

ICC-ES Evaluation Report

ESR-3201

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

REPORT HOLDER:

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EVALUATION SUBJECT:

R4™ MULTI PURPOSE SCREW, TRIM™ SCREW, KAMELEON™ SCREW AND CLIMATEK™ COATING

1.0 EVALUATION SCOPE**Compliance with the following codes:**

- 2009 *International Building Code*® (IBC)
- 2009 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Corrosion resistance

2.0 USES

The R4™ Multi Purpose Screw, Trim™ Screw and Kameleon™ Screw fasteners described in this report are alternate dowel-type, multipurpose screws, less than 1/4 inch (6.4mm) in shank diameter, used in wood-to-wood connection applications. Climatek™ coated screws are used where carbon steel screws must exhibit corrosion resistance when exposed to adverse environmental conditions and/or preservative-treated wood, and are alternates to stainless steel or hot-dip-zinc galvanized fasteners with a coating weight in compliance with ASTM A 153, Class D. The Climatek™ coated screws have been evaluated for use with wood chemically treated with waterborne alkaline copper quaternary (ACQ-D) preservative and copper azole (CA-B) preservative.

3.0 DESCRIPTION**3.1 General:**

The R4™ Multi Purpose Screw, Trim™ Screw and Kameleon™ Screw fasteners described in this report are

self-tapping screws manufactured using a cold-forming process, and are heat-treated. All of the screws are coated with Climatek™. The R4™ fasteners have a countersink head with cutting pockets and teeth, CEE-Thread™ rolled threads, W-Cut™ threads and a Type 17 point (Zip-Tip™). The TRIM™ fasteners have a finish head with or without a reversed thread beneath, rolled threads, W-Cut™ threads and a Type 17 point (Zip-Tip™). The Kameleon™ fasteners have a pan framer head with saw-blade-like cutting teeth, rings with three indented fiber traps on each ring, CEE-Thread™, rolled threads, W-Cut™ threads and a Type 17 point (Zip-Tip™). See Table 1 and Figure 1 of this report for the fastener dimensions for each type of fastener.

3.2 Material:

3.2.1 Fasteners: The screws are made of hardened carbon steel wire. The minimum bending yield strengths of the fasteners are listed in Table 1. All of the fasteners are produced in accordance with the approved quality control manual.

3.2.2 Coating: The proprietary Climatek™ coating consists of multiple layers of various materials, including layers of zinc and polymer.

4.0 DESIGN AND INSTALLATION**4.1 Design:**

Allowable fastener tension and shear strengths are given in Table 1. Minimum wood specific gravity for use in design of connections with all screws evaluated in this report is 0.67. Design values for withdrawal connections must be as specified in Table 2. Design values for pull-through must be as specified in Table 3. Design values for lateral resistance in wood-to-wood connections loaded parallel to the grain must be as specified in Table 4. Design details not covered in this section must be in accordance with Parts 10 and 11 of the NDS.

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, adjusted by all applicable adjustment factors; (b) the reference head pull-through design value given in Table 3, 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 4, adjusted by all applicable adjustment factors; and (b) the allowable screw shear strength given in Table 1.

Connections containing multiple screws must be designed in accordance with Sections 10.1.2, 10.2.2 and 11.6 of the NDS.

Where the screws are subjected to combined lateral and withdrawal loads, connections shall be designed in accordance with Section 11.4.1 of the NDS.

Use of the Climatek™ coated screws must be limited to typical applications and limitations defined in Table 6. The Climatek™ coated screws are recognized for use in wood treated with waterborne alkaline copper quaternary (ACQ-D) preservatives with a maximum retention of 0.40 pcf (6.4kg/m³) or in wood treated with copper azole (CA-B) preservatives with a maximum retention of 0.40 pcf (6.4kg/m³).

