

# ICC-ES Evaluation Report


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<p><b>DIVISION: 06 00 00—</b> <b>WOOD, PLASTICS AND</b> <b>COMPOSITES</b></p> <p><b>Section: 06 05 23—</b> <b>Wood, Plastic, and</b> <b>Composite Fastenings</b></p>	<p><b>REPORT HOLDER:</b> <b>YUYAO ALFIRSTE</b> <b>HARDWARE CO., LTD</b></p>	<p><b>EVALUATION SUBJECT:</b> <b>ALFIRSTE WAFERHEAD</b></p>	
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## 1.0 EVALUATION SCOPE

**Compliance with the following codes:**

- 2021 and 2018 [International Building Code® \(IBC\)](#)
- 2021 and 2018 [International Residential Code® \(IRC\)](#)

**Properties evaluated:**

- Structural

## 2.0 USES

The Alfirste Waferhead Screws are alternative dowel-type threaded fasteners used for wood-to-wood connections that are designed in accordance with the IBC. The screws may be used under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

## 3.0 DESCRIPTION

### 3.1 General:

The Alfirste Waferhead Screws are designed to be installed in wood predrilled with a lead hole. The screws are manufactured from SAE C10B21 carbon steel, heat treated, and surface coated with zinc, phosphate, or Ruspert coating.

The screws are partially threaded with a <sup>11</sup>/<sub>16</sub>-inch (17.5 mm) diameter waferhead. See [Figure 1](#) for a depiction of the screw.

### 3.2 Wood Members:

For purposes of connection design, sawn lumber members must have an assigned specific gravity as indicated in the tables in this report. Assigned specific gravity for sawn lumber must be determined in accordance with Table 12.3.3A of the ANSI/AWC National Design Specification for Wood Construction® (NDS). Unless otherwise noted, sawn lumber members must have a moisture content of 19 percent or less.

For the purposes of connection design, structural glued laminated timber (GL) must have a Specific Gravity for Fastener Design (addressed in Tables 5A through 5D of the NDS Supplement), as indicated in the tables in this report. Unless otherwise noted, GL must have a moisture content of less than 16 percent.

When designing connections with screws installed into the face of cross-laminated timber (CLT) panels fabricated with sawn lumber laminations, all of the laminations must have a minimum assigned specific gravity in accordance with the NDS as indicated in the tables in this report. Moisture content must be less than 16 percent.

Use of the screws in engineered wood products (EWP) other than those addressed above is outside the scope of this report.

For wood-to-wood connections, the tabulated side member thickness is an absolute value (not a minimum or maximum value). The thickness of the wood main member must be equal to or greater than the screw length less the thickness of the side member.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

The design values in this report are intended to aid the designer in meeting the requirements of IBC Section 1604.2. For connections not completely described in this report, determination of the suitability of the Alfirste Waferhead Screws for the specific application is the responsibility of the designer and is outside the scope of this report. The designer is responsible for determining the available strengths for the connection, considering all applicable limit states, and for considering serviceability issues.

**4.1.1 Screw Strength:** Allowable screw shear and tension strengths (ASD) and design screw shear and tension strengths (LRFD) and minimum specified bending yield strength for the screws are shown in [Table 2](#).

**4.1.2 Reference Withdrawal and Pull-through Design Values:** Reference withdrawal ( $W$ ) design values in pounds per inch of thread penetration, for screws installed perpendicular to the face of the wood member are shown in [Table 4](#), and reference head pull-through values ( $W_H$ ) are shown in [Table 5](#).

**4.1.3 Reference Lateral Design Values:** Reference lateral design values for two-member connections are shown in [Table 3](#) and are based on testing. The values are based on the use of a pilot hole in the main and side members with diameters of 90% of the root diameter of the screw.

**4.1.4 Adjustments to Reference Design Values:** The reference design values must be adjusted in accordance with the requirements for dowel-type fasteners in Section 11.3 of the NDS to determine allowable loads for use with ASD and/or design loads for use with LRFD. Use is limited to dry in-service conditions, such that the wet service factor,  $C_M$ , is 1.0 in accordance with the NDS. The reference design values must also be adjusted in accordance with Section 12.5 of the NDS, as applicable. When the capacity of a connection is controlled by the fastener strength, the allowable connection strength must not be increased by the adjustment factors specified in the NDS.

**4.1.5 Governing Design Values:** The allowable lateral load for a two-member, single-screw connection is the lesser of: (a) the allowable the reference lateral design value given in [Table 3](#), adjusted by all applicable adjustment factors, and (b) the allowable screw shear strength given in [Table 2](#) of this report. The allowable load for a two-member, single-screw connection in which the screw is subject to tension is the least of: (a) the reference withdrawal design load value given in [Table 4](#), multiplied by the embedded thread length, and adjusted by all applicable adjustment factors; (b) the reference head pull-through design value given in [Table 5](#), adjusted by all applicable factors; and (c) the allowable screw tension strength given in [Table 2](#) of this report.

