ICC-ES Evaluation Report

ESR-2761

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This report also contains:

- City of LA Supplement
- CA Supplement
- FL Supplement w/ HVHZ

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DIVISION: 06 00 00 – WOOD, PLASTICS AND COMPOSITES Section:06 05 23 – Wood, Plastic, and Composite Fastenings	REPORT HOLDER: MITEK® INC.	EVALUATION SUBJECT: MITEK WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC AND WSF STRUCTURAL WOOD SCREWS	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2024, 2021, 2018, 2015 and 2012 *International Building Code®* (IBC)
- 2024, 2021, 2018, 2015 and 2012 *International Residential Code®* (IRC)

Property evaluated:

- Structural

2.0 USES

The MiTek WS (Hex Head), WSWH (Washer Head), WSBH (Bugle Head), LL (Fillister Head) and LC (Hex Head) Structural Wood Screws described in this report are used for wood-to-wood and steel-to-wood connections that are designed in accordance with the IBC. The MiTek WSTS (Truss/Stud) Structural Wood Screws and WSTS6PT Partially Threaded Truss/Stud Screws described in this report are used for connecting wood trusses to wood top plates to resist uplift and lateral loads. For structures regulated under the IRC, the screws may be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC. The MiTek WSF (Floor-to-Floor) Structural Wood Screws described in this report are only used with the MiTek PW3 Shrinkage Compensation Device described in ESR-2190.

3.0 DESCRIPTION

3.1 Notation and Symbols:

a	=	Connection geometry parameter (See Table 6.)
D	=	Outside thread (major) diameter
D_H	=	Diameter of screw head
D_r	=	Minor thread (root) diameter
D_s	=	Unthreaded shank diameter
$F_{yb,nom}$	=	Nominal specified bending yield strength determined in accordance with ASTM F1575 using D_r. Not to be used for design in accordance with the NDS.
L	=	Overall screw length (See Figures 1A and 1B.)
$L_{emb,w}$	=	Minimum required embedment length in holding member, applicable to tabulated withdrawal design values

$L_{emb,l}$	=	Minimum required embedment length in holding member, applicable to tabulated lateral design values
L_{SH}	=	Length of shank (See Figures 1A and 1B.)
L_{thread}	=	Length of thread, including tip
SG_{eq}	=	Structural composite lumber equivalent specific gravity used for connection design
SG_{NDS}	=	Assigned specific gravity for the applicable species combination, glulam or other wood material in accordance with the NDS.
$t_{s,s}$	=	Thickness of steel side member
$t_{s,w}$	=	Thickness of wood side member
t_m	=	Thickness of wood main member
W	=	Reference unit withdrawal design value for screws installed perpendicular to face of the wood
W_H	=	Reference head pull-through design value
Z	=	Reference lateral design value

3.2 MiTek Structural Wood Screws:

3.2.1 MiTek WS, WSWH and WSBH Structural Wood Screws: WS, WSWH and WSBH Structural Wood Screws are manufactured using a cold-forming process and are heat-treated. The screws have a Type 17 self-drilling (fluted) tip. The WS screws have rolled threads, spaced 10 threads per inch (0.393 thread per millimeter), and a plain (unslotted) hex washer head. The WSWH and WSBH screws have rolled threads spaced 7 threads per inch (0.276 thread per millimeter) or 10 threads per inch (0.393 thread per millimeter). WSWH screws have a flat washer head and WSBH screws have a fluted bugle head. The washer and bugle head styles each have a six lobe recess which accepts a T30 bit. Screws having a nominal length of 2.5 inches or greater have a reamer knurl to facilitate installation. See Table 1 for descriptions of the screws. See Figure 1A for a diagram of the screws.

3.2.2 MiTek LL Structural Wood Screws: LL Structural Wood Screws are manufactured using a cold-forming process and are heat-treated. The screws have rolled threads spaced 12 threads per inch (0.472 thread per millimeter) in a twin-lead configuration. The fillister style head has a six-lobe recess that accepts a T20 bit. The tip style is a sharp gimlet point. See Table 1 for descriptions of the screws. See Figure 1A for a diagram of the LL wood screws.

3.2.3 MiTek LC Structural Wood Screws: LC Structural Wood Screws are manufactured using a cold-forming process and are heat-treated. The screws have rolled threads spaced 12 threads per inch (0.472 thread per millimeter) in a twin-lead configuration. The hex washer style head accepts a $^1/_4$-inch hex-head driver. The tip style is a sharp gimlet point. See Table 1 for descriptions of the screws. See Figure 1A for a diagram of the LC wood screws.

3.2.4 MiTek WSTS Structural Wood Screws: WSTS Structural Wood Screws are manufactured using a cold-forming process and are heat-treated. The screws have rolled threads, spaced 8 threads per inch (0.315 thread per millimeter), and a Type 17 self-drilling (fluted) tip. The screw head has a six lobe recess which accepts a T30 bit. The shank has an asymmetric thread along its entire length, with the thread angle reversed on opposite ends of the screw. See Table 1 for descriptions of the screws. See Figure 1B for a diagram of the WSTS screws and Figures 4 and 5 for installation guidelines.

3.2.5 MiTek WSTS6PT Partially Threaded Truss/Stud Screws: WSTS6PT partially threaded truss/stud screws are manufactured using a cold-forming process and are heat-treated. The screws have asymmetrical rolled threads, spaced 12 threads per inch (0.472 thread per millimeter), and a Type 17 self-drilling (fluted) tip. The screw head has a six-lobe recess, which accepts a T30 bit. See Figure 1B for a diagram of the WSTS6PT screws and Figures 4 and 5 for installation guidelines.

3.2.6 WSF Structural Wood Screws: WSF Wood Screws are manufactured using a cold-forming process and are heat-treated. The screws have rolled threads with 12 threads per inch (0.472 thread per millimeter). All WSF screws have a plain (unslotted) hex washer head and a thread length of 6 inches. The screws feature a self-drilling tip and a reamer knurl to facilitate installation. The WSF screw is designed to be used with MiTek's PW3 shrinkage compensation device, as described in ESR-2190. See Table 1 for descriptions of the screws. See Figure 1B for a diagram of the WSF screws.

