

Technical Evaluation Report™

TER 1703-03

Starborn® Structural F19, F23-W, F23-E, and F23 Screws: Multi-Ply Applications

Starborn® Industries, Inc.

Product:

**Starborn® Structural F19 Screws,
Starborn® Structural F23-W Screws,
Starborn® Structural F23-E Screws and
Starborn® Structural F23 Screws**

Issue Date:

November 7, 2019

Revision Date:

August 3, 2023

Subject to Renewal:

January 1, 2024



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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

1 Products Evaluated^{1,2}

- 1.1 Starborn® Structural F19 Screws
- 1.2 Starborn® Structural F23-W Screws
- 1.3 Starborn® Structural F23-E Screws
- 1.4 Starborn® Structural F23 Screws

2 Applicable Codes and Standards^{3,4}

2.1 Codes

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

2.2 Standards and Referenced Documents

- 2.2.1 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.2 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

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

² 24 CFR 3280.2 "Listed or certified" means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner. Listed. Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose Listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. Labeled. Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

³ This Listing is a code defined research report, which is also known as a duly authenticated report, provided by an approved agency (see IBC Section 1703.1) and/or an approved source (see IBC Section 1703.4.2). An approved agency is "approved" as an approved agency when it is ANAB accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory. A professional engineer is "approved" as an approved source when that professional engineer is properly licensed to transact engineering commerce. Where sealed by a professional engineer, it is also a duly authenticated report certified by an approved source. (i.e., Registered Design Professional). DrJ is an ANAB accredited product certification body.

⁴ Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.



3 Performance Evaluation

- 3.1 Tests, test reports, research reports, duly authenticated reports and related engineering evaluations are defined as intellectual property and/or trade secrets and protected by Defend Trade Secrets Act 2016 (DTSA).⁵
- 3.2 Testing and/or inspections conducted for this TER were performed at an ISO/IEC 17025 accredited testing laboratory,⁶ an ISO/IEC 17020 accredited inspection body,⁷ which are internationally recognized accreditations through International Accreditation Forum (IAF), and/or a licensed Registered Design Professional (RDP).
- 3.3 Starborn® Structural F19, F23, F23-E and F23-W screws were evaluated to determine their ability to provide multi-ply attachment in trusses, sawn lumber, and engineered wood applications.
- 3.4 Any building code and/or accepted engineering evaluations (i.e. research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDPs / approved sources. DrJ is qualified⁸ to practice product and code compliance services within its scope of accreditation and engineering expertise, respectively.
- 3.5 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope, which are also its areas of professional engineering competence.
- 3.6 Any regulation specific issues not addressed in this section are outside the scope of this TER.

4 Product Description and Materials

4.1 General

- 4.1.1 Starborn® Structural F19, F23, F23-E and F23-W screws are alternate dowel-type threaded fasteners designed for use in wood-to-wood and multi-ply connections. The fasteners listed in Table 1 are evaluated in this TER.

⁵ <https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90>. As our professional duty to inform, please be aware that whoever, with intent to convert a trade secret (TS), that is related to a product or service used in or intended for use in interstate or foreign commerce, to the economic benefit of anyone other than the owner thereof, and intending or knowing that the offense will, injure any owner of that trade secret, knowingly without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys such information; shall be fined under this title or imprisoned not more than 10 years, or both. Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of \$5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. As the National Society of Professional Engineers states, "Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve." Therefore, to protect intellectual property (IP) and TS, and to achieve compliance with public records and trade secret legislation, requires approval through the use of Listings, certified reports, technical evaluation reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.

⁶ Internationally recognized accreditations are performed by members of the International Accreditation Forum (IAF). Accreditation Body and Regional Accreditation Group Members of IAF are admitted to the IAF MLA only after a stringent evaluation of their operations by a peer evaluation team, which is charged to ensure that the applicant complies fully with both international standards and IAF requirements. Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.

⁷ Ibid.

⁸ Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

Table 1. Starborn® Structural Fastener Designation and Product Name

Product Name	Unthreaded Shank Diameter ¹ (in)	Head Type	Coating Type (Application)
Structural F19	0.19	Flat (T-30)	Exterior/Interior Use
Structural F23-W	0.23	Flat (T-40)	Interior Use
Structural F23-E			Exterior/Interior Use
Structural F23			
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 F19, F23, F23-E and F23-W 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.

4.3 Fastener Coatings

- 4.3.1 Starborn® F23-E and F23-W screws are designated for interior, dry use only.
- 4.3.2 Starborn® F19 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. They feature a proprietary coating system that meets or exceeds the corrosion protection of hot dipped galvanizing per ASTM A153 in accordance with [IBC Section 2304.10](#) and [IRC Section R317.3](#).

