

Technical Evaluation Report™

TER 2011-02

Starborn® Structural Screws: Fastener Properties and Design Values – Canada

Starborn® Industries, Inc.

Product:
Starborn® Structural Screws

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COMPANY
INFORMATION:

ADDITIONAL
LISTEES:

Starborn® Industries, Inc.
45 Mayfield Ave
Edison, NJ 08837-3820

P: 800-596-7747
F: 732-381-9830

info@starbornindustries.com

starbornindustries.com

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

1 Product Evaluated¹

1.1 Starborn® Structural Screws:

- 1.1.1 Starborn® Structural H19 screws
- 1.1.2 Starborn® Structural F19 screws
- 1.1.3 Starborn® Structural H23 screws
- 1.1.4 Starborn® Structural F23 screws
- 1.1.5 Starborn® Structural F23-E screws
- 1.1.6 Starborn® Structural F23-W screws

2 Applicable Codes and Standards²

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)*³

2.2 Standards and Referenced Documents

- 2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear Strengths of Screws*
- 2.2.2 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.3 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.4 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*
- 2.2.5 *CSA O86: Engineering Design in Wood*

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

3 Performance Evaluation

- 3.1 Testing and related engineering evaluations are defined as intellectual property and/or trade secrets.
- 3.2 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.3 Starborn® Structural screws were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for limit states design (LSD) in accordance with CSA O86. The following conditions were evaluated:
 - 3.3.1 Withdrawal strength in accordance with ASTM D1761 per CSA O86 Clause 12.11.4⁴
 - 3.3.2 Bending yield in accordance with ASTM F1575
 - 3.3.3 Tensile strength in accordance with AISI S904
 - 3.3.4 Shear strength in accordance with AISI S904 per CSA O86 Clause 12.11.3⁵
 - 3.3.5 Head pull-through in accordance with ASTM D1761 per CSA O86 Clause 12.11.4.3⁶
 - 3.3.6 Corrosion resistance of fasteners meeting or exceeding the protection afforded hot dipped galvanized fasteners in accordance with ASTM A153.
- 3.4 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.
- 3.5 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 *General*
 - 4.1.1 Starborn® Structural screws are alternate dowel-type self-drilling fasteners designed for use in wood-to-wood connections. The fasteners in Table 1 are evaluated in this TER.

Table 1. Starborn® Structural Fastener Designation and Product Name

Product Name	Unthreaded Shank Diameter ¹ in (mm)	Head Type in (mm)	Coating Type (Application)
Structural H19	0.19 (4.8)	5/16 Hex (7.9)	Exterior Use
Structural F19		Flat (T-30)	
Structural H23	0.23 (5.8)	3/8 Hex (9.5)	
Structural F23		T-40 Flat	Interior Use
Structural F23-E			
Structural F23-W			

SI: 1 in = 25.4 mm
 1. Unthreaded shank diameter is measured on uncoated parts. Finished part dimensions are larger due to the thickness of the proprietary coating.

4.2 Fastener Material

- 4.2.1 Starborn® Structural screws are manufactured with heat-treated carbon steel grade 10B21 wire using a standard cold-forming process. All fasteners are produced in accordance with the approved quality control procedures referred to in Section 9.

⁴ 2014 CSA O86 Clause 12.11.5
⁵ 2014 CSA O86 Clause 12.11.4
⁶ 2014 CSA O86 Clause 12.11.5.3

4.3 Fastener Coatings

- 4.3.1 Starborn® F23-E and F23-W screws are designated for interior, dry use only.
- 4.3.2 Starborn® H19, F19, H23, and F23 screws are designed for exterior use and may be used where fasteners are required to exhibit corrosion resistance when exposed to adverse environmental conditions and/or in preservative treated wood subject to the limitations of Section 9. These fasteners are alternates to hot-dip-zinc-galvanized fasteners and meet the requirements of NBC Subsection 5.9.1. They feature a proprietary coating system that meets or exceeds the corrosion protection of hot-dipped galvanizing per ASTM A153.
 - 4.3.2.1 Starborn® H19, F19, H23, and F23 screws were evaluated for use in wood chemically treated with waterborne Alkaline Copper Quaternary, Type D (ACQ-D).
 - 4.3.2.2 Starborn® H19, F19, H23, and F23 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.

