

ICC-ES Evaluation Report


ESR-3408

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<p>DIVISION: 06 00 00— WOOD, PLASTICS AND COMPOSITES</p> <p>Section: 06 05 23— Wood, Plastic, and Composite Fastenings</p>	<p>REPORT HOLDER: BI-MIRTH CORP.</p>	<p>EVALUATION SUBJECT: BI-MIRTH (BM) HEXFAST, HEXFAST+, TIMBERFAST AND TIMBERFAST+ SERIES WOOD SCREWS</p>	
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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 [International Building Code® \(IBC\)](#)
- 2012, 2009 and 2006 [International Residential Code® \(IRC\)](#)

Property evaluated:

Structural

2.0 USES

The Bi-Mirth (BM) HexFast, HexFast+, TimberFast and TimberFast+ series wood screws are used for wood-to-wood connections that are designed in accordance with the IBC and IRC.

3.0 DESCRIPTION

3.1 General:

The BM HexFast, HexFast+, BM TimberFast and TimberFast+ series wood screws are partially-threaded, self-drilling dowel-type screws designed to be installed in wood without drilling a lead hole. The BM HexFast and HexFast+ screws are produced in a hex drive and the BM TimberFast and TimberFast+ (30 & 40) screws are made with a Torx drive. The screws have rolled threads and flat washer-like heads. The screws must be installed using a drill in the rotary mode only.

The HexFast and HexFast+ screws have an unslotted hex washer head. The HexFast+ screws have a U thread design above the primary threads.

The dimensions of the HexFast and HexFast+ screws are shown in [Table 1](#) and images of the screws are shown in [Figure 1](#). [Table 1](#)

The BM TimberFast and TimberFast+ screws have a wafer head, with a Torx drive recess. The TimberFast+ screws have a U thread design above the primary threads. The dimensions of the TimberFast and TimberFast+ (TORX 30^{5/16} and TORX 40^{3/8}) screws are shown in [Tables 2](#) and [3](#), and images of the screws are shown in [Figures 2](#) and [3](#).

3.2 Materials:

3.2.1 BM Series Wood Screws: The screws are manufactured from C10B21 steel with supplementary heat treatment. The BM HexFast and HexFast+ screws have a Cr3 acidic zinc plating and an E-coating in black. The BM TimberFast and TimberFast+ (TORX 30^{5/16} and TORX 40^{3/8}) screws have a Cr3 acidic zinc coating and Nano Gold + Wax coating, which is available in multiple colors including blue, white, silver, and bronze.

3.2.2 Wood Members: Three species of wood side and main members are addressed in this report: Douglas Fir-Larch (DFL), Southern Pine (SP) and Spruce-Pine-Fir (SPF). Wood side and main members must have a moisture content of less than 19 percent both at time of screw installation, and in service. Douglas Fir-Larch (DFL) wood members must have an assigned specific gravity of 0.50. Southern Pine (SP) wood members must have an assigned specific gravity of 0.55 and Spruce-Pine Fir (SPF) wood members must have an assigned specific gravity of 0.42 or greater.

The thickness of the wood main member, t_m , must be equal to or greater than the screw length less the thickness of the side member. For wood-to-wood connections, the actual thickness of the wood side member, t_s , must be 1½ inches (38.1 mm), as specified in [Table 4](#). The wood side member thickness is an actual value, and is not a minimum or maximum value.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Reference lateral and withdrawal design values in the report are for allowable stress design, and must be multiplied by all applicable adjustment factors, as applicable to wood screws, in accordance with the NDS to determine adjusted design values. 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 stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group. Connections containing multiple screws must also be designed in accordance with Sections 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. Structural members forming the connection must be designed in accordance with the code.

Reference lateral (Z) design values for Bi-Mirth wood screws for single shear wood-to-wood connections loaded parallel to grain are shown in [Table 4](#), reference withdrawal (W) design values are shown in [Table 5](#), and reference head pull-through values are shown in [Table 7](#).

The allowable lateral load for a single-screw connection must be the lesser of: (a) the reference lateral design values given in [Table 4](#), adjusted by all applicable adjustment factors, and (b) the allowable screw shear strength given in [Table 1, 2, or 3](#), as applicable. The allowable load for a single-screw connection in which the screw is subject to tension must be the least of: (a) the reference withdrawal design load value given in [Table 5](#), adjusted by all applicable adjustment factors; (b) the reference head pull-through design value given in [Table 7](#), adjusted by all applicable factors; and (c) the allowable screw tension strength given in [Table 1, 2, or 3](#), as applicable.

