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# ICC-ES Evaluation Report

## ESR-2999

Reissued February 2023

This report is subject to renewal February 2025.

**DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES**  
**Section: 06 17 53—Shop-Fabricated Wood Trusses**

### REPORT HOLDER:

**BARRETTE STRUCTURAL DISTRIBUTION, INC.**

### EVALUATION SUBJECT:

**TRIFORCE® PREFABRICATED OPEN WEB JOISTS**

## 1.0 EVALUATION SCOPE

### 1.1 Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2021, 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)<sup>†</sup>

<sup>†</sup>The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

### Property evaluated:

Structural

### 1.2 Evaluation to the following green code(s) and/or standards:

- 2022 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2020, 2015, 2012 and 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2020, ICC 700-2015, ICC 700-2012 and ICC 700-2008)

### Attributes verified:

See Section 3.1

## 2.0 USES

The TRIFORCE® prefabricated open web wood joists are used as uniformly loaded floor joists and roof joists in simple span and cantilever applications.

## 3.0 DESCRIPTION

### 3.1 General:

The TRIFORCE® prefabricated open web wood joists have solid-sawn lumber flanges connected by solid-sawn lumber

vertical and diagonal web members forming a diagonal webbed truss along the length; except at one end, which has a continuous oriented strand board (OSB) web to permit

trimming to length in the field. The top and bottom flanges are parallel, creating a constant depth joist. The vertical- and diagonal-to-flange connection is a proprietary glued finger joint, and the OSB end section connection is a proprietary glued tongue-and-groove joint to the flanges and to a vertical web transition post. Joist depths vary from 9.5 inches to 16 inches (241 mm to 406 mm). The joist has a distinct top and bottom, with the bottom flange marked for proper orientation during joist placement. A vertical web member is always placed at the joist end opposite the OSB web end. See Table 1 and Figure 1 for descriptive information.

The attributes of the wood joists have been verified as conforming to the provisions of (i) CALGreen Section A4.404.3 for efficient framing techniques; (ii) ICC 700-2020 Sections 608.1(2), 11.608.1(2) and 13.104.3.1(4); (iii) ICC 700-2015 and ICC 700-2012 Sections 608.1(2), 11.608.1(2) and 12(A).608.1 for resource-efficient materials; and (iv) ICC 700-2008 Section 607.1(2) for resource-efficient materials. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

### 3.2 Material:

**3.2.1 Flanges:** The TRIFORCE® flange material is solid-sawn, spruce-pine-fir (SPF) finger-jointed lumber meeting the grade requirements listed in the approved quality control manual. Flange width, thickness and grade are specified in Table 1.

**3.2.2 Diagonal Webs:** The TRIFORCE® diagonal web material is SPF proprietary grade solid-sawn lumber meeting the requirements listed in the approved quality control manual. Diagonal web size and grade are specified in Table 1.

**3.2.3 Vertical Webs:** The TRIFORCE® end post and vertical web post material is SPF proprietary grade solid-sawn lumber meeting the size and grade requirements listed in the approved quality control manual.

**3.2.4 OSB Webs:** The TRIFORCE® OSB web material is nominally  $\frac{3}{8}$  inch thick complying with DOC Voluntary Product Standard PS2, Exposure 1 and requirements listed in the approved quality control manual. The OSB web is continuous from the web post to the ends of the flanges. The OSB is oriented with face grain parallel to the joist flanges.

**3.2.5 Adhesive:** The adhesive used in the TRIFORCE® joist fabrication complies with ASTM D2559, Section 5.4.3 of ASTM D5055-16, and requirements listed in the approved quality control manual.

## 4.0 DESIGN AND INSTALLATION

### 4.1 General:

The design and installation of the TRIFORCE® prefabricated open web wood joists described in this report must comply with Sections 4.2 through 4.12 and the manufacturer's published installation instructions. Additionally, design of the TRIFORCE® joists is governed by the applicable code and corresponding editions of the ANSI/AWC *National Design Specification® for Wood Construction* (NDS).