3.3 Materials:

3.3.1 MiTek Structural Wood Screws: The MiTek structural wood screws are manufactured from carbon steel complying with the specifications in the manufacturer's quality documentation and are heat-treated. The WS, WSWH and WSBH screws have either a zinc electroplated finish or a proprietary finish. WSTS, WSTS6PT and LL screws have a zinc electroplated coating combined with a proprietary finish. LC screws have either an ASTM B695 Class 55 mechanically galvanized finish or a proprietary finish. WSF screws have a proprietary finish.

3.3.2 Wood Members: For purpose of connection design, sawn lumber members must have SG_{NDS} as indicated in the tables in this report. SG_{NDS} for solid-sawn lumber must be determined in accordance with Table 12.3.3A of the ANSI/AWC *National Design Specification® for Wood Construction* (NDS) (Table 11.3.3A of NDS-12 for the 2012 IBC). Unless otherwise noted, sawn lumber members must have a moisture content of 19 percent or less.

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

Structural composite lumber (SCL) must be one of the following types of structural composite lumber and must be addressed in an ICC-ES evaluation report: LVL grade 1.3E or higher, LSL grade 1.35E or better, or PSL grade 1.8E or higher. The SCL must have the SG_{eq} noted in Tables 2, 3, 4 and 5, as applicable. The moisture content at the time of screw installation and in service must be in accordance with the applicable ICC-ES evaluation report on the SCL.

Use of the screws in engineered wood products 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, t_m, must be equal to or greater than the screw length less the thickness of the side member.

3.3.3 Steel Members: Steel side plates must be designed in accordance with AISI S100 or AISC 360, as applicable. Steel side members with design thicknesses of 0.046 inch, 0.058 inch, 0.074 inch, 0.136 inch and 0.180 inch (1.2 mm, 1.5 mm, 1.9 mm, 3.5 mm and 4.6 mm) must have a minimum tensile strength, F_u, of 45 ksi (310.1 MPa). Steel side members with a design thickness of 0.250 inch (6.4 mm) must have F_u of 58 ksi (400 MPa). The hole in the steel side member for the WS screws must be predrilled or pre-punched and must have a standard round hole diameter no greater than 0.281 inch (7.14 mm). The hole in the steel side member for the LL and LC screws must be predrilled or pre-punched, and must have a standard round hole diameter no greater than 0.180 inch (4.57 mm). Hole sizes may deviate from these limitations when the screws are specified in a current ICC-ES evaluation report for use with a specific steel connector.

4.0 DESIGN AND INSTALLATION

4.1 Design - General:

Allowable screw shear and tension strengths (ASD) and design screw shear and tension strengths (LRFD), as well as the minimum specified bending yield strengths are shown in Table 1.

4.2 WS, WSWH, WSBH, LL and LC Design:

4.2.1 General: 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 WS, WSWH, WSBH, LL and LC Structural Wood 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. The designer is responsible for determining the required spacing, edge distance and end distance for the screws, based on Table 6 of this report and the material being connected.

4.2.2 Adjustments to Reference Design Values: Reference lateral and withdrawal design values given in this report are for allowable stress design, and must be adjusted in accordance with the requirements for dowel-type fasteners in Section 11.3 of the NDS (Section 10.3 of the NDS for the 2012 IBC), to determine the

allowable strengths for use in ASD and design strengths for use in LRFD. Reference head pull-through design values must be adjusted in accordance with Section 11.3 of the NDS (Section 10.3 of the NDS for the 2012 IBC). When the capacity of a connection is controlled by fastener or side plate steel strength, rather than wood strength, the allowable connection strength must not be increased by the adjustment factors specified in the NDS.

4.2.3 Connections with Multiple Screws: See Sections 11.1.2, 11.2.2 and 12.6 of the NDS (Sections 10.1.2, 10.2.2 and 11.6 of the NDS for the 2012 IBC) regarding multiple fastener connections and consideration of local stresses in the wood member.

4.2.4 Combined Loading: Where the screws are subjected to combined lateral and withdrawal loads, connections must be designed in accordance with Section 12.4.1 of the NDS (Section 11.4.1 of the NDS for the 2012 IBC).

4.2.5 Reference Lateral Design Values: Reference lateral (Z) design values for screws in single shear wood-to-wood connections loaded perpendicular and parallel to grain, are as shown in Table 3. Reference lateral (Z) design values for WS, LL and LC screws for single shear steel-to-wood connections loaded perpendicular and parallel to grain, are as shown in Table 4.

4.2.6 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 member, and minimum required embedded thread lengths for the screws are shown in Table 2. Reference pull-through (W_H) design values for the screws are provided in Table 5 for installation with $90° \geq \alpha \geq 30°$. Lesser angles of installation are outside the scope of this report.

4.3 WSTS and WSTS6PT Design: The design information for connections of trusses to wood top plates using the WSTS and WSTS6PT screws is given in Table 7 and shown in Figures 4 and 5, including all notes.

4.4 WSF Design: The design information for the WSF screw is included in ESR-2190.

4.5 Installation:

WS and WSF screws must be installed using a low-speed clutch drill with a $^3/_8$-inch hex-head driver. LC screws must be installed using a low-speed clutch drill with a $^1/_4$-inch hex-head driver. WSWH, WSBH, WSTS and WSTS6PT screws must be installed using a low-speed clutch drill with a T30 bit. LL screws must be installed using a low-speed clutch drill with a T20 bit. The screws must be installed perpendicular to the plane of the steel or wood side member. For WS, WSWH, LL, LC and WSTS6PT screws, the underside of the head must bear on the surface of the steel or wood side member. For WSBH and WSTS screws, the top of head must be flush with the surface of the wood member. Screws must not be overdriven and should be installed using the minimum amount of torque necessary to drive the screw. Installation may be performed without predrilling wood members.

Edge distances, end distances and spacing of the screws must be sufficient to prevent splitting of the wood, or as required by Table 6 of this report (for the WS, WSWH, WSBH, LL and LC screws), whichever is more restrictive.

