DrJ CERTIFICATION

#1131
ISO/IEC 17065
Product Certification Body

Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1503-01

FastenMaster® FlatLOK™ Fasteners –
Limit States Design

OMG, Inc.
DBA FastenMaster®

Product:

FastenMaster® FlatLOK™ Fasteners

Issue Date:

August 7, 2015

Revision Date:

June 19, 2019

Subject to Renewal:

July 1, 2020

COMPANY
INFORMATION:

OMG, Inc.
DBA FastenMaster®

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 05 23 - Wood, Plastic, and Composite Fastenings

1 PRODUCT EVALUATED[1]

1.1 FastenMaster® FlatLOK™ Fasteners

2 APPLICABLE CODES AND STANDARDS[2,3]

2.1 *Codes*

2.1.1 *NBC—10, 15: National Building Code of Canada*

2.2 *Standards and Referenced Documents*

2.2.1 *ASME B18.6.1: Wood Screws (Inch Series)*

2.2.2 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

2.2.3 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

2.2.4 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*

2.2.5 *CSA O86: Engineering Design in Wood*

3 PERFORMANCE EVALUATION

3.1 FlatLOK™ fasteners were tested and evaluated to determine their structural resistance properties, which are used to develop factored design values using the Limit States Design Method (LSD) in accordance with *CSA O86*. The following conditions were evaluated:

3.1.1 Withdrawal strength in accordance with *ASTM D1761* and in accordance with *CSA O86* Clause 12.11.5.

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[1] Building codes require data from valid certification, evaluation, and qualification reports be obtained from accredited third-party organizations. An accredited certifying organization (a type of accredited third-party organization) is a certification body that performs "certification of a product, process, or system." An accredited third-party organization is accomplished via accreditation using ISO/IEC 17065 evaluation procedures meeting code requirements of independence, accredited testing, and professional personnel. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation, DrJ certification can be used to obtain product approval in any country that is an IAF MLA Signatory, such as Canada, and covered by an IAF MLA Evaluation per the Purpose of the MLA – "certified once, accepted everywhere." Manufacturers can go to jurisdictions in any IAF MLA Signatory Country and have their products readily approved by *authorities having jurisdiction* using DrJ's ANSI accreditation. For more information about DrJ's accreditation, refer to this letter from the Standards Council of Canada (SCC).

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, see drjcertification.org.

[2] Unless otherwise noted, all references in this TER are from the 2015 version of the *NBC*. This *alternative solution* is also approved for use with the 2010 *NBC* and the standards referenced therein (e.g., *CAN/CSA*, *CAN/ULC*). Where this TER is not approved, the AHJ shall respond in writing stating the reasons this TER was not approved. For any variations in provincial, territorial, and local codes, see Section 8.

[3] All terms defined in the applicable building codes are italicized.

3.1.2 Shear strength for use as an alternative to metal straps, ties or fasteners in shear (lateral) loaded applications either parallel or perpendicular to wood grain in accordance with *ASTM D1761* and in accordance with *CSA O86* Clause 12.11.4.

3.1.3 Head pull-through in accordance with *ASTM D1761* and in accordance with *CSA O86* Clause 12.11.5.3.

3.2 Use in wet service conditions is outside the scope of this TER.

3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

3.4 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

4 Product Description and Materials

4.1 The product evaluated in this TER is shown in Figure 1.

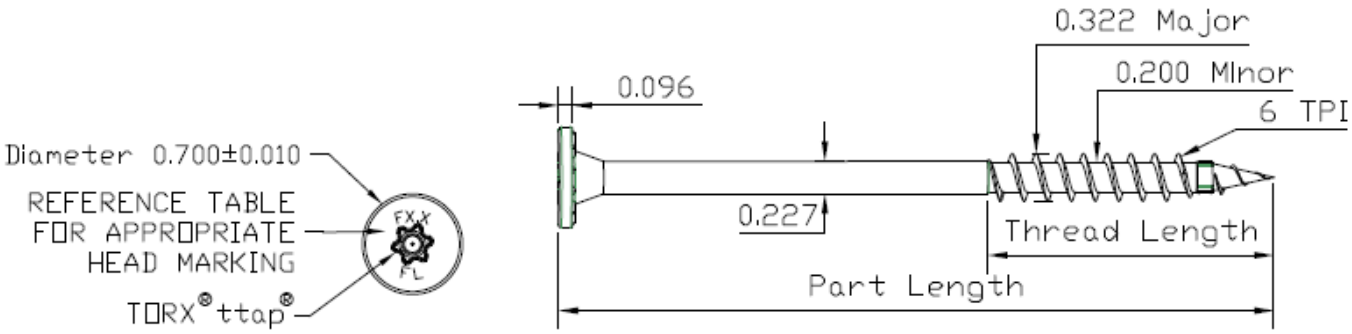

FIGURE 1. FASTENMASTER® FLATLOK™

4.2 FlatLOK™ fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.

4.3 Fasteners are coated with a proprietary coating that exceeds the protection provided by hot-dipped galvanized coatings conforming to *ASTM A153*.