### 4.2 Design Properties:

Table 2 specifies allowable moment capacity, allowable shear capacity, joist bending stiffness (EI) and shear deflection coefficient (K). Reference allowable design values given in Table 2 must be adjusted by applicable factors in accordance with Sections 4.2.1 through 4.2.5.

**4.2.1 Load Duration Factor,  $C_D$ :** Adjustments for duration of load apply to the reference design values in accordance with Section 7.3.2 of the NDS.

**4.2.2 Wet Service Factor,  $C_M$ :** TRIFORCE® joists must be installed in dry, covered conditions where the in-service moisture content of the joist is less than 16 percent. The wet service factor,  $C_M$ , for TRIFORCE® joists under these conditions is 1.0.

**4.2.3 Temperature Factor,  $C_t$ :** Where TRIFORCE® joists will be exposed to sustained in-service temperatures greater than 100°F (38°C), the reference design values must be adjusted by the temperature factor,  $C_t$ , in accordance with Section 7.3.4 of the NDS.

**4.2.4 Beam Stability Factor,  $C_L$ :** The TRIFORCE® joist compression flange must be provided with lateral support in accordance with Section 4.7. The beam stability factor,  $C_L$ , for TRIFORCE® joists under these conditions is 1.0.

**4.2.5 Repetitive Member Factor,  $C_r$ :** The applicable repetitive member factor,  $C_r$ , for reference design moments is 1.0.

### 4.3 Fasteners:

Reference fastener withdrawal and lateral design values for nails installed into the flanges must be determined in accordance with the NDS and the applicable code, using a maximum specific gravity of 0.42. Fastener spacing must comply with the requirements prescribed by the applicable code for nails installed in sawn lumber.

### 4.4 Member Cutting:

Flanges, diagonal webs and vertical webs must not be cut or notched. Table 4 shows the size of duct that will pass through the open web portions of the TRIFORCE® joist. No hole cutting is permitted in the OSB web portion of the joist.

### 4.5 Web Stiffeners on OSB End:

Field-installed web stiffeners must be provided at bearings when required by Table 3. Web stiffeners must be sized and installed as described in Figure 2.

### 4.6 Bearing Length:

Ends of TRIFORCE® joists must be provided a minimum of 1½ inches (38.1 mm) of bearing length. Allowable end reactions based on bearing lengths are presented in Table 3. Linear interpolation between values presented is permitted.

### 4.7 Lateral Support:

The TRIFORCE® joist compression flange requires continuous lateral support and joist ends require restraint to prevent rollover and resist rotation. Methods specified in the applicable code for lateral support of sawn lumber are acceptable. Bridging is not required for floor joist applications.

### 4.8 Joist Span:

The TRIFORCE® joist span must be determined in accordance with Section 3.2.1 of the NDS. Vertical shear calculations must include all loads within the span from face to face of supports.

### 4.9 Cantilevers:

The TRIFORCE® joist OSB end section may be cantilevered beyond the support a maximum of 24 inches (610 mm), or one-third of the adjacent span, whichever is less. The interior support adjacent to the cantilever must have a bearing length of 3½ inches (89 mm) located entirely within the OSB web section of the joist.

### 4.10 Simple Span Deflection:

Mid-span deflection for a uniformly loaded simple span TRIFORCE® joist must be calculated using the equation given in the footnotes to Table 2.

### 4.11 Concentrated Loads:

Design for concentrated loads is beyond the scope of this report.

### 4.12 End Blocking Panels:

Where TRIFORCE® joists have bearing walls above aligned over joist bearings, either full-depth blocking between joists or a rim board is required to support the wall above.

## 5.0 CONDITIONS OF USE

The TRIFORCE® prefabricated open web wood joists described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1** TRIFORCE® joists must be installed in accordance with this report, the manufacturer's published installation instructions and the approved plans. If there are conflicts between this report and the manufacturer's published installation instructions or plans submitted for approval, this report governs.
- 5.2** Design calculations and details for specific applications must be furnished to the code official. Calculations and drawings must be prepared, signed and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3** Use of the TRIFORCE® joists is limited to dry, interior applications in accordance with Section 4.2.2.
- 5.4** The TRIFORCE® joists are manufactured by Barrette Structural Distribution, Inc. at their plant located in Trois-Rivieres, Quebec, Canada, under a quality-control program with inspections by ICC-ES.