4.2 Installation:

Screws must be installed in accordance with GRK Canada's published installation instructions and this report. 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 5, whichever is more restrictive. The screws must be installed with pilot holes having a diameter of $0.99D_r$, where D_r (Minor Thread Diameter as shown in Table 1) is the root diameter of the screw. The screws must be installed by turning with Star drive (Torx) bits, not by driving with a hammer.

5.0 CONDITIONS OF USE

The R4™ Multi Purpose Screw, Trim™ Screw and Kameleon™ Screw fasteners 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 Installation must comply with this report, the manufacturer's published instructions and the applicable code. A copy of the manufacturer's published installation instructions must be available at the jobsite at all times during installation. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 When the capacity of the connection is controlled by the fastener metal strength, rather than wood strength, the metal strength must not be multiplied by the adjustment factors specified in the NDS.

5.3 When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 10.1.2 of the NDS, and local stress within the connection must be checked against Appendix E in the NDS to ensure the capacity of the connection and fastener group.

5.4 Installation must be limited to connections between wood members used in dry service conditions where the wood moisture content does not exceed 19 percent.

5.5 Installation must be limited to connections between wood members each with a minimum specific gravity of 0.67.

5.6 The screws are manufactured and coated in Taiwan and Germany under a quality control program with inspections by PFS Corporation (AA-652) or Ingenieurbüro Eligehausen und Asmus (IEA) (AA-707), respectively.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners (AC233), dated June 2011.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effects of Wood Treatment Chemicals (AC257), dated October 2009.

7.0 IDENTIFICATION

Packing labels for these screws include the GRK Fasteners name, evaluation report number (ESR-3201), fastener designation (R4™ Multi Purpose Screw, Trim™ Screw or Kameleon™ Screw), fastener size and length, coating designation and the compatible treated wood types (0.40 pcf ACQ-D and 0.40 pcf CA-B), where applicable.

TABLE 1—FASTENER SPECIFICATIONS

FASTENER DESIGNATION		OVERALL LENGTH ¹ (inches)	LENGTH OF THREAD ² (inches)	MINOR THREAD DIAMETER ³ (inch)	SHANK DIAMETER ³ (inch)	OUTSIDE THREAD DIAMETER ³ (inch)	ALLOWABLE STEEL STRENGTH		
							Bending Yield Strength ⁴ <i>F_{yb}</i> (psi)	Tensile (psi) [pounds]	Shear (psi) [pounds]
R4	9x2"	2	1 ¹ / ₄	0.117	0.130	0.174	167160	61760 [627]	39660 [428]
	9x2 ¹ / ₂ "	2 ³ / ₈	1 ⁵ / ₈						
	9x2 ³ / ₄ "	2 ³ / ₄	1 ⁷ / ₈						
	9x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈						
	10x2 ¹ / ₂ "	2 ³ / ₈	1 ⁵ / ₈	0.128	0.142	0.194	151150	62640 [846]	44520 [542]
	10x2 ³ / ₄ "	2 ³ / ₄	1 ⁷ / ₈						
	10x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈						
	10x3 ¹ / ₂ "	3 ¹ / ₂	2 ³ / ₈						
	10x4"	3 ⁷ / ₈	2 ⁵ / ₈						
	10x4 ³ / ₄ "	4 ⁵ / ₈	3						
	12x2 ¹ / ₂ "	2 ³ / ₈	1 ¹ / ₂						
	12x2 ³ / ₄ "	2 ³ / ₄	1 ³ / ₄						
	12x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈	0.153	0.172	0.238	141350	60580 [1134]	38610 [655]
	12x3 ¹ / ₂ "	3 ¹ / ₂	2 ³ / ₈						
	12x4"	3 ⁷ / ₈	2 ⁵ / ₈						
	12x4 ³ / ₄ "	4 ⁵ / ₈	3						
	12x5 ⁵ / ₈ "	5 ¹ / ₂	3						
	12x6 ³ / ₈ "	6 ¹ / ₄	3						
	12x7 ¹ / ₄ "	7	3						
12x8"	7 ⁷ / ₈	2 ⁵ / ₈							
12x10"	9 ³ / ₄	2 ³ / ₄							
12x12"	11 ³ / ₄	2 ³ / ₄							
TRIM	8x2 ¹ / ₂ "	2 ³ / ₈	1 ¹ / ₂	0.106	0.116	0.160	156220	56580 [499]	40000 [360]
	8x2 ³ / ₄ "	2 ³ / ₄	1 ⁷ / ₈						
	8x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈						
	9x2 ¹ / ₂ "	2 ³ / ₈	1 ⁵ / ₈	0.114	0.128	0.176	155030	57000 [576]	42160 [425]
	9x2 ³ / ₄ "	2 ³ / ₄	1 ³ / ₄						
9x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈							
KAMEL EON	9x2 ¹ / ₂ "	2 ¹ / ₂	1 ⁵ / ₈	0.119	0.134	0.177	168640	57490 [634]	37870 [437]
	9x2 ³ / ₄ "	2 ³ / ₄	1 ³ / ₄						
	9x3 ¹ / ₈ "	3 ¹ / ₈	2 ¹ / ₈						

