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## TESTING EVALUATION SUMMARY OF:

### CAMO® STRUCTURAL WOOD SCREWS

#### 1.0 USES

The CAMO® Structural fasteners described in this testing evaluation summary are alternate dowel- type threaded fasteners used for wood-to-wood connections

#### 2.0 DESCRIPTION

##### 2.1 General:

The CAMO® Structural fasteners are manufactured using a standard cold-forming process and are heat-treated. These fasteners depart from ANSI B18.2.1 and B18.6.1 in thread design, exceed the bending yield strengths documented in table A2 of the 2015 edition of the American Wood Council (AWC) Technical Report 12, and are installed with lead holes in accordance with the ANSI/AWC National Design Specification (NDS) for Wood Construction. The CAMO® Structural fasteners shown in this testing evaluation summary are describe in sections 2.1.1 and 2.1.2

**2.1.1 1/4" CAMO® Structural fasteners:** The 1/4" CAMO® structural fasteners have a Hexalobular (T-30 or T-40) drive flat head design, rolled threads, and a gimlet point, they have the ProTech corrosion resistant coating. See Table 1 for dimensional information

**2.1.2 5/16" CAMO® Structural fasteners:** The 5/16" CAMO® structural fasteners have a Hexalobular (T-40) drive flat head design, rolled threads, and a gimlet point, they have the ProTech corrosion resistant coating. See Table 1 for dimensional information

##### 2.2 Materials:

**2.2.1 Fasteners:** The CAMO® structural fasteners are made of carbon steel grade 1022 wire, and have ProTech corrosion resistant coating. Minimum bending yield strengths of fastener are listed in Table 1 of this testing evaluation summary

**2.2.2 Wood Members:** Wood members tested were solid sawn Douglas Fir–Larch (DF) material, values presented only apply if the lumber use is solid sawn DF lumber. As indicated in Tables 2-4, Assumptions about other lumber grades of different densities are not included in this testing evaluation summary.

#### 3.0 DESIGN AND INSTALLATION

##### 3.1 Design:

**3.1.1 Reference Design Values:** Reference design values for direct withdrawal connections are specified in Table 2 of this testing evaluation summary. Reference design

values for lateral resistance in wood-to-wood connections loaded parallel to the grain and perpendicular to the grain are specified in Table 3. When lateral loads are applied such that the fastener bears on either the main or side member in a direction other than parallel or perpendicular to the grain, the applicable design value for the connection must be calculated in accordance with Section 12.3.4 of NDS-15 (Section 11.3.4 of NDS-12 for the 2012 IBC; Section 11.3.3 of NDS-05 for the 2009 IBC), using the applicable design values given in Tables 2, 3 and 4 of this testing evaluation summary. Reference design values for fastener head pullthrough resistance for connections having a minimum side member thickness of 1 inches (25 mm) are specified in Table 4.

The reference design values given in Tables 2, 3, and 4 must be multiplied by all adjustment factors applicable to dowel-type fasteners and wood screws, in accordance with the NDS, including a wet service factor, CM, where applicable. Reference head pullthrough design values must be adjusted using the NDS adjustment factors applicable to withdrawal for wood screws.

The allowable load for a single-screw connection in which the screw is subject to tension is the least of: (a) the reference withdrawal design value given in Table 2, multiplied by the thread length and adjusted by all applicable adjustment factors; (b) the reference head pullthrough design value given in Table 4, adjusted by all applicable adjustment factors; and (c) the allowable screw tension strength given in Table 1.

The allowable lateral load for a single-screw connection is the lesser of: (a) the reference lateral design value given in Table 3; or as determined for loading at an intermediate angle to the grain; as applicable, adjusted by all applicable adjustment factors, and (b) the allowable screw shear strength given in Tables 1.

When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 11.1.2 of NDS-15 (Section 10.1.2 of NDS-12 and NDS-05 for the 2012 and 2009 IBC), and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and the fastener group.

Connections comprised of multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of

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NDS-15 (Sections 10.2.2 and 11.6 of the NDS -12 and NDS-05 for the 2012 and 2009 IBC).

Where the screws are subjected to combined lateral and withdrawal loads, connections shall be designed in accordance with Section 12.4.1 of NDS-15 (Section 11.4.1 of the NDS-12 and NDS-05 for the 2012 and 2009 IBC).