**4.1.6 Connections with Multiple Screws:** Connections made with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS.

**4.1.7 Combined Loading:** Where the screws are subjected to combined lateral and withdrawal loads, connections shall be designed in accordance with Section 12.4.1 of the NDS.

**4.1.8 Capacity Requirements for Wood Members:** When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 11.1.2 of the NDS, and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group.

### 4.2 Installation:

The Alfirste Waferhead Screws must be installed in accordance with the report holder's published installation instructions and this report. The screws must be installed perpendicular to the face of the wood member. Screws must be installed with the minimum spacing, end distances, and edge distances needed to prevent splitting of the wood or as noted in [Table 6](#), whichever is more restrictive. For the Alfirste Waferhead Screws, the bottom of the screw head must be flush with the surface of the wood side member. Pilot holes must be used as indicated in Section 4.1.3. Screws must not be overdriven. The screws must be installed by turning with a power driver, not by driving with a hammer.

## 5.0 CONDITIONS OF USE:

The Alfirste Waferhead Screws described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The screws must be installed in accordance with the report holder’s published installation instructions and this report. In the case of a conflict between this report and the report holder’s instructions, this report governs.
- 5.2 Design loads for the screws must not exceed the available strengths described in Section 4.1.
- 5.3 Calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 The screws have only been evaluated for use in dry service applications. Use in wet service conditions is outside the scope of this report.
- 5.5 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 5.6 Use of the screws in contact with preservative-treated or fire-retardant-treated wood is outside the scope of this report.
- 5.7 The screws are manufactured under a quality control program with inspections by ICC-ES.

**6.0 EVIDENCE SUBMITTED**

Data in accordance with the [ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners \(AC233\)](#), dated February 2022.

**7.0 IDENTIFICATION**

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5085) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 In addition, the packaging for the screws is labeled with the product name, the fastener designation, the nominal fastener size and length and the coating designation.
- 7.3 The report holder’s contact information is the following:

**YUYAO ALFIRSTE HARDWARE CO., LTD**  
**HUIQIAO RD #1211, LANGXIA STREET**  
**YUYAO, ZHEJIANG 315400**  
**CHINA**  
**0574-87166296**  
[www.chinanchor.com](http://www.chinanchor.com)

**TABLE 1— ALFIRSTE WAFERHEAD SCREW DIMENSIONS AND STRENGTHS**

DESIGNATION	OVERALL LENGTH <sup>1</sup> , L (inches)	THREAD LENGTH <sup>2</sup> , L T (inches)	HEAD DIAMETER, DK (inch) (DRIVE SIZE)	UNTHREADED SHANK DIAMETER (inch)	MINOR THREAD (ROOT) DIAMETER, d (inch)	OUTSIDE THREAD DIAMETER, D (inch)
#17 x 4	4	2.95	0.689	0.227	0.209	0.295
#17 x 6	6	2.95				
#17 x 8	8	3.94				
#17 x 10	10	3.94				
#17 x 12	12	3.94				

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

<sup>1</sup>Overall length is measured from the underside of the integral washer to the tip.

<sup>2</sup>Length of thread includes tip.

<sup>3</sup>Diameter of integral washer.

<sup>4</sup>Bending yield strength determined in accordance with ASTM F 1575 using the minor thread (root) diameter, D<sub>r</sub>.

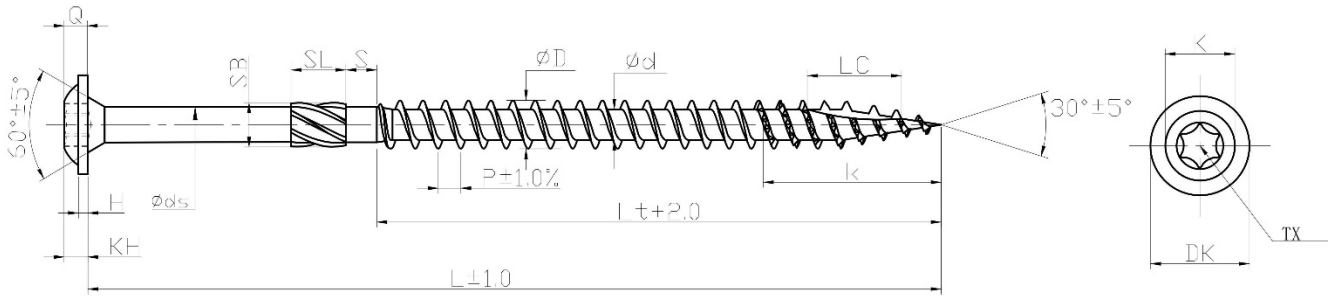


FIGURE 1—ALFIRSTE WAFERHEAD SCREW

TABLE 2—SCREW STEEL STRENGTHS

SCREW TYPE	NOMINAL DIAMETER, (inch)	BENDING YIELD STRENGTH <sup>1</sup> F <sub>yb</sub> (psi)	ALLOWABLE STEEL STRENGTHS (ASD)		DESIGN STEEL STRENGTHS (LRFD)	
			Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
#17	0.295	39,000	768	335	1153	503

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

<sup>1</sup>Bending yield strength determined in accordance with ASTM F1575 using the minor thread (root) diameter.