4.4 Wood Members

- 4.4.1 Solid sawn wood members connected with Starborn® Structural F19, F23, F23-E and F23-W screws shall consist of lumber species or species combinations having a specific gravity of 0.42 to 0.55.
- 4.4.2 Structural composite lumber members (e.g., LVL, PSL, LSL, etc.) connected with Starborn® Structural F23-E and F23 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 specific gravities of the sawn lumber shown in 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 4.

Table 2. Fastener Specifications

Product Name	Head Marking	Fastener Length (in)	Thread Length (in)	Unthreaded Shank Diameter ¹ (in)	Thread Diameter (in)		Nominal Bending Yield (f _{yb}) (psi)	Allowable Fastener Strength (lbf)	
					Minor ²	Major		Tensile	Shear
Structural F19	D19 2.9	2 ⁷ / ₈	2	0.189	0.169	0.260	192,879	1,495	1,016
	D19 4	4 ¹ / ₂	2						
	D19 6	6	2						
	D19 8	8							
	D19 10	10							
	D19 12	12							
	D19 14	14							
	D19 16	16							
Structural F23-W	D23 2.9 XFW	2 ⁷ / ₈	1.4	0.229	0.209	0.307	183,155	1,980	1,490
	D23 4.4 XFW	4 ³ / ₈							
	D23 5.9 XFW	5 ⁷ / ₈							
Structural F23-E	D23 3.4 XFE	3 ³ / ₈	1 ¹ / ₂						
	D23 5 XFE	5							
	D23 6.8 XFE	6 ³ / ₄							
Structural F23	D23 2.9	2 ⁷ / ₈	1.4						
	D23 4	4	2 ³ / ₈						
	D23 5	5	3						
	D23 6	6	2 ³ / ₄						

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

1. 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.