4.4 Wood Members

- 4.4.1 Solid sawn wood members connected with Starborn® Structural screws shall consist of lumber species or species combinations having a relative density of 0.42 to 0.50.
- 4.4.2 Structural composite lumber (LVL, LSL, PSL, etc.) connected with Starborn® Structural screws shall be recognized in evaluation reports having published equivalent specific gravities for lateral and withdrawal resistance. Equivalent specific gravities for structural composite lumber may be used in the design of connections using the relative densities of the sawn lumber shown in Table 3, Table 4, and Table 5.

4.5 Fastener Specifications

- 4.5.1 The fasteners evaluated in this TER are specified in Table 2 and Figure 1 through Figure 6.

Table 2. Fastener Specifications

Product Name	Head Marking	Fastener Length in (mm)	Thread Length in (mm)	Unthreaded Shank Diameter ¹ in (mm)	Thread Diameter in (mm)		Nominal Bending Yield, fyb psi (MPa)	Factored Fastener Strength lb (kN)	
					Minor ²	Major		Tensile	Shear
Structural H19	D19 2.9	2 ⁷ / ₈ (73)	1.4 (36)	0.189 (4.8)	0.169 (4.3)	0.26 (6.6)	196,700 (1,355)	2305 (10.3)	1955 (8.7)
	D19 4	4 (102)	2 ¹ / ₄ (57)						
	D19 6	6 (152)	2 ¹ / ₂ (64)						
	D19 8	8 (203)							
	D19 10	10 (254)							
Structural F19	D19 2.9	2- ⁷ / ₈	2	0.189 (4.8)	0.169 (4.3)	0.26 (6.6)	196,880 (1,358)	2690 (12.0)	1830 (8.1)
	D19 4	4- ¹ / ₂							
	D19 6	6							
	D19 8	8							

Product Name	Head Marking	Fastener Length in (mm)	Thread Length in (mm)	Unthreaded Shank Diameter ¹ in (mm)	Thread Diameter in (mm)		Nominal Bending Yield, fyb psi (MPa)	Factored Fastener Strength lb (kN)	
					Minor ²	Major		Tensile	Shear
	D19 10	10							
	D19 12	12							
	D19 14	14							
	D19 16	16							
Structural H23	D23 4	4 (102)	2 ³ / ₈ (60)	0.229 (5.8)	0.209 (5.3)	0.307 (7.8)	183,155 (1,262)	3565 (15.9)	2680 (11.9)
	D23 5	5 (127)	3 (76)						
Structural F23	D23 2.9	2 ⁷ / ₈ (73)	1.4 (36)	0.229 (5.8)	0.209 (5.3)	0.307 (7.8)	183,155 (1,262)	3565 (15.9)	2680 (11.9)
	D23 4	4 (102)	2 ³ / ₈ (60)						
	D23 5	5 (127)	3 (76)						
	D23 6	6 (152)	2 ³ / ₄ (70)						
	D23 8	8 (203)							
	D23 10	10 (254)							
Structural F23-E	D23 3.4 XFE	3 ³ / ₈ (86)	1 ¹ / ₂ (38)	0.229 (5.8)	0.209 (5.3)	0.307 (7.8)	183,155 (1,262)	3565 (15.9)	2680 (11.9)
	D23 5 XFE	5 (127)							
	D23 6.8 XFE	6 ³ / ₄ (171)							
Structural F23-W	D23 2.9 XFW	2 ⁷ / ₈ (73)	1.4 (36)	0.229 (5.8)	0.209 (5.3)	0.307 (7.8)	183,155 (1,262)	3565 (15.9)	2680 (11.9)
	D23 4.4 XFW	4 ³ / ₈ (111)							
	D23 5.9 XFW	5 ⁷ / ₈ (149)							

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa

1. The unthreaded shank diameter is measured on uncoated parts. Finished part dimensions are larger due to the thickness of the proprietary coating.
2. Minor thread diameter is calculated as the average value of upper and lower manufacturing tolerances.

