ICC-ES Evaluation Report

ESR-5302

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DIVISION: 06 00 00—WOOD, PLASTICS, AND COMPOSITES **Section: 06 05 23—Wood, Plastic, and Composite Fastenings**	**REPORT HOLDER:** **WKRĘT-MET SP. Z O. O.**	**EVALUATION SUBJECT:** **KLIMAS® SELF-TAPPING WOOD SCREWS**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Property evaluated:

- Structural

2.0 USES

Klimas® self-tapping wood screws are used in wood-to-wood and steel-to-wood connections that are designed in accordance with the IBC. For structures regulated under the IRC, the screws may be used when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 Notation and Symbols:

a	=	Connection geometry parameter (See Table 8 and Figures 13 and 14.)
D	=	Outside thread diameter
D_H	=	Diameter of fastener head or integral washer
D_{nom}	=	Fastener size designation
D_r	=	Minor thread (root) diameter
D_s	=	Unthreaded shank diameter
F_u	=	Minimum specified tensile strength of steel material.
$F_{yb,spec}$	=	Minimum specified bending yield strength, determined in accordance with ASTM F1575 using D_r.
L	=	Fastener length measured as shown in Figures 1 through 11.
$L_{emb,w}$	=	Minimum required embedded thread length in holding member, not including tip, applicable to tabulated withdrawal design values
L_{thread}	=	Length of thread including tip, unless otherwise noted. See Figures 1 through 11.

L_{tip}	=	Length of tip
N_a	=	Allowable tension strength of the fastener for use in ASD
N_u	=	Design tension strength of the fastener, for use in LRFD
SG_{eq}	=	Equivalent specific gravity for structural composite lumber, as reported by ICC-ES
SG_{NDS}	=	Assigned specific gravity (See Section 3.4.)
$t_{s,w}$	=	Thickness of wood side member
$t_{s,s}$	=	Thickness of steel side member
W	=	Reference unit withdrawal design value for fasteners installed perpendicular to face of the wood
W_H	=	Reference head pull-through design value
Z	=	Reference lateral design value
$Z_{\parallel}$	=	Reference lateral design value for fasteners loaded parallel to the wood grain
$Z_{\perp}$	=	Reference lateral design value for fasteners loaded perpendicular to the wood grain

3.2 Klimas Screws:

Klimas self-tapping wood screws are dowel-type threaded fasteners, available in many designs. The screws are formed from carbon steel and are heat treated and coated with zinc or other corrosion resistant coatings.

3.2.1 Partially-threaded Screws: Klimas partially-threaded self-tapping wood screws have tapered tips with a double-helix thread and a cutting feature near the tip. The screws typically have a reamer knurl between the smooth shank and the threaded portion of the screw. See Table 1 for head styles, dimensions and coating information. See Figures 1 through 4 for images of the partially-threaded screw types. WKCS screws are compatible with PWKCS countersunk washers described in Section 3.3.

3.2.2 Fully-threaded Screws: Klimas fully-threaded self-tapping wood screws have tapered tips with a single thread and a cutting feature near the tip or a self-drilling tip. See Table 2 for head styles, tip styles, dimensions and coating information. See Figures 5 through 9 for images of the fully-threaded screw types.

3.2.3 Double-thread Screws: Klimas double-thread screws have two threaded portions - one under the screw head and one at the tip end. Between the smooth portion and the threads at the tip end there is a reamer knurl. The tip is tapered with a cutting feature near the tip. See Table 3 for head styles, dimensions and coating information. See Figures 10 and 11 for images of the double-thread screw types.

3.3 PWKCS Steel Washers:

PWKCS countersunk washers are available from the report holder for use with WKCS screws used in wood-to-wood connections. The PWKCS washers are formed from carbon steel and have zinc plating coating. See Figure 12 for washer dimensions and a depiction of the washer.

3.4 Wood Members:

Wood members may be sawn lumber or structural glued laminated timber (glulam) and laminated veneer lumber (LVL), which is a type of structural composite lumber (SCL). The screws may also be used in the face of cross-laminated timber (CLT) panels. Use of the screws in engineered wood products (EWP) other than those addressed above is outside the scope of this report.

For the purpose of connection design, sawn lumber, glulam and CLT members must have SG_{NDS} as indicated in the tables in this report and the moisture content must be less than or equal to 19 percent at the time of screw installation and while in service. SG_{NDS} for sawn lumber is the assigned specific gravity for the applicable grade mark, which must be determined in accordance with ANSI/AWC National Design Specification for Wood Construction® (NDS) Table 12.3.3A or the latest NDS Supplement. SG_{NDS} for glulam members is the Specific Gravity for Fastener Design addressed in Tables 5A through 5D of the NDS Supplement. When designing connections with screws installed into CLT panels, all of the laminations must have a minimum SG_{NDS} as indicated in the tables in this report.

For the purpose of connection design, LVL must be addressed in an ICC-ES evaluation report and must have a minimum equivalent specific gravity, SG_{eq}, given in the applicable ICC-ES evaluation report, of 0.50. The moisture content at the time of installation and in service must be in accordance with the applicable ICC-ES evaluation report on the LVL.