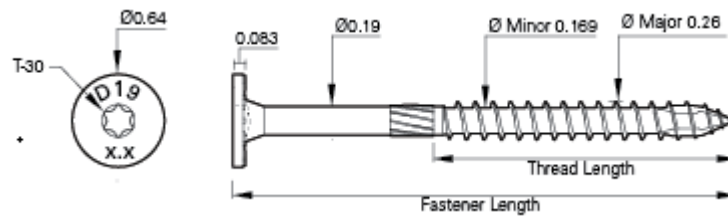


Figure 1. Starborn® Structural F19 Screw

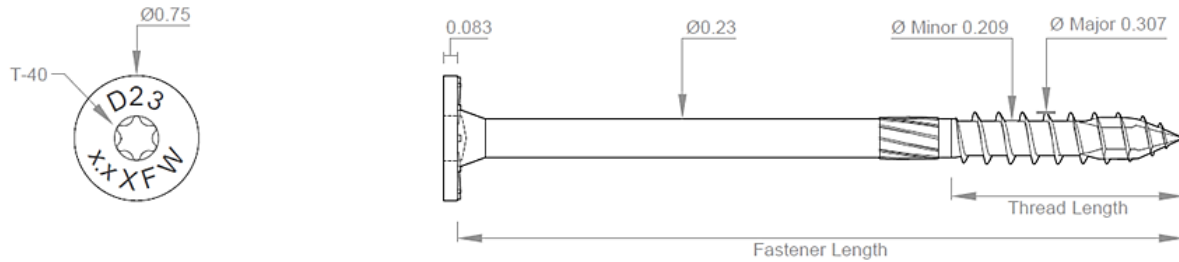


Figure 2. Starborn® Structural F23-W Screw

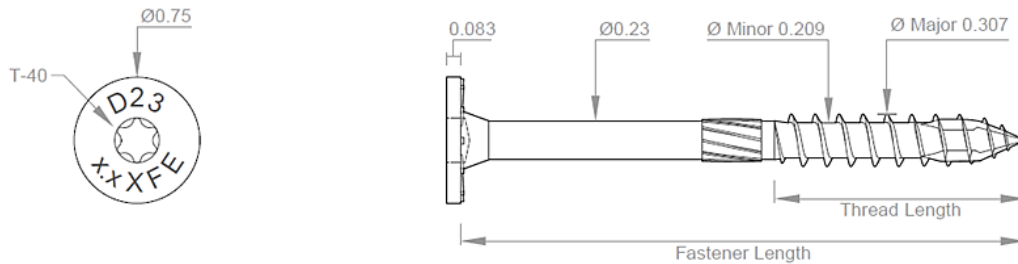


Figure 3. Starborn® Structural F23-E Screw

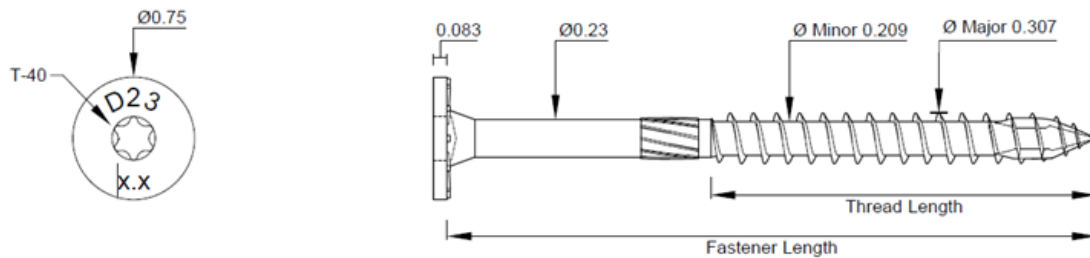


Figure 4. Starborn® Structural F23 Screw

- 4.6 In-plant quality control procedures, under which the Starborn® Structural F19, F23, F23-E and F23-W screws are manufactured, are audited through an inspection process performed by an approved agency.

5 Applications

5.1 General

- 5.1.1 Starborn® Structural F19, F23, F23-E and F23-W screws are self-tapping screws used for attaching multi-ply wood members including trusses, sawn lumber, and engineered wood products.
- 5.1.2 Starborn® Structural F19, F23, F23-E and F23-W screws are installed without lead holes, as prescribed in NDS.

5.1.3 Design

- 5.1.3.1 The design of Starborn® Structural F19, F23, F23-E and F23-W screws is governed by the applicable code and the provisions for dowel type fasteners in NDS.
- 5.1.3.2 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.2 Multi-Ply Connection Design Values

5.2.1 Starborn® Structural F19 Screw:

- 5.2.1.1 Starborn® Structural F19 screws have the design values set forth in Table 3. Assembly conditions are detailed in Figure 5.

Table 3: Starborn® Structural F19 Screw Allowable Lateral Design Values^{2,3,4} (plf)

Multiple Members		Product Fastener Length ¹ (in)	Loaded Side	SPF/HF (SG=0.42)						DF/SP (SG=0.50)					
				12" o.c.		16" o.c.		24" o.c.		12" o.c.		16" o.c.		24" o.c.	
Assembly	Components			2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows
A	2-ply 1½"	2½	Either	1160	1740	870	1305	580	870	1520	2280	1145	1720	760	1140
B	3-ply 1½"	4½	Either	1140	1710	855	1285	570	855	870	1305	655	985	435	655
C	4-ply 1½"	6	Either	870	1305	655	985	435	655	1140	1710	855	1285	570	855

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

- Fastener length is measured from the underside of the head to the top.
- Wood framing shall be any species with specific gravity, SG, of 0.42 or greater.
- Allowable design values are based on a load duration factor $C_D = 1.0$ and shall be multiplied by all applicable adjustment factors per the NDS.
- For top-loaded members with even loading across the width of the entire assembly, fasteners shall be installed in two (2) rows with a maximum distance of 32" o.c. between fasteners in the same row.

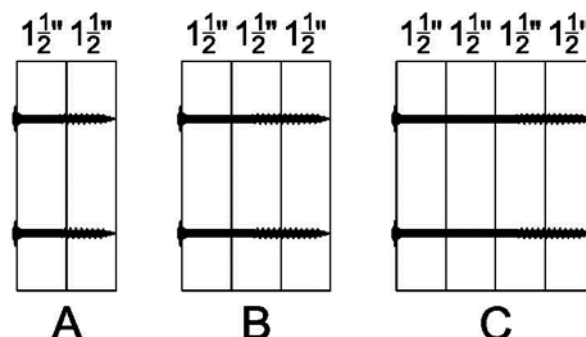


Figure 5: Starborn® Structural F19 Screw Assemblies

5.2.2 Starborn® Structural F23-W Screw

5.2.2.1 Starborn® Structural F23-W screws have the design values set forth Table 4. Assembly conditions are detailed in Figure 6.

Table 4. Starborn® Structural F23 and F23-W Screw Allowable Lateral Design Values^{2,3,4} (plf)

Multiple Members		Product Fastener Length ¹ (in)	Loaded Side	SPF/HF (SG=0.42)						DF/SP (SG=0.50)					
				12" o.c.		16" o.c.		24" o.c.		12" o.c.		16" o.c.		24" o.c.	
Assembly	Components			2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows
A	2-ply 1½"	F23-W: 2⅞" F23: 2⅞"	Either	1460	2190	1100	1650	730	1095	1660	2490	1250	1875	830	1245
B	3-ply 1½"	F23-W: 4⅞" F23: 4"	Either	1260	1890	945	1420	630	945	1680	2520	1265	1900	840	1260
C	4-ply 1½"	F23-W: 5⅞" F23: 6"	Either	1120	1680	840	1260	560	840	1495	2245	1125	1690	750	1125

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

- Fastener length is measured from the underside of the head to the top.
- Wood framing shall be any species with specific gravity, SG, of 0.42 or greater.
- Allowable design values are based on a load duration factor $C_D = 1.0$ and shall be multiplied by all applicable adjustment factors per the NDS.
- For top-loaded members with even loading across the width of the entire assembly, fasteners shall be installed in two (2) rows with a maximum distance of 32" o.c. between fasteners in the same row.