TABLE 3—REFERENCE LATERAL DESIGN VALUES (Z) FOR TWO MEMBER WOOD-TO-WOOD CONNECTIONS<sup>1,2,3,4,5</sup>

FASTENER DESIGNATION	MINIMUM OVERALL LENGTH, L (inches)	SIDE MEMBER THICKNESS l <sub>s</sub> (inches)	MINIMUM PENETRATION IN MAIN MEMBER (inches)	Z (lbf) FOR FOR SPECIFIC GRAVITIES (G) OF:					
				0.42 ≤ G < 0.50		0.50 ≤ G < 0.55		0.55 ≤ G	
				Parallel to Grain, Z <sub>  </sub>	Perp. to Grain, Z <sub>⊥</sub>	Parallel to Grain, Z <sub>  </sub>	Perp. to Grain, Z <sub>⊥</sub>	Parallel to Grain, Z <sub>  </sub>	Perp. to Grain, Z <sub>⊥</sub>
#17	4 & longer	2	2	217	90	332	223	409	244
	8 & longer	5.9	2	126	142	305	228	369	220

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

<sup>1</sup> Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD and/or design loads for use with LRFD.

<sup>2</sup> Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

<sup>3</sup> The wood main member thickness must be equal to or greater than the screw length less the thickness of the wood side member.

<sup>4</sup> The tabulated lateral design values are based on both wood members having the same specific gravity.

<sup>5</sup> Pilot holes were used in testing.

TABLE 4—REFERENCE WITHDRAWAL DESIGN VALUES (W) FOR INSTALLATION INTO THE FACE OF THE WOOD MEMBER<sup>1,2,3</sup>

FASTENER DESIGNATION	MINIMUM EMBEDDED THREAD LENGTH <sup>4</sup> , T (inches)	REFERENCE WITHDRAWAL DESIGN VALUE, W (lbf/in)		
		0.42 ≤ G < 0.50	0.50 ≤ G < 0.55	0.55 ≤ G
#17	3	255	311	322
	4	192	259	291

For SI: 1 inch = 25.4 mm, 1 lbf/in = 175N/m; 1 lbf = 4.45 N.

<sup>1</sup> Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD and/or design loads for use with LRFD.

<sup>2</sup> Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

<sup>3</sup> The tabulated reference withdrawal design value is in pounds-force per inch of thread embedment into the main member.

<sup>4</sup> Embedded thread length is that portion of the screw held in the main member including the screw tip.

TABLE 5—REFERENCE PULL THROUGH DESIGN VALUES ( $W_H$ )<sup>1,2</sup>

FASTENER DESIGNATION	MINIMUM SIDE MEMBER THICKNESS (inches)	REFERENCE PULL-THROUGH DESIGN VALUE, $W_H$ (lbf)		
		$0.42 \leq G < 0.50$	$0.50 \leq G < 0.55$	$0.55 \leq G$
#17	2.0	386	515	519

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

<sup>1</sup> Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD and/or design loads for use with LRFD.

<sup>2</sup> Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

TABLE 6—CONNECTION GEOMETRY REQUIREMENTS<sup>1,2,3</sup>

CONDITION		REQUIRED DIMENSION		
		$G < 0.50$	$0.50 \leq G$	
End distance	Tension loading parallel to grain (fastener bearing toward end)		15D	20D
	Compression loading parallel to grain (fastener bearing away from end)		10D	15D
	Loading perpendicular to grain		10D	15D
	Axial loading (fastener withdrawal or pull-through)		10D	10D
Edge distance	Loading parallel to grain		5D	7D
	Loading perpendicular to grain	Load toward edge	10D	12D
		Load away from edge	5D	7D
	Axial Loading		4D	4D
Spacing between fasteners in a row (parallel to grain of main member)	Loading parallel to grain		15D	15D
	Loading perpendicular to grain		10D	10D
	Axial loading		7D	7D
Spacing between rows (perpendicular to grain of main member)	Lateral loading	In-line rows	5D	7D
		Staggered rows <sup>4</sup>	2.5D	3D
	Axial loading		4D	4D

For SI: 1 inch = 25.4 mm.

<sup>1</sup>End distances, edge distances and fastener spacing must be sufficient to prevent splitting of the wood, or as required by this table, whichever is the more restrictive.

<sup>2</sup>Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

<sup>3</sup>D refers to the outside thread diameter.

<sup>4</sup>Values for spacing between staggered rows apply where fasteners in adjacent rows are offset by half of the spacing between fasteners in a row.