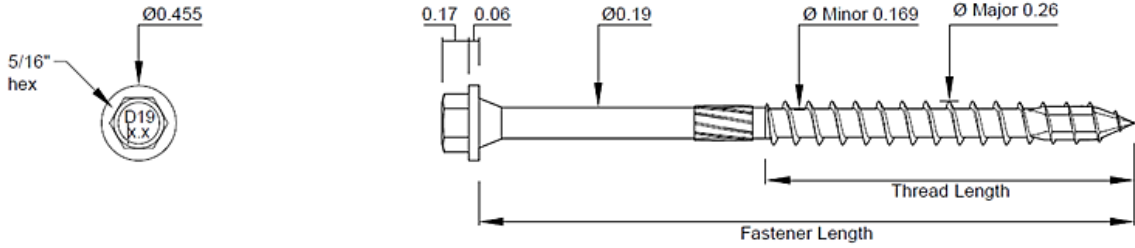


Figure 1. Starborn® Structural H19 Screw (Dimensions in Inches)

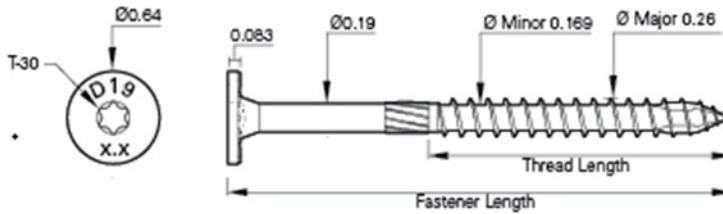


Figure 2. Starborn® Structural F19 Screw (Dimensions in Inches)

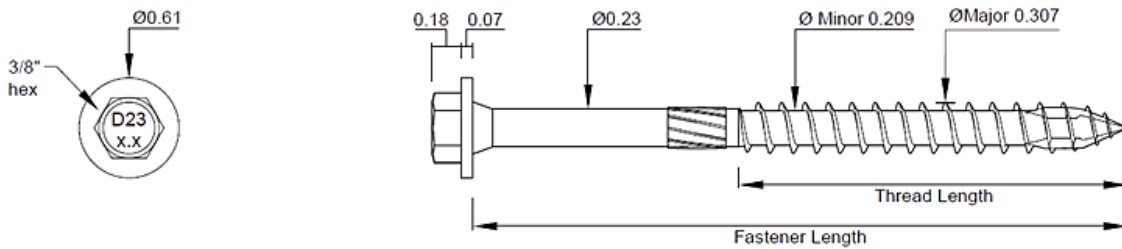


Figure 3. Starborn® Structural H23 Screw (Dimensions in Inches)

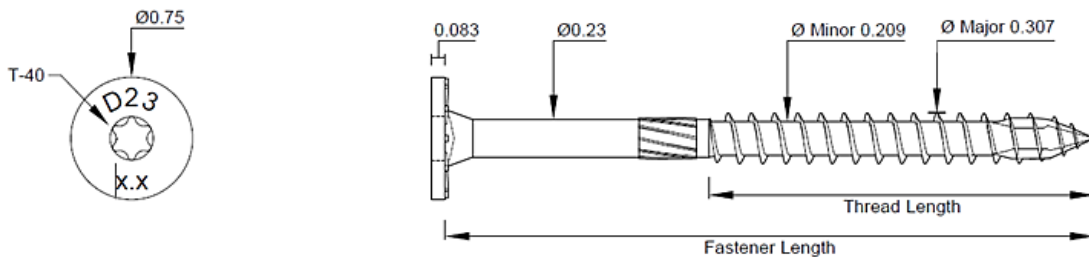


Figure 4. Starborn® Structural F23 Screw (Dimensions in Inches)