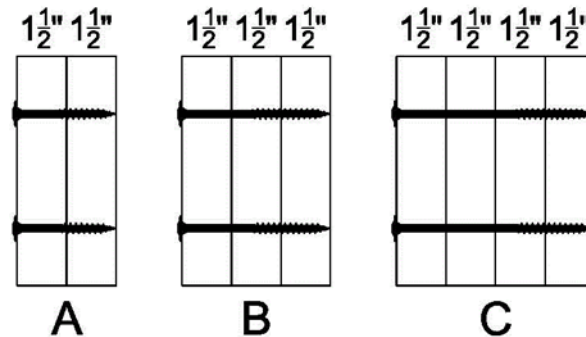


Figure 6. Starborn® Structural F23-W and F23 Screw Assemblies

5.2.3 Starborn® Structural F23-E Screw:

5.2.3.1 Starborn® Structural F23-E screws have the design values set forth in Table 5. Assembly conditions are detailed in Figure 7.

Table 5. Starborn® Structural F23-E Screw Allowable Lateral Design Values^{2,3,4} (plf)

Multiple Members		Fastener Length ¹ (in)	Loaded Side	12" o.c.		16" o.c.		24" o.c.	
Assembly	Components			2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows
A	2-ply 1 $\frac{3}{4}$ "	3 $\frac{3}{8}$	Either	1660	2490	1250	1875	830	1245
B	3-ply 1 $\frac{3}{4}$ "	5	Head	1680	2520	1265	1900	840	1260
			Point	1495	2245	1125	1690	750	1125
C	4-ply 1 $\frac{3}{4}$ "	6 $\frac{3}{4}$	Either	1680	2520	1265	1900	840	1260
D	2-ply 1 $\frac{3}{4}$ " & 3 $\frac{1}{2}$ "	5	Either	1495	2245	1125	1690	750	1125
E	3-ply 1 $\frac{3}{4}$ " & 3 $\frac{1}{2}$ "	6 $\frac{3}{4}$	Either	1660	2490	1250	1875	830	1245
F	2-ply 3 $\frac{1}{2}$ "	6 $\frac{3}{4}$	Either	1660	2490	1250	1875	830	1245

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Fastener length is measured from the underside of the head to the top.
2. Wood framing shall be any species with specific gravity, SG, of 0.50 or greater.
3. Allowable design values are based on a load duration factor of $C_D = 1.0$ and shall be multiplied by all applicable adjustment factors per the NDS.
4. For top-loaded members with even loading across the width of the entire assembly, and a depth of 18" or less, fasteners shall be installed in two (2) rows with a maximum distance of 24" o.c. between fasteners in the same row. Use three (3) rows for members deeper than 18".

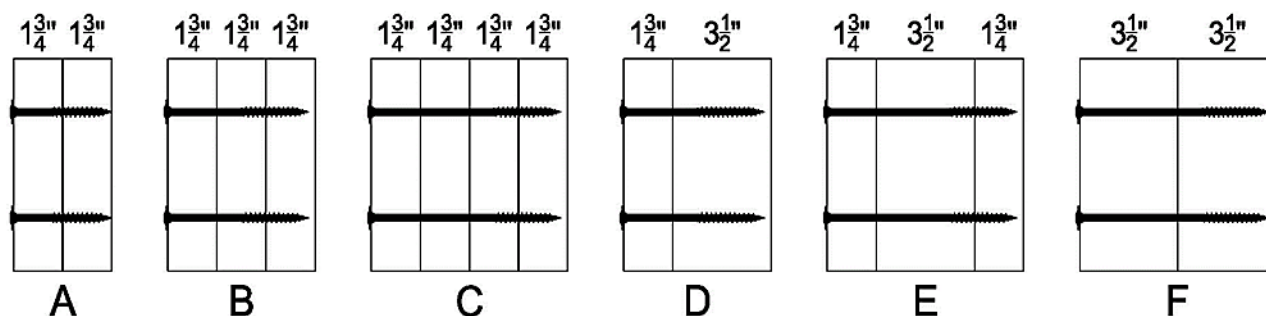


Figure 7. Starborn® Structural F23-E Screw Assemblies

5.3 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science, and fire science.

6 Installation

- 6.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this TER, and the applicable building code.
- 6.2 In the event of a conflict between the manufacturer installation instructions and this TER, the more restrictive shall govern.

