ICC-ES Evaluation Report

ESR-4645

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Subject to renewal March 2027

This report also contains:

- FL Supplement w/ HVHZ

See ELC-4645 for Canadian Code Report

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES Section: 06 05 23—Wood, Plastic, and Composite Fastenings	REPORT HOLDER: ROTHO BLAAS S.R.L.	EVALUATION SUBJECT: ROTHO BLAAS 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)

Properties evaluated:

- Structural
- Corrosion resistance

2.0 USES

Rotho Blaas self-tapping wood screws are used for wood-to-wood and metal-to-wood connections that are designed in accordance with the IBC. For structures regulated under the IRC, the screws may be used where an engineered design is submitted in accordance with IRC Section R301.1.3. Rotho Blaas screws and washers with EVO coating are intended for use in the Exposure Conditions shown in Table 13.

3.0 DESCRIPTION

3.1 Notation and Symbols:

a	=	Connection geometry parameter (See Tables 8, 10 and 12 and Figures A, B, C and 9.)
D	=	Outside thread diameter
D_H	=	Diameter of fastener head or integral washer
D_{nom}	=	Fastener size designation (nominal diameter)
D_r	=	Minor thread (root) diameter
D_s	=	Unthreaded shank diameter
F_u	=	Minimum specified tensile strength of metal 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 the applicable figures.
$L_{eff,m}$	=	Effective embedded thread length in the wood main member (See Section 4.1.3.)
$L_{eff,s}$	=	Effective embedded thread length in the wood side member (See Section 4.1.3.)

$L_{emb,l}$	=	Minimum required embedded fastener length in holding member, including tip, applicable to tabulated lateral design values
$L_{emb,w}$	=	Minimum required embedded thread length in holding member, including tip, applicable to tabulated withdrawal design values
L_{thread}	=	Length of thread including tip
L_{tip}	=	Length of tip
L_{un}	=	Length of unthreaded portion of the fastener, measured from the head of the fastener to the start of the threads
N_a	=	Allowable tension strength of the fastener for use in ASD
N_u	=	Design tension strength of the fastener, for use in LRFD
R_α	=	Reduction factor for withdrawal resistance of inclined fasteners (See Section 4.1.4.)
SG_{NDS}	=	Assigned specific gravity (See Section 3.3.)
t_m	=	Thickness of wood main member
$t_{s,s}$	=	Thickness of steel side member
$t_{s,w}$	=	Thickness of wood 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
W_L	=	Total reference withdrawal value (See Section 4.1.4)
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
$Z_{\perp/\parallel}$	=	Reference lateral design value for fasteners loaded perpendicular to the wood grain (side member and parallel to grain (main member)
Z_{end}	=	Reference lateral design value for screws installed in end grain of wood
α	=	Angle between the axis of the fastener and the grain of the applicable wood member, degrees

3.2 Rotho Blaas Screws:

The Rotho Blaas self-tapping wood screws are dowel-type threaded fasteners designed to be installed in wood without drilling a lead hole due to their self-drilling tip. The screws are manufactured from carbon steel or stainless-steel wire complying with the manufacturer's specifications. Following the head forming and thread rolling processes, the carbon steel screws are heat-treated. The carbon steel screws are zinc plated, with or without a colored E-coating, or are coated with EVO or EVO C5 coating. EVO and EVO C5 coatings are proprietary multi-layer corrosion-resistant coatings. The EVO coating is gray in color.

The screw dimensions and strengths are provided in Tables 1 through 4. Screws with intermediate lengths are also available upon request. Screw geometry (available head type and tip type) is shown in Figures 1 through 6, as indicated below.

Some of the products addressed in this report are available with alternative product names, as shown in Table 14.

3.2.1 Partially-threaded Screws:

3.2.1.1 HBS and HBS EVO Screws: HBS and HBS EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 1A and Figure 1A. The screws have a countersunk head with milling ribs under the head. HBS and HBS EVO screws have zinc plating and EVO (or EVO C5) coating, respectively. HBS and HBS EVO screws are compatible with HUS, HUS EVO and HUS15 countersunk washers described in Section 3.5.1.

3.2.1.2 HBS PLATE and HBS PLATE EVO Screws: HBS PLATE and HBS PLATE EVO screws are carbon steel screws available in various diameters and lengths. The version of these screws designated HBSP have a washer head combined with a cylindrical feature under the head, as shown in Table 1B and Figure 1B. The version of these screws designated HBSPL have a small washer head combined with a smooth cylindrical feature under the head as shown in Table 1C and Figure 1B. HBS PLATE and HBS PLATE EVO screws have zinc plating and EVO coating, respectively.

3.2.1.3 HBS PLATE A4 Screws: HBS PLATE A4 screws are made of austenitic stainless steel Type 316 and are available in various diameters and lengths as shown in Table 1D and Figure 1B. The screws have a small washer head combined with a smooth cylindrical feature under the head.

3.2.1.4 KKF Screws: KKF screws are made of martensitic stainless steel Type 410 and are available in various diameters and lengths as shown in Table 4A and Figure 6. The screws have a washer head combined with a cylindrical feature under the head.

3.2.1.5 SHS AS Screws: SHS AS screws are made of martensitic stainless steel Type 410, and are available with or without a black E-coating. The screws are available in various diameters and lengths as shown in Table 4B and Figure 6. The screws have a countersunk head combined with milling ribs under the head.

3.2.1.6 TBS, TBS MAX, TBS FRAME and TBS EVO screws: TBS, TBS MAX, TBS FRAME and TBS EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 1E and Figure 1A. TBS and TBS EVO screws have zinc plating and EVO (or EVO C5) coating, respectively. TBS MAX screws are zinc plated. TBS FRAME screws have zinc plating and a black E-coating.

3.2.2 Fully-threaded Screws:

3.2.2.1 LBS and LBS EVO Screws: LBS and LBS EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 2A and Figure 2. The screws have a round head combined with a cylindrical feature under the head. LBS and LBS EVO screws have zinc plating and EVO coating, respectively.

3.2.2.2 LBSH and LBSH EVO Screws: LBSH and LBSH EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 2A and Figure 2. The screws have a round head combined with a cylindrical feature under the head and a knurled tip design. LBSH and LBSH EVO screws have zinc plating and EVO coating, respectively.

3.2.2.3 VGZ and VGZ EVO Screws: VGZ and VGZ EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 2B and Figure 3. The screws have a cylindrical head. VGZ and VGZ EVO screws have a zinc plating and EVO (or EVO C5) coating, respectively.

3.2.2.4 VGS and VGS EVO Screws: VGS and VGS EVO screws are carbon steel screws available in various diameters and lengths as shown in Table 2C and Figure 3. The screws have either a countersunk or hexagonal star drive head. VGS and VGS EVO screws have zinc plating and EVO (or EVO C5) coating, respectively. VGS and VGS EVO screws with a countersunk head are compatible with the Rotho Blaas washers described in Section 3.5.

3.2.2.5 VGS PLATE Screws: VGS PLATE screws are carbon steel screws available in various diameters and lengths as shown in Table 2D and Figure 3. The screws have a countersunk hexagonal washer head combined with a cylindrical feature under the head. VGS PLATE screws have black zinc plating.

3.2.2.6 VGS A4 Screws: VGS A4 screws are made of austenitic stainless steel Type 316 and are available in various diameters and lengths as shown in Table 2E and Figure 3. The screws have a countersunk head with milling ribs under the head and are compatible with the Rotho Blaas washers described in Section 3.5.

3.2.3 Double-thread Carbon Steel Screws - DGZ, DGZ EVO and CTC Screws: DGZ, DGZ EVO and CTC screws are double threaded and available in various diameters and lengths as shown in Table 3 and Figures 4 and 5. The screws have a cylindrical head. The outside thread diameter and root diameter are the same for both threaded portions of the screw. For the DGZ and DGZ EVO screws, both threads are oriented in the same direction. For the CTC screws, the threads at the head end of the screw are reversed. DGZ and DGZ EVO screws have zinc plating and EVO coating, respectively. CTC screws are zinc plated.

3.3 Wood Members:

Wood members may be sawn lumber; structural glued laminated timber (glulam); and 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 purposes 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 Table 12.3.3A of the ANSI/AWC National Design Specification for Wood Construction® (NDS) 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 wood-to-wood connections, the tabulated side member thickness, $t_{s,w}$, is an absolute value (not a minimum or maximum value). The thickness of the wood main member, t_m, must be adequate to fully encapsulate the screw in the wood.

3.4 Metal Members:

Metal side plates must be designed in accordance with AISI S100, AISC 360 or the ADM, as applicable. Metal side members must have a minimum tensile strength, F_u, equal to 58 ksi (400 MPa) for steel and 38 ksi (262 MPa) for aluminum. The holes in the metal side member for the screws must be predrilled or prepunched, with hole shape and dimension as indicated in this report. For applications using the VGU 45˚ countersunk washer, the geometry requirements for the slotted holes and the metal plate thickness are shown in Figure 8.

3.5 Rotho Blaas Steel Washers:

3.5.1 HUS, HUS EVO and HUS15 Countersunk Washers: HUS, HUS EVO and HUS15 countersunk washers are available for use with countersunk screws used in wood-to-wood and metal-to-wood connections. The HUS and HUS EVO washers are formed from carbon steel and have zinc plating and EVO coating, respectively. The HUS15 washers are formed from aluminum. See Figure 7 for washer dimensions and a depiction of the washer.

3.5.2 VGU 45˚ and VGU EVO 45° Countersunk Washers: VGU 45˚ and VGU EVO 45° countersunk washers are available for use with VGS and VGS EVO screws with countersunk heads used in metal-to-wood connections with the screws oriented at 45˚ angle to the face of the members. VGU 45˚ and VGU EVO 45° countersunk washers are formed from carbon steel and have zinc plating and EVO coating, respectively. See Figure 8 for washer dimensions and a depiction of the washer.

4.0 DESIGN AND INSTALLATION

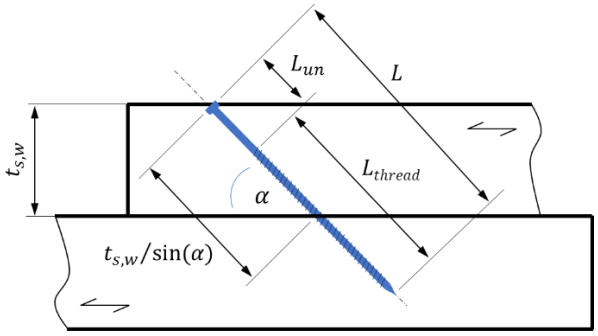
4.1 Design:

4.1.1 The design values in this report are intended to aid the registered design professional in meeting the requirements of IBC Section 1604.2. For connections not completely described in this report, determination of the suitability of the screws for the specific application is the responsibility of the registered design professional and is outside the scope of this report. The registered design professional is responsible for determining the available strengths for the connection, considering all applicable limit states, and for considering serviceability issues. The registered design professional is responsible for determining the required spacing, edge distance and end distance for the screws, based on the characteristics of the connected building materials.