4.4 Fasteners are approved for use in interior conditions and in chemically treated or untreated lumber where *ASTM A153* coatings are approved for use in accordance with *NBC* Table 5.10.1.1 and Section 9.20.16.1.

4.4.1 The proprietary coating has been tested and found to exceed the protection provided by code approved hot-dipped galvanized coatings meeting *ASTM A153*, allowing for its use in pressure treated (ACQ) wood.

4.4.2 Fasteners are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.

4.5 The fasteners evaluated in this TER are set forth in Table 1.

TABLE 1. FASTENER DIMENSIONS AND STRENGTH DETAILS

Fastener Name	Head in (mm)			Fastener Length[1] in (mm)	Shank Diameter[2] in (mm)	Thread Length[1] in (mm)	Thread Diameter in (mm)		Nominal Bending Yield,[3] f_{yb} psi (kPa)	Allowable Fastener Strength, lbf (N)	
	Marking	Diameter	Thickness				Minor	Major		Tensile	Shear
FlatLOK™	F2.8FL	0.70 (17.8)	0.095 (2.41)	$2^{7}/_{8}$ (73)	0.227 (5.8)	1.75 (44.5)	0.200 (5.1)	0.322 (8.2)	171,600 (1,183,180)	1940 (8630)	1230 (5470)
	F3.5FL			$3/_{2}$ (89)		2.00 (50.8)					
	F4.0FL			4 (102)							
	F4.5FL			$4^{1}/_{2}$ (114)							
	F5.0FL			5 (127)							
	F6.0FL			6 (152)							
	F6.75FL			$6^{3}/_{4}$ (171)							

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. Fastener length is measured from the underside of the head to the tip. Thread length includes tapered tip (see Figure 1).
2. Shank diameter based on manufactured thickness. Finished dimensions are larger, due to the proprietary coatings added.
3. Bending yield determined at shank diameter

5 APPLICATIONS

5.1 *General*

5.1.1 FlatLOK™ fasteners are used to attach wood framing members in conventional light-frame construction and provide resistance to lateral and withdrawal loads applied parallel and/or perpendicular to the structural framing member. See Section 6 for installation requirements.

5.1.2 FlatLOK™ fasteners are installed without lead holes, as prescribed in *CSA O86* Clause 12.11.2.1, except when the relative density (G) of the wood is greater than 0.50.

5.1.3 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

5.1.4 *Design:*

5.1.4.1 Design of FlatLOK™ fasteners is governed by the applicable code and the provisions for fasteners in *CSA O86* Clause 12.2.

5.1.4.2 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with *CSA O86* Clause 4.3.2.

5.2 *FlatLOK™ Factored Lateral Design Values – Face Grain Applications*

5.2.1 The factored lateral design values for shear load perpendicular and parallel to grain for FlatLOK™ fasteners, as depicted in Figure 2, are specified in Table 2, Table 3, and Table 4.