For SI: 1 inch = 25.4 mm; 1 psi = 6.9 kPa.

¹Overall length of fastener is measured from the top of the head to bottom of the tip. See Figure 1.

²Length of thread includes tip. See detailed illustration, Figure 1.

³Minor thread, shank and outside thread diameters are shown in the table without manufacturing tolerances.

⁴Bending yield strength determined in accordance with ASTM F 1575 using the minor thread diameter.

TABLE 2—REFERENCE WITHDRAWAL DESIGN VALUES (*W*)^{1,2}

[Tabulated Withdrawal Design Values (*W*) Are in Pounds per Inch of Thread Penetration into Side Grain of Main Member]

FASTENER DESIGNATION	THREAD LENGTH ³ , (inches)	WITHDRAWAL, <i>W</i> (lbs./in.) ³ FOR SPECIFIC GRAVITY =0.67
R4	9x2"	1 ¹ / ₄
	9x2 ¹ / ₂ "	1 ⁵ / ₈
	9x2 ³ / ₄ "	1 ⁷ / ₈
	9x3 ¹ / ₈ "	2 ¹ / ₈
	10x2 ¹ / ₂ "	1 ⁵ / ₈
	10x2 ³ / ₄ "	1 ⁷ / ₈
	10x3 ¹ / ₈ "	2 ¹ / ₈
	10x3 ¹ / ₂ "	2 ³ / ₈
	10x4"	2 ⁵ / ₈
	10x4 ³ / ₄ "	3
	12x2 ¹ / ₂ "	1 ¹ / ₂
	12x2 ³ / ₄ "	1 ³ / ₄
12x3 ¹ / ₈ "	2 ¹ / ₈	
12x3 ¹ / ₂ "	2 ³ / ₈	
12x4"	2 ⁵ / ₈	
12x4 ³ / ₄ "	3	
12x5 ⁵ / ₈ "	3	
12x6 ³ / ₈ "	3	
12x7 ¹ / ₄ "	3	
12x8"	2 ⁵ / ₈	
12x10"	2 ³ / ₄	
12x12"	2 ³ / ₄	
TRIM	8x2 ¹ / ₂ "	1 ¹ / ₂
	8x2 ³ / ₄ "	1 ⁷ / ₈
	8x3 ¹ / ₈ "	2 ¹ / ₈
	9x2 ¹ / ₂ "	1 ⁵ / ₈
	9x2 ³ / ₄ "	1 ³ / ₄
KAMELEON	9x3 ¹ / ₈ "	2 ¹ / ₈
	9x2 ¹ / ₂ "	1 ⁵ / ₈
	9x2 ³ / ₄ "	1 ³ / ₄

For SI: 1 inch = 25.4 mm; 1 lbf/in = 175.127 N/m.

¹Values shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1).

²Fastener withdrawal was tested in accordance with ASTM D 1761.