Tabulated design and connection geometry information for zinc plated, carbon steel screws and washers also applies to EVO, E-coating and EVO C5 coated screws and washers.

4.1.2 Screw Strength: Allowable screw tensile strength (N_a), design screw tensile strength (N_u) and minimum bending yield strength (F_{yb}) for the screws are shown in Tables 1 through 4.

4.1.3 Effective Embedded Thread Length: The effective embedded thread length is the length of fastener thread in a wood member that is completely surrounded by the wood. For example, for a wood-to-wood connection the maximum effective lengths in the side and main members are determined as shown below. Also see the report holder's guidance.



$$L_{eff,s} = \left(\frac{t_{s,w}}{\sin(\alpha)}\right) - L_{un} \quad \text{(Eq. 1)}$$

$$L_{eff,m} = \left(L - \left(\frac{t_{s,w}}{\sin(\alpha)}\right) - L_{tip}\right) \leq L_{thread} \quad \text{(Eq. 2)}$$

4.1.4 Reference Withdrawal Design Values: Reference withdrawal design values, W , in pounds per inch of effective embedded thread, l_{eff}, for screws installed perpendicular ($\alpha = 90°$) to the face of the wood member are shown in Table 5. For inclined fastening, the applicable reduction factor from the following table must be applied. The total reference withdrawal design load value, W_L, for a given angle α, must be calculated using Equation 3.

$$W_L = W \cdot R_\alpha \cdot l_{eff} \quad \text{(Eq. 3)}$$

α [°]	R_α	α [°]	R_α
90	1.00	35	0.84
85	1.00	30	0.77
80	0.99	25	0.69
75	0.99	20	0.61
70	0.98	15	0.53
65	0.97	α [°]	R_α
60	0.95	(at least four screws required)	
55	0.94	14	0.52
50	0.92	10	0.46
45	0.91	5	0.38
40	0.89	0	0.30

For values of α which are not tabulated, R_α can be determined from the following equations.

$$35^\circ < \alpha \leq 90^\circ;\ k_\alpha = \frac{1}{1.2\times\cos^2(\alpha)+\sin^2(\alpha)} \quad \text{(Eq. 4)}$$

$$0^\circ \leq \alpha \leq 35^\circ;\ k_\alpha = 0.3 + 0.7 \times \frac{\alpha}{45} \quad \text{(Eq. 5)}$$

4.1.5 Reference Head Pull-through Design Values: For screws used with wood side members, reference head pull-through values, W_H, for partially threaded carbon steel screws are shown in Table 6 for $90° \geq \alpha \geq 30°$. Angles $30° > \alpha \geq 0°$ are outside the scope of this evaluation. No reduction factor is applied for inclined fasteners. For double-thread DGZ and DGZ EVO screws, reference head pull-through values for screws installed at an angle to grain of 60° are shown in Table 7. For fully threaded screws, the reference head pull-through value is the reference withdrawal design value, W_L, for $l_{eff,s}$, determined in accordance with Section 4.1.4.

4.1.6 Lateral Connections Designed in Accordance with the NDS: Reference lateral design values for screws addressed in this report may be determined in accordance with the NDS, subject to the following conditions:

1. The applicable $F_{yb,spec}$, from Tables 1 through 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. SG_{NDS} must be 0.55 or less.
4. The wood side member thickness, $t_{s,w}$, must be in accordance with the report holder's recommendations.
5. The metal side member thickness, $t_{s,s}$, must be in accordance with the report holder's recommendations and must have properties complying with Section 3.4.
6. The minimum screw penetration into the main member must be $6D$, including the tip length.
7. For installation in end grain, the minimum screw penetration must be $6D$.
8. The dowel bearing length must be determined in accordance with Section 12.3.5.3 of the NDS, using L_{tip}, given in Tables 1 through 4, as applicable.
9. Spacing, edge and end distance must be in accordance with Table 8 or 12, as applicable, and as needed to prevent splitting of the wood.

4.1.7 Design of Lateral Connections with Screws Installed at an Angle to the Grain: Connections used to transfer lateral load between side members and a main member using groups of Rotho Blaas screws installed at an angle between 90˚ and 0˚ to the wood grain must be designed in accordance with this section.

4.1.7.1 Design Method - General: The design method applies to wood-to-wood and metal-to-wood connections where the lateral load is transferred between the side and main member through the axial capacity of the screw installed at an angle $90° > \alpha \geq 0°$ to the wood grain. The following conditions apply:

1. The connection consists of one or two side members, which can be either wood or metal, and a wood main member.
2. Sawn lumber, GL and CLT must comply with Section 3.3.
3. For metal-to-wood connections with a VGU 45˚ countersunk washer, VGS and VGS EVO screws must be used and installed at 45˚ angle to the metal side member as shown in Figure 8.
4. The minimum screw penetration in both the wood main and side member must be $8D$, measured along the axis of the screw.
5. A minimum of two screws must be used in each connection.
6. The minimum spacing, edge and end distance must comply with the connection geometry requirements of Table 8.
7. The minimum thickness of the wood main and side member must be in accordance with the report holder's published design manual for the respective application.
8. The metal thickness ($t_{s,s}$) of the side plate used in combination with VGU 45˚ countersunk washer must comply with Figure 8.
9. A minimum of four screws must be used in connections with screws installed at an angle less than 15 degrees between the grain direction and the screw axis.
10. For the effective number of screws loaded axially refer to the report holder's published recommendation.

4.1.7.2 Wood-to-wood Connections: The available lateral load for a wood-to-wood connection must be determined as follows:

1. Determine the minimum effective embedded thread length of all screws in the connection in accordance with Section 4.1.3.

2. Determine the reference withdrawal design value, W_L, in accordance with Section 4.1.4 for the main member and apply adjustment factors in accordance with the NDS to determine available withdrawal strength.
3. Determine the reference head pull-through design value in accordance with Section 4.1.5 for the side member, as applicable, and apply adjustment factors in accordance with the NDS to determine available head pull-through strength or withdrawal strength, as applicable.
4. The available axial capacity of the screw is the minimum of the available withdrawal strength in the main member, the available head pull-through or withdrawal strength in the side member and the available screw tension strength.
5. The allowable lateral design load for one screw in a wood-to-wood connection is the available axial capacity of the screw, projected along the load vector.
6. The structural wood members must be checked for load-carrying capacity in accordance with Section 4.1.10.
7. Group effects must be considered when using multiple screws in one connection.

4.1.7.3 Metal-to-wood Connections: The available lateral load for a metal-to-wood connection with a metal side member and a wood main member must be determined as follows:

1. Determine the minimum effective embedded thread length of all screws in the connection in accordance with Section 4.1.3.
2. Determine the reference withdrawal design value in the wood member, W_L, in accordance with Section 4.1.4, and apply adjustment factors in accordance with the NDS to determine available withdrawal strength.
3. The available axial capacity of the screw is the minimum of the available withdrawal strength, the available metal pull-over strength (outside the scope of this report) and the available screw tension strength.
4. The available lateral design load for one screw in a metal-to-wood connection is the available axial capacity of the screw, projected along the load vector.
5. For applications with a VGU 45° countersunk washer and VGS and VGS EVO screws, the failure mode of metal washer pull-over does not govern.
6. The metal member must be checked for load-carrying capacity in accordance with Section 3.4 and the wood member must be checked for load-carrying capacity in accordance with Section 4.1.10.
7. Group effects must be considered when using multiple screws in one connection.

4.1.7.4 Stiffness: The expected axial slip modulus (K_{axial}) along the screw axis at the allowable load level of the threaded part of the screw must be determined in accordance with Equation 6 as follows:

$$K_{axial} = 92000 \times D \times l_{eff,min} \quad \text{[lbf/inch]} \qquad \text{(Eq. 6)}$$

$l_{eff,min}$: minimum of $l_{eff,m}$ and $l_{eff,s}$ for wood-to-wood connections
: $l_{eff,m}$ for metal-to-wood connections [inch]

4.1.8 Reference Lateral Design Values Based on Testing:

4.1.8.1 Wood-to-wood Side-grain Connections: Reference lateral design values for tested wood-to-wood connections for screws installed perpendicular to the faces of the wood members are shown in Table 9.

4.1.8.2 Metal-to-wood End-Grain Connections: For metal-to-wood connections with LBS/LBS EVO or HBS PLATE/HBS PLATE EVO screws installed in the end-grain, reference lateral design values determined from testing are given in Table 11. The metal side member must have a minimum tensile strength, F_u, equal to 38 ksi (262 MPa) and minimum thickness of 0.197 inches. The hole in the metal side member must be pre-drilled or prepunched and must be no greater than 0.244 inch (6.2 mm) for LBS and HBS PLATE screws with D_{nom} = 0.20 inch, 0.303 inch (7.7 mm) for LBS screws with D_{nom} = 0.28 inch and 0.591 inch (15.0 mm) for HBS PLATE screws with D_{nom} = 0.48 inch. Minimum fastener spacing and edge distance must be in accordance with Table 12 and Figure 9.

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

4.1.10 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.

4.1.11 Combined Loading: Where the fasteners are subjected to combined lateral and withdrawal loads, connections shall be designed in accordance with Section 12.4.1 of the NDS, as applicable.

4.2 Corrosion Resistance:

The EVO coated screws and washers may be used in Southern Pine and other species commercially available in the United States, treated with ACQ preservative with a maximum retention of 0.40 pcf (6.4 kg/m³), and in other treated wood products that have been demonstrated to have a lower level of corrosivity.EVO coated fasteners must be limited to use in the Exposure Conditions 1 and 3, as shown in Table 13. Corrosion resistance of EVO C5 coating and E-coating on carbon steel screws is outside the scope of this report.

4.3 Installation:

Rotho Blaas self-tapping screws must be installed in accordance with the report holder'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 Tables 8, 10 and 12, as applicable, whichever is more restrictive.

For TBS, TBS MAX, TBS FRAME and TBS EVO screws the underside of the flat screw head must bear against the surface of the wood side member. For LBS, LBS EVO, LBSH, LBSH EVO, HBS PLATE (HBSP and HBSPL), HBS PLATE EVO (HBSP EVO and HBSPL EVO), HBS PLATE A4 and KKF screws, and VGS,VGS EVO and VGS PLATE screws with a hexagonal head, the underside of the flat portion of the screw head must bear against the surface of the metal plate.

For HBS, HBS EVO, VGZ, VGZ EVO, DGZ, DGZ EVO, CTC and SHS AS screws, and VGS, VGS EVO and VGS A4 screws with a countersunk head, the top of the screw head must either be flush with the surface of the wood side member or recessed into the wood side member, if a pre-drilled hole of the size of the screw head is made. Side member thickness requirements given in this report apply to the wood dimension below the top of the screw head.