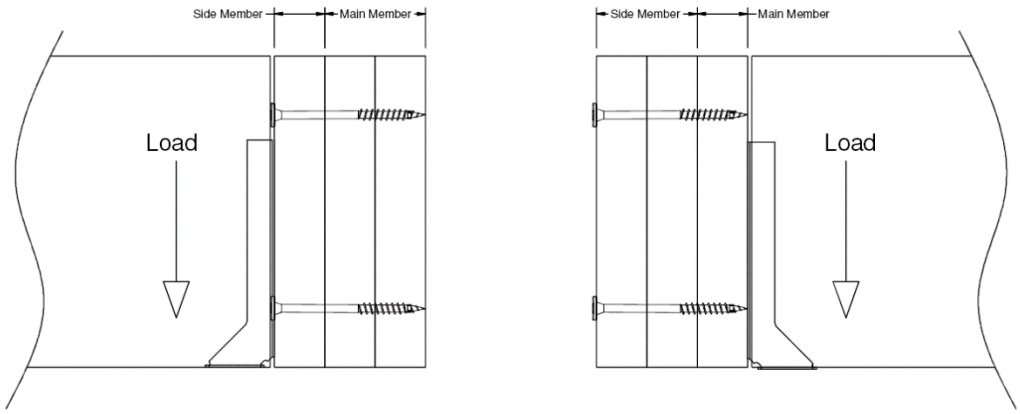

FIGURE 2. LOADING DIAGRAM FOR SHEAR PERPENDICULAR TO GRAIN

TABLE 2. FLATLOK™ FACTORED LATERAL DESIGN VALUES – DIMENSIONAL LUMBER

FlatLOK™ Fastener	Fastener Length in (mm)	Side Member Thickness in (mm)	Min. Penetration into Main Member in (mm)	Lateral Design Values by Species (Specific Gravity) & Load Orientation, lbf (N)			
				N (0.35)	SPF (0.42)	H.Fir (0.46)	D.Fir (0.49)
FL278	2 7/8 (73)	1 1/2 (38)	1 3/8 (35)	250 (1110)	300 (1335)	330 (1460)	350 (1555)
FL312	3 1/2 (89)	1 1/2 (38)	2 (51)	305 (1355)	365 (1625)	400 (1780)	425 (1895)
FL004	4 (102)	1 1/2 (38)	2½ (64)	345 (1545)	415 (1855)	455 (2030)	485 (2145)
FL412	4 1/2 (114)	1 1/2 (38)	3 (76)	370 (1640)	425 (1895)	460 (2040)	485 (2145)
		3 (76)	1 1/2 (38)	390 (1740)	470 (2085)	515 (2285)	545 (2435)
FL005	5 (127)	1 1/2 (38)	3 (76)	370 (1640)	425 (1895)	460 (2040)	485 (2145)
FL006	6 (152)	1 1/2 (38)	3 (76)	370 (1640)	425 (1895)	460 (2040)	485 (2145)
		4 1/2 (114)	1 1/2 (38)	475 (2115)	540 (2405)	575 (2560)	600 (2670)
FL634	6¾ (171)	1 1/2 (38)	3 (76)	370 (1640)	425 (1895)	460 (2040)	485 (2145)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Factored lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
2. Values shall be adjusted by all applicable adjustment factors per *CSA O86* Subsection 4.3.2.
3. All values calculated using fastener bending yield and diameter at the shank.

TABLE 3. FLATLOK™ FACTORED LATERAL DESIGN VALUES – ENGINEERED LUMBER IN FACE GRAIN APPLICATIONS

FlatLOK™ Fastener	Fastener Length in (mm)	Side Member Thickness in (mm)	Min. Penetration into Main Member in (mm)	Lateral Design Values by Species (Specific Gravity) & Load Orientation, lbf (N)	
				LVL (0.50)	LSL (0.50)
FL278	2 7/8 (73)	1 1/4 (32)	1 5/8 (32)	355 (1585)	355 (1585)
FL312	3 1/2 (89)	1 3/4 (44.5)	1 3/4 (44.5)	435 (1930)	435 (1930)
FL005	5 (127)	1 3/4 (44.5)	3 1/4 (83)	520 (2320)	520 (2320)
		3 1/2 (89)	1 1/2 (38)	610 (2710)	610 (2710)
FL634	6 3/4 (171)	1 3/4 (44.5)	5 (127)	520 (2320)	520 (2320)
		5 (127)	1 3/4 (44.5)	610 (2710)	610 (2710)
FL634	6 3/4 (171)	3 1/2 (89)	3 1/4 (83)	610 (2710)	610 (2710)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Factored lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
2. Values shall be adjusted by all applicable adjustment factors per *CSA O86* Subsection 4.3.2.
3. All values calculated using fastener bending yield and diameter at the shank.

5.3 *FlatLOK™ Factored Lateral Design Values – Edge Grain Applications*

TABLE 4. FLATLOK™ FACTORED DESIGN LOADS – EDGE GRAIN APPLICATIONS

FlatLOK™ Fastener	Fastener Length in (mm)	Side Member Thickness in (mm)	Min. Penetration into Main Member in (mm)	Lateral Design Values by Species (Specific Gravity) & Load Orientation, lbf (N)				
				N (0.35)	SPF (0.42)	H.Fir (0.46)	D.Fir (0.49)	LSL[3] (0.50)
FL006	6 (152)	3½ (89)	2½ (63.5)	130 (580)	175 (790)	205 (910)	225 (1000)	230 (1030)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
2. Values shall be adjusted by all applicable adjustment factors per *CSA O86* Subsection 4.3.2.
3. Minimum thickness 1¼"

5.4 *FlatLOK™ Factored Withdrawal Load*

5.4.1 The design provisions for withdrawal in *CSA-O86* Section 12.11.5 apply to FlatLOK™ fasteners, unless otherwise noted in this TER. Factored withdrawal design values for FlatLOK™ fasteners in select lumber species are specified in Table 5 and Table 6.