**6.0 EVIDENCE SUBMITTED**

Data in accordance with the ICC-ES Acceptance Criteria for Prefabricated Parallel Chord Wood Trusses (AC224) dated October 2018 (editorially revised January 2023).

**7.0 IDENTIFICATION**

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-2999) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 In addition, TRIFORCE® prefabricated open web wood joists are identified by a stamp that includes the product designation, the manufacturing plant location, and the production date. See Figure 3.

7.3 The report holder’s contact information is the following:

**BARRETTE STRUCTURAL DISTRIBUTION, INC.**  
**555 RANG SAINT-MALO**  
**TROIS-RIVIERES, QUEBEC G8V 0A8**  
**CANADA**  
**(800) 263-7265**  
[www.openjoisttriforce.com](http://www.openjoisttriforce.com)

**TABLE 1—TRIFORCE® PREFABRICATED OPEN WEB JOISTS**

Series	Joist Depth (inches)	Flange Material Grade <sup>1</sup>	Flange Dimensions (depth x width) (inches)	Diagonal Web Material <sup>1</sup>	Diagonal Web Dimensions (depth x width) (inches)	Trimtable End Web Material
OJ-314	9½ - 16	G14	1.5 x 2.5	G14	1.5 x 1.5	¾ OSB
OJ-315	9½ - 16	G15 – 1.5E	1.5 x 2.5	G14	1.5 x 1.5	¾ OSB
OJ-318	9½ - 16	G18 – 1.8E	1.5 x 2.5	G14	1.5 x 1.5	¾ OSB
OJ-320	9½ - 16	G20 – 2.0E	1.5 x 2.5	G14	1.5 x 1.5	¾ OSB
OJ-414	9½ - 16	G14	1.5 x 3.5	G14	1.5 x 1.5	¾ OSB
OJ-415	9½ - 16	G15 – 1.5E	1.5 x 3.5	G14	1.5 x 1.5	¾ OSB
OJ-418	9½ - 16	G18 – 1.8E	1.5 x 3.5	G14	1.5 x 1.5	¾ OSB
OJ-420	9½ - 16	G20 – 2.0E	1.5 x 3.5	G14	1.5 x 1.5	¾ OSB

For **SI**: 1 inch = 25.4 mm.

<sup>1</sup>Flange and diagonal grades are proprietary grades that meet requirements listed in the quality control manual.

TABLE 2—TRIFORCE® REFERENCE DESIGN PROPERTIES<sup>1,2,3</sup>

Series	Depth (in)	Flange Width (in)	Ma (lbs-ft)	Va (lbs)	EI (x 10 <sup>6</sup> lb-in <sup>2</sup> )	K (x 10 <sup>6</sup> lbs)	Joist Weight (plf)
OJ-314	9.5	2.5	2 344	1 078	170	2,7	2.70
	11.875	2.5	3 035	1 250	285	3,7	2.80
	14	2.5	3 635	1 404	413	4,6	2.85
	16	2.5	4 131	1 549	554	5,5	2.95
OJ-315	9.5	2.5	2 836	1 078	182	2,7	2.70
	11.875	2.5	3 672	1 250	305	3,7	2.80
	14	2.5	4 420	1 404	442	4,6	2.85
	16	2.5	5 124	1 549	594	5,5	2.95
OJ-318	9.5	2.5	3 607	1 078	219	2,7	2.73
	11.875	2.5	4 670	1 250	366	3,7	2.83
	14	2.5	5 621	1 404	530	4,6	2.88
	16	2.5	6 516	1 549	712	5,5	2.98
OJ-320	9.5	2.5	3 738	1 078	243	2,7	2.73
	11.875	2.5	4 840	1 250	407	3,7	2.83
	14	2.5	5 826	1 404	589	4,6	2.88
	16	2.5	6 753	1 549	791	5,5	2.98
OJ-414	9.5	3.5	3 339	1 078	238	3,3	3.23
	11.875	3.5	4 324	1 250	398	4,6	3.33
	14	3.5	5 178	1 404	577	5,7	3.43
	16	3.5	5 884	1 549	776	6,8	3.53
OJ-415	9.5	3.5	4 041	1 078	255	3,3	3.25
	11.875	3.5	5 231	1 250	427	4,6	3.35
	14	3.5	6 296	1 404	618	5,7	3.45
	16	3.5	7 298	1 549	831	6,8	3.55
OJ-418	9.5	3.5	5 138	1 078	306	3,3	3.25
	11.875	3.5	6 652	1 250	512	4,6	3.35
	14	3.5	8 007	1 404	742	5,7	3.45
	16	3.5	9 282	1 549	997	6,8	3.55
OJ-420	9.5	3.5	5 325	1 078	340	3,3	3.25
	11.875	3.5	6 894	1 250	569	4,6	3.35
	14	3.5	8 298	1 404	824	5,7	3.45
	16	3.5	9 620	1 549	1108	6,8	3.55