For wood-to-wood connections, the tabulated side member thickness must be as indicated in this report. The thickness of the wood main member must be sufficient to ensure that the tip of the screw is fully embedded in the wood.

3.5 Steel Side Plates:

Steel side plates must be designed in accordance with AISI S100 or AISC 360, as applicable. The steel must have a minimum tensile strength, F_u, equal to 58 ksi (400 MPa) and design thickness (base-metal thickness exclusive of any coating) as indicated in Section 4.1.4. Holes in the steel side member for the WKLC, WKCR and WKCH screws must be predrilled or prepunched, and must have a standard hole diameter equal to the nominal screw diameter, D_{nom}, with a tolerance of $+^1/_{16}$-inch and -0-inch (+1.6 mm and -0 mm).

4.0 DESIGN AND INSTALLATION

4.1 Engineered Design:

4.1.1 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 Klimas 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 the characteristics of the connected building materials.

4.1.2 Screw Strength: Available screw tension and minimum specified bending yield strength for the screws are shown in Table 4.

4.1.3 Reference Withdrawal Design Values (W) and Reference Head Pull-through Design Values (W_H): Reference withdrawal (W) design values in pounds per inch of thread penetration, for screws installed perpendicular to the face of the wood member are given in Table 5. Reference head pull-through (W_H) design values for screws intended for use in wood-to-wood connections are given in Table 6.

4.1.4 Reference Lateral Design Values (Z) Determined in Accordance with the NDS: Reference lateral design values (Z) for WKCS and WKCP screws used in wood-to-wood connections and for WKLC, WKCR and WKCH screws used in steel-to-wood connection configurations are given in Table 7, based on calculations in accordance with the NDS. For other connection configurations, the reference lateral design values (Z) for WKCS and WKCP screws used in wood-to-wood connections and for WKLC, WKCR and WKCH screws used in steel-to-wood connections may be designed in accordance with the NDS, subject to the following conditions:

1. $F_{yb,spec}$ from Table 4 must be used for design.
2. D_r must be used where 'D' is referenced in Tables 12.3.1A, 12.3.1B and 12.3.3 of the NDS. For partially-threaded screws, when determining if Footnote 1 to Table 12.3.1B applies, D_s must be considered the nominal diameter.
3. Wood must have SG_{NDS} of 0.50 or less.
4. Wood side member thickness must be a minimum of 1.5 inches (38 mm).
5. Steel side member thickness must be minimum 0.236-inch (6 mm) for WKLC screws and minimum 0.394-inch (10 mm) for WKCR and WKCH screws and must have minimum tensile strength of 58 ksi (400 MPa). For steel-to-wood connections, the reference lateral design value must be limited to 166 lbf (738 N) for the WKLC or 415 lbf (1,846 N) for the 8mm WKCR and WKCH screws.
6. Fastener penetration into the main member must be a minimum of 10D.
7. Dowel bearing length shall be determined in accordance with Section 12.3.5.3 of the NDS, using the tip length given in Table 1 and 2, as applicable.
8. Spacing, edge and end distance must be in accordance with Table 8, and as needed to prevent splitting of the wood.

4.1.5 Adjustments to Reference Design Values: Reference design values must be adjusted in accordance with the NDS provisions for dowel-type fasteners to determine allowable strengths for use in ASD and the design strengths for use in LRFD.

4.1.6 Connections with Multiple Screws: See Sections 11.1.2, 11.2.2 and 12.6 of the NDS regarding multiple fastener connections and consideration of local stresses in the wood members.

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

4.2 Installation:

Klimas® self-tapping wood 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, the more restrictive requirements govern. The screws must be installed at the angle required by the construction documents, with the minimum spacing, end distances, and edge distances needed to prevent splitting of the wood or as noted in Table 8, whichever is more restrictive. For the washer head screws, the underside of the integral washer must bear against the surface of the wood side member or steel plate. For the countersunk screws, the top of the screw head must be flush with the surface of the wood side member. Screws must not be overdriven. Installation may be performed without predrilling, but predrilled holes as recommended by report holder may be used to reduce the likelihood of splitting. The screws must be installed by turning with a power driver, not by driving with a hammer.

5.0 CONDITIONS OF USE:

The Klimas® self-tapping 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 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.

5.2 Connection design for lateral loading applications using inclined fasteners is outside the scope of this report.

5.3 The screws have only been evaluated for use in dry service applications. Use in wet service conditions is outside the scope of this report.

5.4 Use of the screws in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.

5.5 Use of the screws in contact with preservative-treated or fire-retardant-treated wood is outside the scope of this report.

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

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5302) 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 Klimas® self-tapping wood screws are identified by the screw designation (for example WKCS), along with the diameter and length in millimeters, as shown in Tables 1, 2 and 3. Where space allows, the screw heads are marked with 'WK' and digits indicating the fastener length in mm.