WSTS and WSTS6PT screws must be installed in accordance with footnotes in Table 7 and Figures 4 and 5 of this report.

WSF screws must be installed with MiTek's PW3 device in accordance with the requirements stated in ESR-2190.

5.0 CONDITIONS OF USE:

The wood screws 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 Screws must be installed in accordance with this report and the manufacturer's installation instructions. In the event of a conflict between this report and the manufacturer's published installation instructions, the more restrictive requirements govern.

5.2 Design loads for the WS, WSWH, WSBH, LL, LC, WSTS and WSTS6PT screws must not exceed the available strengths (allowable strengths for ASD and design strengths for LRFD) described in this report.

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 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 Dowel-type Threaded Fasteners Used in Wood (AC233), dated June 2023 (editorially revised June 2024).

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-2761) 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 designation “WSx, WSWHx, WSBHx, WSTSx, WSTS6PT, LLx, LCx or WSFx” where “x” designates the fastener size, and each screw head is marked with the letters “MiTek” or “MTK” and a number designating the screw length, as shown in Table 1.

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

MITEK® INC.
16023 SWINGLEY RIDGE ROAD
CHESTERFIELD, MISSOURI 63017
(800) 328-5934
www.mitek-us.com

TABLE 1—FASTENER SPECIFICATIONS AND SCREW STRENGTHS

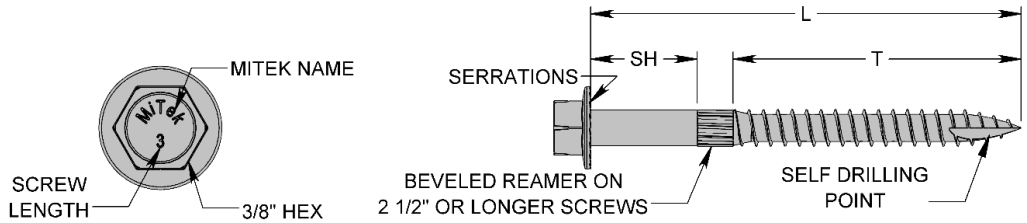
FASTENER DESIGNATION	HEAD MARKING	SCREW DIMENSIONS[1] (inches)							NOMINAL SPECIFIED BENDING YIELD STRENGTH[2], $F_{yb,nom}$ (psi)	ALLOWABLE SCREW STRENGTH		DESIGN SCREW STRENGTH	
		Screw Length (L)	Shank (L_{SH})	Thread Length[1] (L_{thread})	Major Diameter, D	Shank Diameter, D_s	Minor (Root) Diameter, D_r	Head Diameter, D_H		Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
WS Hex Head Screws													
WS15	MiTek 15	$1^1/_2$	$^1/_4$	$1^1/_4$	0.254	0.241	0.185	0.540	180,000	1,370	855	2,055	1,280
WS2	MiTek 2	2	$^1/_4$	$1^3/_4$									
WS25	MiTek 25	$2^1/_2$	$^1/_4$	2									
WS3	MiTek 3	3	$^3/_4$	2									
WS35	MiTek 35	$3^1/_2$	$^3/_4$	$2^1/_2$									
WS45	MiTek 45	$4^1/_2$	$1^1/_4$	3									
WS5	MiTek 5	5	$1^3/_4$	3									
WS6	MiTek 6	6	$1^3/_4$	4									
WS8	MiTek 8	8	$4^3/_4$	3									
WSWH Washer Head Screws													
WSWH278	MiTek 278	$2^7/_8$	$^5/_8$	2	0.280	0.241	0.185	0.750	180,000	1,370	855	2,055	1,280
WSWH338	MiTek 338	$3^3/_8$	$1^1/_8$	2									
WSWH358	MiTek 358	$3^5/_8$	$1^3/_8$	2									
WSWH45	MiTek 45	$4^1/_2$	$2^1/_4$	2									
WSWH5	MiTek 5	5	$2^3/_4$	2									
WSWH6	MiTek 6	6	$3^3/_4$	2									
WSWH638	MiTek 638	$6^3/_8$	$4^1/_8$	2									
WSWH634	MiTek 634	$6^3/_4$	$4^1/_2$	2									
WSWH8	MiTek 8	8	$5^3/_4$	2									
WSBH Bugle Head Screws													
WSBH25	MiTek 25	$2^1/_2$	$^1/_4$	2	0.280	0.241	0.185	0.459	180,000	1,370	855	2,055	1,280
WSBH4	MiTek 4	4	$1^3/_4$	2									
WSBH6	MiTek 6	6	$3^3/_4$	2									
WSBH8	MiTek 8	8	$5^3/_4$	2									
WSBH10	MiTek 10	10	$7^3/_4$	2									
LL Screws													
LL915	MTK 1.5	$1^3/_8$	$^1/_4$	$1^1/_8$	0.170	See Note 3	0.109	0.365	170,000	450	316	675	475
LL930	MTK 3	$2^7/_8$	$1^3/_8$	$1^1/_2$	0.170	See Note 3	0.109						
LC Screws													
LC915	MTK 1.5	$1^3/_8$	$^1/_4$	$1^1/_8$	0.170	See Note 3	0.109	0.365	170,000	450	316	675	475
LC930	MTK 3	$2^7/_8$	$1^3/_8$	$1^1/_2$	0.170	See Note 3	0.109						
WSTS and WSTS6PT Truss/Stud Screws													
WSTS45	MTK45	$4^1/_2$	—	4.3	0.222	—	0.152	0.330	150,000	876	547	1,315	820
WSTS6	MTK6	6	—	5.8		—							
WSTS6PT	MTK6	6	3.5	2.5	0.269	0.192	0.158	0.470	130,000	876	626	1,315	940
WSF Floor-to-Floor Screw													
WSF08	MiTek F08	8	$1^3/_4$	6	0.314	0.250	0.232	0.540	190,000	1,400	1,665	2,100	2,500
WSF17	MiTek F17	17	$10^3/_4$	6									
WSF19	MiTek F19	19	$12^3/_4$	6									
WSF21	MiTek F21	21	$14^3/_4$	6									
WSF25	MiTek F25	25	$18^3/_4$	6									
WSF29	MiTek F29	29	$22^3/_4$	6									
WSF33	MiTek F33	33	$26^3/_4$	6									