6.3 Installation Procedure

- 6.3.1 Starborn® Structural F19, F23, F23-E and F23-W 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, NDS, and standard framing practice as applied to wood fasteners. Use of an impact driver is also permitted.
- 6.3.2 In the event of a conflict between the manufacturer installation instructions and this TER, the more restrictive shall govern.
- 6.3.3 The fasteners must be installed using a Torx® T-30 star driver bit for the F19 screws and a T-40 star driver bit for the F23 screws. Pre-drilling of pilot holes is not required but may be used where lumber is prone to splitting.
- 6.3.4 Minimum penetration into main member (final member in multi-ply assembly) is 1" unless otherwise stated in this TER.
- 6.3.5 Starborn® Structural F19, F23, F23-E and F23-W screw edge and end distances shall be as specified in Table 6 and Figure 8.
- 6.3.6 For applications outside the scope of this TER, an engineered design is required.

Table 6. Starborn® Structural F19, F23, F23-W and F23-E Screw Edge and End Distance Requirements

Number	Installed Condition	Minimum Distance or Spacing ¹ (in)		
		Face	Edge	End
1	Minimum End Distance	6	3	1 ³ / ₄
2	Minimum Edge Distance	1 ³ / ₄	³ / ₄	³ / ₄
3	Minimum Spacing Between Fasteners in a Row	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂
4	Minimum Spacing Between Non-Staggered Rows	3 ¹ / ₂	NA	NA
5	Minimum Spacing Between Staggered Rows	⁵ / ₈	NA	NA
6	Minimum Stagger Between Fasteners in Adjacent Rows	⁵ / ₈	NA	NA

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 more restrictive.

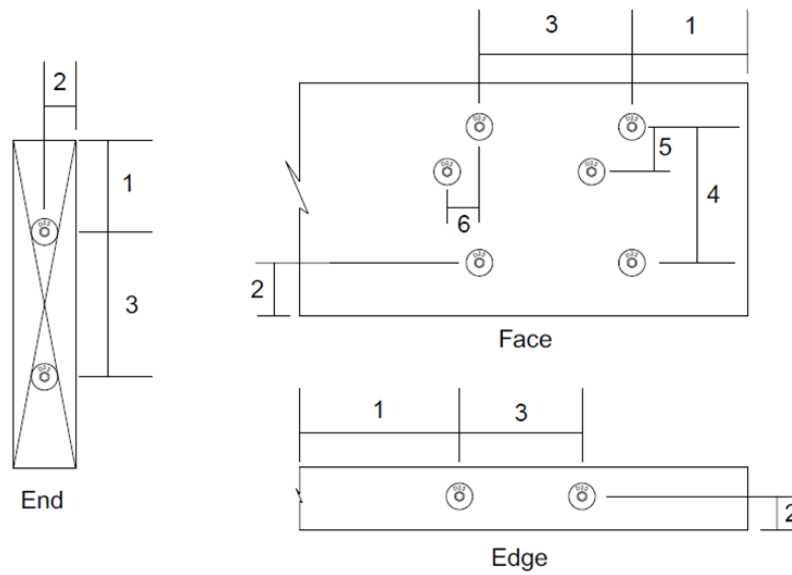


Figure 8. Starborn® F19, F23, F23-E and F23-W Screw Edge and End Distance Requirements

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 ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction
 - 7.1.2 Material properties and design values in accordance with [TER 1703-05](#).
 - 7.1.3 Multi-ply design value calculations by DrJ Engineering, LLC, 2019.
- 7.2 Information contained herein may include the result of testing and/or data analysis by sources that are [approved agencies](#) (i.e., ANAB accredited agencies), [approved sources](#) (i.e., RDPs), and/or [professional engineering regulations](#). Accuracy of external test data and resulting analysis is relied upon.
- 7.3 Where pertinent, testing and/or engineering analysis is based upon provisions that have been codified into law through state or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ's engineering practice may use a code-adopted provision as the control sample. A control sample versus a test sample establishes a product as [being equivalent](#) to the code-adopted provision in terms of quality, [strength](#), effectiveness, [fire resistance](#), durability, and safety.
- 7.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, [Listings](#), [certified reports](#), [duly authenticated reports](#) from [approved agencies](#), and [research reports](#) prepared by [approved agencies](#) and/or [approved sources](#) provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this TER, may be dependent upon published design properties by others.
- 7.5 Testing and engineering analysis: The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.⁹
- 7.6 Where additional condition of use and/or code compliance information is required, please search for one of Starborn® Structural F19 Screws, Starborn® Structural F23-W Screws, Starborn® Structural F23-E Screws and Starborn® Structural F23 Screws on the [DrJ Certification](#) website.

⁹ See Code of Federal Regulations (CFR) [Title 24 Subtitle B Chapter XX Part 3280](#) for definition.