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

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WINCENTEGO WITOSA 170/176, KUŹNICA KIEDRZYŃSKA
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POLAND
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www.wkret-met.com

TABLE 1—PARTIALLY THREADED KLIMAS SCREWS

D_{nom} [in. (mm)]	D [in. (mm)]	D_s [in. (mm)]	D_r [in. (mm)]	D_H [in. (mm)]	HEAD RECESS TYPE AND SIZE	L^1 [in. (mm)]	L_{thread} [in. (mm)]	L_{tip} [in. (mm)]	AVAILABLE COATINGS
Designation: WKCS Head Style: Countersunk Tip Style: Tapered									
1/4 (6)	0.236 (6.0)	0.169 (4.3)	0.150 (3.8)	0.472 (12)	TX 30	2 to 2 3/8 (50 to 60)	1 3/16 (30)	0.236 (6)	Yellow zinc, White zinc, SQ Ceramic
						2 3/4 (70)	1 5/8 (40)		
						3 1/8 to 3 1/2 (80 to 90)	2 (50)		
						4 to 4 3/8 (100 to 110)	2 3/8 (60)		
						4 3/4 to 11 3/4 (120 to 300)	3 (75)		
5/16 (8)	0.315 (8.0)	0.228 (5.8)	0.217 (5.5)	0.551 (14)	TX 40	1 5/8 (40)	1 3/8 (35)	0.315 (8)	
						2 (50)	1 3/4 (45)		
						2 3/8 to 4 (60 to 100)	2 (50)		
						4 3/4 (120)	3 1/8 (80)		
						5 1/2 to 23 5/8 (140 to 600)	4 (100)		
3/8 (10)	0.394 (10.0)	0.276 (7.0)	0.248 (6.3)	0.709 (18)	TX 40 / TX-50	2 3/8 to 4 (60 to 100)	2 (50)	0.394 (10)	
						4 3/4 to 5 1/2 (120 to 140)	3 1/8 (80)		
						6 1/4 to 23 5/8 (160 to 600)	4 (100)		
Designation: WKCP Head Style: Washer Tip Style: Tapered									
1/4 (6)	0.236 (6.0)	0.169 (4.3)	0.150 (3.8)	0.551 (14)	TX 30	2 to 2 3/8 (50 to 60)	1 3/16 (30)	0.236 (6)	Yellow zinc, White zinc, SQ Ceramic
						2 3/4 (70)	1 5/8 (40)		
						3 1/8 to 3 1/2 (80 to 90)	2 (50)		
						4 to 4 3/8 (100 to 110)	2 3/8 (60)		
						4 3/4 to 11 3/4 (120 to 300)	3 (75)		
5/16 (8)	0.315 (8.0)	0.228 (5.8)	0.217 (5.5)	0.827 (21)	TX 40	1 5/8 (40)	1 3/8 (35)	0.315 (8)	
						2 (50)	1 3/4 (45)		
						2 3/8 to 4 (60 to 100)	2 (50)		
						4 3/4 (120)	3 1/8 (80)		
						5 1/2 to 23 5/8 (140 to 600)	4 (100)		
3/8 (10)	0.394 (10.0)	0.276 (7.0)	0.248 (6.3)	0.984 (25)	TX 40 / TX-50	2 3/8 to 4 (60 to 100)	2 (50)	0.394 (10)	
						4 3/4 to 5 1/2 (120 to 140)	3 1/8 (80)		
						6 1/4 to 23 5/8 (160 to 600)	4 (100)		
Designation: WKCR Head Style: Round Tip Style: Tapered									
1/4 (6)	0.236 (6.0)	0.169 (4.3)	0.150 (3.8)	0.394 (10)	TX 30	2 to 2 3/8 (50 to 60)	1 3/16 (30)	0.236 (6)	Yellow zinc, White zinc, SQ Ceramic
						2 3/4 (70)	1 5/8 (40)		
						3 1/8 to 3 1/2 (80 to 90)	2 (50)		
						4 to 4 3/8 (100 to 110)	2 3/8 (60)		
						4 3/4 to 11 3/4 (120 to 300)	3 (75)		
5/16 (8)	0.315 (8.0)	0.228 (5.8)	0.217 (5.5)	0.512 (13)	TX 40	1 5/8 (40)	1 3/8 (35)	0.315 (8)	
						2 (50)	1 3/4 (45)		
						2 3/8 to 4 (60 to 100)	2 (50)		
						4 3/4 (120)	3 1/8 (80)		
						5 1/2 to 23 5/8 (140 to 600)	4 (100)		
3/8 (10)	0.394 (10.0)	0.276 (7.0)	0.248 (6.3)	0.591 (15)	TX 40 / TX-50	2 3/8 to 4 (60 to 100)	2 (50)	0.394 (10)	
						4 3/4 to 5 1/2 (120 to 140)	3 1/8 (80)		
						6 1/4 to 23 5/8 (160 to 600)	4 (100)		

(continued)

TABLE 1—PARTIALLY THREADED KLIMAS SCREWS (cont.)