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N; 1 psi = 6.89 kPa

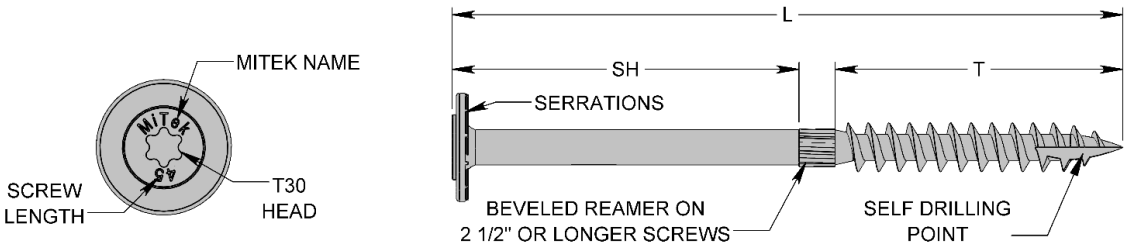
[1]Refer to Figures 1A and 1B for depictions of the screw dimensions. The L_{thread} dimension represents the threaded portion of the shank, including the tip. WS, WSWH, WSBH, and WSF screws $2^1/_2$ inches or longer have a ¼-inch long reamer knurl.

[2]Bending yield strength is determined in accordance with ASTM F1575 using D_r. The bending yield strength provided in the table is for informational purposes only, and is not intended for use in calculating reference lateral design values in accordance with NDS. Reference lateral design values for the WS, WSWH, WSBH, LL and LC screws are as given in Tables 3 & 4 of this report. Design values for the WSTS and WSTS6PT screws are given in Table 7 of this report. Allowable load values for the PW3/WSF assembly are included in ESR-2190.

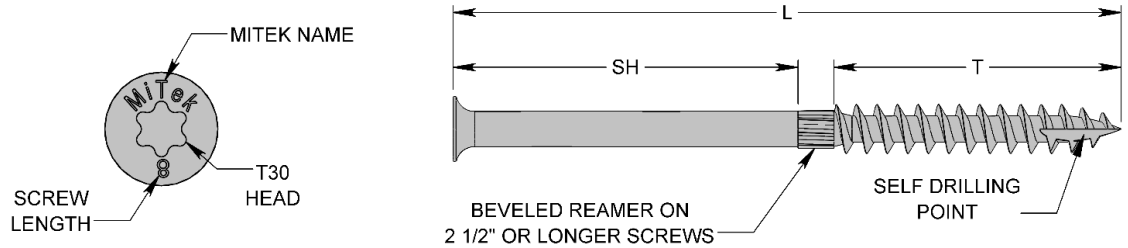
[3]The LL915 and LC915 screws are almost fully threaded, with an unthreaded shank diameter of 0.170 inch (4.3 mm). The LL930 and LC930 screws are partially threaded with a stepped smooth shank having diameters of 0.170 inch (4.3 mm) and 0.145 inch (3.7 mm).