For screws with countersunk heads (HBS, HBS EVO, VGS, VGS EVO) installed in combination with a HUS, HUS EVO or HUS15 countersunk washer, the underside of the countersunk washer must bear against the wood or metal side member with the underside of the screw head seated in the washer.

For wood-to-wood and metal-to-wood connections with screws installed at 45˚ angle to the grain, a 45˚ angle assembly jig is offered and recommended by the report holder to facilitate the installation.

Predrilling is required for $SG_{NDS} > 0.55$. For $SG_{NDS} \leq 0.55$ predrilling is optional. The respective drill hole diameter requirements are given below.

Nominal Diameter D_{nom} (inch)	Drill Hole Diameter for $SG_{NDS} \leq 0.55$ (inch)	Drill Hole Diameter for $SG_{NDS} > 0.55$ (inch)
0.20	7/64	9/64
0.21	9/64	5/32
0.23	9/64	5/32
0.24	5/32	5/32
0.28	5/32	3/16
0.32	13/64	7/32
0.36	13/64	15/64
0.40	15/64	17/64
0.44	15/64	17/64
0.48	17/64	9/32
0.52	5/16	11/32

Screws must not be overdriven. The screws must be installed by turning with a power driver, not by driving with a hammer, using the bit size provided by the report holder.

5.0 CONDITIONS OF USE:

The 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 The screws must be installed in accordance with the report holder's installation instructions and this report. In the case of a conflict between this report and the report holder's instructions, this report governs.

5.2 Design loads for the screws must not exceed the available strengths described in Section 4.1.

5.3 Calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 Except as described in Section 4.1.7, design for lateral loading applications using inclined fasteners is outside the scope of this report.

5.5 Connection geometry for inclined fastening must be justified to the satisfaction of the code official, including the minimum required wood thickness between crossing fasteners.

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

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

5.8 Use of screws with coatings other than the EVO coating in contact with preservative-treated wood is outside the scope of this report.

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

5.10 The screws are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

6.1 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).

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effects of Wood Treatments (AC257), dated June 2023 (editorially revised April 2024).

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-4645) 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 self-tapping wood screws is labeled with the product designation (or alternative product designation shown in Section 3.2.4), the screw size (D_{nom}) and length (in both inches and millimeters), the thread length and the head type and drive size. The packaging also bears an image of the screw showing the head, thread and tip design.

7.3 The packaging for the Rotho Blaas washers is labeled with the product type.

7.4 "C4 EVO coating" and "C5 EVO coating" is either reported on the label or in the leaflet inside the container of the self-tapping wood screws and washers with EVO or EVO C5 coating, respectively.

7.5 The screw head is marked with the product family type according to Figures 1 through 6.

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

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www.rothoblaas.com

TABLE 1A—HBS SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.14 (3.5)	1 9/16	11/16	0.276	TX 15	0.096	0.089	0.138	0.138	257,000	320	490
	1 3/4 to 1 15/16	15/16									
0.16 (4)	1 3/16 to 1 3/8	11/16	0.315	TX 20	0.108	0.100	0.157	0.157	248,000	430	640
	1 9/16	15/16									
	1 3/4 to 1 15/16	1 3/16									
	2 3/8	1 3/8									
	2 3/4 to 3 1/8	1 9/16									
0.18 (4.5)	1 9/16	15/16	0.354	TX 20	0.124	0.110	0.177	0.177	253,500	540	810
	1 3/4 to 1 15/16	1 3/16									
	2 3/8	1 3/8									
	2 3/4 to 3 1/8	1 9/16									
0.20 (5)	1 9/16 to 1 15/16	15/16	0.394	TX 25	0.144	0.134	0.197	0.197	220,000	690	1,030
	2 3/8	1 3/16									
	2 3/4	1 3/8									
	3 1/8	1 9/16									
	3 1/2	1 3/4									
	4	1 15/16									
	4 3/4	2 3/8									
0.24 (6)	1 9/16 to 1 15/16	1 3/8	0.472	TX 30	0.169	0.156	0.236	0.236	200,000	1,180	1,780
	2 3/8	1 3/16									
	2 3/4 to 3 1/8	1 9/16									
	3 1/2 to 4	1 15/16									
	4 3/8 to 5 1/8	2 3/8									
	5 1/2 to 15 3/4	2 15/16									
0.32 (8)	3 1/8 to 4	2 1/16	0.571	TX 40	0.228	0.213	0.315	0.315	180,000	2,040	3,060
	4 3/4 to 5 1/2	2 3/8									
	6 1/4 to 11	3 1/8									
	11 3/4 to 23 5/8	4									
0.40 (10)	3 1/8 to 4	2 1/16	0.719	TX 40	0.276	0.252	0.394	0.394	185,000	2,700	4,060
	4 3/4 to 5 1/2	2 3/8									
	6 1/4 to 11	3 1/8									
	11 3/4 to 23 5/8	4									
0.48 (12)	4 3/4 to 11	3 1/8	0.817	TX 50	0.315	0.268	0.472	0.472	190,000	3,060	4,600
	12 5/8 to 39 3/8	4 3/4									

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

[1]The overall length is measured from the top of the head to the screw tip, as shown in Figure 1A.

TABLE 1B—HBS PLATE (HBSP) SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.20 (5)	1 15/16	1 3/16	0.380	TX 25	0.144	0.134	0.197	0.197	220,000	690	1,030
	2 3/8	1 3/8									
	2 3/4	1 9/16									
	3 1/8	1 15/16									
0.24 (6)	3 1/8	1 15/16	0.472	TX 30	0.169	0.156	0.236	0.236	200,000	1,180	1,780
	3 1/2	2 3/16									
0.32 (8)	1 9/16	1 1/4	0.571	TX 40	0.228	0.213	0.315	0.315	180,000	2,040	3,060
	2 3/8	2 1/16									
	3 1/8	2 3/16									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
0.40 (10)	2 3/8	2 1/16	0.719	TX 40	0.276	0.252	0.394	0.394	185,000	2,700	4,060
	3 1/8	2 3/8									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
	7 1/8	6									
0.48 (12)	4	2 15/16	0.817	TX 50	0.315	0.268	0.472	0.472	190,000	3,060	4,600
	4 3/4	3 1/2									
	5 1/2	4 3/8									
	6 1/4	4 3/4									
	7 1/8	5 1/2									
	8	6 1/4									

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

[1]The overall length is measured from the underside of the washer head to the screw tip, as shown in Figure 1B.

TABLE 1C—HBS PLATE (HBSPL) SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.32 (8)	1 9/16	1 1/4	0.531	TX 40	0.248	0.232	0.315	0.315	172,000	2,660	3,990
	2 3/8	2 1/16									
	3 1/8	2 3/16									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
0.40 (10)	2 3/8	2 1/16	0.650	TX 40	0.283	0.260	0.394	0.394	168,000	3,350	5,030
	3 1/8	2 3/8									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
	7 1/8	6									
0.48 (12)	4	2 15/16	0.728	TX 50	0.337	0.287	0.472	0.472	178,000	4,310	6,460
	4 3/4	3 1/2									
	5 1/2	4 3/8									
	6 1/4	4 3/4									
	7 1/8	5 1/2									
	8	6 1/4									

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

[1]The overall length is measured from the underside of the washer head to the screw tip, as shown in Figure 1B.

TABLE 1D—HBS PLATE A4 SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.32 (8)	1 9/16	1 1/4	0.531	TX 40	0.248	0.232	0.315	0.315	106,000	1,280	1,920
	2 3/8	2 1/16									
	3 1/8	2 3/16									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
0.40 (10)	2 3/8	2 1/16	0.650	TX 40	0.283	0.260	0.394	0.394	104,000	1,510	2,260
	3 1/8	2 3/8									
	4	2 15/16									
	4 3/4	3 3/4									
	5 1/2	4 3/8									
	6 1/4	5 1/8									
	7 1/8	6									
0.48 (12)	4	2 15/16	0.728	TX 50	0.337	0.287	0.472	0.472	110,000	2,370	3,560
	4 3/4	3 1/2									
	5 1/2	4 3/8									
	6 1/4	4 3/4									
	7 1/8	5 1/2									
	8	6 1/4									

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

[1]The overall length is measured from the underside of the washer head to the screw tip, as shown in Figure 1B.

TABLE 1E—TBS, TBS MAX AND TBS FRAME SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
TBS											
0.24 (6)	2 3/8 to 2 3/4	1 9/16	0.610	TX 30	0.169	0.156	0.236	0.236	200,000	1,180	1,780
	3 1/8 to 3 1/2	1 15/16									
	4	2 3/8									
	4 3/4 to 8	2 15/16									
	8 5/8 to 15 3/4	4									
0.32 (8)	1 9/16	1 1/4	0.748	TX 40	0.228	0.213	0.315	0.315	180,000	2,040	3,060
	2 3/8 to 4	2 1/16									
	4 3/4 to 5 1/2	3 1/8									
	6 1/4 to 23 5/8	4									
0.40 (10)	4	2 1/16	0.984	TX 50	0.276	0.252	0.394	0.394	185,000	2,700	4,060
	4 3/4 to 5 1/2	2 3/8									
	6 1/4 to 7 1/8	3 1/8									
	8 to 113/4	4									
	12 5/8 to 23 5/8	4 3/4									
0.48 (12)	8 to 14 1/4	4 3/4	1.142	TX 50	0.315	0.268	0.472	0.472	190,000	3,060	4,600
	15 3/4 to 23 5/8	5 1/2									
	31 1/2 to 39 3/8	6 1/4									
TBS MAX											
0.32 (8)	4 3/4	4	0.965	TX 40	0.228	0.213	0.315	0.315	180,000	2,040	3,060
	6 1/4 to 15 3/4	4 3/4									
TBS FRAME											
0.32 (8)	2 7/8 to 6 7/8	1 5/16	0.748	TX 40	0.228	0.213	0.315	0.315	180,000	2,040	3,060

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

[1]The overall length is measured from the underside of the large washer head to the screw tip, as shown in Figure 1A.