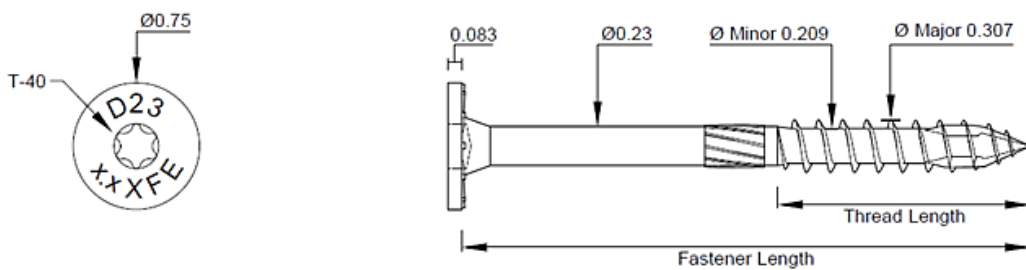


Figure 5. Starborn® Structural F23-E Screw (Dimensions in Inches)

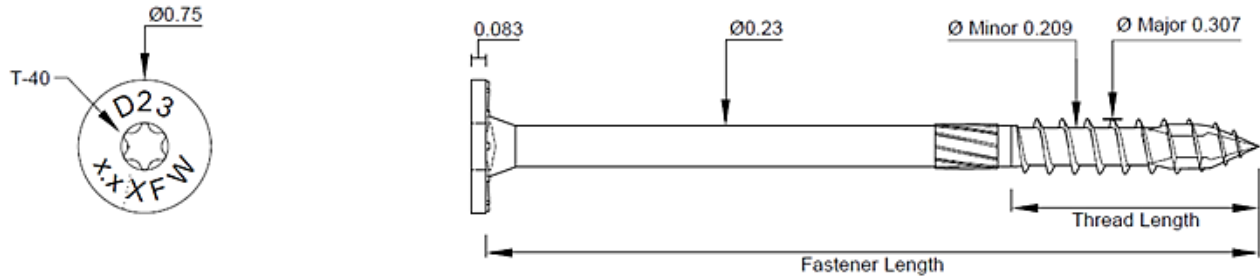


Figure 6. Starborn® Structural F23-W Screw (Dimensions in Inches)

5 Applications

5.1 General

- 5.1.1 Starborn® Structural screws are self-tapping fasteners for wood-to-wood connections in conventional light-frame construction. They provide resistance against withdrawal, head pull-through, axial, and shear loads. See Section 6 for installation requirements.
- 5.1.2 Starborn® Structural screws can be used in applications including structural and general timber construction work. Typical uses include deck ledger attachment, interior framing, staircase and multi-ply beam construction, as well as on rafter insulation and façade attachment.
- 5.1.3 Starborn® Structural screws are installed without lead holes, as prescribed in CSA O86 Article 12.11.2.1.
- 5.1.4 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

5.1.5 Design

- 5.1.5.1 Design of Starborn® Structural screws is governed by the applicable code and the provisions for wood screws in CSA O86.
- 5.1.5.2 Unless otherwise noted, modification factors shall be applied in accordance with the applicable code.
- 5.1.5.3 The design values in Table 3, Table 4, and Table 5 are for the standard load duration in a dry service condition. Tabulated values shall be factored by all the appropriate factors per CSA O86.

5.2 Starborn® Structural Screw Factored Lateral Design Values (N_r)

- 5.2.1 The factored lateral design values for shear load perpendicular-to-grain and parallel-to-grain for Starborn® Structural screws are specified in Table 3.