Designation: WKCH Head Style: Hexagonal Tip Style: Tapered									
D_{nom} [in. (mm)]	D [in. (mm)]	D_s [in. (mm)]	D_r [in. (mm)]	D_H [in. (mm)]	HEAD RECESS TYPE AND SIZE	L^1 [in. (mm)]	L_{thread} [in. (mm)]	L_{tip} [in. (mm)]	AVAILABLE COATINGS
$^1/_4$ (6)	0.236 (6.0)	0.169 (4.3)	0.150 (3.8)	0.394 (10)	TX 30 SW 10	2 to $2^3/_8$ (50 to 60)	$1^3/_{16}$ (30)	0.236 (6)	Yellow zinc, White zinc, SQ Ceramic
						$2^3/_4$ (70)	$1^5/_8$ (40)		
						$3^1/_8$ to $3^1/_2$ (80 to 90)	2 (50)		
						4 to $4^3/_8$ (100 to 110)	$2^3/_8$ (60)		
						$4^3/_4$ to $11^3/_4$ (120 to 300)	3 (75)		
$^5/_{16}$ (8)	0.315 (8.0)	0.228 (5.8)	0.217 (5.5)	0.512 (13)	TX 40 SW 13	$1^5/_8$ (40)	$1^3/_8$ (35)	0,315 (8)	
						2 (50)	$1^3/_4$ (45)		
						$2^3/_8$ to 4 (60 to 100)	2 (50)		
						$4^3/_4$ (120)	$3^1/_8$ (80)		
						$5^1/_2$ to $23^5/_8$ (140 to 600)	4 (100)		
$^3/_8$ (10)	0.394 (10.0)	0.276 (7.0)	0.248 (6.3)	0.591 (15)	TX 40 / TX 50 SW 15	$2^3/_8$ to 4 (60 to 100)	2 (50)	0.394 (10)	
						$4^3/_4$ to $5^1/_2$ (120 to 140)	$3^1/_8$ (80)		
						$6^1/_4$ to $23^5/_8$ (160 to 600)	4 (100)		

[1]For WKCS, WKCP, WKCR, WKCH – 8x40, 8x50, 8x60 and 10x60, 10x70 do not have a knurl above the thread