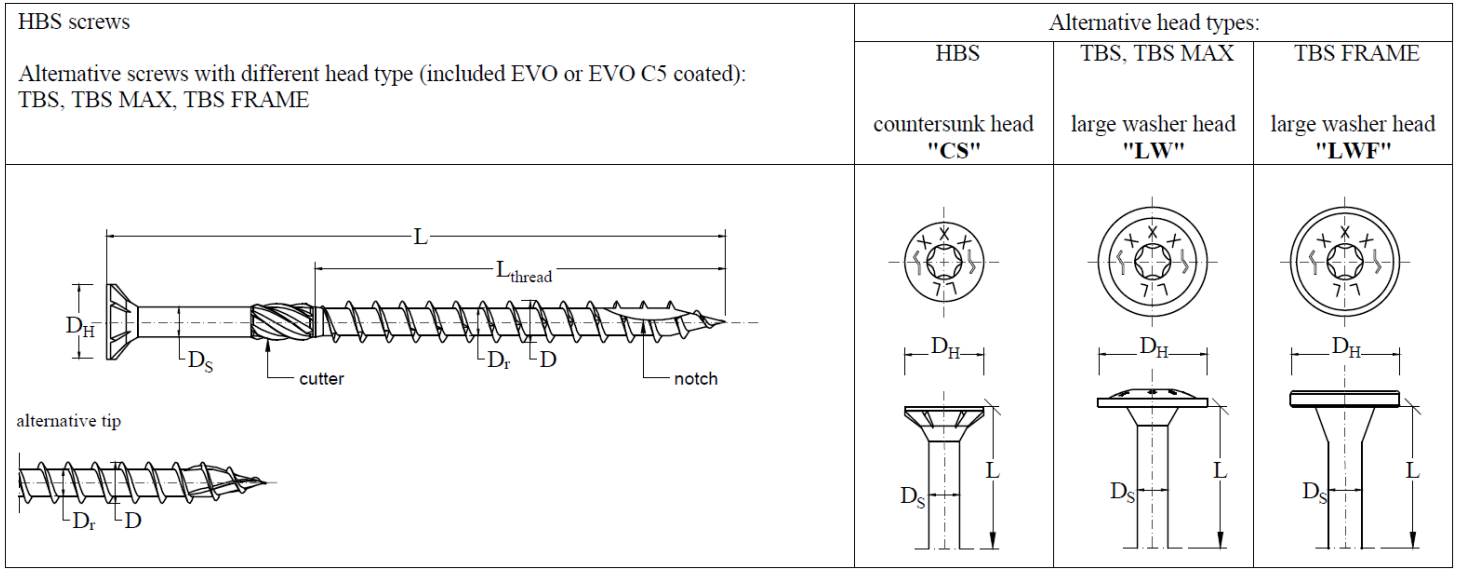


FIGURE 1A—TYPICAL PARTIALLY-THREADED SCREWS FOR WOOD-TO-WOOD CONNECTIONS
Note: The presence or absence of the reamer knurl (cutter) and notch depends on screw size and length.

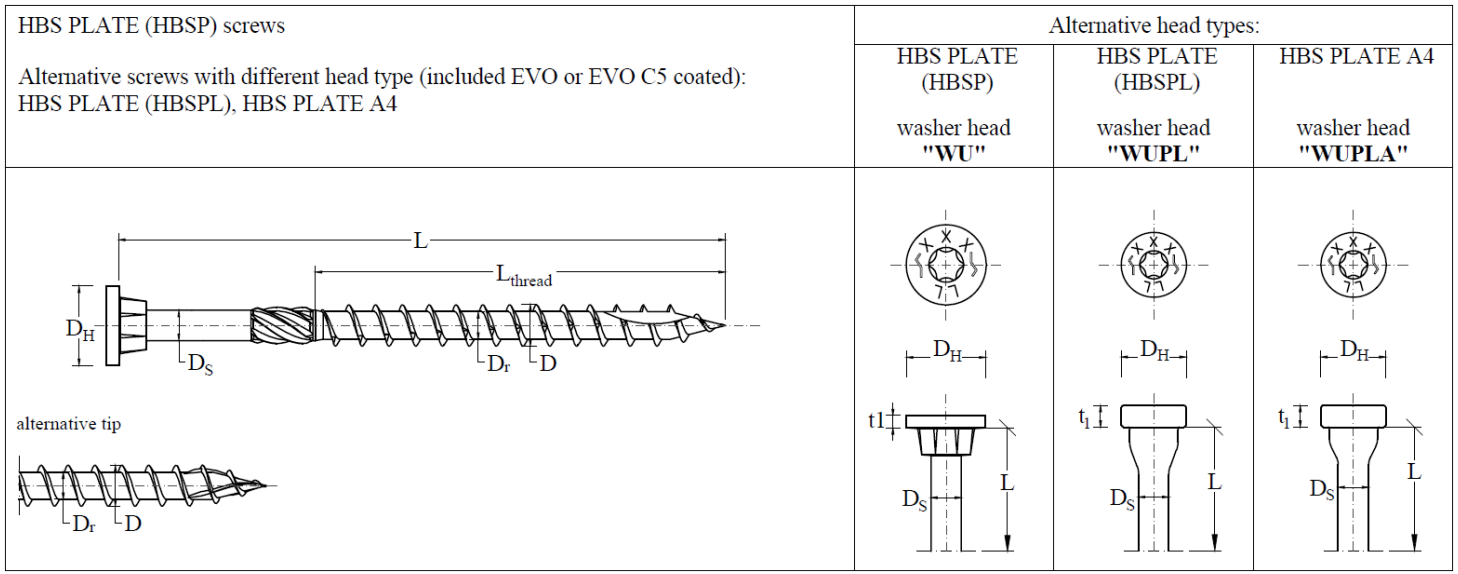


FIGURE 1B—TYPICAL PARTIALLY-THREADED SCREWS FOR STEEL PLATES
Note: The presence or absence of the reamer knurl (cutter) and notch depends on screw size and length.

TABLE 2A—LBS AND LBSH SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
LBS										
0.20 (5)	1 to $2^3/_4$	L – 0.157	0.307	TX 20	0.118	0.197	0.197	180,000	740	1,110
0.28 (7)	$2^3/_8$ to 4	L – 0.197	0.433	TX 30	0.173	0.276	0.276	192,000	1,600	2,410
LBSH										
0.20 (5)	$1^9/_{16}$ to $4^3/_4$	L – 0.157	0.307	TX 20	0.137	0.197	0.197	185,000	980	1,470
0.28 (7)	$2^3/_8$ to 8	L – 0.197	0.433	TX 30	0.191	0.276	0.276	195,000	2,050	3,080

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

[1]The overall length is measured from the underside of the head to the screw tip, as shown in Figure 2.

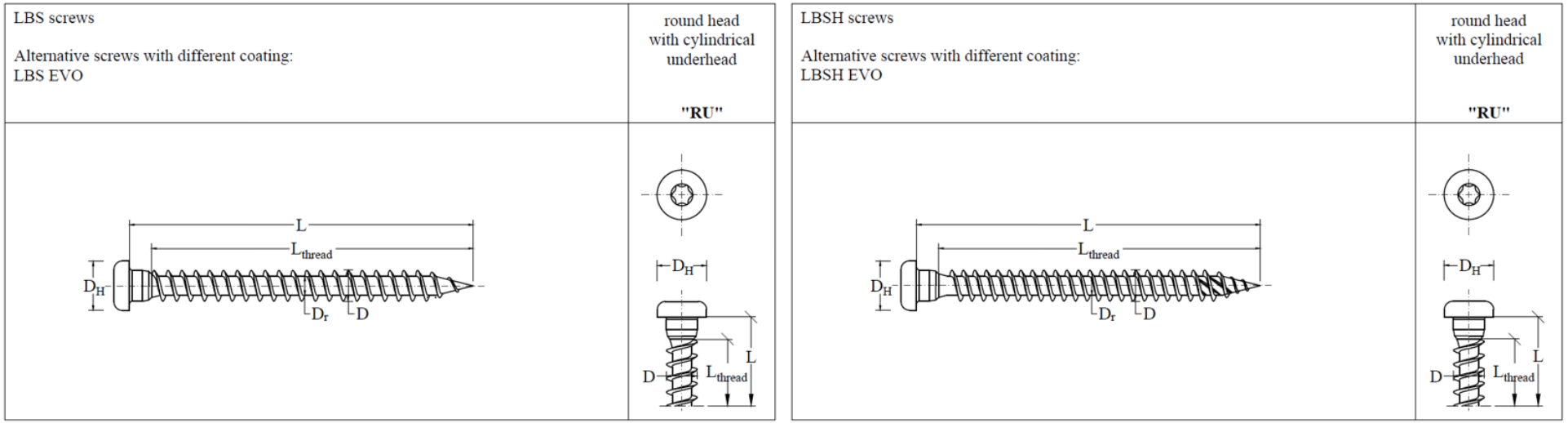


FIGURE 2—LBS AND LBSH FULLY THREADED SCREWS

TABLE 2B—VGZ SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.21 (5.3)	$3^1/_8$ to $4^3/_4$	L – 0.394	0.315	TX 25	0.142	0.209	0.209	168,000	1,000	1,550
0.23 (5.6)	$5^1/_2$ to $6^1/_4$	L – 0.394	0.315	TX 25	0.150	0.220	0.220	168,000	1,100	1,680
0.28 (7)	$3^1/_8$ to $15^3/_4$	L – 0.394	0.374	TX 30	0.181	0.276	0.276	195,000	1,450	2,210
0.36 (9)	$6^1/_4$ to $23^5/_8$	L – 0.394	0.453	TX 40	0.232	0.354	0.354	180,000	2,450	3,710
0.44 (11)	6 to $39^3/_8$	L – 0.394	0.531	TX 50	0.260	0.433	0.433	170,000	3,200	4,820
0.52 (13)	$3^1/_8$ to $59^1/_{16}$	L – 0.394	0.610	TX 50	0.315	0.512	0.512	161,000	4,400	6,650

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

[1]The overall length is measured from the top of the head to the screw tip, as shown in Figure 3.

TABLE 2C—VGS SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	HEAD STYLE	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.36 (9)	Countersunk (CS)	4 to $23^5/_8$	L – 0.394	0.630	TX 40	0.232	0.354	0.354	180,000	2,450	3,710
0.44 (11)	Countersunk (CS)	$3^1/_8$ to $23^5/_8$	L – 0.394	0.760	TX 50	0.260	0.433	0.433	170,000	3,200	4,820
	Hexagonal (EXA)	$25^9/_{16}$ to $39^3/_8$	L – 0.787	0.669	SW 17						
0.52 (13)	Countersunk (CS)	$3^1/_8$ to 10	L – 0.394	0.866	TX 50	0.315	0.512	0.512	161,000	4,400	6,650
		$11^3/_4$ to $23^5/_8$	L – 0.787	0.866	TX 50						
	Hexagonal (EXA)	$25^9/_{16}$ to $59^1/_{16}$	L – 0.787	0.748	SW 19						

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

[1]The overall length is measuredas shown in Figure 3.

TABLE 2D—VGS PLATE SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	HEAD STYLE	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.44 (11)	Countersunk Hexagonal (CEX)	$3^1/_8$ to 11	L – 0.394	0.787	TX 50 SW 17	0.260	0.433	0.433	170,000	3,200	4,820

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

[1]The overall length is measured as shown in Figure 3.