Table 3. Starborn® Structural Screw Factored Lateral Design Values (N_r)

Product Name	Fastener Length, in (mm)	Thread Length, in (mm)	Minimum Side Member Thickness, in (mm)	Main Member Penetration, in (mm)	Factored Lateral Design Values, ^{1,2} lb (N)					
					Species ^{3,4} (Relative Density)					
					HF/SPF (0.42)		DF-L (0.49)		SCL (0.50)	
					$N_{r\perp}$	$N_{r\parallel}$	$N_{r\perp}$	$N_{r\parallel}$	$N_{r\perp}$	$N_{r\parallel}$
Structural H19	2 ⁷ / ₈ (73)	1.4 (36)	1 ¹ / ₂ (38)	1 ³ / ₈ (35)	645 (2,870)	810 (3,605)	810 (3,605)	950 (4,230)	810 (3,605)	950 (4,230)
	4 (102)	2 ¹ / ₄ (57)		2 ¹ / ₂ (64)	700 (3,115)	585 (2,605)	940 (4,185)	895 (3,985)	940 (4,185)	895 (3,985)
	6 (152)	2 ¹ / ₂ (64)		4 ¹ / ₂ (114)						
	8 (203)			6 ¹ / ₂ (165)						
	10 (254)			8 ¹ / ₂ (216)						
Structural F19	2 ⁷ / ₈ (73)		2 (51)	1 ³ / ₈ (35)	625 (2780)	680 (3025)	820 (3650)	725 (3225)	820 (3650)	725 (3225)

Product Name	Fastener Length, in (mm)	Thread Length, in (mm)	Minimum Side Member Thickness, in (mm)	Main Member Penetration, in (mm)	Factored Lateral Design Values, ^{1,2} lb (N)					
					Species ^{3,4} (Relative Density)					
					HF/SPF (0.42)		DF-L (0.49)		SCL (0.50)	
					N _{r⊥}	N _{r∥}	N _{r⊥}	N _{r∥}	N _{r⊥}	N _{r∥}
	4½ (114)			2½ (64)	625 (2780)	680 (3025)	820 (3650)	725 (3225)	820 (3650)	725 (3225)
	6 (152)			4½ (114)	680 (3025)	755 (3360)	920 (4090)	800 (3560)	920 (4090)	800 (3560)
	8 (203)			6½ (165)	735 (3270)	660 (2935)	920 (4090)	810 (3600)	920 (4090)	810 (3600)
	10 (254)			8½ (216)	800 (3560)	700 (3115)	1000 (4450)	790 (3515)	1000 (4450)	790 (3515)
	12 (305)			10½ (266.7)						
	14 (356)			12½ (317.5)						
	16 (406)			14½ (368)						
Structural H23	4 (102)	2¾ (60)		2½ (64)	930 (4,140)	905 (4,025)	1245 (5,535)	1,120 (4,975)	1245 (5,535)	1,120 (4,975)
	5 (127)	3 (76)		3½ (89)						
Structural F23	27/8 (73)	1.4 (36)		13/8 (35)	790 (3,515)	895 (3,985)	875 (3,895)	1,165 (5,185)	875 (3,895)	1,165 (5,185)
	4 (102)	2¾ (60)		2½ (64)	930 (4,140)	905 (4,025)	1245 (5,535)	1,120 (4,975)	1245 (5,535)	1,120 (4,975)
	5 (127)	3 (76)		3½ (89)						
	6 (152)	2¾ (70)		4½ (114)						
	8 (203)			6½ (165)						
	10 (254)			8½ (216)						
Structural F23-W	27/8 (73)	1.4 (36)		13/8 (35)	790 (3,315)	895 (3,985)	875 (3,895)	1,165 (5,185)	875 (3,895)	1,165 (5,185)
	4¾ (111)	1.4 (36)		2¾ (73)	930 (4,140)	905 (4,025)	1,245 (5,535)	1,120 (4,975)	1,245 (5,535)	1,120 (4,975)
	57/8 (149)			4½ (114)						
Structural F23-E	33/8 (86)	1½ (38)	1¾ (44)	15/8 (41)	465 (2070)	465 (2070)	545 (2415)	545 (2415)	875 (3,895)	1,165 (5,185)
	5 (127)			3¼ (83)					1,245 (5,535)	1,120 (4,975)
	6¾ (171)			5 (127)						
	6¾ (171)		3½ (89)	3¼ (83)						