³Reference withdrawal design values (*W*) shall be multiplied by the length of thread penetration in the main member (including tip).

TABLE 3—REFERENCE PULL-THROUGH DESIGN VALUES (*P*)¹

[Tabulated Pull-Through Design Values (*P*) are in Pounds]

FASTENER DESIGNATION	SIDE MEMBER THICKNESS (inch)	PULL-THROUGH, <i>P</i> (lbs.) FOR SPECIFIC GRAVITY = 0.67
R4	9x2"	0.75
	9x2 ¹ / ₂ "	
	9x2 ³ / ₄ "	
	9x3 ¹ / ₈ "	
	10x2 ¹ / ₂ "	0.75
	10x2 ³ / ₄ "	
	10x3 ¹ / ₈ "	
	10x3 ¹ / ₂ "	
	10x4"	
	10x4 ³ / ₄ "	
	12x2 ¹ / ₂ "	0.75
	12x2 ³ / ₄ "	
12x3 ¹ / ₈ "		
12x3 ¹ / ₂ "		
12x4"		
12x4 ³ / ₄ "		
12x5 ⁵ / ₈ "		
12x6 ³ / ₈ "		
12x7 ¹ / ₄ "		
12x8"		
12x10"		
12x12"		
TRIM	8x2 ¹ / ₂ "	0.75
	8x2 ³ / ₄ "	
	8x3 ¹ / ₈ "	
	9x2 ¹ / ₂ "	0.75
	9x2 ³ / ₄ "	
9x3 ¹ / ₈ "	0.75	
9x2 ¹ / ₂ "		
9x2 ³ / ₄ "		

For SI: 1 inch = 25.4 mm; 1 lbf/in = 175.127 N/m.

¹Values shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1) as applicable to withdrawal.

TABLE 4—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR (TWO-MEMBER) CONNECTIONS^{1,2}
[For Sawn Lumber or SCL with Both Members of Identical Specific Gravity]

FASTENER DESIGNATION	SIDE MEMBER THICKNESS, t_s (inch)	FASTENER PENETRATION, P (inches)	REFERENCE LATERAL DESIGN VALUE, Z (pounds) FOR SPECIFIC GRAVITY OF:
			0.67 Parallel to Grain, $Z_{ }$
R4	9x2"	$\frac{25}{32}$	$1\frac{1}{8}$
	9x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{1}{2}$
	9x2 $\frac{3}{4}$ "	$\frac{25}{32}$	2
	9x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{3}{8}$
	10x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{1}{2}$
	10x2 $\frac{3}{4}$ "	$\frac{25}{32}$	2
	10x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{3}{8}$
	10x3 $\frac{1}{2}$ "	$\frac{25}{32}$	$2\frac{3}{4}$
	10x4"	$\frac{25}{32}$	$3\frac{1}{8}$
	10x4 $\frac{3}{4}$ "	$\frac{25}{32}$	$3\frac{7}{8}$
	12x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{1}{2}$
	12x2 $\frac{3}{4}$ "	$\frac{25}{32}$	2
	12x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{3}{8}$
	12x3 $\frac{1}{2}$ "	$\frac{25}{32}$	$2\frac{3}{4}$
	12x4"	$\frac{25}{32}$	$3\frac{1}{8}$
	12x4 $\frac{3}{4}$ "	$\frac{25}{32}$	$3\frac{7}{8}$
	12x5 $\frac{5}{8}$ "	$\frac{25}{32}$	$4\frac{3}{4}$
	12x6 $\frac{3}{8}$ "	$\frac{25}{32}$	$5\frac{1}{2}$
12x7 $\frac{1}{4}$ "	$\frac{25}{32}$	$6\frac{1}{4}$	
12x8"	$\frac{25}{32}$	7	
12x10"	$\frac{25}{32}$	9	
12x12"	$\frac{25}{32}$	11	
TRIM	8x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{1}{2}$
	8x2 $\frac{3}{4}$ "	$\frac{25}{32}$	2
	8x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{1}{2}$
	9x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{1}{2}$
	9x2 $\frac{3}{4}$ "	$\frac{25}{32}$	2
	9x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{3}{8}$
KAMEL EON	9x2 $\frac{1}{2}$ "	$\frac{25}{32}$	$1\frac{5}{8}$
	9x2 $\frac{3}{4}$ "	$\frac{25}{32}$	$1\frac{7}{8}$
	9x3 $\frac{1}{8}$ "	$\frac{25}{32}$	$2\frac{3}{8}$

For SI: 1 inch = 25.4 mm.

