Species (Relative Density)
				HF/SPF (0.42)
CTX	14 x 1"	1 (25)	1 (25)	110 (495)
	14 x 1½"	1½ (38)	1½ (38)	
	14 x 2"	2 (51)	2 (51)	
	14 x 2½"	2½ (64)	2¼ (57)	
	14 x 3"	3 (76)	2 (51)	
	14 x 4"	4 (102)	2 (51)	
	14 x 5"	5 (127)	3 (76)	
	14 x 6"	6 (152)	3 (76)	
	15 x 2"	2 (51)	1½ (38)	
	15 x 2½"	2½ (64)	1½ (38)	
	15 x 3"	3 (76)	2 (51)	
	15 x 3½"	3½ (89)	2½ (64)	
	15 x 4"	4 (102)	2½ (64)	
	15 x 5"	5 (127)	3 (76)	
	15 x 6"	6 (152)	3 (76)	
	17 x 4"	4 (102)	2½ (64)	
	17 x 5"	5 (127)	3 (76)	
	17 x 6"	6 (152)	3 (76)	
	17 x 7"	7 (178)	3½ (89)	
	17 x 8"	8 (203)	4 (102)	
	17 x 10"	10 (254)	4 (102)	
	17 x 12"	12 (305)	4 (102)	
	17 x 14"	14 (356)	5 (127)	
	17 x 16"	16 (406)	5 (127)	

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per *CSA O86* for wood screws.
2. Pull-through design value applies to connections having a minimum wood side member thickness of ¾".

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" (25.4 mm), unless otherwise noted in this TER. Install fasteners with the underside of the 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

Symbol	Dimension	Minimum Spacing[1,2] (mm)		
		Wood Species (Relative Density)		
		HF/SPF (0.42)		
		CTX 14	CTX 15	CTX 17
S_P	Spacing parallel to grain	98	112	120
S_Q	Spacing perpendicular to grain	49	56	60
a	End distance parallel to grain	74	84	90
e	Edge distance perpendicular to grain	25	28	30

SI: 1 in = 25.4 mm

1. Table values are based on the major thread diameter from Table 1 in accordance with *CSA O86* Table 12.25.
2. Spacing, edge distances, and end distances of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is more restrictive.

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 Bending yield testing in accordance with *ASTM F1575*

7.1.2 Shear and tensile testing in accordance with *ASTM S904*

7.1.3 Lateral strength testing in accordance with *ASTM D1761*

7.1.4 Withdrawal strength testing in accordance with *ASTM D1761*

7.1.5 Head pull-through testing in accordance with *ASTM D1761*

7.1.6 Corrosion resistance testing in accordance with *ASTM B117* and *ASTM G85*

7.2 Calculations for factored lateral design values in accordance with *CSA O86* and accepted engineering practice.

7.3 Information contained herein is the result of testing and/or data analysis by sources which conform to the evaluation requirements of *NBC* Volume 1 Relationship of the *NBC* to Standards Development and Conformity Assessment and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

7.4 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through provincial, territorial, 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 product 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. Findings

8 Findings

8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product listed in Section 1.1 have the design value properties defined herein and are approved for use in accordance with the applicable code.

8.2 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known provincial, territorial, and local building codes. Where there are known variations in provincial, territorial, or local codes applicable to this TER, they are listed here.

8.2.1 No known variations

8.3 *NBC* Volume 1 Relationship of the NBC to Standards Development and Conformity Assessment:

> **Certification**
> Certification is the confirmation by an independent organization that a product, service, or system meets a requirement… Certification bodies publish lists of certified products and companies…Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services.
>
> **Evaluation**
> An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of the Code requirement...

8.4 ISO/IEC 17065 accreditation bodies, including but not limited to SCC and ANAB, confirm that product certification bodies have the expertise to provide evaluation services within their scope of accreditation. All SCC and ANAB product certification bodies meet NBC requirements to offer evaluation services for alternative solutions.[10]

8.4.1 DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs professional engineers.[11]

8.5 Product certification organizations, accredited by the SCC and ANAB, are defined as equivalent evaluation services:

8.5.1 The Canada-United States-Mexico Agreement (CUSMA) Article 11.6 Conformity Assessment confirms mutual recognition by stating, "...each Party shall accord to conformity assessment bodies located in the territory of another Party treatment no less favorable than that it accords to conformity assessment bodies located in its own territory or in the territory of the other Party."

8.5.2 The SCC National Conformity Assessment Principles states, "SCC is a member of a number of international organizations developing voluntary conformity assessment agreements that help ensure the international acceptance of Canadian conformity assessment results. Signatories to these agreements (like SCC) recognize each other's accreditations as being equivalent to their own."[12]

8.6 Building official approval of a licensed professional engineer is performed by verifying the professional engineer and/or their business entity are listed by the licensing board of the relevant jurisdiction.

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[10] *NBC* Division A Clause A-1.2.1.1.(1)(b) provides information on code compliance via alternative solutions and defines alternative solutions as "...achiev[ing] at least the minimum level of performance required by Division B." *NBC* Division C Section 2.3 includes additional guidance for documentation of alternative solutions.

[11] Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain material, product, design, or method of construction approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "certified once, accepted everywhere."

[12] The National Conformity Assessment Principles states, "Product regulations and standards may vary from country to country. If these are set arbitrarily, they could be deemed as protectionist. The World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT Agreement) is intended to ensure that technical regulations, standards and conformity assessment procedures of member countries do not create unnecessary obstacles to trade. Under the TBT Agreement, members of the WTO agree to use international standards, including conformity assessment standards and guides, as a basis for their technical requirements."

9 Conditions of Use

9.1 Wood member moisture content shall be less than or equal to 19% for sawn lumber.

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

9.3 Where required by 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 *designer* (e.g., *owner*).

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

9.7 This product has an internal quality control program and a third-party quality assurance program in accordance with ISO/IEC 17065 certification procedures.

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.

9.9 This TER shall be reviewed for code compliance by the AHJ in concert with the duties and powers granted to the building official by the provincial regulations governing such duties and powers.

9.10 The implementation of this TER for this product is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections, and any other code or regulatory requirements that may apply.

10 Identification

10.1 The product listed in Section 1.1 is 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, visit drjcertification.org.

11.2 For information on the current status of this TER, contact DrJ Certification.