TABLE 2E—VGS A4 SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	HEAD STYLE	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.36 (9)	Countersunk (CS)	$4^3/_4$ to $14^1/_4$	L – 0.394	0.630	TX 40	0.232	0.354	0.354	115,000	1,780	2,670
0.44 (11)	Countersunk (CS)	4 to $23^5/_8$	L – 0.394	0.760	TX 50	0.260	0.433	0.433	136,000	2,270	3,400

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

[1]The overall length is measured as shown in Figure 3.

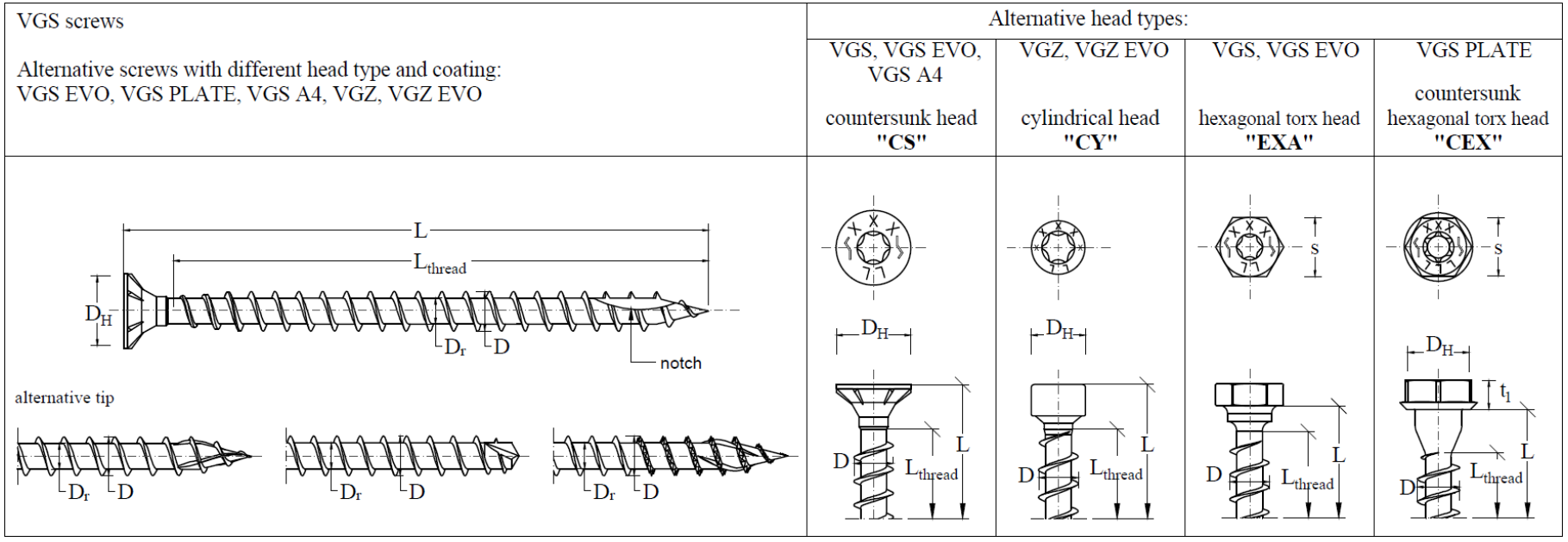


FIGURE 3—TYPICAL VGS, VGS EVO, VGS PLATE, VGS A4, VGZ AND VGZ EVO FULLY THREADED SCREWS

Note: The presence or absence of the milling ribs and notch depends on screw size and length.

TABLE 3—DGZ AND CTC SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	DESIGNATION	L^1 (inches)	$L_{thread,1} - L_{thread,2}$ (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.28 (7)	DGZ	$8^5/_8$ to 15	$4 - 2^3/_8$	0.374	TX 30	0.197	0.181	0.276	0.276	195,000	1,750	2,640
	CTC	$6^1/_4$	$4^3/_8 - 1^9/_{16}$	0.374	TX 30	0.197	0.181	0.276	0.276	195,000	1,750	2,640
		$9^1/_2$	$7^1/_2 - 1^9/_{16}$									
0.36 (9)	DGZ	$9^1/_2$ to $20^1/_2$	$4 - 2^3/_8$	0.453	TX 40	0.256	0.232	0.354	0.354	180,000	2,900	4,360
	CTC	$6^1/_4$	$4^3/_8 - 1^9/_{16}$	0.453	TX 40	0.256	0.232	0.354	0.354	180,000	2,900	4,360
		$9^1/_2$	$7^1/_2 - 1^9/_{16}$									

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

[1]The overall length is measured from the top of the head to the screw tip.

[2]$L_{thread,1}$ includes the screw tip. $L_{thread,2}$ is located towards the screw head, as shown in Figures 4 and 5.

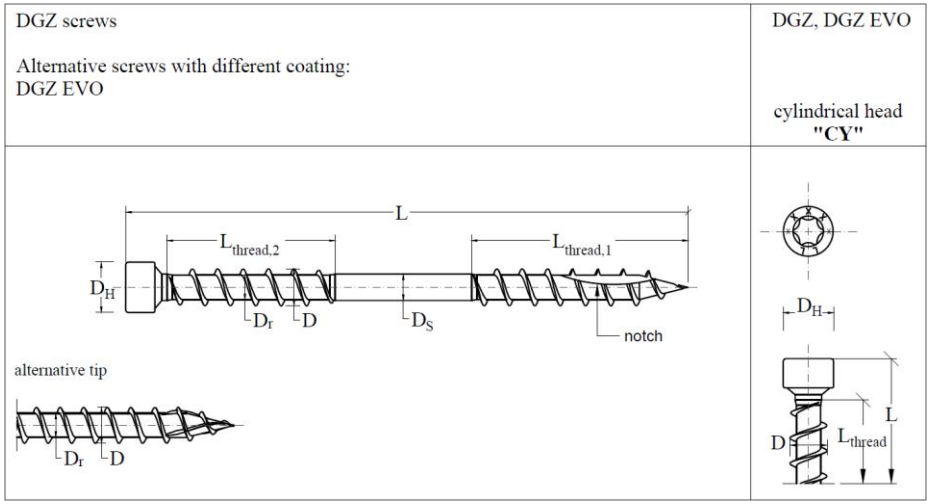


FIGURE 4—DGZ AND DGZ EVO DOUBLE THREADED SCREWS
Note: The presence or absence of the notch depends on screw size and length.

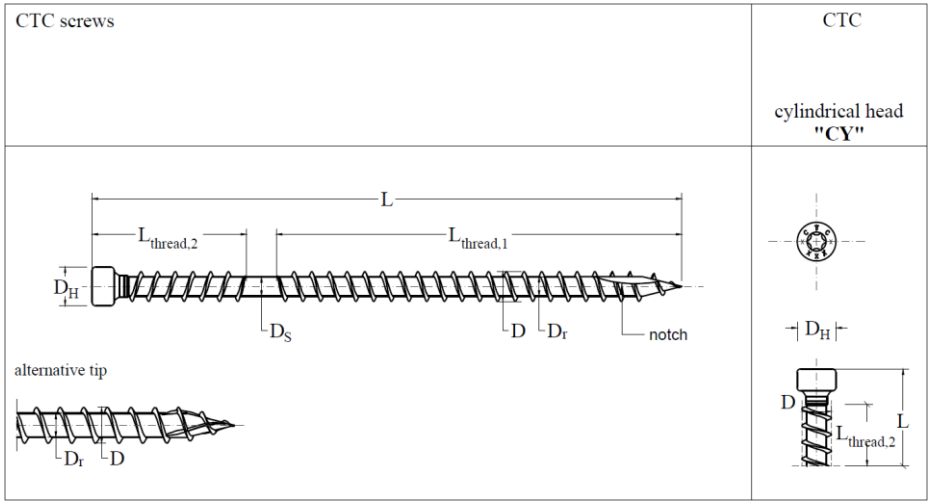


FIGURE 5—CTC DOUBLE THREADED SCREWS
Note: The presence or absence of the notch depends on screw size and length.

TABLE 4A—KKF SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.16 (4)	1 3/16	11/16	0.303	TX 20	0.114	0.102	0.157	0.157	179,000	480	720
	1 3/8	13/16									
	1 9/16	15/16									
	1 3/4 to 1 15/16	1 3/16									
0.18 (4.5)	13/16	9/16	0.343	TX 20	0.132	0.120	0.177	0.177	185,000	740	1,120
	1 9/16	15/16									
	1 3/4 to 1 15/16	1 3/16									
	2 3/8	1 3/8									
	2 3/4	1 9/16									
0.20 (5)	1 9/16	15/16	0.380	TX 25	0.142	0.128	0.197	0.197	164,000	810	1,220
	1 15/16	1 3/16									
	2 3/8	1 3/8									
	2 3/4	1 9/16									
	3 1/8	1 15/16									
	3 1/2	2 3/16									
	4	2 3/8									
0.24 (6)	3 1/8	1 15/16	0.459	TX 30	0.169	0.159	0.236	0.236	150,000	1,170	1,760
	4	2 3/8									
	4 3/4	2 15/16									

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

[1]The overall length is measured from the underside of the washer head to the screw tip, as shown in Figure 6.

TABLE 4B—SHS AS SCREW DIMENSIONS AND STRENGTHS

D_{nom} [inch (mm)]	L^1 (inches)	L_{thread} (inches)	D_H (inch)	DRIVE TYPE AND SIZE	D_S (inch)	D_r (inch)	D (inch)	L_{tip} (inch)	$F_{yb,spec}$ (psi)	N_a (lbf)	N_u (lbf)
0.18 (4.5)	$1^{15}/_{16}$	$1^{3}/_{16}$	0.295	TX 20	0.132	0.120	0.177	0.177	185,000	740	1,120
	$2^{3}/_{8}$	$1^{3}/_{8}$									
	$2^{3}/_{4}$	$1^{9}/_{16}$									
0.20 (5)	$1^{15}/_{16}$	$^{15}/_{16}$	0.335	TX 25	0.142	0.128	0.197	0.197	164,000	810	1,220
	$2^{3}/_{8}$	$1^{3}/_{16}$									
	$2^{3}/_{4}$	$1^{3}/_{8}$									
	$3^{1}/_{8}$	$1^{9}/_{16}$									
	4	$1^{15}/_{16}$									
0.24 (6)	$3^{1}/_{8}$	$1^{9}/_{16}$	0.433	TX 30	0.169	0.159	0.236	0.236	150,000	1,170	1,760
	4	$1^{15}/_{16}$									
	$4^{3}/_{4}$	$2^{3}/_{8}$									
	$5^{1}/_{2}$ to 8	$2^{15}/_{16}$									
0.32 (8)	$4^{3}/_{4}$ to $5^{1}/_{2}$	$2^{3}/_{8}$	0.512	TX 40	0.228	0.213	0.315	0.315	180,000	2,180	3,280
	$6^{1}/_{4}$ to 11	$3^{1}/_{8}$									

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

[1]The overall length is measured from the top of the head to the screw tip, as shown in Figure 6.