¹Values shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1).

²Lateral load testing was performed in accordance with ASTM D 1761.

TABLE 5—CONNECTION GEOMETRY

CONNECTION GEOMETRY / CRITERIA	DIAMETERS ¹	#8	#9	#10	#12
Minimum edge distance					
Loading parallel to grain	8	1	1	1 ^{1/8}	1 ^{3/8}
Loading perpendicular to grain, loaded edge	8	1	1	1 ^{1/8}	1 ^{3/8}
Loading perpendicular to grain, unloaded edge	8	1	1	1 ^{1/8}	1 ^{3/8}
Minimum end distance					
Tension load parallel to grain	15	2	2	2 ^{1/8}	2 ^{5/8}
Compression load parallel to grain	10	1 ^{1/8}	1 ^{1/4}	1 ^{3/8}	1 ^{3/4}
Load perpendicular to grain	10	1 ^{1/8}	1 ^{1/4}	1 ^{3/8}	1 ^{3/4}
Spacing (pitch) between fasteners in a row					
Parallel to grain	15	1 ^{3/4}	2	2 ^{1/8}	2 ^{5/8}
Perpendicular to grain	10	1 ^{1/8}	1 ^{1/4}	1 ^{3/8}	1 ^{3/4}
Spacing (gage) between rows of fasteners					
In-line	5	5/8	5/8	3/4	7/8
Staggered	2.5	1/4	3/8	3/8	3/8
Minimum penetration into main member for single shear connections	10	1 ^{1/8}	1 ^{1/4}	1 ^{3/8}	1 ^{3/4}

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

¹Diameter is the shank diameter as specified in Table 1.

NOTES:

1. SEE TABLE 1 FOR OVERALL LENGTH, THREAD LENGTH, SHANK DIAMETER, OUTSIDE THREAD DIAMETER AND MINOR THREAD DIAMETER
2. CEE-THREAD ON SCREWS WITH LENGTHS GREATER THAN OR EQUAL TO THOSE INDICATED. NOT USED FOR CALCULATIONS
3. DIMENSIONS GIVEN IF NOT OTHERWISE STATED ARE IN INCHES (FOR S1 1INCH=25.4MM)

SCREW TYPE	HEAD ϕ	CEE-THREAD
R4 - # 9 (4.5mm)	0.328 ± 0.006	LENGTH => 2"
R4 - #10 (5.0mm)	0.368 ± 0.006	LENGTH => 2"
R4 - #12 (6.0mm)	0.439 ± 0.010	LENGTH => 2"
TRIM - #8 (4.0mm)	0.197 ± 0.006	N/A
TRIM - #9 (4.5mm)	0.230 ± 0.006	N/A
KAMELEON - #9 (4.5mm)	0.258 ± 0.006	ALL LENGTHS