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

- N_{r⊥} = lateral design value for perpendicular-to-grain loading, N_{r∥} = lateral design value for parallel-to-grain loading
- Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per CSA O86.
- HF = Hemlock-Fir, SPF = Spruce-Pine-Fir, DF-L = Douglas Fir, Larch, SCL = Structural Composite Lumber
- Reference 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 (side grain). Where the members are of different relative densities, use the lower of the two.

5.3 *Starborn® Structural Screw Factored Withdrawal Design Values (P_{rw})*

5.3.1 The design provisions for withdrawal noted in CSA O86 Subsection 12.11.4⁷ apply to Starborn® Structural screws, unless otherwise noted in this TER. Factored withdrawal design values for Starborn® Structural screws in select lumber species are specified in Table 4.

Table 4. Starborn® Structural Screw Factored Withdrawal Design Values (P_{rw}) in Side Grain Applications

Product Name	Thread Penetration ² into Member, in (mm)	Fastener Length, in (mm)	Thread Length, in (mm)	Factored Withdrawal Values ¹ , lb (N)						
				Species (Relative Density)						
				HF/SPF (0.42)	DF-L (0.49)	SCL (0.50)				
Structural H19	1 (25.4)	2 ⁷ / ₈ (73)	1.4 (36)	550 (2,450)	735 (3,270)	735 (3,270)				
		4 (102)	2 ¹ / ₄ (57)							
		6 (152)	2 ¹ / ₂ (64)							
		8 (203)								
		10 (254)								
Structural F19		2 ⁷ / ₈ (73)	2				550 (2,450)	735 (3,270)	735 (3,270)	
		4 ¹ / ₂ (114)								
		6 (152)								
		8 (203)								
		10 (254)								
	12 (305)									
	14 (356)									
16 (406)										
Structural H23	1 (25.4)	4 (102)	2 ³ / ₈ (60)	605 (2,690)	775 (3,450)	775 (3,450)				
		5 (127)	3 (76)							
Structural F23	1 (25.4)	2 ⁷ / ₈ (73)	1.4 (36)	605 (2,690)	775 (3,450)	775 (3,450)				
		4 (102)	2 ³ / ₈ (60)							
		5 (127)	3 (76)							
		6 (152)	2 ³ / ₄ (70)							
		8 (203)								
		10 (254)								
Structural F23-E		1 (25.4)	3 ³ / ₈ (86)				1 ¹ / ₂ (38)	605 (2,690)	775 (3,450)	775 (3,450)
			5 (127)							
			6 ³ / ₄ (171)							
Structural F23-W		1 (25.4)	2 ⁷ / ₈ (73)				1.4 (36)	605 (2,690)	775 (3,450)	775 (3,450)
	4 ³ / ₈ (111)									
	5 ⁷ / ₈ (149)									
Structural H19	2 (51)	4 (102)	2 ¹ / ₄ (57)	1,295 (5,765)	1,705 (7,585)	1,705 (7,585)				