**3.1.2 Corrosion Resistance:** The CAMO® Structural Screws having the proprietary ProTech coating and are designed for use in wood treated with waterborne alkaline copper quaternary (ACQ) These fasteners must be limited to use in typical applications; for treated wood in dry use applications, or General Construction; and limitations where exposure is Limited to use where equilibrium moisture content of the chemically treated wood meets the dry service conditions as described in the NDS. Or Limited to freshwater and chemically treated wood exposure, e.g., no saltwater exposure. Supported by National Nails warranty

#### 4.0 CONDITIONS OF USE

The fasteners described in this testing evaluation are subject to the following conditions:

**4.1** Design and installation of connections with CAMO® structural screw fasteners must comply with this testing evaluation summary, and CAMO® fasteners published instructions and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this testing evaluation summary, the more restrictive governs.

**4.2** Use of the fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this testing evaluation summary.

#### 5.0 EVIDENCE USED

**5.1** Data calculated based on the ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners (AC233), dated October 2020 as a guideline, and based on testing report: ICTT Test Report HJ-QT-17340-R1 Issued Dec. 20<sup>th</sup> 2020.

**5.2** Accelerated Fastener Corrosion Testing by MSU

#### 6.0 IDENTIFICATION

**6.1** Packages of fasteners are identified by the company name or Brand Name (National Nail®, or CAMO®), one of the product names shown in Table 1, the fastener size and the testing evaluation summary. Head markings on the fasteners indicate fastener length and are applied as noted in Table 1

**6.2** The contact information regarding CAMO® fasteners is

**CAMO® FASTENERS**

c/o National Nail

2964 Clydon SW

Grand Rapids, MI 49519

(800) 968-6245

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**TABLE 1-FASTENER DIMENSIONS AND STRENGTHS**

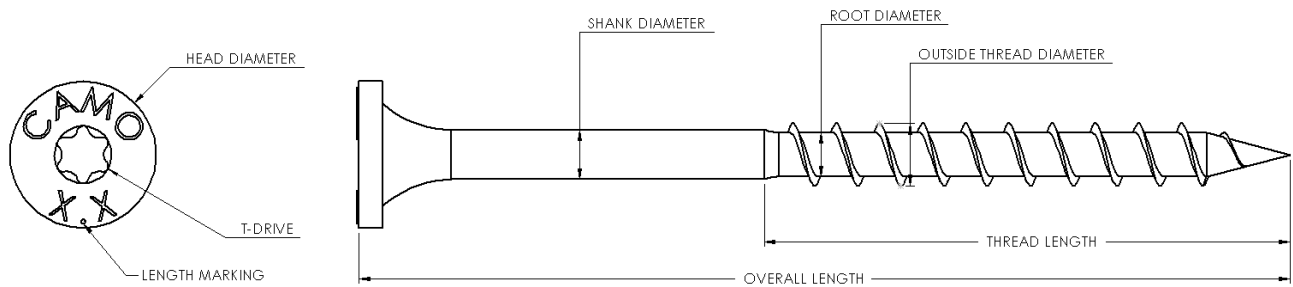
FASTENER DESIGNATION	OVERALL LENGTH <sup>1</sup> (in)	THREAD LENGTH <sup>2</sup> (in)	ROOT DIAMETER D <sub>r</sub> (in)	SHANK DIAMETER D <sub>s</sub> (in)	OUTSIDE THREAD DIAMETER D (in)	HEAD DIAMETER, D <sub>H</sub> (in)	DRIVE TYPE AND SIZE	SPECIFIED BENDING YIELD STRENGTH <sup>3</sup> F <sub>yb</sub> (psi)	ALLOWABLE FASTENER STRENGTH	
									Tension (lbf)	Shear (lbf)
CAMO® Structural Screw										
1/4" x 2-1/2"	2 1/2	2	0.170	0.191	0.241	0.56	140,000	1444	537	T-30
1/4" x 3"	3									
1/4" x 3-1/2"	3 1/2									
1/4" x 4"	4									
1/4" x 5"	5									
1/4" x 6"	6									
1/4" x 8"	8									
1/4" x 10"	10									
5/16" x 3-5/8"	3 5/8	2	0.190	0.213	0.302	0.60	109,000	1457	469	T-40
5/16" x 4"	4									
5/16" x 5"	5									
5/16" x 6"	6									
5/16" x 8"	8									

For SI: 1 in = 25.4mm; 1 lbf = 4.4 N; 1 psi = 6.9 kPa

<sup>1</sup>For CAMO® structural fasteners the length is inclusive of the head as seen in the drawing below.