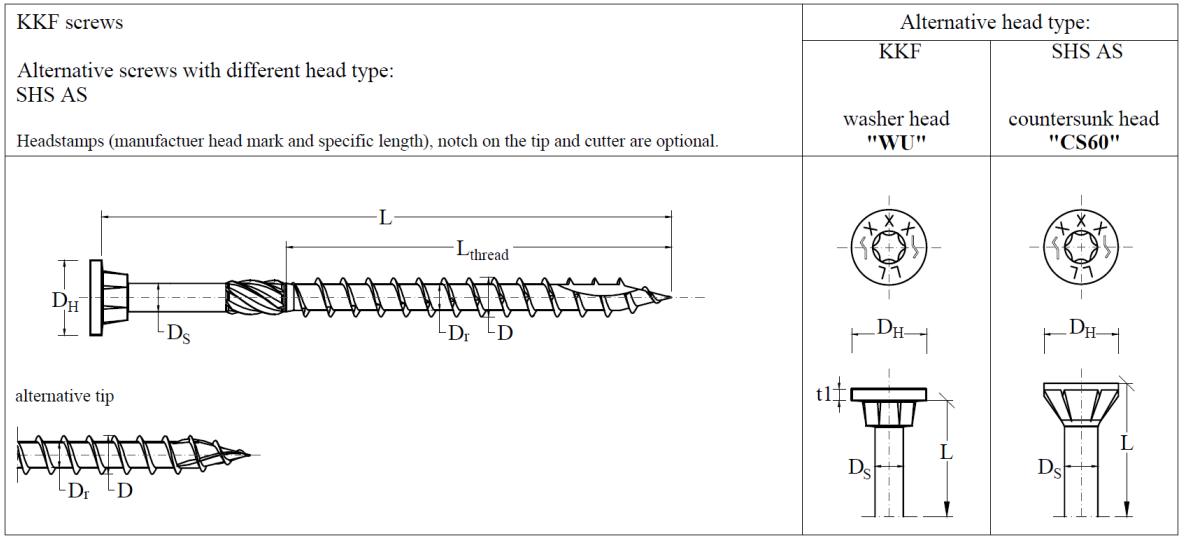
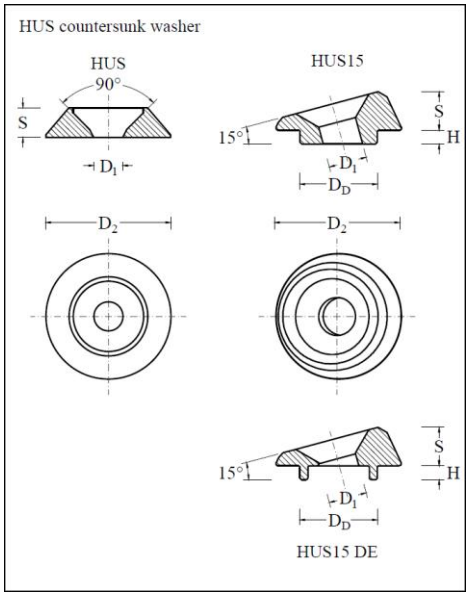


FIGURE 6—KKF AND SHS AS PARTIALLY THREADED STAINLESS-STEEL SCREWS

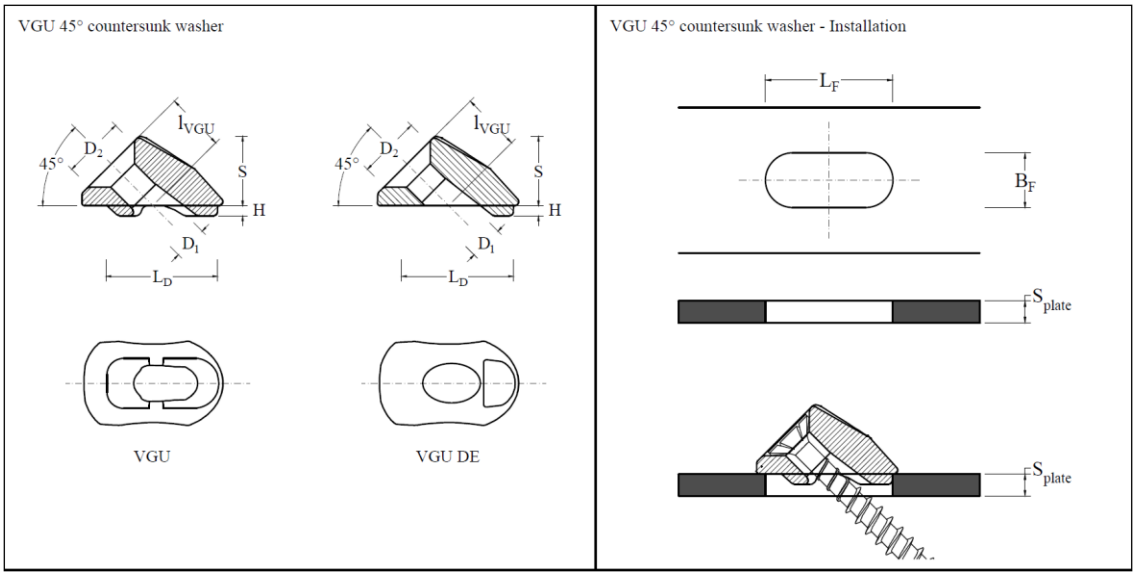
Note: The presence or absence of the reamer knurl (cutter) and notch depends on screw size and length.



DESIGNATION	APPLICABLE SCREW TYPE	D_1 (inch)	D_2 (inch)	S (inch)	H (inch)	D_D (inch)
HUS6, HUSEVO6	HBS6, HBSEVO6	0.295	0.787	0.177	-	-
HUS8, HUSEVO8	HBS8, HBSEVO8, VGS9, VGSEVO9	0.335	0.984	0.217	-	-
HUS10, HUSEVO10	HBS10, HBSEVO10, VGS11, VGSEVO11	0.425	1.181	0.256	-	-
HUS12, HUSEVO12	HBS12, HBSEVO12 VGS13, VGSEVO13	0.551	1.457	0.335	-	-
HUS815, HUS815DE	HBS8, HBSEVO8, VGS9, VGSEVO9	0.374	1.236	0.378	0.138	0.764

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

FIGURE 7—HUS, HUS EVO AND HUS15 COUNTERSUNK WASHERS



DESIGNATION	APPLICABLE SCREW TYPE	D_1 (inch)	D_2 (inch)	S (inch)	H (inch)	L_D (inch)	l_{VGU} (inch)	Slotted hole length L_F (inch)	Slotted hole width B_F (inch)	Metal plate thickness S_{plate} (inch)[1]
VGU945 VGU945DE	VGS9, VGSEVO9	0.382	0.748	0.787	0.118	1.252	0.740	min. 1.299 max. 1.339	min. 0.551 max. 0.591	min. 0.118 max. 0.472
VGU1145 VGU1145DE	VGS11, VGSEVO11	0.465	0.906	0.961	0.142	1.528	0.906	min. 1.614 max. 1.654	min. 0.669 max. 0.709	min. 0.157 max. 0.591
VGU1345 VGU1345DE	VGS13, VGSEVO13	0.551	1.079	1.130	0.169	1.803	1.059	min. 1.929 max. 1.969	min. 0.787 max. 0.827	min. 0.197 max. 0.591

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

[1]For metal plates with thickness greater than the tabulated maximum, the bottom of the hole must be flared to prevent contact between the screw thread and the metal plate.

FIGURE 8—VGU 45˚ AND VGU 45˚ EVO COUNTERSUNK WASHER

TABLE 5—REFERENCE WITHDRAWAL DESIGN VALUES (W) FOR INSTALLATION INTO THE FACE OF THE WOOD MEMBER[1]

SCREW DESIGNATION	D_{nom} [inch (mm)]	D_r (inch)	TIP TYPES	$L_{emb,w}$[2] (inches)	REFERENCE WITHDRAWAL DESIGN VALUE, W (lbf/in) FOR SELECTED SG_{NDS} VALUES:			
					0.35	0.42	0.49	0.55
Partially-threaded Screws								
HBS	0.14 (3.5)	0.089	Notch, ribbed	13/16	86	99	111	121
HBS	0.16 (4)	0.100	Notch, ribbed	15/16	86	99	111	121
KKF		0.102	Notch, ribbed	15/16	86	99	111	121
HBS	0.18 (4.5)	0.110	Notch, ribbed	1 1/16	86	99	111	121
KKF / SHS AS		0.120	Notch, ribbed	1 1/16	86	99	111	121
HBS HBS PLATE (HBSP)	0.20 (5)	0.134	Notch, ribbed	1 3/16	103	119	133	146
KKF / SHS AS		0.120	Notch, ribbed	1 3/16	103	119	133	146
HBS HBS PLATE (HBSP) TBS	0.24 (6)	0.156	Notch, ribbed	1 7/16	131	151	171	188
KKF / SHS AS		0.159	Notch, ribbed	1 7/16	131	151	171	188
HBS HBS PLATE (HBSP) TBS / TBS MAX / TBS FRAME SHS AS	0.32 (8)	0.213	Notch, ribbed	1 7/8	172	199	225	247
HBS PLATE (HBSPL) HBS PLATE (HBSPL) A4		0.232	Notch, ribbed	2 1/2	141	162	183	200
HBS HBS PLATE (HBSP) TBS	0.40 (10)	0.252	Notch, ribbed	2 3/8	206	239	270	296
HBS PLATE (HBSPL) HBS PLATE (HBSPL) A4		0.260	Notch, ribbed	3 7/8	186	214	241	263
HBS HBS PLATE (HBSP) TBS	0.48 (12)	0.268	Notch, ribbed	2 13/16	220	255	288	316
HBS PLATE (HBSPL) HBS PLATE (HBSPL) A4		0.287	Notch, ribbed	4 1/4	222	255	288	314
Double-thread and Fully-threaded Screws								
VGZ	0.21 (5.3)	0.142	Notch, ribbed, drill	1 1/4	102	118	132	145
VGZ	0.23 (5.6)	0.150	Notch, ribbed, drill	1 5/16	107	123	139	152
VGZ	0.28 (7)	0.181	Notch, ribbed, drill	1 5/8	141	164	185	203
DGZ / CTC		0.181	Notch, ribbed	1 5/8	141	164	185	203
VGZ / VGS / VGS A4	0.36 (9)	0.232	Notch, ribbed, drill	2 1/8	192	220	255	280
DGZ / CTC		0.232	Notch, ribbed	2 1/8	192	220	255	280
VGZ / VGS / VGS A4 / VGS PLATE	0.44 (11)	0.260	Notch, ribbed, drill	2 5/8	207	240	272	298
VGZ / VGS	0.52 (13)	0.315	Notch, ribbed, drill	3 1/16	235	272	308	338
LBS	0.20 (5)	0.118	Sharp	1 3/16	99	114	128	140
LBS	0.28 (7)	0.173	Sharp	1 5/8	115	132	149	162
LBSH	0.20 (5)	0.137	Sharp with ribs	1 5/8	113	129	146	159
LBSH	0.28 (7)	0.191	Sharp with ribs	2 3/4	144	166	187	204

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

[1] The determination of the reference withdrawal design values (W_α) for screws installed at an angle to the grain between 0° and 90° is addressed in Section 4.1.4.