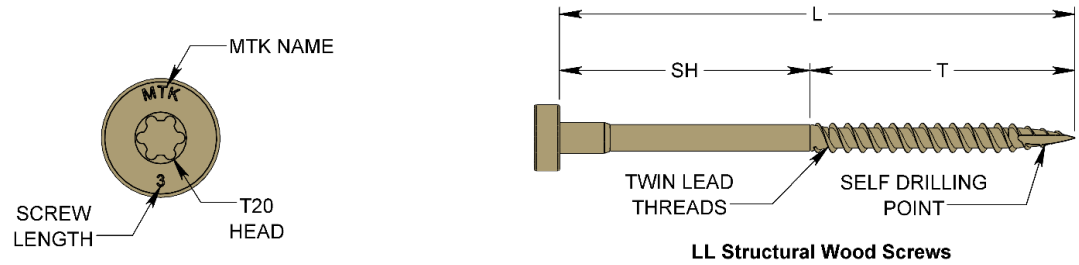
WS Hex Head Structural Wood Screws



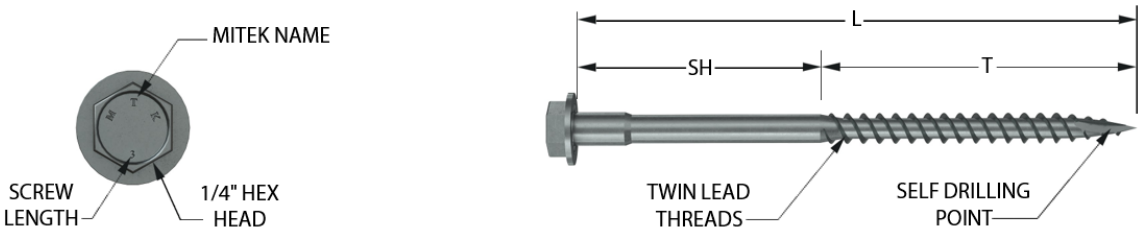
WSWH Washer Head Structural Wood Screws



WSBH Bugle Head Structural Wood Screws

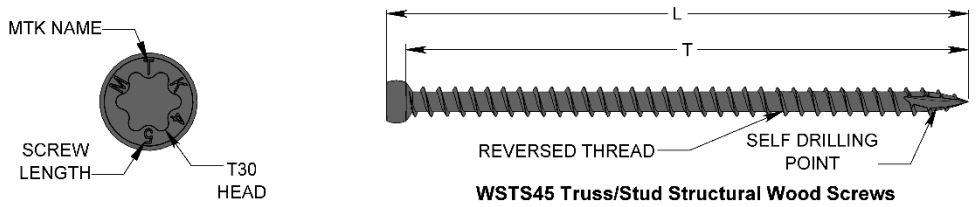


LL Structural Wood Screws

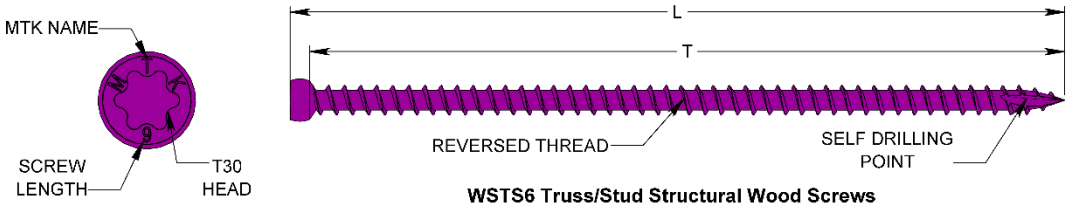


LC Structural Wood Screws

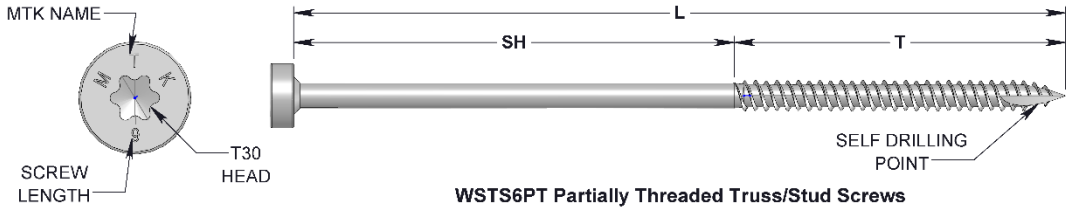
FIGURE 1A—WS, WSWH, WSBH, LL AND LC STRUCTURAL WOOD SCREWS



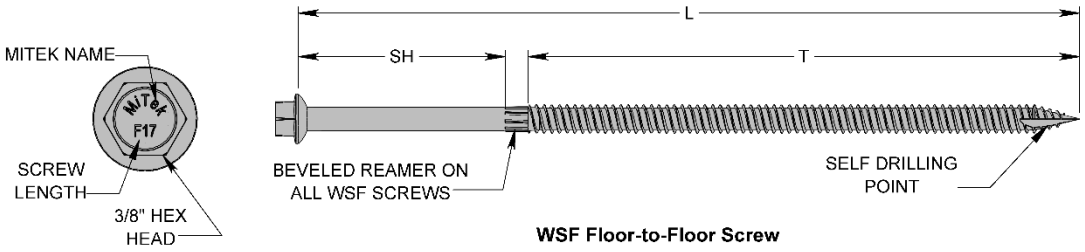
WSTS45 Truss/Stud Structural Wood Screws



WSTS6 Truss/Stud Structural Wood Screws



WSTS6PT Partially Threaded Truss/Stud Screws



WSF Floor-to-Floor Screw

FIGURE 1B—WSTS, WSTS6PT AND WSF WOOD SCREWS

TABLE 2—REFERENCE WITHDRAWAL DESIGN VALUES (*W*) FOR WS, WSWH, WSBH, LL AND LC SCREWS INSTALLED PERPENDICULAR TO THE FACE OF THE MEMBER [1]

FASTENER TYPE [2]	$L_{emb,w}$ (inches)	REFERENCE WITHDRAWAL DESIGN VALUE, *W* (lbf/inch)		
		$0.42 \le SG_{NDS} < 0.50$	$SG_{NDS} \ge 0.50$ or PSL & LSL[3]	LVL[3]
WS Hex Head Screws	$1^1/_4$	103	164	157
	$1^3/_4$	117	160	154
	2	141	199	191
	$2^1/_2$	154	208	200
	3	163	214	212
	4	163	214	212
WSWH Washer Head Screws	2	141	199	191
WSBH Bugle Head Screws	2	141	199	191
LL and LC Screws	$1^1/_8$	110	120	—
	$1^1/_2$	150	150	—

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N

[1]Tabulated reference withdrawal design values (*W*) are in pounds per inch of thread penetration (including the screw tip) into the side grain of the main member.
[2]See Table 1 for complete fastener designations.
[3]Tabulated values are applicable to screws installed in the broad face of LVL, LSL and PSL which must be as described in Section 3.3.2. SG_{eq} must be a minimum of 0.50, as indicated in the ICC-ES evaluation report on the SCL.

TABLE 3—REFERENCE LATERAL DESIGN VALUES (*Z*) FOR SINGLE SHEAR WOOD-TO-WOOD CONNECTIONS WITH WS, WSWH, WSBH, LL AND LC SCREWS[1,2]

FASTENER TYPE [3]	$L_{emb,l}$ [4] (inches)	$t_{s,w}$ (inches)	REFERENCE LATERAL DESIGN VALUE (*Z*) FOR SELECTED *SG* VALUES (lbf):		
			$0.42 \le SG_{NDS} < 0.50$	$SG_{NDS} \ge 0.50$ or PSL & LSL[6]	LVL[6]
WS Hex Head Screws	$1^1/_2$	See Note 5	227	268	—
	2		311	398	319
	3		364	415	358
WSWH Washer Head Screws	$1^3/_8$	See Note 5	227	268	—
	$1^7/_8$		311	398	319
	3		364	415	358
WSBH Bugle Head Screws	$2^1/_2$	See Note 5	246	315	252
	$4^1/_2$		288	328	283
LL930 and LC930 Screws	$1^1/_2$	$1^1/_2$	100	105[7]	—

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N

[1]Tabulated reference lateral design values (*Z*) apply to loading both parallel- and perpendicular-to-grain, and are based on installations in which the screw is driven into the side grain of the wood main members, with the screw axis perpendicular to the wood fibers.
[2]Tabulated values apply to connections where both members are of the same type of wood (sawn lumber, LVL, etc.) and of the same SG_{NDS} or SG_{eq}, as applicable.
[3]See Table 1 for complete fastener designations.
[4]Tabulated values may be reduced by 1/4" for LVL side members.
[5]Side member thickness is $1^1/_2$" for sawn lumber, PSL and LSL, and $1^3/_4$" for LVL.
[6]Tabulated values are applicable to screws installed in the broad face of LVL, LSL, or PSL, which must be as described in Section 3.3.2. SG_{eq} must be a minimum of 0.50 for LVL and PSL and a minimum of 0.55 for LSL, as indicated in the ICC-ES evaluation report on the SCL.
[7]Tabulated values apply to sawn lumber installations only.