<sup>2</sup>Length of thread includes the thread as seen in the drawing below.

<sup>3</sup>Bending yield strength determined in accordance with ASTM F1575 using the root diameter.



**TABLE 2-REFERENCE WITHDRAWAL DESIGN VALUES(W)<sup>1</sup>**

FASTENER DESIGNATION <b>CAMO</b> <sup>®</sup> Structural Screw	THREAD LENGTH <sup>2</sup> , L (in)	REFERENCE WITHDRAWAL DESIGN VALUES, W (lbf/in)	REFERENCE WITHDRAWAL DESIGN VALUES, WMAX (lbf)
		DF MAIN MEMBER	DF MAIN MEMBER
1/4" x 2-1/2"	2	67.97	135.94
1/4" x 3"			
1/4" x 3-1/2"			
1/4" x 4"			
1/4" x 5"			
1/4" x 6"			
1/4" x 8"			
1/4" x 10"			
5/16" x 3-5/8"	2	84.96	169.92
5/16" x 4"			
5/16" x 5"			
5/16" x 6"			
5/16" x 8"			

For SI: 1 in = 25.4mm; 1 lbf/in = 175 N/m

<sup>1</sup>Reference withdrawal design values must be multiplied by all applicable adjustment factors in accordance with the NDS.

<sup>2</sup>Reference withdrawal design values are to be multiplied by the length of thread penetration in the main member. Thread length includes tip.

<sup>3</sup>Reference withdrawal design values for connections in wood having specific gravities other than those given above may be interpolated from the tabulated values. Extrapolation to specific gravities greater than 0.67 or less than 0.31 is not permitted.

**TABLE 3-REFERENCE LATERAL DESIGN VALUES (Z)  
FOR SINGLE SHEAR (TWO-MEMBER) CONNECTIONS<sup>1</sup>**

For sawn Lumber

FASTENER DESIGNATION <b>CAMO</b> <sup>®</sup> Structural Screw	SIDE MEMBER THICKNESS t <sub>s</sub> (in)	FASTENER PENETRATION p (in)	REFERENCE LATERAL DESIGN VALUE (Z) (lbf)	
			DF MEMEBERS	
			Z <sub>  </sub>	Z <sub>⊥</sub>
1/4" x 2-1/2"	3/4"	2	180.06	229.68
1/4" x 3"				
1/4" x 3-1/2"				
1/4" x 4"				
1/4" x 5"				
1/4" x 6"				
1/4" x 8"				
1/4" x 10"				
5/16" x 3-5/8"	3/4"	2	178.64	233.22
5/16" x 4"				
5/16" x 5"				
5/16" x 6"				
5/16" x 8"				

For SI: 1 inch = 25.4 mm; 1 lbf = 4.448 N.

<sup>1</sup>Reference lateral design values must be multiplied by all applicable adjustment factors in accordance with the NDS.

<sup>2</sup>Minimum fastener penetration depth, p, into the main member includes the length of the tip.

<sup>3</sup>Reference lateral design values for connections in wood having specific gravities other than those given above may be interpolated from the tabulated values. Extrapolation to specific gravities greater than 0.67 or less than 0.31 is not permitted.

**TABLE 4-REFERENCE PULL-THROUGH DESIGN VALUES( $W_H$ )<sup>1</sup>**

FASTENER DESIGNATION CAMO <sup>®</sup> Structural Screw	MINIMUM SIDE MEMBER THICKNESS (in)	$W_H$ (lbf) FOR DF SAWN LUMBER <sup>2</sup> :
1/4" x 2-1/2"	1	250
1/4" x 3"		
1/4" x 3-1/2"		
1/4" x 4"		
1/4" x 5"		
1/4" x 6"		
1/4" x 8"		
1/4" x 10"		
5/16" x 3-5/8"	1	275
5/16" x 4"		
5/16" x 5"		
5/16" x 6"		
5/16" x 8"		

For SI: 1 inch = 25.4 mm; 1 lbf = 4.448 N.

<sup>1</sup>Reference pull-through design values must be multiplied by adjustment factors as applicable to reference withdrawal design values,  $W$ , in accordance with the NDS.

<sup>2</sup>Reference pull-through design values for connections in wood having specific gravities other than those given above may be interpolated from the tabulated values. Extrapolation to specific gravities greater than 0.67 or less than 0.31 is not permitted.