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m, 1 lb = 4.448 N, 1 lbs-in<sup>2</sup> = 0.00287 N-m<sup>2</sup>.

<sup>1</sup>The tabulated design properties are reference design values for normal duration load. Reference allowable design moment and shear properties, Ma and Va, must be adjusted in accordance with Section 4.2.

<sup>2</sup>Allowable moment capacity must not be increased by any repetitive member use factor.

<sup>3</sup>Maximum deflection at mid-span is calculated as follows for a uniformly loaded joist:

$$Deflection(\Delta) = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$$

Where:

- L = Span
- EI = Bending stiffness
- K = Shear deflection factor
- w = Uniform Load

TABLE 3—TRIFORCE® ALLOWABLE BEARING REACTIONS<sup>1,2,3,4</sup>

Series	Depth (in)	2x3 Post End (lbs)		OSB End (lbs)		
		1 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>2</sub> "	1 <sup>1</sup> / <sub>2</sub> "	1 <sup>1</sup> / <sub>2</sub> " with web stiffeners	3 <sup>1</sup> / <sub>2</sub> "
OJ-300 OJ-400	9.5	1514	1830	1030	1341	1349
	11.875	1581	1951	1047	1595 <sup>5</sup>	1349
	14	1595 <sup>5</sup>	2059	1063	1595 <sup>5</sup>	1349
	16	1595 <sup>5</sup>	2160	1078	1595 <sup>5</sup>	1349

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m, 1 lb = 4.448 N, 1 lbs-in<sup>2</sup> = 0.00287 N-m<sup>2</sup>.

<sup>1</sup>Unless otherwise indicated, the tabulated reaction values are for normal duration of load and are permitted to be increased for other load durations in accordance with Section 4.2.1, limited by flange perpendicular to grain bearing stress of 425 psi.

<sup>2</sup>End reactions require a minimum bearing length of 1<sup>1</sup>/<sub>2</sub>, linear interpolation between bearing lengths is permitted.

<sup>3</sup>A length of up to 24 inches may be removed from the OSB end without any modification of the tabulated allowable design properties. See Figure 1.

<sup>4</sup>Web Stiffeners must be installed in accordance with Figure 2.

<sup>5</sup>Table value is limited by flange perpendicular to grain bearing stress and must not be further increased for duration of load.