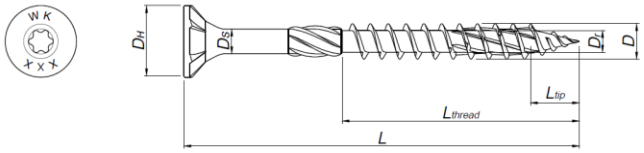

FIGURE 1—WKCS SCREWS

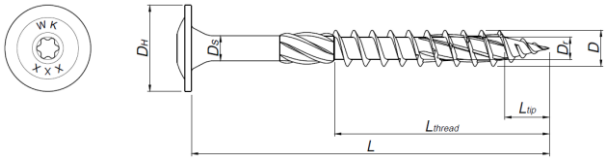

FIGURE 2—WKCP SCREWS

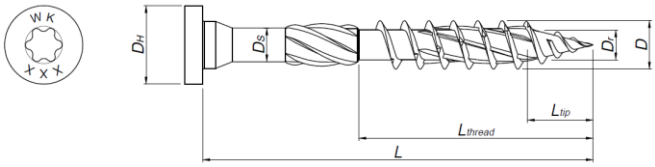

FIGURE 3—WKCR SCREWS

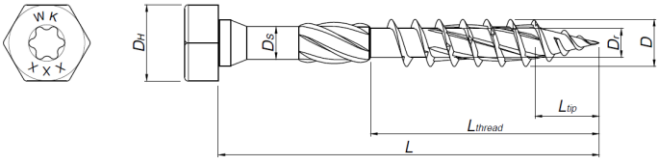

FIGURE 4—WKCH SCREWS

TABLE 2—FULLY THREADED KLIMAS SCREWS

D_{nom} [in. (mm)]	D [in. (mm)]	D_r [in. (mm)]	D_H [in. (mm)]	HEAD RECESS TYPE AND SIZE	L [in. (mm)]	L_{thread} [in. (mm)]	L_{tip} [in. (mm)]	TIP STYLE	AVAILABLE COATINGS
Designation: WKLC Head Style: Round									
3/16 (5)	0.197 (5.0)	0.124 (3.2)	0.291 (7.4)	TX 20	1 3/16 (30)	7/8 (22)	0.197 (5)	Tapered	Yellow zinc, White zinc, SQ Ceramic
					1 3/8 to 1 5/8 (35 to 40)	1 3/16 (30)			
					1 3/4 to 2 3/4 (45 to 70)	L - 3/8 (L - 10)			
Designation: WKFC Head Style: Cylinder									
1/4 (6)	0.236 (6.0)	0.152 (3.9)	0.315 (8)	TX 30	2 to 11 3/4 (50 to 300)	L - 5/16 (L - 8)	0.236 (6)	Tapered	Yellow zinc, White zinc, SQ Ceramic
5/16 (8)	0.315 (8.0)	0.195 (5.0)	0.394 (10)	TX 40	3 1/8 to 19 5/8 (80 to 500)	L - 1/2 (L - 12)	0.315 (8)		
3/8 (10)	0.394 (10.0)	0.236 (6.0)	0.512 (13)	TX 50	4 to 23 5/8 (100 to 600)	L - 9/16 (L - 15)	0.394 (10)		
Designation: WKFS Head Style: Countersunk									
1/4 (6)	0.236 (6.0)	0.152 (3.9)	0.472 (12)	TX 30	2 to 11 3/4 (50 to 300)	L - 5/16 (L - 8)	0.236 (6)	Tapered	Yellow zinc, White zinc, SQ Ceramic
5/16 (8)	0.315 (8.0)	0.195 (5.0)	0.551 (14)	TX 40	3 1/8 to 19 5/8 (80 to 500)	L - 1/2 (L - 12)	0.315 (8)		
3/8 (10)	0.394 (10.0)	0.236 (6.0)	0.709 (18)	TX 50	4 to 23 5/8 (100 to 600)	L - 9/16 (L - 15)	0.394 (10)		
Designation: WKFC-SD Head Style: Cylinder									
1/4 (6)	0.236 (6.0)	0.152 (3.9)	0.315 (8)	TX 30	2 to 11 3/4 (50 to 300)	L - 5/16 (L - 8)	0.236 (6)	Self-drill	Yellow zinc, White zinc, SQ Ceramic
5/16 (8)	0.315 (8.0)	0.195 (5.0)	0.394 (10)	TX 40	3 1/8 to 19 5/8 (80 to 500)	L - 1/2 (L - 12)	0.315 (8)		
3/8 (10)	0.394 (10.0)	0.236 (6.0)	0.512 (13)	TX 50	4 to 23 5/8 (100 to 600)	L - 9/16 (L - 15)	0.394 (10)		
Designation: WKFS-SD Head Style: Countersunk									
1/4 (6)	0.236 (6.0)	0.152 (3.9)	0.472 (12)	TX 30	2 to 11 3/4 (50 to 300)	L - 5/16 (L - 8)	0.236 (6)	Self-drill	Yellow zinc, White zinc, SQ Ceramic
5/16 (8)	0.315 (8.0)	0.195 (5.0)	0.551 (14)	TX 40	3 1/8 to 19 5/8 (80 to 500)	L - 1/2 (L - 12)	0.315 (8)		
3/8 (10)	0.394 (10.0)	0.236 (6.0)	0.709 (18)	TX 50	4 to 23 5/8 (100 to 600)	L - 9/16 (L - 15)	0.394 (10)		