8 Findings

- 8.1 As delineated in Section 3, Starborn® Structural F19 Screws, Starborn® Structural F23-W Screws, Starborn® Structural F23-E Screws and Starborn® Structural F23 Screws have performance characteristics that were tested and/or meet pertinent standards and is suitable for use pursuant to its specified purpose.
- 8.2 When used and installed in accordance with this TER and the manufacturer installation instructions, Starborn® Structural F19 Screws, Starborn® Structural F23-W Screws, Starborn® Structural F23-E Screws and Starborn® Structural F23 Screws shall be approved for the following applications:
 - 8.2.1 Starborn® Structural F19, F23, F23-W and F23-E screws are suitable to provide multi-ply attachment in trusses, sawn lumber, and engineered wood applications.
- 8.3 These products have been evaluated in the context of the codes listed in Section 2 and are 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
- 8.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Starborn® Industries, Inc.

8.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10)¹⁰ are similar) in pertinent part states:

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

- 8.6 **Approved:**¹¹ Building codes require that the building official shall accept duly authenticated reports¹² or research reports¹³ from approved agencies and/or approved sources (i.e., licensed RDP) with respect to the quality and manner of use of new products, materials, designs, services, assemblies, or methods of construction.
- 8.6.1 Acceptability of an approved agency, by a building official, is performed by verifying that the agency is accredited by a recognized accreditation body of the International Accreditation Forum (IAF).
- 8.6.2 Acceptability of a licensed RDP, by a building official, is performed by verifying that the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.
- 8.6.3 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved, as denial without written reason deprives a protected right to free and fair competition in the marketplace.
- 8.7 DrJ is an engineering company, employs RDPs and is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131.
- 8.8 Through ANAB accreditation and the IAF Multilateral Agreements, this TER 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.*” IAF specifically says, “*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.*”¹⁴

9 Conditions of Use

- 9.1 Material properties shall not fall outside the boundaries defined in Section 3.
- 9.2 As defined in Section 3, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.
- 9.3 When installed in preservative treated wood or fire retardant treated wood, connections shall be designed using the treatment manufacturers reductions for connections.
- 9.4 Starborn® Structural F19, F23, F23-W and F23-E screws covered in this TER shall be installed in accordance with this TER and the manufacturer installation instructions.
- 9.5 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 the NDS.

¹⁰ 2018 IFC Section 104.9

¹¹ Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

¹² <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1>

¹³ <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2>

¹⁴ <https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise>



- 9.6 Starborn® Structural F19, F23, F23-E, and F23-W screws are produced by Starborn® Industries, Inc. at its facilities located in Edison, New Jersey.
- 9.7 Starborn® Structural F19, F23, F23-E, and F23-W screws are produced under a quality control program subject to periodic inspections performed by an approved agency in accordance with IBC Section 1703.5.2.
- 9.8 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:
- 9.8.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice, and, when prepared by an approved source, shall be approved when requirements of adopted legislation are met.
 - 9.8.2 This TER and the installation instructions shall be submitted at the time of permit application.
 - 9.8.3 These products have an internal quality control program and a third-party quality assurance program.
 - 9.8.4 At a minimum, these products shall be installed per Section 6 of this TER.
 - 9.8.5 The review of this TER, by the AHJ, shall be in compliance with IBC Section 104 and IBC Section 105.4.
 - 9.8.6 These products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.
 - 9.8.7 The application of these products in the context of this TER is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2 and any other regulatory requirements that may apply.
- 9.9 The approval of this TER by the AHJ shall comply with IBC Section 1707.1, where legislation states in pertinent part, “*the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11”*, all of IBC Section 104, and IBC Section 105.4.
- 9.10 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 (i.e., owner or RDP).
- 9.11 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.

10 Identification

- 10.1 The products listed in Section 1.1 through 1.4 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.
- 10.1.1 Individual fasteners are marked with a head stamp indicating fastener diameter and length as described in Table 2.
- 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](#).

12 Approved for Use Pursuant to US and International Legislation Defined in Appendix A

- 12.1 Starborn® Structural F19 Screws, Starborn® Structural F23-W Screws, Starborn® Structural F23-E Screws and Starborn® Structural F23 Screws are included in this TER published by an approved agency that is concerned with evaluation of products or services, maintains periodic inspection of the production of listed materials or periodic evaluation of services, and whose TER Listing states either that the material, product, or service meets identified standards or has been tested and found suitable for a specified purpose. This TER meets the legislative intent and definition of being acceptable to the AHJ.