[2] Includes tip length.

TABLE 6—REFERENCE HEAD PULL-THROUGH DESIGN VALUES FOR HBS, TBS, TBS FRAME AND TBS MAX SCREWS (W_H)

SCREW DESIGNATION	NOMINAL DIAMETER D_{nom} [inch (mm)]	HEAD DIAMETER D_H (inch)	MINIMUM SIDE MEMBER THICKNESS $t_{s,w}$ (inches)	REFERENCE HEAD PULL-THROUGH DESIGN VALUE, W_H (lbf) FOR SELECTED SG_{NDS} VALUES:			
				0.35	0.42	0.49	0.55
HBS	0.14 (3.5)	0.276	1	51	59	67	73
HBS	0.16 (4)	0.315	1 1/2	75	87	98	108
HBS	0.18 (4.5)	0.354	1 1/2	95	110	124	136
HBS	0.20 (5)	0.394	1 1/2	117	136	153	168
HBS	0.24 (6)	0.472	1 1/2	142	165	186	204
HBS	0.32 (8)	0.571	1 1/2	220	264	298	327
HBS	0.40 (10)	0.719	1 1/2	273	316	357	392
HBS	0.48 (12)	0.817	1 1/2	392	453	513	562
TBS	0.24 (6)	0.610	1 1/2	182	263	357	450
TBS / TBS FRAME	0.32 (8)	0.748	1 1/2	223	322	438	552
TBS	0.40 (10)	0.984	1 1/2	314	452	615	774
TBS MAX	0.32 (8)	0.965	1	421	484	545	594

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

TABLE 7—REFERENCE HEAD PULL-THROUGH DESIGN VALUES FOR DGZ SCREWS (W_H)[1]

SCREW DESIGNATION	NOMINAL DIAMETER D_{nom} [inch (mm)]	HEAD DIAMETER D_H (inch)	MINIMUM SIDE MEMBER THICKNESS $t_{s,w}$ (inches)	REFERENCE HEAD PULL-THROUGH DESIGN VALUE, W_H (lbf) FORSELECTED SG_{NDS} VALUES:			
				0.35	0.42	0.49	0.55
DGZ	0.28 (7)	0.374	1 1/2	191	220	248	270
DGZ	0.36 (9)	0.453	1 1/2	196	225	253	277

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

[1] Tabulated values for DGZ screws are applicable to screws installed at 60˚ angle to the grain.

TABLE 8—CONNECTION GEOMETRY REQUIREMENTS FOR FASTENERS INSTALLED PERPENDICULAR TO THE FACE OF WOOD MEMBERS AND INCLINED FASTENERS BASED ON D[1,2,3]

CONDITION		MINIMUM DISTANCE OR SPACING		
		Self-drilled		Predrilled Hole
		$SG_{NDS} < 0.50$	$SG_{NDS} \geq 0.50$	
For screws with D_s of less than $^1/_4$ inch, installed into sawn lumber, structural glued laminated timber (GL) and cross laminated timber (CLT) panels				
End distance (Figures A and C)	Loading toward end, $a_{end,1}$ ($a_{3,t}$)	15D	20D	12D
	Loading perpendicular to grain or away from end, $a_{end,2}$ ($a_{3,c}$)	10D	15D	7D
	Axial loading, $a_{end,2}$ ($a_{3,a}$)	10D	10D	7D
	Inclined fastener, $a_{end,CG}$ ($a_{1,CG}$)			
Edge distance (Figures A and C)				
	Loading toward edge, $a_{edge,1}$ ($a_{4,t}$)	10D	12D	7D
	Loading parallel to grain or away from edge, $a_{edge,2}$ ($a_{4,c}$)	5D	7D	3D
	Axial Loading, $a_{edge,2}$ ($a_{4,a}$)	4D	4D	3D
	Inclined fastener, $a_{edge,CG}$ ($a_{2,CG}$)			
Spacing between fasteners, parallel to grain (Figures B and C)	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
	Inclined fastener, a_1			
Spacing between fasteners, perpendicular to grain (Figures B and C)	Lateral loading, a_2	5D	7D	4D
	Axial loading, a_2	4D	4D	3D
	Inclined fastener, a_2			
	Inclined fastener, crossed screws, $a_{2,cross}$	1.5D	1.5D	1.5D
For screws with D_s equal to or greater than $^1/_4$ inch, installed into sawn lumber, structural glued laminated timber (GL) and cross laminated timber (CLT) panels				
End distance (Figures A and C)	Loading toward end, $a_{end,1}$ ($a_{3,t}$)	15D	20D	7D
	Loading perpendicular to grain or away from end, $a_{end,2}$ ($a_{3,c}$)	10D	15D	4D
	Axial loading, $a_{end,2}$ ($a_{3,a}$)	10D	10D	4D
	Inclined fastener, $a_{end,CG}$ ($a_{1,CG}$)			
Edge distance (Figures A and C)				
	Loading toward edge, $a_{edge,1}$ ($a_{4,t}$)	10D	12D	4D
	Loading parallel to grain or away from edge, $a_{edge,2}$ ($a_{4,c}$)	5D	7D	3D
	Axial Loading, $a_{edge,2}$ ($a_{4,a}$)	4D	4D	3D
	Inclined fastener, $a_{edge,CG}$ ($a_{2,CG}$)			
Spacing between fasteners, parallel to grain [4] (Figures B and C)	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
	Inclined fastener, a_1			
Spacing between fasteners, perpendicular to grain (Figures B and C)	Lateral loading, a_2	5D	7D	5D
	Axial loading, a_2	5D	5D	5D
	Inclined fastener, a_2			
	Inclined fastener, crossed screws $a_{2,cross}$	1.5D	1.5D	1.5D

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

(Footnotes on following page)

[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]Values in Table 8 are applicable for wood-to-wood and steel-to-wood connections.
[4]Spacing, edge and end distance may be reduced in accordance with Table 10, when applicable.
[5]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.
[6]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 what is shown in Section 4.3.

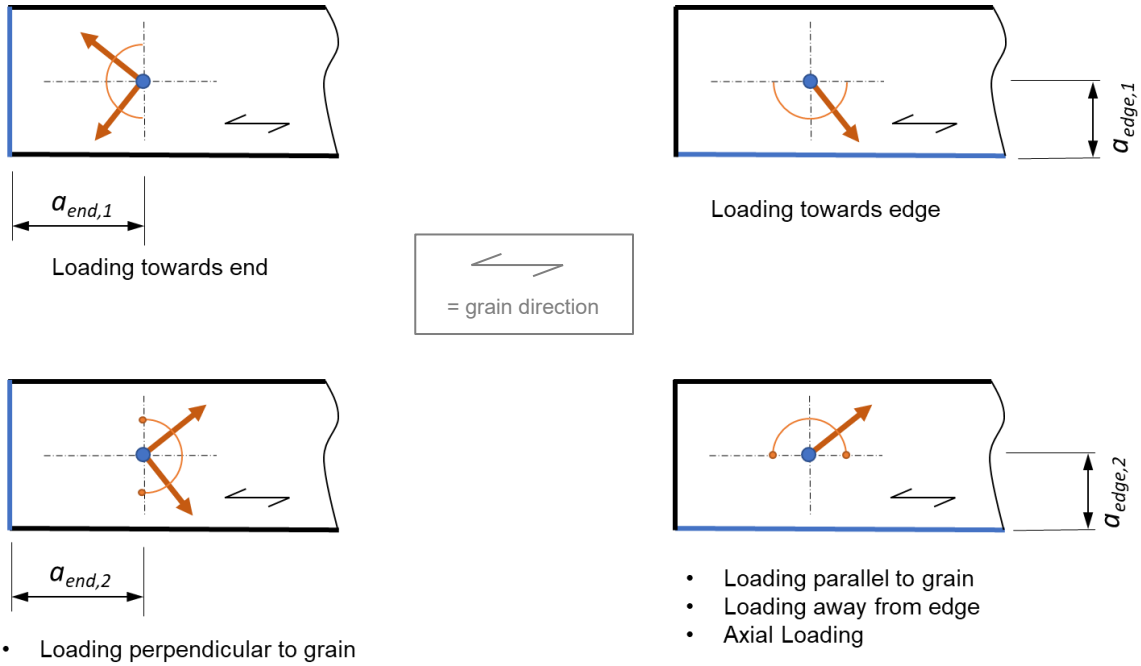


FIGURE A—END AND EDGE DISTANCE DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN

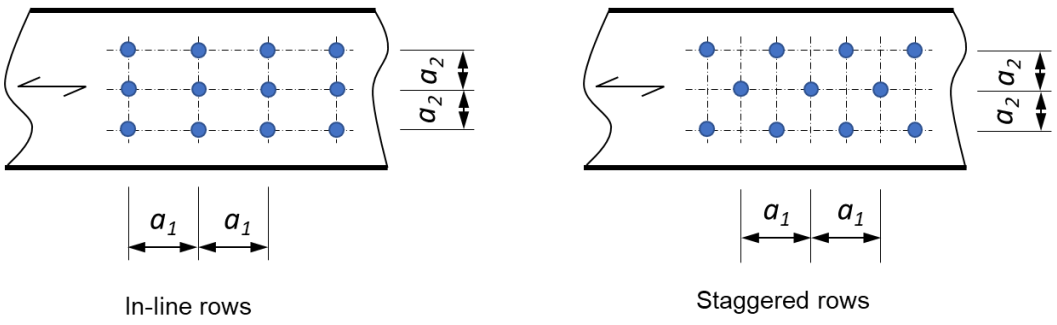


FIGURE B—SPACING DEFINITIONS FOR SCREWS INSTALLED PERPENDICULAR TO GRAIN

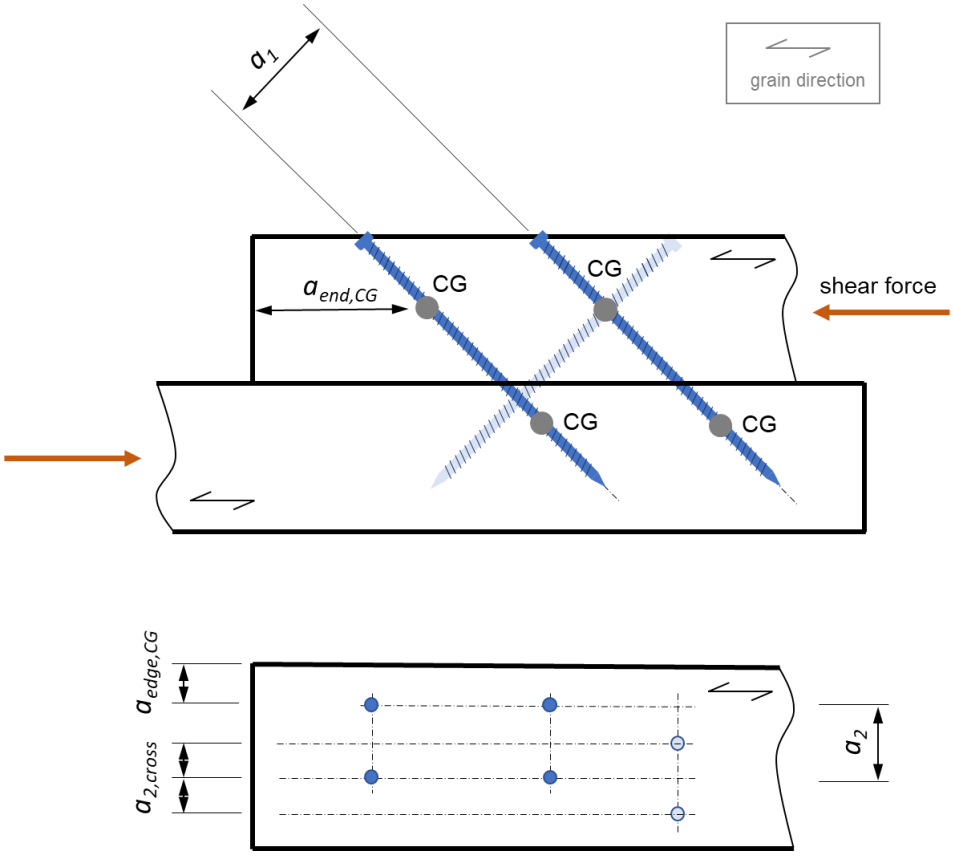


FIGURE C—SPACING DEFINITIONS FOR INCLINED AND CROSSED SCREWS

TABLE 9—REFERENCE LATERAL DESIGN VALUES (Z) FOR TESTED WOOD-TO-WOOD CONNECTIONS WITH PARTIALLY THREADED SCREWS[1]

SCREW DESIGNATION[2]	D_{nom} [inch (mm)]	$L_{emb,l}$ (inches)	$t_{s,w}$ (inches)	Z (lbf) FOR SELECTED SG_{NDS} VALUES:											
				0.35			0.42			0.49			0.51		
				$Z_{\parallel}$	$Z_{\perp/\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp/\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp/\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp/\parallel}$	$Z_{\perp}$
HBS / TBS	0.32 (8mm)	$6^1/_4$	$2^1/_4$	207	207	207	245	245	245	282	282	282	292	292	292
	0.40 (10mm)	$6^1/_4$	$2^7/_8$	308	308	308	338	338	338	365	365	365	372	372	372
	0.48 (12mm)	$6^1/_4$	$3^1/_2$	353	353	353	387	387	387	418	418	418	426	426	426

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

[1]See Table 10 for applicable connection geometry requirements.
[2]Tabulated values apply to screws with EVO and EVO C5 coatings also.

TABLE 10—REDUCED CONNECTION GEOMETRY REQUIREMENTS BASED ON TESTING OF WOOD-TO-WOOD CONNECTIONS WITH HBS, TBS AND HBS PLATE SCREWS[1,2,3,4]

SCREW DESIGNATION[5]	D_{nom} [inch (mm)]	MINIMUM $t_{s,w}$ (inches)	CONDITION		MINIMUM REQUIREMENT	
					$SG_{NDS} < 0.48$	$0.48 \le SG_{NDS} \le 0.51$
HBS HBS PLATE (HBSP) TBS	0.32 (8mm)	$2^1/_4$	Spacing between screws, parallel to grain, a_1 (Figure B)	Loading parallel to grain	10D	See Table 8
	0.40 (10mm)	$2^7/_8$			10D	See Table 8
	0.48 (12mm)	$3^1/_2$			10D	See Table 8
	0.32 (8mm)	$2^1/_4$		Loading perpendicular to grain	5D	7D
	0.40 (10mm)	$2^7/_8$			5D	7D
	0.48 (12mm)	$3^1/_2$			5D	7D

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

[1]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 screw spacing may need to be increased accordingly.
[3]Tabulated values are applicable for connections with self-drilled screws.
[4]For conditions not addressed above, refer to Table 8 for connection geometry requirements.
[5]Tabulated values apply to screws with EVO and EVO C5 coatings also.

TABLE 11—REFERENCE LATERAL DESIGN VALUES (Z) FOR TESTED METAL-TO-WOOD CONNECTIONS WITH PARTIALLY AND FULLY THREADED SCREWS[1]

SCREW DESIGNATION[2]	D_{nom} [inch (mm)]	$L_{emb,l}$ (inches)	$t_{s,s}$[4] (inches)	Z_{end} (lbf) FOR SELECTED SG_{NDS} VALUES:			
				0.35	0.42	0.49	0.51
LBS	0.20 (5mm)	$2^3/_4$	0.236	95	112	128	132
	0.28 (7mm)	$3^1/_8$	0.236	195	226	255	263
HBS PLATE (HBSP)	0.20 (5mm)	$1^{15}/_{16}$	0.236	84	108	125	129
	0.48 (12mm)[3,5]	$4^3/_4$	0.250	179	201	223	228

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

[1]See Table 12 for applicable connection geometry requirements.
[2]Tabulated values apply to screws with EVO and EVO C5 coatings also.[3]Rereference lateral design values have been limited to values determined in accordance with the NDS.
[4]Unless otherwise noted, the metal side member must have a minimum tensile strength, F_u, equal to 38 ksi (262 MPa) and minimum thickness of 0.197 inches.
[5]The side member must be steel and have a minimum tensile strength, F_u, equal to 58 ksi (400 MPa) and minimum thickness of 0.25 inches.

TABLE 12— END GRAIN SPACING AND DISTANCES FOR METAL TO WOOD CONNECTIONS BASED ON TESTING

CONDITION	LBS SCREWS		HBS PLATE SCREWS		
	D_{nom} = 0.20 inch (5mm)	D_{nom} = 0.28 inch (7mm)	D_{nom} = 0.20 inch (5mm)	D_{nom} = 0.48 inch (12mm)	
	$SG_{NDS} \leq 0.51$		$SG_{NDS} \leq 0.51$	$SG_{NDS} < 0.48$	$0.48 \leq SG_{NDS} \leq 0.51$
Spacing between screws - horizontal, $a_{1,H}$	7D	10.7D	7D	5D	7D
Spacing between screws - vertical, $a_{1,V}$	7D	7.1D	7D	8D	12D
Edge distance - horizontal, loading away from edge, $a_{4,c,H}$	4D	3.4D	4D	5D	7D
Edge distance - vertical, loading away from edge, $a_{4,c,V}$	6.5D	5D	6.5D	10D	15D
Edge distance, loading towards edge, $a_{4,t}$	12.5D	10.7D	12.5D	15D	20D

[1]See Figure 9 for fastener layout.

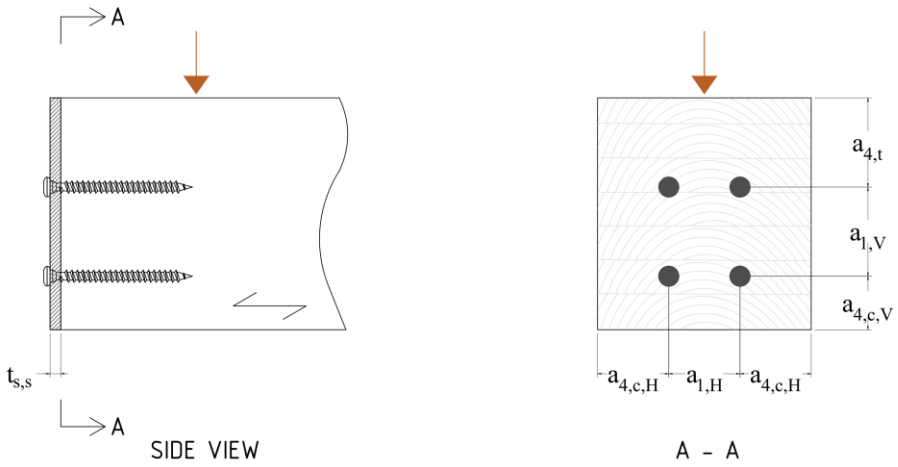


FIGURE 9— END GRAIN SPACING AND DISTANCES FOR LBS AND HBS PLATE SCREWS FOR METAL TO WOOD CONNECTIONS (BASED ON TESTING)

TABLE 13—APPLICABLE EXPOSURE CONDITIONS

EXPOSURE CONDITION	TYPICAL APPLICATIONS	LIMITATIONS
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 with occasional exposure to high humidity.
3	General construction	Limited to freshwater and chemically treated wood exposure, without saltwater exposure.

[1]Treated wood refers to the specific wood species, treatment and retention level described in Section 4.2.

TABLE 14—ALTERNATIVE PRODUCT DESIGNATIONS

PRIMARY PRODUCT DESIGNATION	ALTERNATIVE PRODUCT DESIGNATION
DGZ	DWZ
HBS HBS EVO	SNK SNK EVO
HBS PLATE (HBSP) HBS PLATE EVO (HBSP EVO)	KGL KGL EVO
HBS PLATE (HBSPL) HBS PLATE EVO (HBSPL EVO)	KGLPL KGLPL EVO
KKF	KGA
LBS	SBL
TBS TBS EVO	TLL TLL EVO
VGZ (Ø5.3 and Ø5.6) VGZ EVO (Ø5.3 and Ø5.6)	GWZ (Ø5.3 and Ø5.6) GWZ EVO (Ø5.3 and Ø5.6)

ICC-ES Evaluation Report

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Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

ROTHO BLAAS S.R.L.

EVALUATION SUBJECT:

ROTHO BLAAS SELF-TAPPING WOOD SCREWS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Rotho Blaas self-tapping screws described in ICC-ES evaluation report ESR-4645 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 Rotho Blaas self-tapping screws and washers, described in ICC-ES evaluation report ESR-4645, comply with the *Florida Building Code—Building* and the *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-4645 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* and the *Florida Building Code—Residential,* as applicable.

Use of the Rotho Blaas self-tapping screws and washers has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code-Building* or the *Florida Building Code-Residential*.

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 March 2025 and revised November 2025.