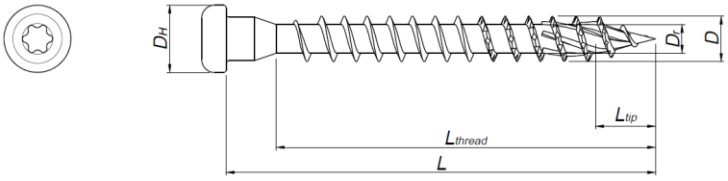

FIGURE 5—WKLC SCREWS

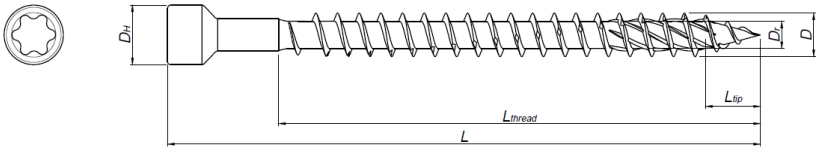

FIGURE 6—WKFC SCREWS

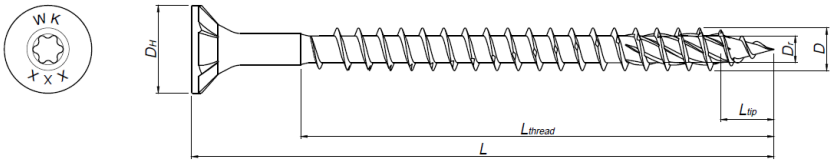

FIGURE 7—WKFS SCREWS

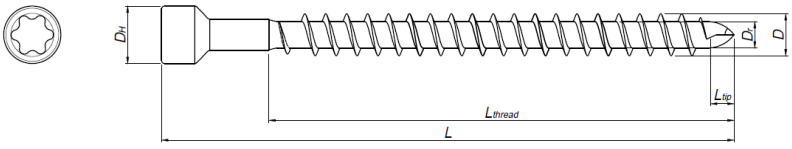

FIGURE 8—WKFC-SD SCREWS

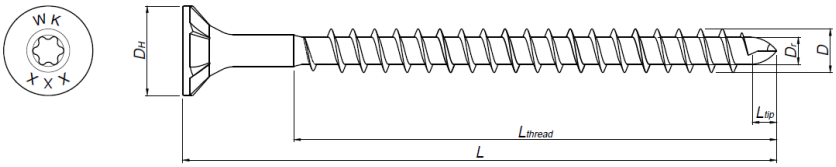

FIGURE 9—WKFS-SD SCREWS

TABLE 3—DOUBLE-THREADED KLIMAS SCREWS

D_{nom} [in. (mm)]	D [in. (mm)]	D_s [in. (mm)]	D_r [in. (mm)]	D_H [in. (mm)]	HEAD RECESS TYPE AND SIZE	L [in. (mm)]	$L_{thread,1}$ [in. (mm)]	$L_{thread,2}$ [in. (mm)]	L_{tip} [in. (mm)]	AVAILABLE COATINGS
Designation: WKPC Head Style: Cylinder Tip Style: Tapered										
$^5/_{16}$ (8)	0.315 (8.0)	0.228 (5.8)	0.213 (5.4)	0.394 (10)	TX 40	6½ (165)	$3\ ^1/_8$ (80)	$2\ ^3/_8$ (60)	0.315 (8)	Yellow zinc, White zinc, SQ Ceramic
						$7\ ^5/_8$ to $18\ ^5/_8$ (195 to 472)	4 (100)			
Designation: WKPS Head Style: Countersunk Tip Style: Tapered										
$^5/_{16}$ (8)	0.315 (8.0)	0.228 (5.8)	0.213 (5.4)	0.551 (14)	TX 40	6½ (165)	$3\ ^1/_8$ (80)	$2\ ^3/_8$ (60)	0.315 (8)	Yellow zinc, White zinc, SQ Ceramic
						$7\ ^5/_8$ to $18\ ^5/_8$ (195 to 472)	4 (100)			

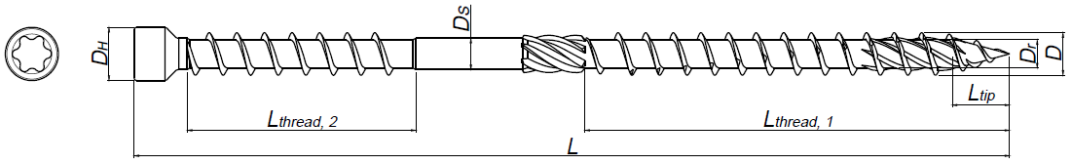

FIGURE 10—WKPC SCREWS

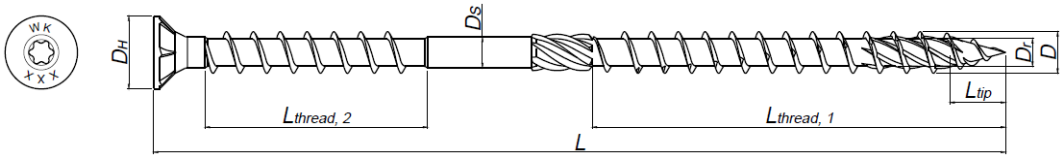

FIGURE 11—WKPS SCREWS

DESIGNATION	APPLICABLE SCREW TYPE	D_1 [in. (mm)]	D_2 [in. (mm)]	S [in. (mm)]
PWKCS-6	WKCS-6	0.295 (7.5)	0.787 (20)	0.157 (4.0)
PWKCS-8	WKCS-8	0.335 (8.5)	0.984 (25)	0.197 (5.0)
PWKCS-10	WKCS-10	0.433 (11)	1.260 (32)	0.236 (6.0)

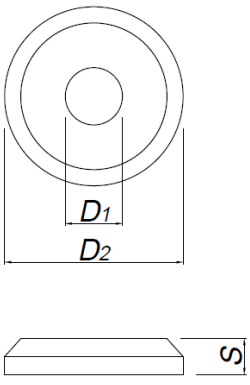

FIGURE 12—PWKCS WASHERS

TABLE 4—SCREW STEEL STRENGTHS

DESIGNATION	D_{nom} (mm)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
Partially-threaded Screws				
WKCS WKCP WKCR WKCH	6	190,000	1,123	1,688
	8	200,000	2,124	3,186
	10	200,000	3,069	4,604
Fully-threaded Screws				
WKLC	5	220,000	767	1,150
WKFC WKFC-SD WKFS WKFS-SD	6	220,000	1,402	2,103
	8	210,000	2,062	3,093
	10	210,000	2,910	4,365
Double-Thread Screws				
WKPC WKPS	8	210,000	2,142	3,213

For **SI:** 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

TABLE 5—REFERENCE WITHDRAWAL DESIGN VALUES (W)[1,2]

DESIGNATION	D_{nom} (mm)	$L_{emb,w}$ (inches)	W for SELECTED SG_{NDS} VALUES (lbf/in)				W for SELECTED SG_{eq} VALUES of LVL (lbf/in)
			0.35	**0.42**	**0.50**	**0.55**	**0.50**
WKCS WKCP WKCR WKCH	6	See Note 3	129	149	171	185	151
	8		163	188	217	234	187
	10		199	230	265	286	217
WKLC	5		114	132	152	164	144
WKFC WKFS WKFC-SD WKFS-SD	6		113	131	150	162	158
	8		166	192	221	238	177
	10		207	239	275	297	208
WKPC WKPS	8[4]		154	178	205	221	-
	8[5]		133	154	177	191	-

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

[1]Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.