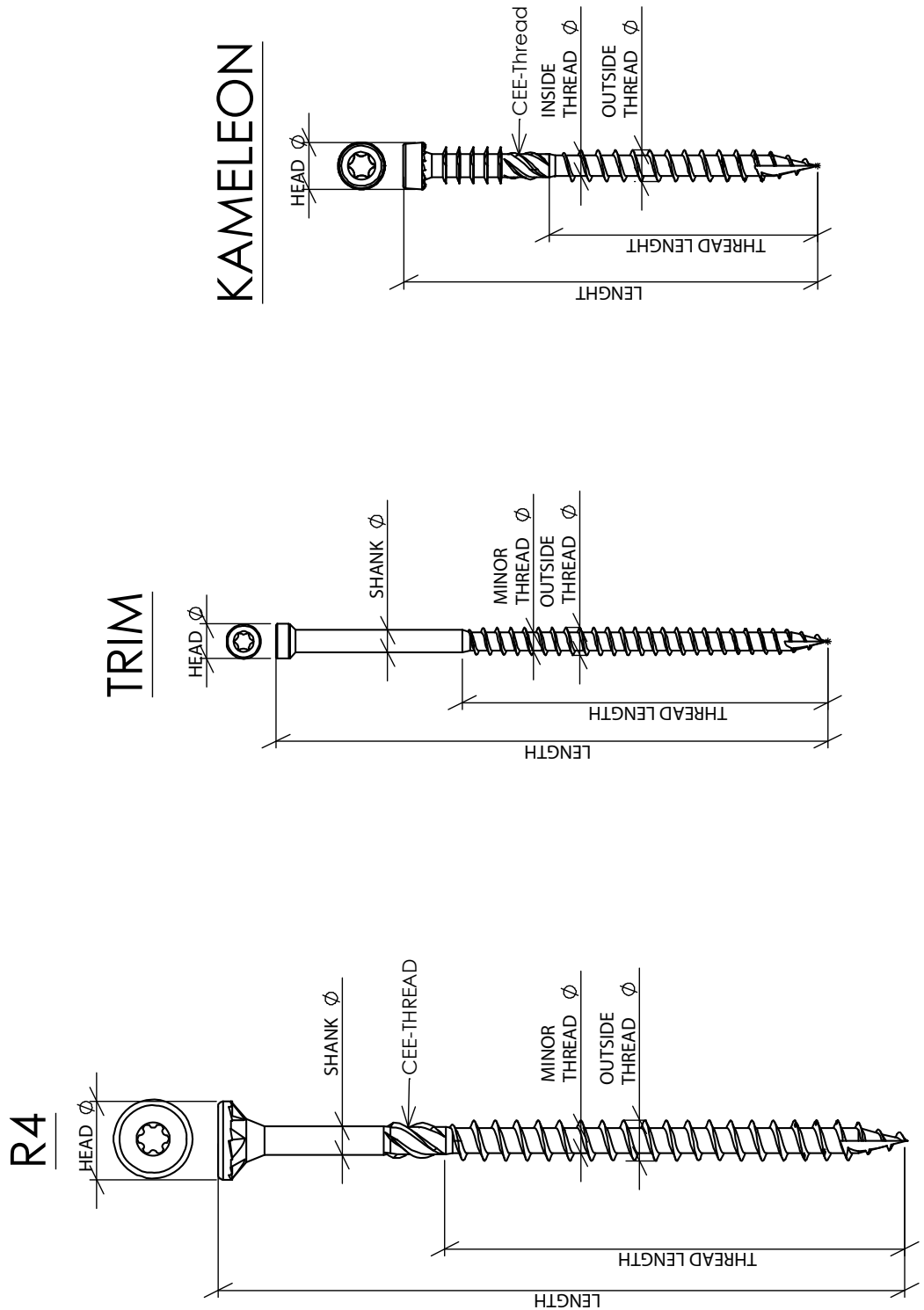


FIGURE 1 -R4™ , TRIM™, KAMELEON™

TABLE 6—EXPOSURE CONDITIONS FOR FASTENERS WITH INTENDED USE AND LIMITATIONS OF RECOGNITION

EXPOSURE CONDITION	TYPICAL APPLICATIONS	RECOGNITION LIMITATIONS
Corrosion Resistance of Fasteners		
1	Treated wood in dry use applications	Limited to use where equilibrium moisture content of the chemically treated wood meets the dry service conditions as described in the NDS.
3	General construction	Limited to freshwater and chemically treated wood exposure, i.e., no saltwater exposure.