4.2 Installation:

BM HexFast and HexFast+ series wood screws must be installed with a 5/16-inch (7.94 mm) hex head driver and a low-speed drill. Installation may be performed without predrilling wood members. BM TimberFast and TimberFast+ series wood screws must be installed with a star driver. Edge distances, end distances and spacing of the screws must be sufficient to prevent splitting of the wood, or as required by [Table 6](#) of this report, whichever is more restrictive. The bottom of the screw heads must be installed flush to the surface of the member being connected. The screws must not be overdriven.

5.0 CONDITIONS OF USE:

The Bi-Mirth (BM) HexFast, HexFast+, TimberFast and TimberFast+ series 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 The 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, this report governs.
- 5.2 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.
- 5.3 Use of the screws in contact with preservative-treated or fire-retardant-treated wood is outside the scope of this report.

6.0 EVIDENCE SUBMITTED

Data in accordance with the [ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners \(AC233\)](#), dated June 2014.

7.0 IDENTIFICATION

The packaging for the BM series wood screws is labeled with the designation “Bi-Mirth HexFast or HexFast+” or “Bi-Mirth TimberFast or TimberFast+ (TORX 30 & TORX 40)”, the report holder (Bi-Mirth Co.) name and address, the fastener size, and the ICC-ES evaluation report number (ESR-3408). Each screw head is marked with the letters ‘BM’.

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

BI-MIRTH CORP.
NO. 3 ALLEY 7 LANE 96, PING DER ROAD
40678 TAICHUNG, TAIWAN R.O.C
+886-4-22971981
www.bi-mirth.com

TABLE 1—BM HEXFAST & HEXFAST+ SERIES WOOD SCREW SPECIFICATIONS

DESIGNATION	OVERALL LENGTH ¹ , L (inches)	THREAD LENGTH ² , T (inches)	UNTHREADED SHANK DIAMETER (inch)	MINOR THREAD (ROOT) DIAMETER D _r (inch)	OUTSIDE THREAD DIAMETER (inch)	BENDING YIELD ³ F _{yb} (psi)	ALLOWABLE STEEL STRENGTH	
							TENSION (lbf)	SHEAR (lbf)
HF & HF+ 1/4 X 2 1/4	2 1/4	1 1/4	0.196	0.174	0.265	115,500	1,460	1,010
HF & HF+ 1/4 X 4	4	2 1/2						
HF & HF+ 1/4 X 6	6							
HF & HF+ 1/4 X 8	8							
HF & HF+ 1/4 X 10	10							
HF & HF+ 1/4 X 12	12							
HF & HF+ 1/4 X 14	14							
HF & HF+ 1/4 X 16	16							

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

¹Overall length is measured from the underside of head to bottom of tip.

²Length of thread includes tip.

³Bending yield strengths determined in accordance with ASTM F1575 using the minor thread (root) diameter, D_r.