Appendix A

1 Legislation that Authorizes AHJ Approval

- 1.1 **Fair Competition:** State legislatures have adopted Federal regulations for the examination and approval of building code referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:
- 1.1.1 Advance Innovation,
 - 1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and
 - 1.1.3 Benefit consumers through lower prices, better quality, and greater choice.
- 1.2 **Adopted Legislation:** The following local, state, and federal regulations affirmatively authorize Starborn® Structural F19 Screws, Starborn® Structural F23-W Screws, Starborn® Structural F23-E Screws and Starborn® Structural F23 Screws to be approved by AHJs, delegates of building departments, and/or delegates of an agency of the federal government:
- 1.2.1 Interstate commerce is governed by the Federal Department of Justice to encourage the use of innovative products, materials, designs, services, assemblies and/or methods of construction. The goal is to “protect economic freedom and opportunity by promoting free and fair competition in the marketplace.”
 - 1.2.2 Title 18 US Code Section 242 affirms and regulates the right of individuals and businesses to freely and fairly have new products, materials, designs, services, assemblies and/or methods of construction approved for use in commerce. Disapproval of alternatives shall be based upon non-conformance with respect to specific provisions of adopted legislation, and shall be provided in writing stating the reasons why the alternative was not approved, with reference to the specific legislation violated.
 - 1.2.3 The federal government and each state have a public records act. In addition, each state also has legislation that mimics the federal Defend Trade Secrets Act 2016 (DTSA).
 - 1.2.3.1 Compliance with public records and trade secret legislation requires approval through the use of listings, certified reports, Technical Evaluation Reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.
 - 1.2.4 For new materials¹⁵ that are not specifically provided for in any building code, the design strengths and permissible stresses shall be established by tests, where suitable load tests simulate the actual loads and conditions of application that occur.
 - 1.2.5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design using accepted engineering practice.¹⁶
 - 1.2.6 The commerce of approved sources (i.e., registered PEs) is regulated by professional engineering legislation. Professional engineering commerce shall always be approved by AHJs, except where there is evidence, provided in writing, that specific legislation has been violated by an individual registered PE.
 - 1.2.7 The AHJ shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in IBC Section 104.11.¹⁷

¹⁵ <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706.2>

¹⁶ IBC 2021, Section 1706.1 Conformance to Standards

¹⁷ IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General

- 1.3 **Approved¹⁸ by Los Angeles:** The Los Angeles Municipal Code (LAMC) states in pertinent part that the provisions of LAMC are not intended to prevent the use of any material, device, or method of construction not specifically prescribed by LAMC. The Department shall use Part III, Recognized Standards in addition to Part II, Uniform Building Code Standards of Division 35, Article 1, Chapter IX of the LAMC in evaluation of products for approval where such standard exists for the product or the material and may use other approved standards, which apply. Whenever tests or certificates of any material or fabricated assembly are required by Chapter IX of the LAMC, such tests or certification shall be made by a testing agency approved by the Superintendent of Building to conduct such tests or provide such certifications. The testing agency shall publish the scope and limitation(s) of the listed material or fabricated assembly.¹⁹ The Superintendent of Building roster of approved testing agencies is provided by the Los Angeles Department of Building and Safety (LADBS). The Center for Building Innovation (CBI) Certificate of Approval License is TA24945. Tests and certifications found in a CBI Listing are LAMC approved. In addition, the Superintendent of Building shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the California Building Code (CBC) Section 1707.1.²⁰
- 1.4 **Approved by Chicago:** The Municipal Code of Chicago (MCC) states in pertinent part that an Approved Agency is a Nationally Recognized Testing Laboratory (NRTL) acting within its recognized scope and/or a certification body accredited by the American National Standards Institute (ANSI) acting within its accredited scope. Construction materials and test procedures shall conform to the applicable standards listed in the MCC. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material, service, design, assembly and/or method of construction not specifically provided for in the MCC. This technical data shall consist of research reports from approved sources (i.e., MCC defined Approved Agencies).
- 1.5 **Approved by New York City:** The NYC Building Code 2022 (NYCBC) states in pertinent part that an approved agency shall be deemed²¹ an approved testing agency via ISO/IEC 17025 accreditation, an approved inspection agency via ISO/IEC 17020 accreditation, and an approved product evaluation agency via ISO/IEC 17065 accreditation. Accrediting agencies, other than federal agencies, must be members of an internationally recognized cooperation of laboratory and inspection accreditation bodies subject to a mutual recognition agreement²² (i.e., ANAB, International Accreditation Forum (IAF), etc.).

¹⁸ See Section 8 for the distilled building code definition of **Approved**

¹⁹ Los Angeles Municipal Code, SEC. 98.0503. TESTING AGENCIES

²⁰ https://up.codes/viewer/california/ca-building-code-2022/chapter/17/special-inspections-and-tests#1707.1

²¹ New York City, The Rules of the City of New York, § 101-07 Approved Agencies

²² New York City, The Rules of the City of New York, § 101-07 Approved Agencies

- 1.6 **Approved by Florida:** Statewide approval of products, methods, or systems of construction shall be approved, without further evaluation, by 1) A certification mark or listing of an approved certification agency, 2) A test report from an approved testing laboratory, 3) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, from an approved product evaluation entity; 4) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a professional engineer or architect, licensed in Florida. For local product approval, products or systems of construction shall demonstrate compliance with the structural wind load requirements of the Florida Building Code (FBC) through one of the following methods; 1) A certification mark, listing, or label from a commission-approved certification agency indicating that the product complies with the code; 2) A test report from a commission-approved testing laboratory indicating that the product tested complies with the code; 3) A product-evaluation report based upon testing, comparative or rational analysis, or a combination thereof, from a commission-approved product evaluation entity which indicates that the product evaluated complies with the code; 4) A product-evaluation report or certification based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a Florida professional engineer or Florida registered architect, which indicates that the product complies with the code; 5) A statewide product approval issued by the Florida Building Commission. The Florida Department of Business and Professional Regulation (DBPR) website provides a listing of companies certified as a Product Evaluation Agency (i.e., EVLMiami 13692), a Product Certification Agency (i.e., CER10642), and as a Florida Registered Engineer (i.e., ANE13741).
- 1.7 **Approved by Miami-Dade County (i.e., Notice of Acceptance [NOA]):** A Florida statewide approval is an NOA. An NOA is a Florida local product approval. By Florida law, Miami-Dade County shall accept the statewide and local Florida Product Approval as provided for in Florida legislation 553.842 and 553.8425.
- 1.8 **Approved by New Jersey:** Pursuant to Building Code 2018 of New Jersey in IBC Section 1707.1 General,²³ it states: "In the absence of approved rules or other approved standards, the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the administrative provisions of the Uniform Construction Code (N.J.A.C. 5:23)".²⁴ Furthermore N.J.A.C 5:23-3.7 states: Municipal approvals of alternative materials, equipment, or methods of construction. **(a) Approvals:** Alternative materials, equipment, or methods of construction shall be approved by the appropriate subcode official provided the proposed design is satisfactory and that the materials, equipment, or methods of construction are suitable for the intended use and are at least the equivalent in quality, strength, effectiveness, fire resistance, durability and safety of those conforming with the requirements of the regulations. 1. A field evaluation label and report or letter issued by a nationally recognized testing laboratory verifying that the specific material, equipment, or method of construction meets the identified standards or has been tested and found to be suitable for the intended use, shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. 2. Reports of engineering findings issued by nationally recognized evaluation service programs, such as, but not limited to, the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress International (SBCCI), the International Code Council (ICC), and the National Evaluation Service, Inc., shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. The New Jersey Department of Community Affairs has confirmed that technical evaluation reports, from any accredited entity listed by ANAB, meets the requirements of item 2 given that the listed entities are no longer in existence and/or do not provide "reports of engineering findings".

²³ https://up.codes/viewer/new_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1

²⁴ <https://www.nj.gov/dca/divisions/codes/codereg/ucc.html>

- 1.9 **Approved by the Code of Federal Regulations Manufactured Home Construction and Safety Standards:** Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14²⁵ and Part 3280,²⁶ the Department encourages innovation and the use of new technology in manufactured homes. The design and construction of a manufactured home shall conform with the provisions of Part 3282 and Part 3280 where key approval provisions in mandatory language follow: 1) “All construction methods shall be in conformance with accepted engineering practices”; 2) “The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.”; and 3) “The design stresses of all materials shall conform to accepted engineering practice.”
- 1.10 **Approval by US, Local, and State Jurisdictions in General:** In all other local and state jurisdictions, the adopted building code legislation states in pertinent part that:
- 1.10.1 For new materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests.²⁷
- 1.10.2 For innovative alternative products, materials, designs, services and/or methods of construction, in the absence of approved rules or other approved standards...the building official shall accept duly authenticated reports (i.e., listing and/or research report) from approved agencies with respect to the quality and manner of use of new materials or assemblies.²⁸ A building official approved agency is deemed to be approved via certification from an accreditation body that is listed by the International Accreditation Forum²⁹ or equivalent.
- 1.10.3 The design strengths and permissible stresses of any structural material...shall conform to the specifications and methods of design of accepted engineering practice performed by an approved source.³⁰ An approved source is defined as a PE subject to professional engineering laws, where a research and/or a technical evaluation report certified by a PE, shall be approved.
- 1.11 **Approval by International Jurisdictions:** The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements:
- 1.11.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,
- 1.11.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.
- 1.11.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

²⁵ <https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14>

²⁶ <https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280>

²⁷ IBC 2021, Section 1706 Design Strengths of Materials, 1706.2 New Materials. Adopted law pursuant to IBC model code language 1706.2.

²⁸ IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General. Adopted law pursuant to IBC model code language 1707.1.

²⁹ Please see the ANAB directory for building official approved agencies.

³⁰ IBC 2021, Section 1706 Design Strengths of Materials, Section 1706.1 Conformance to Standards Adopted law pursuant to IBC model code language 1706.1.



- 1.11.4 **Approved:** The purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories to the MLA, and subsequently acceptance of accredited certification and validation/verification statements in many markets based on one accreditation for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.