[2]Tabulated reference withdrawal design values are in pounds per inch of thread penetration, and must be multiplied by thread length embedded in the member, not including the tip, in order to determine the total reference withdrawal design value in lbf.

[3]Member penetration must be at least 8 times the nominal diameter.

[4] For $L_{thread1}$ embedded into the wood main member.

[5] For $L_{thread2}$ embedded into the wood side member.

TABLE 6—REFERENCE HEAD PULL-THROUGH DESIGN VALUES (W_H)

DESIGNATION	HEAD STYLE	D_{nom} (mm)	D (in)	MINIMUM $t_{s,w}$ (inches)	W_H for SELECTED SG_{NDS} VALUES (lbf)				W_H for SELECTED SG_{eq} VALUES of LVL (lbf)
					0.35	0.42	0.50	0.55	0.50
WKCS	Countersunk	6	0.236	8D	136	157	181	195	197
		8	0.315		160	185	213	230	276
		10	0.394		259	299	344	371	390
WKCP	Washer	6	0.236	8D	231	267	307	331	320
		8	0.315		366	424	487	526	487
		10	0.394		458	530	609	657	636

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

TABLE 7—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR (TWO-MEMBER) WOOD-TO-WOOD AND STEEL-TO-WOOD CONNECTIONS[1,2,3]

DESIGNATION	D_{nom} (mm)	CONNECTION TYPE	MINIMUM SCREW LENGTH L (mm)	MINIMUM SIDE MEMBER THICKNESS $t_{s,w}$ / $t_{s,s}$ (inches)	Z for SELECTED SG_{NDS} VALUES (lbf)								
					SG_{NDS}								
					0.35			0.42			0.50		
					$Z_{\parallel}$	$Z_{\parallel m \perp s}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\parallel m \perp s}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\parallel m \perp s}$	$Z_{\perp}$
WKCS, WKCP	6	Wood-wood	120	2	126	126	126	149	149	149	174	174	174
WKCS, WKCP	8	Wood-wood	160	$2^3/_4$	233	178	178	263	211	211	309	247	247
WKCS, WKCP	10	Wood-wood	200	$3^3/_4$	255	204	204	301	241	241	354	283	283
WKCR, WKCH	8	Steel-wood	100	0.394	303	-	242	356	-	285	415	-	332
WKLC	5	Steel-wood	60	0.236	121	-	121	142	-	142	166	-	166

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

[1]Tabulated values are applicable to screws installed perpendicular to the faces of the wood members.
[2]The wood main member thickness must be equal to or greater than the screw length less the thickness of the side member so that the fastener is fully embedded in the wood.
[3]The tabulated lateral design values are based on both wood members having the same specific gravity.

TABLE 8—CONNECTION GEOMETRY REQUIREMENTS FOR SCREWS INSTALLED PERPENDICULAR TO THE FACE OF WOOD MEMBERS[1,2,3]

CONDITION		MINIMUM DISTANCE OR SPACING		
		Self-drilled		Predrilled Hole[4]
		SG_{NDS} < 0.50	0.50 ≤ SG_{NDS}	
For screws with D_{nom} ≤ 8 mm installed into sawn lumber, structural glued laminated timber (GL) and cross laminated timber (CLT) panels				
End distance (see Figure 13)	Loading toward end, $a_{end,1}$	15D	20D	12D
	Loading perpendicular to grain or away from end, $a_{end,2}$	10D	15D	7D
	Axial loading, $a_{end,2}$	10D	10D	7D
Edge distance (see Figure 13)	Loading toward edge, $a_{edge,1}$	10D	12D	7D
	Loading parallel to grain or away from edge, $a_{edge,2}$	5D	7D	3D
	Axial Loading, $a_{edge,2}$	4D	4D	3D
Spacing between fasteners, parallel to grain (see Figure 14)	Loading parallel to grain, a_1	15D	15D	10D
	Loading perpendicular to grain, a_1	10D	10D	5D
	Axial loading, a_1	7D	7D	7D
Spacing between fasteners, perpendicular to grain (see Figure 14)	Loading parallel to grain, a_2	5D	7D	4D
	Loading perpendicular to grain, a_2	5D	7D	4D
	Axial loading, a_2	4D	4D	3D
For screws with D_{nom} ≥ 10 mm, installed into sawn lumber, structural glued laminated timber (GL) and cross laminated timber (CLT) panels				
End distance (See Figure 13)	Loading toward end, $a_{end,1}$	15D	20D	7D
	Loading perpendicular to grain or away from end, $a_{end,2}$	10D	15D	4D
	Axial Loading, $a_{edge,2}$	10D	10D	4D
Edge distance (see Figure 13)	Loading toward edge, $a_{edge,1}$	10D	12D	4D
	Loading parallel to grain or away from edge, $a_{edge,2}$	5D	7D	3D
	Axial Loading, $a_{edge,2}$	4D	4D	3D
Spacing between fasteners, parallel to grain (see Figure 14)	Loading parallel to grain, a_1	15D	15D	5D
	Loading perpendicular to grain, a_1	10D	10D	5D
	Axial loading, a_1	7D	7D	5D
Spacing between fasteners, perpendicular to grain (see Figure 14)	Loading parallel to grain, a_2	5D	7D	5D
	Loading perpendicular to grain, a_2	5D	7D	5D
	Axial loading, a_2	5D	5D	5D