TABLE 5. FLATLOK™ FACTORED WITHDRAWAL DESIGN VALUES IN FACE GRAIN APPLICATIONS

Thread Penetration into Main Member in (mm)	Reference Withdrawal Design Values by Species (Specific Gravity) lb (N)					
	N (0.35)	SPF (0.42)	HF (0.46)	DF (0.49)	LSL (0.5)	LVL (0.5)
1 (25)	125 (555)	205 (910)	260 (1165)	310 (1385)	330 (1465)	330 (1465)
1¼ (31.7)	235 (1,040)	330 (1475)	395 (1765)	451 (2005)	470 (2090)	470 (2090)
1½ (38)	340 (1,520)	460 (2035)	530 (2365)	590 (2630)	610 (2720)	610 (2720)
1¾ (44.5)	450 (2,005)	585 (2600)	665 (2965)	730 (3250)	755 (3350)	755 (3350)
2 (50.8)	560 (2,485)	710 (3160)	800 (3565)	870 (3875)	895 (3980)	895 (3980)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Values shall be adjusted by all applicable adjustment factors per *CSA O86* Section 12.2 and 12.11.5 for wood screws.
2. Fastener penetration is that threaded length embedded in the main member, including the tip.

TABLE 6. FLATLOK™ FACTORED WITHDRAWAL DESIGN VALUES IN EDGE GRAIN APPLICATIONS

Thread Penetration into Main Member in (mm)	Reference Withdrawal Design Values by Species (Specific Gravity), lb (N)					
	N (0.35)	SPF (0.42)	HF (0.46)	DF (0.49)	LSL (0.5)	LVL (0.5)
1 (25.4)	210 (930)	280 (1240)	320 (1425)	355 (1575)	365 (1625)	365 (1625)
1¼ (31.6)	355 (1585)	430 (1910)	475 (2105)	505 (2255)	520 (2305)	520 (2305)
1½ (38.1)	505 (2240)	580 (2585)	625 (2785)	660 (2935)	670 (2985)	670 (2985)
1¾ (44.5)	650 (2895)	735 (3260)	780 (3465)	810 (3610)	825 (3660)	825 (3660)
2 (50.8)	800 (3550)	885 (3935)	930 (4140)	965 (4290)	975 (4340)	975 (4340)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Values shall be adjusted by all applicable adjustment factors per *CSA O86* Section 12.2 and 12.11.5 for wood screws.
2. Fastener penetration is that threaded length embedded in the main member, including the tip.

5.4.2 Head pull-through in accordance with *CSA O86* Section 12.11.5.3

5.4.2.1 The factored design values for head pull-through for FlatLOK™ fasteners are specified in Table 7.

TABLE 7. FLATLOK™ FACTORED HEAD PULL-THROUGH DESIGN VALUES

Side Member Thickness Minimum in (mm)	Factored Head Pull-Through Load (per each fastener in a connection) Dimensional Lumber, LSL, or LVL lb (N)
1.5 (38.1)	255 (1145)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Values for each fastener in a connection per *CSA O86* Section 12.11.5.3

5.4.3 *Edge and End Distance*:

5.4.3.1 Fastener edge and end distances shall be as specified in Figure 3 and Table 8.

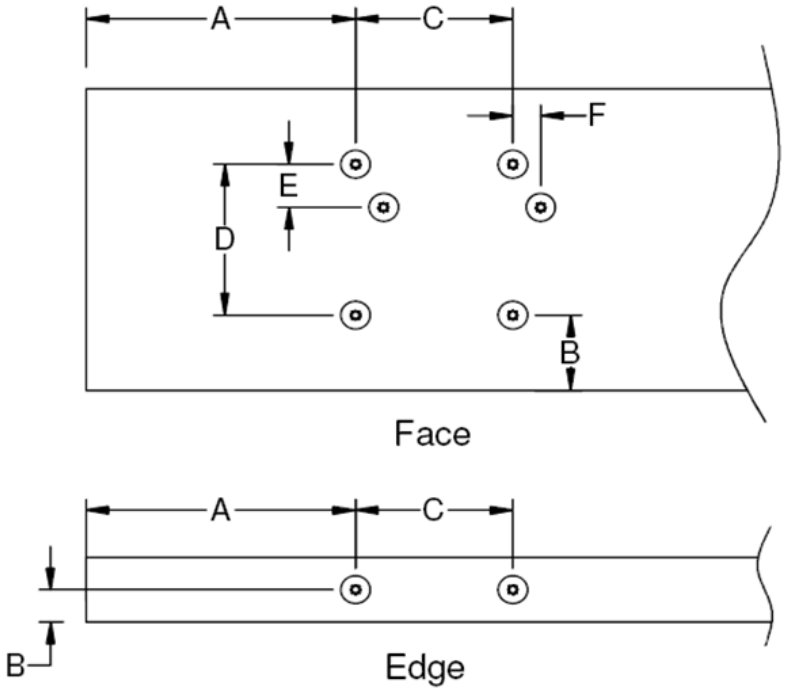

FIGURE 3. FLATLOK™ EDGE AND END DISTANCE REQUIREMENTS

TABLE 8. FLATLOK™ EDGE AND END DISTANCE REQUIREMENTS

Letter	Installed Condition	Minimum Distance or Spacing,[1] in (mm)	
		Face	Edge
A	Min. End Distance	6 (152)	6 (152)
B	Min. Edge Distance	1 3/4 (44.5)	3/4 (19.1)
C	Min. Spacing Between Fasteners in a Row	3 1/2 (88.9)	3 1/2 (88.9)
D	Min. Spacing Between Non-Staggered Rows	3 1/2 (88.9)	NA
E	Min. Spacing Between Staggered Rows	5/8 (15.9)	NA
F	Min. Stagger Between Fasteners in Adjacent Rows	5/8 (15.9)	NA

SI: 25.4 mm = 1 in

1. Edge distances, end distances and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive. These values have been determined by testing and may not correlate with *CSA O86* Section 12.9.2.1.

6 INSTALLATION

6.1 FlatLOK™ fasteners shall be installed in accordance with the applicable code, the approved construction documents, this TER, the manufacturer's installation instructions, *CSA O86*, and standard framing practice as applied to wood fasteners.

6.1.1 In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2 Use a ½" low RPM/high torque drill to drive the fastener head flush with the surface of the framing member using the driver bit included with the fasteners.

7 TEST ENGINEERING SUBSTANTIATING DATA

7.1 Testing for withdrawal, shear and head pull through by SBCRI, under contract with Qualtim, Inc., in accordance with *ASTM D1761*.

7.2 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

7.3 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

7.4 *CSA O86: Engineering Design in Wood*

7.5 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *NBC* Volume I commentary on Conformity Assessment and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.

7.6 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *NBC, NECB, CAN/CSA*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

8.1 When used in accordance with the provisions of this TER and the provisions of the applicable building codes defined in Section 2, FlatLOK™ fasteners have the factored design value properties defined herein and are approved for use as an alternative to those fasteners prescribed by the applicable code.

8.2 *NBC* Article 1.2.1.1. states:

1.2.1.1. Compliance with this Code

1) Compliance with this Code shall be achieved by

a) complying with the applicable acceptable solutions in Division B (see Note A-1.2.1.1.(1)(a)), or

b) using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Note A-1.2.1.1.(1)(b)).

2) For the proposes of compliance with this Code as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.

8.3 *NBC* Division C Section 2.3 includes additional guidance for *alternative solutions*.

8.4 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known provincial, territorial, and local building codes. Where there are known variations in provincial, territorial, or local codes applicable to this evaluation, they are listed here.

8.4.1 No known variations

9 Conditions of Use

9.1 The FlatLOK™ fasteners covered in this TER shall be installed in accordance with this TER and the manufacturer's installation instructions.

9.2 For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.

9.3 Where required by the *authority having jurisdiction* in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.

9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.

9.5 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the *designer* (e.g., *owner*).

9.6 At a minimum, this product shall be installed per the manufacturer's installation instructions and Section 6 of this TER. Where a conflict occurs, the more restrictive shall apply.

9.7 This product is manufactured under a third-party quality control program with quality control inspections established by the governing legislation of the adopting province or territory, as described in *NBC* Volume 1 commentary on Conformity Assessment.

9.8 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the AHJ for acceptance.

9.9 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the AHJ's inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 Identification

10.1 The product(s) listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.

10.2 Additional technical information can be found at fastenmaster.com.

11 Review Schedule

11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.

11.2 For information on the current status of this TER, contact DrJ Certification.