⁷ 2014 CSA O86 Clause 12.11.5

Product Name	Thread Penetration ² into Member, in (mm)	Fastener Length, in (mm)	Thread Length, in (mm)	Factored Withdrawal Values ¹ , lb (N)		
				Species (Relative Density)		
				HF/SPF (0.42)	DF-L (0.49)	SCL (0.50)
		6 (152)	2½ (64)			
		8 (203)				
		10 (254)				
Structural F19		2¾ (73)	2			
		4½ (114)				
		6 (152)				
		8 (203)				
		10 (254)				
		12 (305)				
Structural H23		4 (102)	2¾ (60)	1,640 (7,300)	1,920 (8,545)	1,920 (8,545)
		5 (127)	3 (76)			
Structural F23		4 (102)	2¾ (60)	1,640 (7,300)	1,920 (8,545)	1,920 (8,545)
		5 (127)	3 (76)			
		6 (152)	2¾ (70)			
		8 (203)				
		10 (254)				

SI: 1 in = 25.4 mm, 1 lb = 4.45 N
 5. Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per CSA O86 for wood screws.
 6. Fastener penetration is the threaded length embedded in the main member, including the tip.

5.4 *Starborn® Structural Screw Factored Head Pull-Through Design Values (P_{pt})*

5.4.1 The factored design value for head pull-through for Starborn® Structural screws are specified in Table 5.

Table 5. Starborn® Structural Screw Factored Head Pull-Through Design Values (P_{pt})

Product Name	Fastener Length in (mm)	Thread Length in (mm)	Factored Head Pull-Through Values, ^{1,2} lb (N) (Specific Gravity)		
			HF/SPF (0.42)	DF/SP (0.50)	SCL (0.50)
Structural H19	2 ⁷ / ₈ (73)	1.4 (36)	875 (3,895)	1,298 (5,765)	1,298 (5,765)
	4 (102)	2 ¹ / ₄ (57)			
	6 (152)	2 ¹ / ₂ (64)			
	8 (203)				
	10 (254)				
Structural F19	2- ⁷ / ₈ (73)	2	1845 (8205)	2105 (9365)	2105 (9365)
	4- ¹ / ₂ (114)				
	6 (152)				
	8 (203)				
	10 (254)				
	12 (305)				
	14 (356)				
	2- ⁷ / ₈ (73)				
Structural H23	4 (102)	2 ³ / ₈ (60)	1,670 (7,430)	2,320 (10,325)	2,320 (10,325)
	5 (127)	3 (76)			
Structural F23	2 ⁷ / ₈ (73)	1.4 (36)	2,095 (9,325)	2,610 (11,615)	2,610 (11,615)
	4 (102)	2 ³ / ₈ (60)			
	5 (127)	3 (76)			
	6 (152)	2 ³ / ₄ (70)			
	8 (203)				
	10 (254)				
Structural F23-E	3 ³ / ₈ (86)	1 ¹ / ₂ (38)			
	5 (127)				
	6 ³ / ₄ (171)				
Structural F23-W	2 ⁷ / ₈ (73)	1.4 (36)			
	4 ³ / ₈ (111)				
	5 ⁷ / ₈ (149)				

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

- Values based on 1-¹/₂" thickness of wood member.
- Tabulated values are for a standard load duration. Values shall be factored by all applicable modification factors per CSA O86 for wood screws.

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

6 Installation

- 6.1 Installation shall comply with the manufacturer installation instructions, this TER, the approved construction documents, and the applicable building code.
- 6.2 In the event of a conflict between the manufacturer installation instructions this TER and the applicable building code, the more restrictive shall govern.
- 6.3 *Installation Procedure*
 - 6.3.1 Starborn® Structural screws shall be installed using a high-torque low speed drill in accordance with the manufacturer installation instructions, applicable code, the approved construction documents, this TER, CSA O86, and standard framing practice as applied to wood fasteners.
 - 6.3.2 The fasteners must be installed using a $5/16$ " hex, $3/8$ " hex or Torx® driver bit. Pre-drilling of pilot holes is not required but may be used where lumber is prone to splitting.
 - 6.3.3 All fastener spacing, edge distance, and end distance shall be per Table 6 and Table 7.