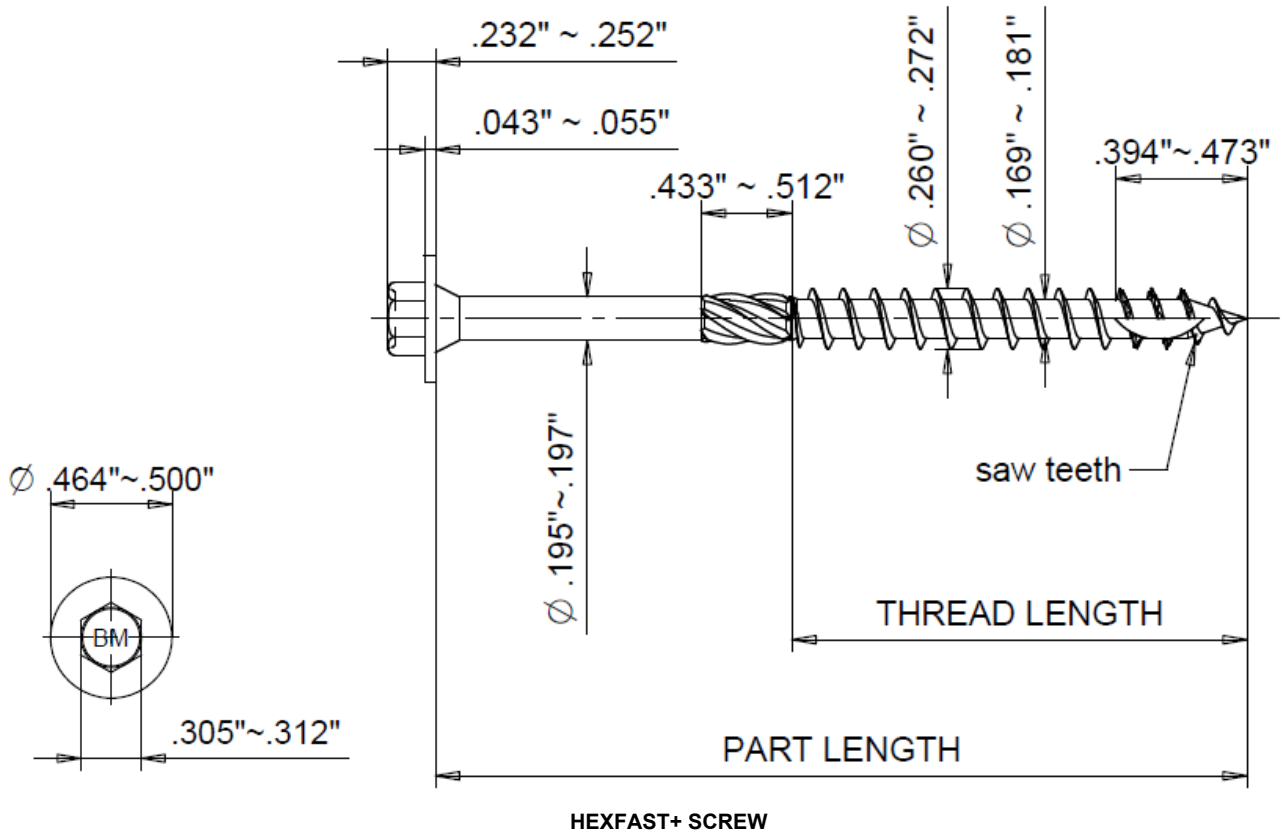
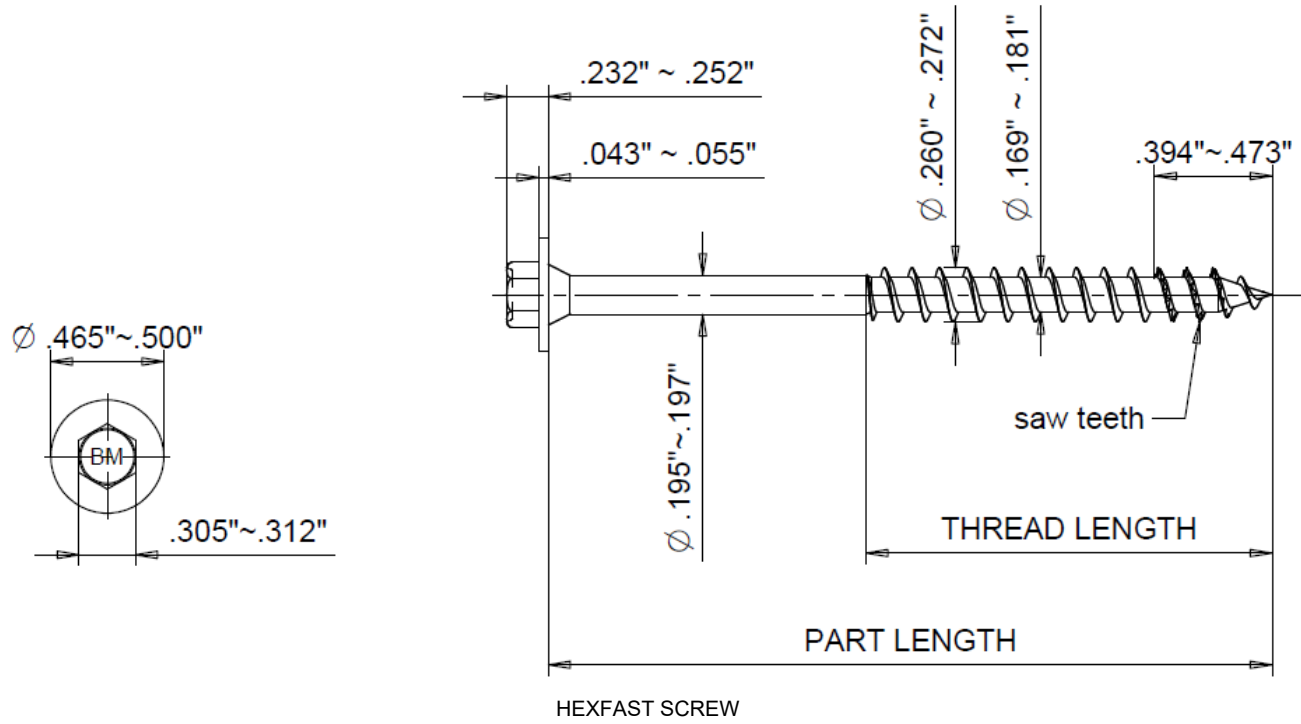


FIGURE 1—BM HEXFAST & HEXFAST+ SERIES WOOD SCREWS

TABLE 2—BM TIMBERFAST TORX 30 & TIMBERFAST+ TORX 30 SERIES WOOD SCREW SPECIFICATIONS

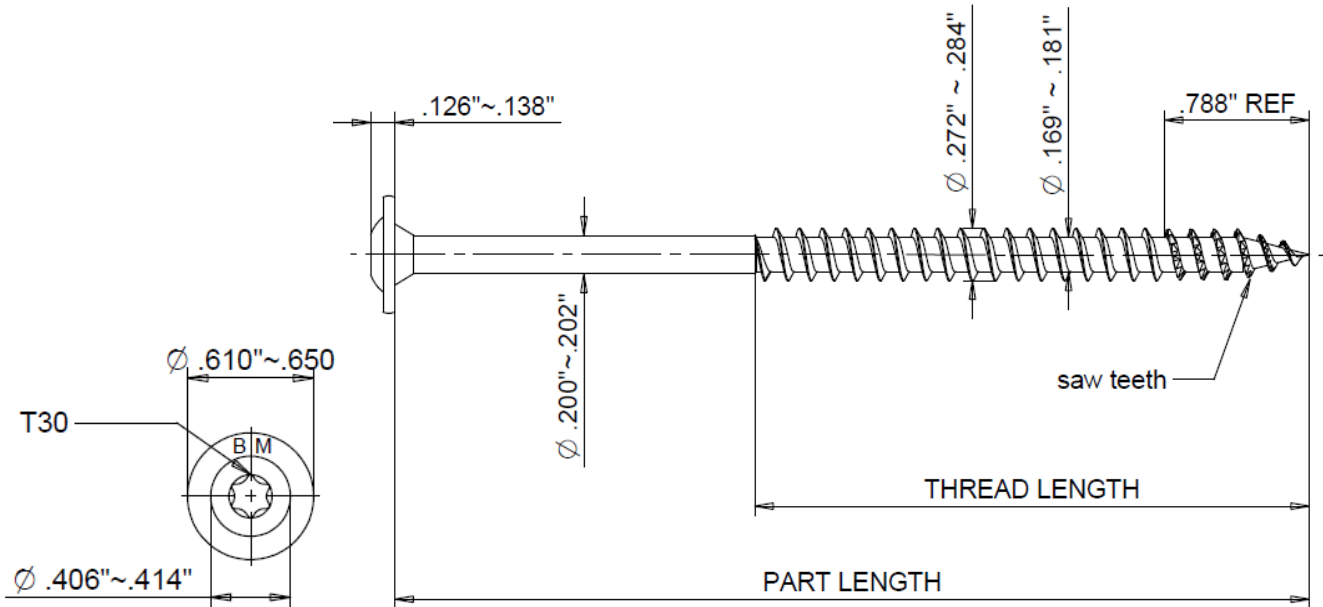
DESIGNATION	OVERALL LENGTH ¹ , L (inches)	THREAD LENGTH ² , T (inches)	UNTHREADED SHANK DIAMETER (inch)	MINOR THREAD (ROOT) DIAMETER D _r (inch)	OUTSIDE THREAD DIAMETER (inch)	BENDING YIELD ³ F _{yb} (psi)	ALLOWABLE STEEL STRENGTH	
							TENSION (lbf)	SHEAR (lbf)
TF & TF+ 30 ⁵ / ₁₆ X 2	2	1 1/2	0.201	0.175	0.275	110,700	1,315	920
TF & TF+ 30 ⁵ / ₁₆ X 2 1/2	2 1/2							
TF & TF+ 30 ⁵ / ₁₆ X 3	3	2						
TF & TF+ 30 ⁵ / ₁₆ X 3 1/2	3 1/2							
TF & TF+ 30 ⁵ / ₁₆ X 4	4	3						
TF & TF+ 30 ⁵ / ₁₆ X 5	5							
TF & TF+ 30 ⁵ / ₁₆ X 6	6	3 1/2						
TF & TF+ 30 ⁵ / ₁₆ X 7	7							
TF & TF+ 30 ⁵ / ₁₆ X 8	8							

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

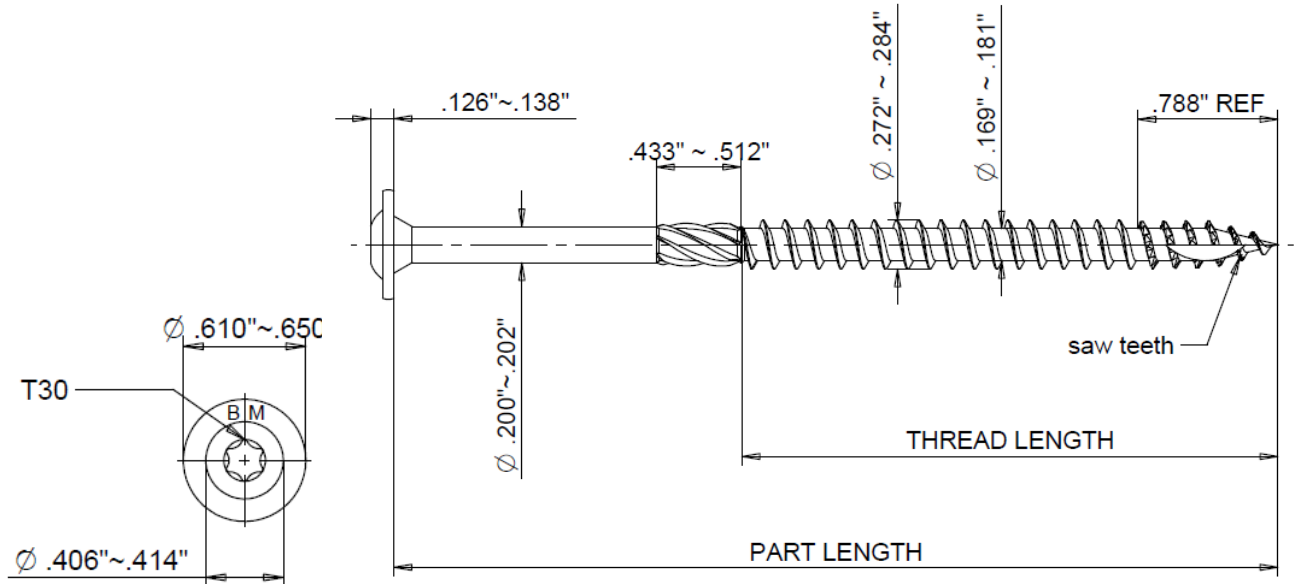
¹Overall length is measured from the underside of head to bottom of tip with a tolerance of ± 0.059 inches. See figures 2.

²Length of thread includes tip with a tolerance of ± 0.039 inches. See figures 2.

³Bending yield strengths determined in accordance with ASTM F1575 using the minor thread (root) diameter, D_r.



TIMBERFAST TORX 30 SCREW



TIMBERFAST+ TORX 30 SCREW

FIGURE 2—BM TIMBERFAST TORX 30 & TIMBERFAST+ TORX 30 SERIES WOOD SCREWS

TABLE 3—BM TIMBERFAST TORX40 AND TIMBERFAST TORX 40+ SERIES WOOD SCREW SPECIFICATIONS

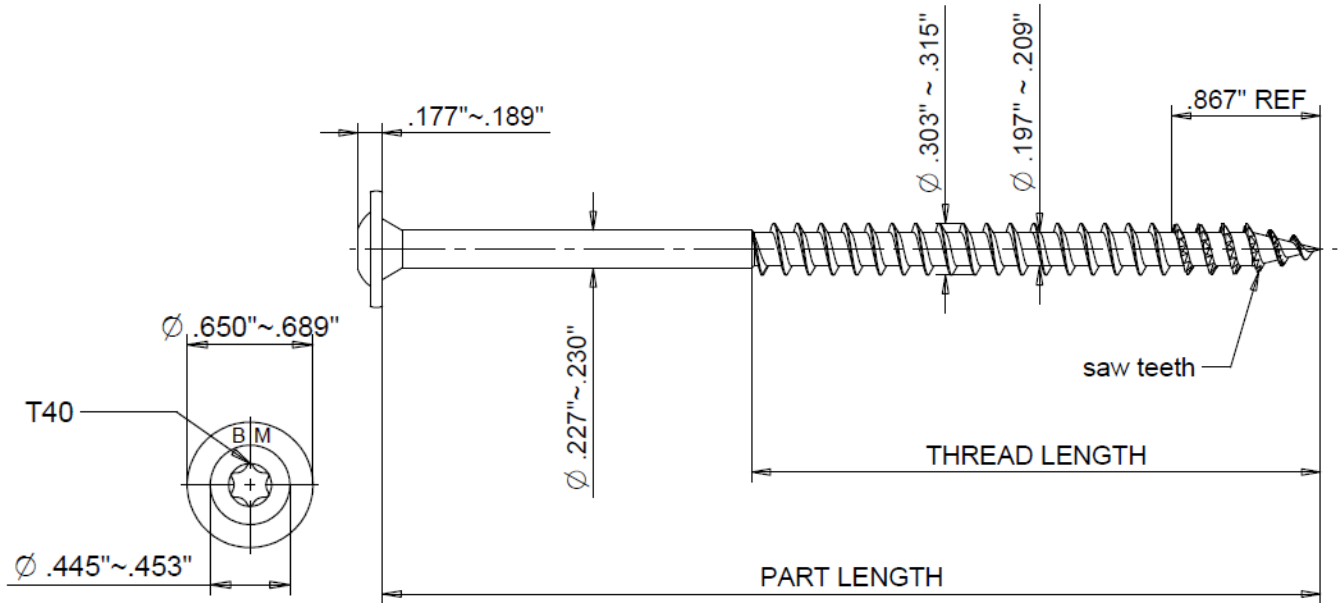
DESIGNATION	OVERALL LENGTH ¹ , L (inches)	THREAD LENGTH ² , T (inches)	UNTHREADED SHANK DIAMETER (inch)	MINOR THREAD (ROOT) DIAMETER D _r (inch)	OUTSIDE THREAD DIAMETER (inch)	BENDING YIELD ³ F _{yb} (psi)	ALLOWABLE STEEL STRENGTH	
							TENSION (lbf)	SHEAR (lbf)
TF & TF+ 40 ³ / ₈ X 7	7	3 ¹ / ₂	0.228	0.204	0.307	122,026	1,770	1,367
TF & TF+ 40 ³ / ₈ X 8	8	4						
TF & TF+ 40 ³ / ₈ X 10	10							
TF & TF+ 40 ³ / ₈ X 12	12							
TF & TF+ 40 ³ / ₈ X 14	14							
TF & TF+ 40 ³ / ₈ X 16	16							

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

¹Overall length is measured from the underside of head to bottom of tip with a tolerance of ± 0.059 inches. See figure 3.

²Length of thread includes tip with a tolerance of ± 0.039 inches. See figures 3.

³Bending yield strengths determined in accordance with ASTM F1575 using the minor thread (root) diameter, D_r.



TIMBERFAST TORX 40 SCREW

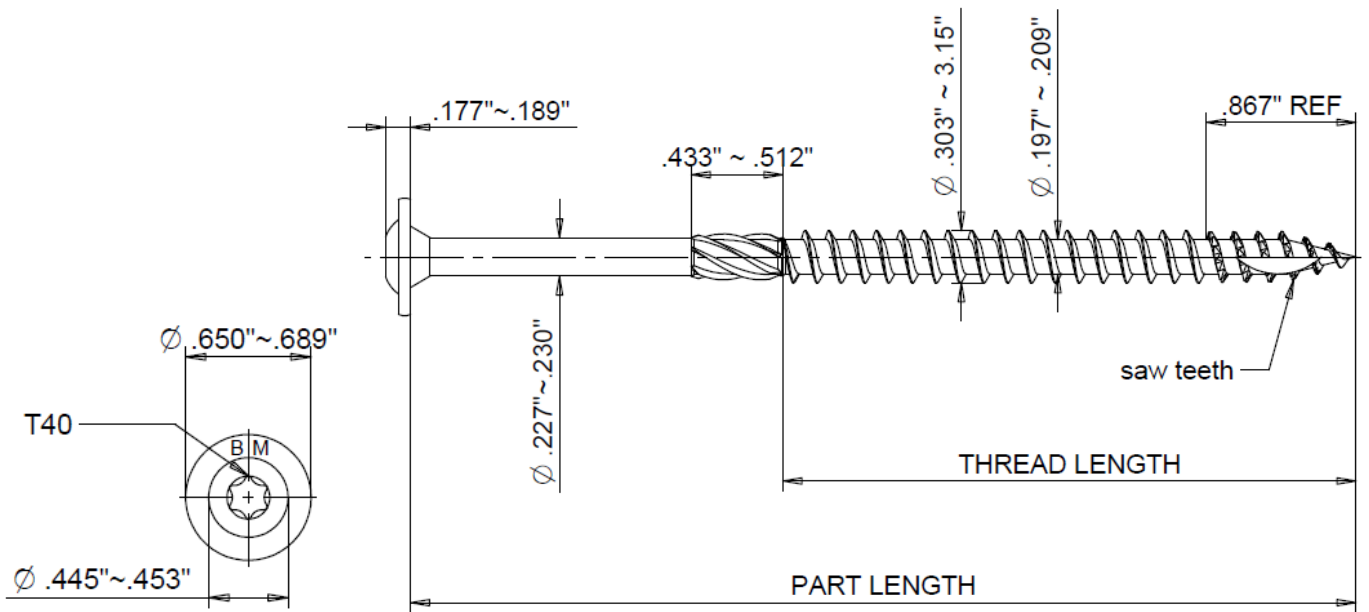


FIGURE 3—BM TIMBERFAST TORX 40 & TIMBERFAST+ TORX 40SERIES SCREW

TABLE 4—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR (TWO MEMBER) WOOD-TO-WOOD CONNECTIONS WITH LOADING PARALLEL TO GRAIN

FASTENER DESIGNATION	OVERALL LENGTH ¹ , L (inches)	SIDE MEMBER THICKNESS <i>I_s</i> min. (inches)	Z ^{1,2,3,4} (lbf) FOR CONNECTIONS LOADED PARALLEL TO THE GRAIN FOR SPECIFIC GRAVITIES OF:		
			0.55 (Southern Pine)	0.50 (Douglas Fir-Larch)	0.42 (Spruce Pine Fir)
HF & HF+ 1/4 X 2 1/4	2 1/4	1 1/2	197	204	138
HF & HF+ 1/4 X 4	4		255	288	226
HF & HF+ 1/4 X 6	6		260	294	224
HF & HF+ 1/4 X 8	8				
HF & HF+ 1/4 X 10	10				
HF & HF+ 1/4 X 12	12				
HF & HF+ 1/4 X 14	14				
HF & HF+ 1/4 X 16	16				
TF & TF+ 30 ⁵ / ₁₆ X 2 1/2	2 1/2	1 1/2	345	314	293
TF & TF+ 30 ⁵ / ₁₆ X 3	3		372	351	343
TF & TF+ 30 ⁵ / ₁₆ X 3 1/2	3 1/2		372	351	343
TF & TF+ 30 ⁵ / ₁₆ X 4	4		386	364	352
TF & TF+ 30 ⁵ / ₁₆ X 5	5				
TF & TF+ 30 ⁵ / ₁₆ X 6	6				
TF & TF+ 30 ⁵ / ₁₆ X 7	7				
TF & TF+ 30 ⁵ / ₁₆ X 8	8				
TF & TF+ 40 ³ / ₈ X 7	7	448			
TF & TF+ 40 ³ / ₈ X 8	8				
TF & TF+ 40 ³ / ₈ X 10	10				
TF & TF+ 40 ³ / ₈ X 12	12				
TF & TF+ 40 ³ / ₈ X 14	14				
TF & TF+ 40 ³ / ₈ X 16	16				

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

¹ Tabulated lateral design values (Z) must be multiplied by all applicable adjustment factors, including the load duration factor C_D, from the NDS as referenced in the IBC or IRC.

² The wood main member thickness must be equal to or greater than the screw length less the thickness of the wood side member.

³ Screws must be installed into the side grain of the wood members with the screw axis perpendicular to wood the fibers.

⁴ The tabulated lateral design values (Z) are based on wood members having the same or greater specific gravity as noted in [Table 4](#).

TABLE 5—REFERENCE WITHDRAWAL DESIGN VALUE (W) FOR SCREWS INSTALLED IN THE SIDE GRAIN OF A MAIN MEMBER HAVING A SPECIFIC GARVITY PER THE TABLE OR GREATER

FASTENER DESIGNATION	OVERALL LENGTH ¹ , L (inches)	THREAD LENGTH ¹ , T (inches)	REFERENCE WITHDRAWAL DESIGN VALUE ^{2,3} , W							
			0.55 (Southern Pine)		0.50 (Douglas Fir-Larch)		0.42 (Spruce Pine Fir)			
			(lbf/in)	(lbf)	(lbf/in)	(lbf)	(lbf/in)	(lbf)		
HF & HF+ 1/4 X 2 1/4	2 1/4	1 1/4	242	302	195	244	139	174		
HF & HF+ 1/4 X 4	4	2 1/2		604		488		348		
HF & HF+ 1/4 X 6	6	2 1/2								
HF & HF+ 1/4 X 8	8	2 1/2								
HF & HF+ 1/4 X 10	10	2 1/2								
HF & HF+ 1/4 X 12	12	2 1/2								
HF & HF+ 1/4 X 14	14	2 1/2								
HF & HF+ 1/4 X 16	16	2 1/2	250	375	223	334	149	223		
TF & TF+ 30 ⁵ / ₁₆ X 2 1/2	2 1/2	1 1/2		500		668		446		
TF & TF+ 30 ⁵ / ₁₆ X 3	3	2								
TF & TF+ 30 ⁵ / ₁₆ X 3 1/2	3 1/2	2								
TF & TF+ 30 ⁵ / ₁₆ X 4	4	2								
TF & TF+ 30 ⁵ / ₁₆ X 5	5	3								
TF & TF+ 30 ⁵ / ₁₆ X 6	6	3								
TF & TF+ 30 ⁵ / ₁₆ X 7	7	3 1/2	875	779	520					
TF & TF+ 30 ⁵ / ₁₆ X 8	8	3 1/2								
TF & TF+ 40 ³ / ₈ X 7	7	3 1/2				266	1065	971	163	652
TF & TF+ 40 ³ / ₈ X 8	8	4								
TF & TF+ 40 ³ / ₈ X 10	10	4								
TF & TF+ 40 ³ / ₈ X 12	12	4								
TF & TF+ 40 ³ / ₈ X 14	14	4								
TF & TF+ 40 ³ / ₈ X 16	16	4								

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

¹ Embedded thread length is that portion held in the main member including the screw tip.

² The tabulated reference withdrawal design value is in pounds with the specified thread length into the side grain of the main member.

³ The tabulated reference withdrawal design value must be multiplied by all applicable factors from the NDS as referenced in the IBC or IRC.

TABLE 6—CONNECTION GEOMETRY

CONDITION ¹		MINIMUM DISTANCE OR SPACING			
		DIAMETERS	HF & HF+ (inches)	TF & TF+ 30 (inches)	TF & TF+ 40 (inches)
Edge Distance	Loading Parallel to grain	8	1½	1⅝	1⅞
End distance	Parallel to grain	18	3½	3⅝	4⅞
Spacing	Between fasteners in a row	15	3	3	3⅞
	Between rows	5	1	1	1⅞
	Between staggered rows	2.5	½	½	⅝

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

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

TABLE 7—PULL THROUGH DESIGN VALUES (P)

FASTENER DESIGNATION	P (lbf) HEAD PULL THROUGH		
	0.55 (Southern Pine)	0.50 (Douglas Fir-Larch)	0.42 (Spruce Pine Fir)
BM HEXFAST & HEXFAST+	312	324	226
BM TIMBERFAST & TIMBERFAST+ T30	488	520	360
BM TIMBERFAST & TIMBERFAST+ T40	566	572	400

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