TABLE 4—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR STEEL-TO-WOOD CONNECTIONS WITH WS, LL AND LC SCREWS (lbf)[1,2,3,4]

FASTENER DESIGNATION	STEEL SIDE MEMBER DESIGN THICKNESS[5,6] $t_{s,s}$ (inch)					
	0.046 (No. 18 gage)	0.058 (No. 16 Gage)	0.074 (No. 14 gage)	0.136 (No. 10 gage)	0.180 (No. 7 gage)	0.250 (No. 3 gage)
Installation in a Wood Main Member with SG_{NDS} Between 0.42 and 0.50						
WS15	—	—	188	211	190	217
WS2	—	—	215	244	249	248
WS25	—	—	256	292	286	294
WS3	—	—	297	340	322	365
WS35	—	—	338	380	356	370
WS45	—	—	421	460	425	379
WS5	—	—	421	460	425	379
WS6	—	—	421	460	425	379
WS8	—	—	421	460	425	379
LL915	105	105	—	—	—	—
LL930	140	140	—	—	—	—
LC915	105	105	—	—	—	—
LC930	140	140	—	—	—	—
Installation in a Wood Main Member with an SG_{NDS} of 0.50 or Greater or Structural Composite Lumber[7]						
WS15	—	—	230	261	259	266
WS2	—	—	306	307	289	316
WS25	—	—	362	352	338	369
WS3	—	—	418	396	387	457
WS35	—	—	451	460	454	481
WS45	—	—	516	588	589	531
WS5	—	—	516	588	589	531
WS6	—	—	516	588	589	531
WS8	—	—	516	588	589	531
LL915	105[8]	130[8]	—	—	—	—
LL930	165[8]	165[8]	—	—	—	—
LC915	105[8]	130[8]	—	—	—	—
LC930	165[8]	165[8]	—	—	—	—

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N

[1]The steel side member must meet the requirements of Section 3.3.3 of this report.
[2]The wood main member must meet the requirements of Section 3.3.2 of this report.
[3]Tabulated reference lateral design values (Z) apply to loading both parallel- and perpendicular-to-grain, and are based on installations in which the screw is installed into the side grain of the wood main member, with the screw axis perpendicular to the wood fibers.
[4]Tabulated reference lateral design values (Z) must be multiplied by all adjustment factors, as applicable to dowel-type fasteners, in accordance with the NDS.
[5]The uncoated minimum steel thickness of the cold-formed steel product delivered to the job site must not be less than 95 percent of tabulated design thickness, $t_{s,s.}$
[6]Minimum fastener penetration must be equal to the screw length less the thickness of the steel side plate.
[7]Structural composite lumber must be LVL, LSL, or PSL, as described in Section 3.3.2. SG_{eq} for laterally-loaded, dowel-type fasteners, installed in the broad face of the engineered wood member, must be a minimum of 0.50 for LVL and PSL and a minimum of 0.55 for LSL, as indicated in an ICC-ES evaluation report.
[8]Tabulated values apply to installations into sawn-lumber, glulam or the face of CLT panels only.

TABLE 5—REFERENCE PULL-THROUGH DESIGN VALUES (W_H) FOR WS, WSWH, WSBH, LL AND LC SCREWS

FASTENER TYPE [1]	$t_{s,w}$ (inches)	REFERENCE PULL-THROUGH DESIGN VALUE (W_H) (lbf)		
		$0.42 \le SG_{NDS} < 0.50$	$SG_{NDS} \ge 0.50$	LVL[3]
WS3	See Note 2	340	357	—
WS35 through WS8 Hex Head Screws		340	357	479
WSWH278		474	535	—
WSWH338 through WSWH8 Washer Head Screws		474	535	619
WSBH25		208	282	—
WSBH4 through WSBH10 Bugle Head Screws		208	282	339
LL930 and LC930 Screws		130	150	—

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N

[1]See Table 1 for complete fastener designations.
[2]Side member thickness is $1^1/_2$" for solid-sawn lumber and $1^3/_4$" for LVL.
[3]Tabulated values are applicable to screws installed in the broad face of LVL which must be as described in Section 3.3.2. SG_{eq} must be a minimum of 0.50, as indicated in the ICC-ES evaluation report on the LVL.

TABLE 6—CONNECTION GEOMETRY REQUIREMENTS FOR WS, WSWH, WSBH, LL AND LC SCREWS INSTALLED PERPENDICULAR TO THE FACE OF WOOD MEMBERS [1,2,3]

CONDITION[4]		MINIMUM DISTANCE OR SPACING	
		Self-drilled	
		SG_{NDS} < 0.50	SG_{NDS} ≥ 0.50
End distance (see Figure 2)	Loading toward end, $a_{end,1}$	10D for WS / WSWH / WSBH screws [5] 11D for LL and LC screws [5]	20D
	Loading perpendicular to grain or away from end, $a_{end,2}$	10D	15D
	Axial loading, $a_{end,2}$	10D	10D
Edge distance (see Figure 2)	Loading toward edge, $a_{edge,1}$	10D	12D
	Loading parallel to grain or away from edge, $a_{edge,2}$	3D for WS / WSWH / WSBH screws [5] 3D for LL and LC screws [5]	7D
	Axial Loading, $a_{edge,2}$	4D	4D
Spacing between fasteners, parallel to grain (see Figure 3)	Loading parallel to grain, a_1	15D	15D
	Loading perpendicular to grain, a_1	10D	10D
	Axial loading, a_1	7D	7D
Spacing between fasteners, perpendicular to grain (see Figure 3)	Loading parallel to grain, a_2	5D	7D
	Loading perpendicular to grain, a_2	5D	7D
	Axial loading, a_2	4D	4D
	Inclined fastener, a_2		

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

[1]Edge distances, end distances and screw spacing must be sufficient to prevent splitting of the wood, or as required by this table, whichever is the more restrictive.

[2]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.

[3]For WS, WSWH, and WSBH outside thread (major) diameter (D) values, use 0.254, 0.280, and 0.280 inch respectively. For LL and LC outside thread (major) diameter (D) values, use 0.170 inch.

[4]For CLT products, parallel and perpendicular-to-grain descriptions apply to the grain orientation at the shear plane for lateral loading and to the face grain orientation for withdrawal loading.

[5]Dimensions are based on testing.

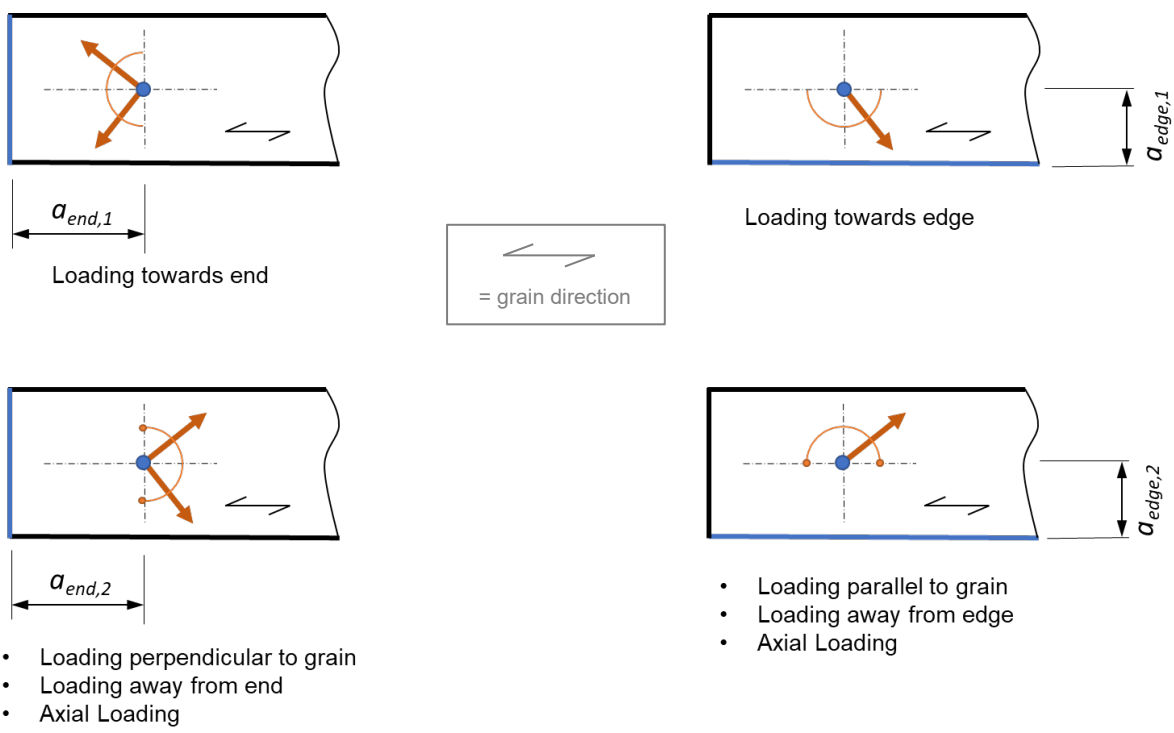


FIGURE 2—END AND EDGE DISTANCE DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN

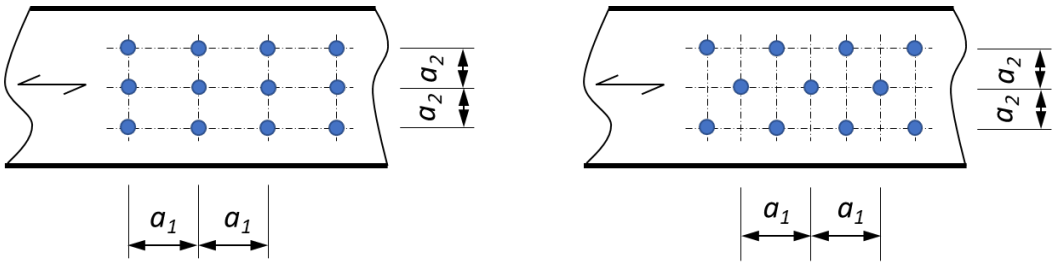


FIGURE 3—SPACING DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN

TABLE 7—WSTS6 TRUSS/STUD SCREW AND WSTS6PT PARTIALLY THREADED TRUSS/STUD SCREW ALLOWABLE LOADS BY INSTALLATION TYPE[1, 2]

FASTENER DESIGNATION	INSTALLATION TYPE	APPLICABLE FIGURE	LOAD DIRECTION[5, 6]	ALLOWABLE LOADS (lbf)					
				DF		SP		SPF	
				100%	160%[3]	100%	160%[3]	100%	160%[3]
WSTS6	Connection of Double Top Plates to Roof Truss[7]	4	Uplift[8]	447	715	559	876[4]	358	573
			F2[9,10]	339	543	393	547[4]	289	463
WSTS6	Connection of Double Top Plates to Gable Truss[11]	5	Uplift[8]	530	847	554	876[4]	414	662
			F1[12,13]	362	547[4]	345	547[4]	324	519
			F2[14,15]	210	336	233	373	147	235
WSTS6PT	Connection of Double Top Plates to Roof Truss[7]	4	Uplift[8]	299	479	309	495	211	338
			F1[13]	289	462	289	462	251	401
			F2[9,10]	375	600	375	600	365	584
WSTS6PT	Connection of Double Top Plates to Gable Truss[11]	5	Uplift[8]	299	479	300	480	211	338
			F1[12,13]	319	511	319	511	310	496
			F2[14,15]	190	305	190	305	190	305

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N

[1]Tabulated values are for top plates and truss chords that are of the same SG_{NDS}. For conditions where this is not the case, the design values for the members with the lower SG_{NDS} apply. Wood members must be solid-sawn lumber having a minimum SG_{NDS} of 0.50 for DF, 0.55 for SP and 0.42 for SPF.