Table 6. Placement of Starborn® Structural H19 and F19 in Side Grain

Symbol	Dimension	Minimum Spacing ^{1,2} (mm)	
		Species (Relative Density)	
		HF/SPF	DF-L
S _P	Spacing parallel to grain	106	132
S _Q	Spacing perpendicular to grain	53	66
a	End distance parallel to grain	79	99
e	Edge distance perpendicular to grain	26	33

SI: 1 in = 25.4 mm

- Table values are based on the major thread diameter from Table 2 in accordance with CSA O86 Table 12.25.
- 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 the more restrictive.

Table 7. Placement of Starborn® Structural H23, F23, F23-E, and F23-W in Side Grain

Symbol	Dimension	Minimum Spacing ^{1,2} (mm)	
		Species (Relative Density)	
		HF/SPF	DF-L
S _P	Spacing parallel to grain	125	156
S _Q	Edge distance perpendicular to grain	62	78
a	Spacing parallel to grain	94	117
e	End distance parallel to grain	31	39

SI: 1 in = 25.4 mm

- Table values are based on the major thread diameter from Table 2 in accordance with CSA O86 Table 12.25.
- 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 the more restrictive.

- 6.3.4 Minimum penetration is 1" (25.4 mm) unless otherwise stated in this TER. Install fasteners with head flush to the surface of the wood member.

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 Withdrawal in accordance with ASTM D1761
 - 7.1.2 Lateral strength in accordance with ASTM D1761
 - 7.1.3 Head pull-through in accordance with ASTM D1761
 - 7.1.4 Bending yield in accordance with ASTM F1575
 - 7.1.5 Tensile strength in accordance with AISI S904
 - 7.1.6 Shear strength in accordance with AISI S904
- 7.2 Information contained herein is the result of testing and/or data analysis by sources that 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.
- 7.3 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.
- 7.4 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 installation instructions, the products listed in Section 1.1:
 - 8.1.1 Meet the requirements of the NBC Article 4.3.1.1.
 - 8.1.2 Are an alternative to wood screws specified in NBC Article 9.23.3.3.
- 8.2 These products 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 Valid evaluations are obtained from independent professional organizations, which include but are not limited to ISO/IEC 17065 accredited evaluation services and professional engineers.⁸

⁸ NBC Division C Article 2.2.1.2

- 8.5 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.⁹
- 8.5.1 DrJ is an ISO/IEC 17065 [ANAB-Accredited Product Certification Body – Accreditation #1131](#), and employs professional engineers.¹⁰
- 8.6 Product certification organizations, accredited by the SCC and ANAB, are defined as equivalent evaluation services:
- 8.6.1 [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.”
- 8.6.2 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.”¹¹
- 8.7 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.

9 Conditions of Use

- 9.1 The Starborn® Structural screws covered in this TER shall be installed in accordance with this TER and the [manufacturer installation instructions](#).
- 9.2 For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice. When the capacity of a connection is controlled by fastener metal strength rather than wood strength, the metal strength must not be multiplied by the adjustment factors specified in CSA O86.
- 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 authority having jurisdiction (AHJ) in which the project is to be constructed:
- 9.4.1 This TER and the [manufacturer installation instructions](#) shall be submitted at the time of permit application.
- 9.4.2 Any calculations required to show compliance with this TER, incorporated as part of the construction documents that are to be examined for conformance to the requirements of the pertinent laws shall conform to accepted engineering practice, and be approved when requirements of the pertinent laws are met.
- 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 designer (i.e., owner).
- 9.7 At a minimum, these products shall be installed per Section 6 of this TER.
- 9.8 These products have an internal quality control program and a third-party quality assurance program in accordance with ISO/IEC 17065 certification procedures.

⁹ 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.

¹⁰ 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”.

¹¹ 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.”



- 9.9 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 the duties and powers granted to the building official by the provincial regulations governing such duties and powers.
- 9.11 The implementation of this TER for these products 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 products listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at starbornindustries.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 status of this TER, contact [DrJ Certification](#).