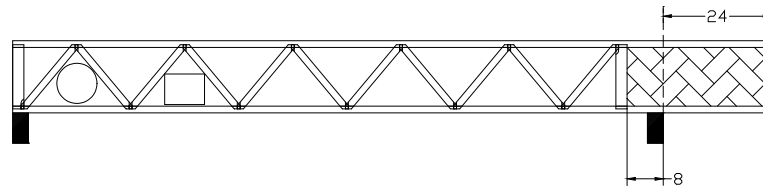


FIGURE 1—TRIFORCE® JOIST

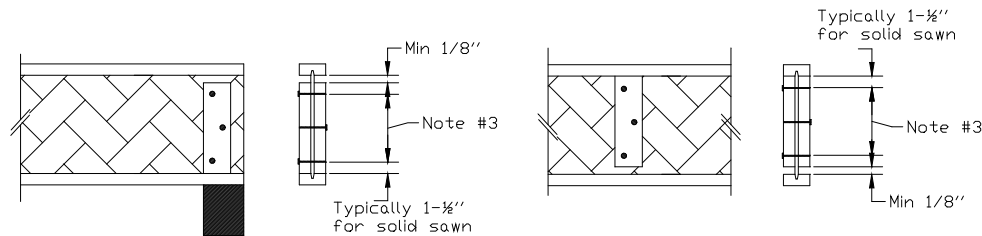


FIGURE 2—WEB STIFFENER ATTACHMENT

- <sup>1</sup>Web stiffeners must be installed at bearing points when required. See Table 3.
- <sup>2</sup>Web stiffeners must be installed on each side of the web, with nails equally spaced vertically.
- <sup>3</sup>Web stiffeners materials must be sheathing meeting requirements of PS-1, PS-2 with face grain parallel to the long axis of the stiffeners or solid sawn lumber.
- <sup>4</sup>Minimum thickness of sheathing material to be used for web stiffeners must be <sup>19</sup>/<sub>32</sub> inch. Minimum stiffener width must be 2<sup>1</sup>/<sub>2</sub> inches.
- <sup>5</sup>A gap must be left at the top of web stiffeners at bearing.
- <sup>6</sup>Nailing requirement for web stiffener connections, 3 – 8d nails for 9.5 and 11.875 depths and 5 – 8d nails for 14 and 16 depths.
- <sup>7</sup>The nails may be driven from one side only.

TABLE 4—TRIFORCE® MAXIMUM DUCT SIZE IN SPAN<sup>1</sup>

Series	Depth (in)	Maximum Round Duct Size (in)	Maximum Rectangular Duct Size (in)	Maximum Square Duct Size (in)
OJ-300 OJ-400	9.5	5	3x 9	4 <sup>1</sup> / <sub>2</sub> x 4 <sup>1</sup> / <sub>2</sub>
	11.875	7 <sup>1</sup> / <sub>4</sub>	3x13	5 <sup>3</sup> / <sub>4</sub> x 5 <sup>3</sup> / <sub>4</sub>
	14	8 <sup>1</sup> / <sub>2</sub>	3x14	6 <sup>3</sup> / <sub>4</sub> x 6 <sup>3</sup> / <sub>4</sub>
	16	9 <sup>1</sup> / <sub>2</sub>	3x15	7 <sup>3</sup> / <sub>4</sub> x 7 <sup>3</sup> / <sub>4</sub>

For SI: 1 inch = 25.4 mm.

<sup>1</sup>OSB end section hole cutting is not permitted.

**BOTTOM**  
BAS - ABAJO

OJ418

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Trois-Rivieres - Quebec

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FIGURE 3—TYPICAL PRODUCT LABELING

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES  
Section: 06 17 53—Shop-Fabricated Wood Trusses

**REPORT HOLDER:**

BARRETTE STRUCTURAL DISTRIBUTION, INC.

**EVALUATION SUBJECT:**

TRIFORCE® PREFABRICATED OPEN WEB JOISTS

**1.0 REPORT PURPOSE AND SCOPE****Purpose:**

The purpose of this evaluation report supplement is to indicate that TRIFORCE® prefabricated open web wood joists, evaluated in ICC-ES evaluation report ESR-2999, have also been evaluated for compliance with the codes noted below.

**Applicable code editions:**

- 2020 Florida Building Code—Building
- 2020 Florida Building Code—Residential

**2.0 CONCLUSIONS**

The TRIFORCE® prefabricated open web wood joists, described in Sections 2.0 through 7.0 of the evaluation report ESR-2999, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design requirements are determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in the evaluation report ESR-2999 for the 2018 and *International Building Code*® (IBC) meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of the TRIFORCE® prefabricated open web wood joists for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* has not been evaluated and is outside the scope of this evaluation report.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report ESR-2999, reissued February 2023.