[2]Use must be limited to dry conditions, such that C_M = 1.0.

[3]Allowable loads have been increased 60% for wind or seismic loads; no further increase is permitted.

[4]Allowable loads are limited by fastener strength.

[5]See Figures 4 and 5 for depictions of each installation type and for load orientations.

[6]Designer must determine the load path needed to transfer these loads to the foundation and must confirm the adequacy of the components and connections along the load path.

[7]Only one fastener is used at each truss. The fastener must be installed perpendicular to the face of the plates and truss chord. The fastener must be installed through the center of the minimum 2-by-4 (1.5 x 3.5 inch) top plates and through the minimum 2-by-4 truss chord.

[8]Since the trusses do not align with the studs, the top plates must be checked for uplift resistance and the connection of the plates to the studs must also be checked for uplift resistance in accordance with the NDS.

[9]Lateral loads perpendicular to the wall are assumed to be transferred from the wall into the truss. The truss must be designed to transfer this load to the roof diaphragm or other lateral force resisting system.

[10]In roof truss applications, in-plane loads from the roof diaphragm are to be transferred into the wall by using blocking, bracing or other methods. WSTS and WSTS6PT screws are not to be used to prevent rolling of the truss bottom chord.

[11]Multiple fasteners may be used for the truss connections. Minimum required spacing is $2^1/_4$ inches (57 mm). The fasteners must be installed perpendicular to the face of the plates and truss chord. The fastener must be installed through the minimum 2-by-4 top plate and through the center of the minimum 2-by-4 truss chord. See Figure 5 for installation details.

[12]Lateral load is assumed to be transferred from the gable truss to the wall. The wall must be designed to resist this force.

[13]Truss bottom chords must be blocked, braced or otherwise restrained against lateral movement.

[14]Truss must be designed to resist out of plane load between bracing points.

[15]The minimum spacing of the fasteners must be designed by a registered design professional taking into account the applied loads, the single fastener connection capacities and the capacities of the connected wood members.

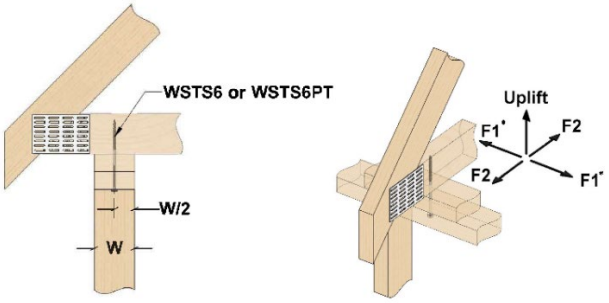


FIGURE 4—CONNECTION OF DOUBLE TOP PLATES TO ROOF TRUSS WITH WSTS OR WSTS6PT SCREWS
***F1 loading applicable to WSTS6PT only. See Table 7.**

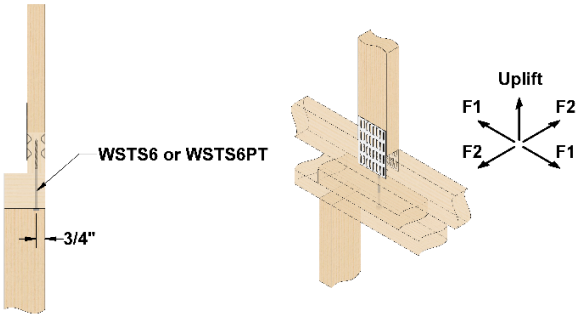


FIGURE 5—CONNECTION OF DOUBLE TOP PLATES TO GABLE TRUSS WITH WSTS OR WSTS6PT SCREWS

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

MITEK® INC.

EVALUATION SUBJECT:

MITEK WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF STRUCTURAL WOOD SCREWS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the MiTek WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF Structural Wood Screws, described in ICC-ES evaluation report ESR-2761, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The MiTek Structural Wood Screws, described in Sections 2.0 through 7.0 of the evaluation report ESR-2761, comply with the LABC Chapter 23 and the LARC and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The MiTek Structural Wood Screws described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-2761.
- The design, installation, conditions of use and identification of the MiTek Structural Wood Screws are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-2761.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16, 17 and 23, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report, reissued October 2023 and revised September 2025.

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DIVISION: 06 00 00—WOOD, PLASTICS, AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

MITEK® INC.

EVALUATION SUBJECT:

MITEK WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF STRUCTURAL WOOD SCREWS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that MiTek WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF Structural Wood Screws, described in ICC-ES evaluation report ESR-2761, have also been evaluated for compliance with the code*(s)* noted below.

Applicable code edition*(s)*:

- *2025 and 2022 California Building Code* (CBC)

For evaluation of applicable Chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- *2025 and 2022 California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The MiTek WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF Structural Wood Screws, described in Sections 2.0 through 7.0 of the evaluation report ESR-2761, comply with CBC Chapter 23, provided the design and installation are in accordance with the 2024 and 2021 *International Building Code®* (IBC) provisions, as applicable, noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 23, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The MiTek WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF Structural Wood Screws, described in Sections 2.0 through 7.0 of the evaluation report ESR-2761, comply with CRC Chapter 3, provided the design and installation are in accordance with the 2024 and 2021 *International Residential Code®* (IRC) provisions, as applicable, noted in the evaluation report and the additional requirements of CRC Chapter 3, as applicable.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

MITEK® INC.

EVALUATION SUBJECT:

MITEK WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF STRUCTURAL WOOD SCREWS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that MiTek WS, WSWH, WSBH, WSTS, WSTS6PT, LL, LC and WSF Structural Wood Screws, described in ICC-ES evaluation report ESR-2761, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The MiTek Structural Wood Screws, described in Sections 2.0 through 7.0 of the ICC-ES evaluation report ESR-2761, comply with the *Florida Building Code—Building* and *Florida Building Code—Residential*. The design requirements must be determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2761 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of the MiTek Structural Wood Screws has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and *Florida Building Code—Residential* with the following condition:

a) For connections subject to uplift, the connection must be designed for no less than 700 pounds (3114 N).

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, reissued October 2023 and revised September 2025.

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