[1]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.
[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 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.
[4]Tabulated geometry is applicable to fasteners installed in predrilled holes that meet the following requirements:

- For installation in Douglas Fir and other species of similar or greater density, the hole must have a diameter between 0.60D_s and 0.75D_s.
- For installation in SPF and other species of similar density, the hole must have a diameter between 0.40D_s and 0.70D_s. The hole diameter must not exceed 0.9D_r.

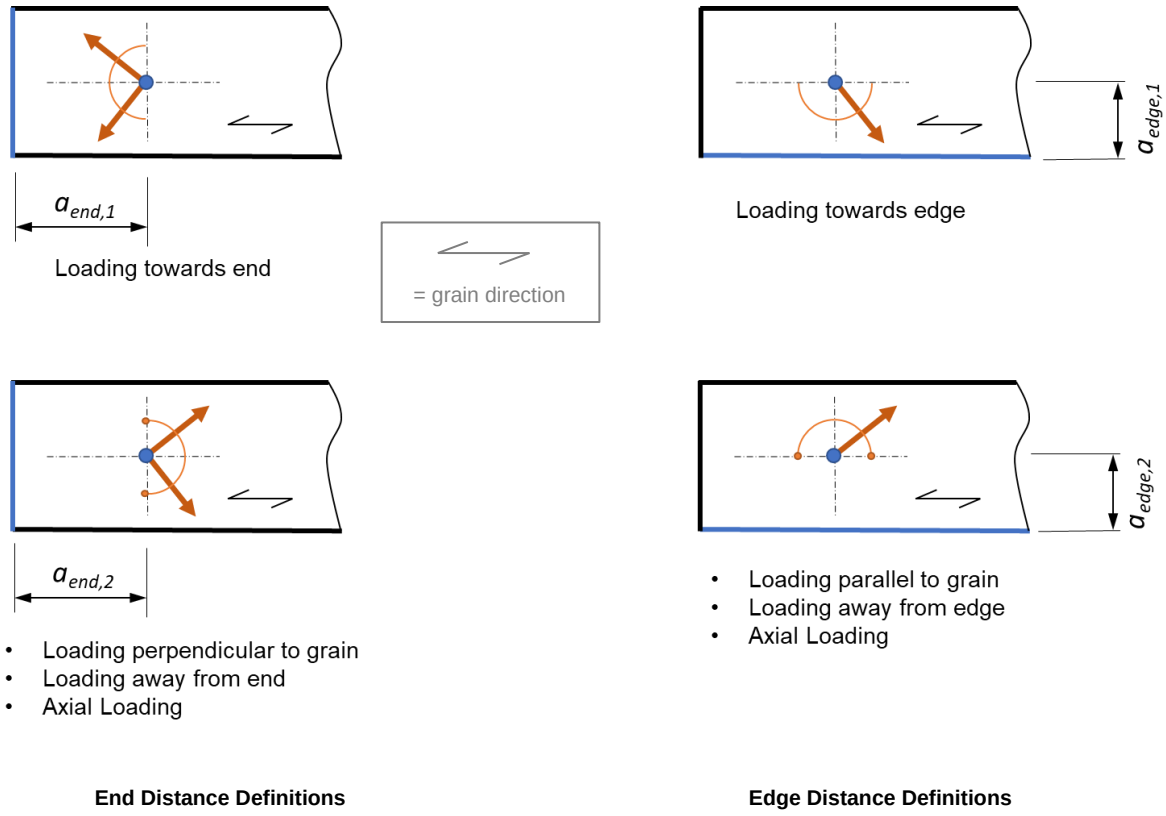

FIGURE 13—END AND EDGE DISTANCE DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN

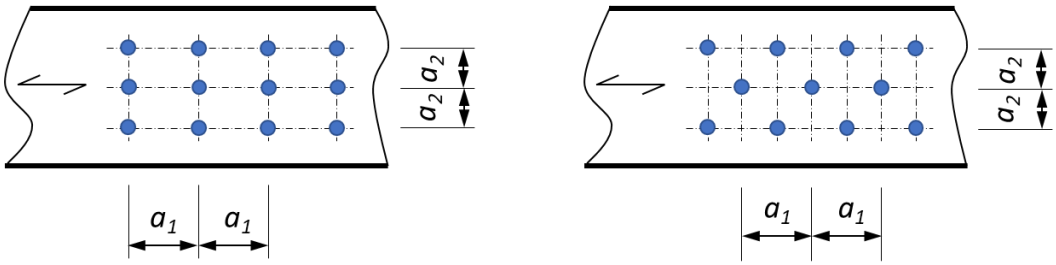

FIGURE 14—SPACING DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN