Technical Evaluation Report

TO ASSIST WITH CODE COMPLIANCE

FastenMaster ThruLOK™
Pole Barn Header Connection

TER No. 1308-11

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DIVISION: 06 00 00 – WOOD, PLASTICS, AND COMPOSITES
Section: 06 05 23 – Wood, Plastic, and Composite Fastenings
Section: 06 11 00 – Wood Framing

1. Product Evaluated:

1.1. ThruLOK™ Screw Bolt Fastening System

1.2. For the most recent version of this report, visit drjengineering.org.

2. Applicable Codes and Standards:[1]

2.1. *2006*, *2009* and *2012 International Building Code* (*IBC*)

2.2. *2006*, *2009* and *2012 International Residential Code* (*IRC*)

2.3. *2010 Florida Building Code* (*FBC*)

2.4. *2011 Ohio Building Code* (*OBC*)

2.5. *2012 National Design Specification for Wood Construction* (*NDS*)

[1] Unless otherwise noted, code references are from the 2012 versions of the codes. This product is also approved for use with the 2000 and 2003 versions of the *IBC* and *IRC* and the standards referenced therein.

The *IBC* defines:

- **APPROVED SOURCE** – "An independent person, firm or corporation, *approved* by the *building official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses."

DrJ's building construction professionals meet the competency requirements as defined in the *IBC* and can seal their work. DrJ is regularly engaged in conducting and providing engineering evaluations of single-element and full-scale building systems tests. This TER is developed from test reports complying with *IBC* Section 104.11.1 Research reports, which states, "Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources."

3. Performance Evaluation:

3.1. The ThruLOK™ Screw Bolt Fastening System was evaluated to determine its ability to provide code-complying attachment of horizontal roof headers to vertical columns to resist roof to header to post gravity loads and the associated load paths.

3.1.1. The evaluation includes both single header and double header configurations (see Figure 2 and Figure 3).

3.2. Use of the ThruLOK™ Screw Bolt Fastening System for other connections is outside the scope of this Technical Evaluation Report (TER).

4. Product Description and Materials:

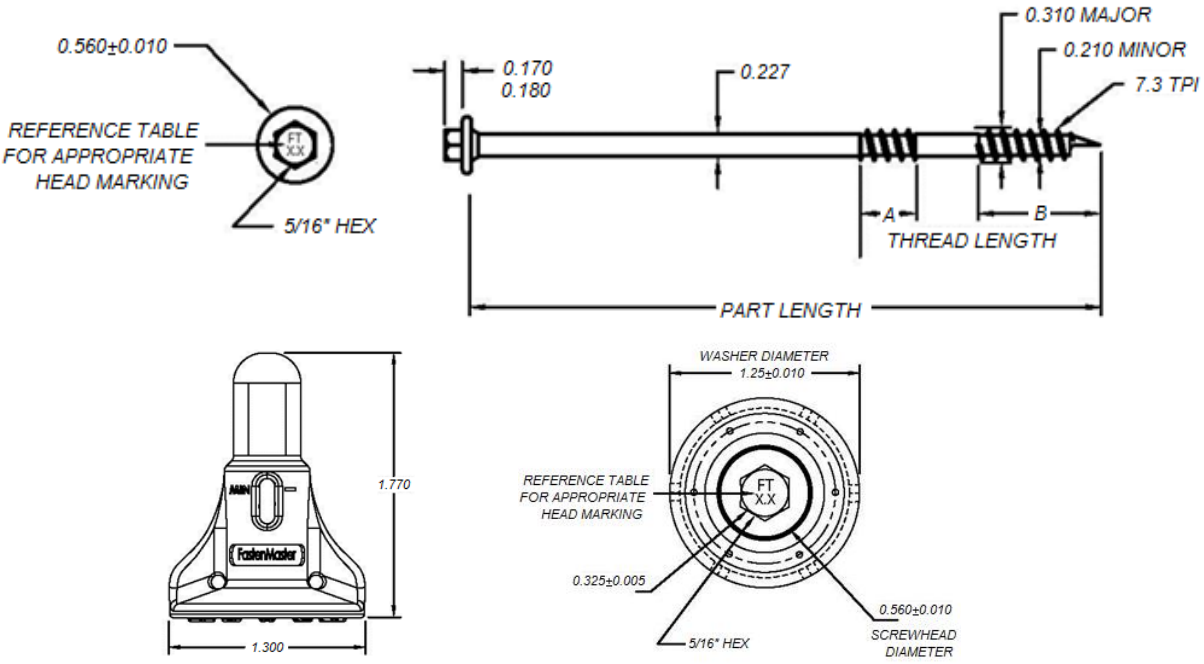

Figure 1: ThruLOK™ Screw Bolt Fastening System

4.1. ThruLOK™ Screw Bolt Fastening System

4.1.1. The FastenMaster ThruLOK™ series fasteners listed in Table 1 were evaluated for TER.

Fastener Name	Fastener Designation	Head Marking	Length[1] (in)	Length of Thread[2] (in)		Unthreaded Shank Diameter (in)	Minor Thread (Root) Diameter (in)	Allowable Bending Yield (psi)[3]
				A	B			
ThruLOK™	THR912	FT9.5	9.5	0.56	1.2	0.227	0.210	218,400
ThruLOK™	THR008	FT8.0	8.0	0.56	1.2	0.227	0.210	218,400

1. Measured from the underside of the head to the bottom of the tip.
2. The thread lengths given for the ThruLOK™ are for zones A and B, as depicted in Figure 1.
3. Determined in accordance with methods specified in *ASTM D 1575*, based on minor thread diameter using a 5% offset of the load displacement curves developed from bending tests.
4. Fastener designs were evaluated under *NDS* wet service (also known as wet-use) conditions to account for the effects of higher header and/or post moisture content.
5. Lumber used shall be either treated Southern Pine, treated Hem-Fir or treated Douglas Fir.

Table 1: Fastener Designation for the ThruLOK™ Fasteners Evaluated in this TER

4.1.2. ThruLOK™ fastener heads have a $^{5}/_{16}$" hex drive.

4.1.3. Allowable bending yield and critical dimensions are found in Table 1.

4.1.4. ThruLOK™ fasteners have a proprietary cutting point and are supplied with a ThruLOK™ washer and nut.

4.1.5. ThruLOK™ fasteners are manufactured with carbon steel grade 1022 or 10B21 wire conforming to *ASTM A510* with a minimum ultimate tensile strength of 60 ksi.

4.1.6. ThruLOK™ fasteners are coated with mechanically applied zinc in accordance with *ASTM B695*, Class 55 as specified in *IRC* Section R317.3.1.

5. Applications:

5.1. Table 2 illustrates the number of ThruLOK™ fasteners required to resist single shear of one header on one side of one column for various loading conditions.

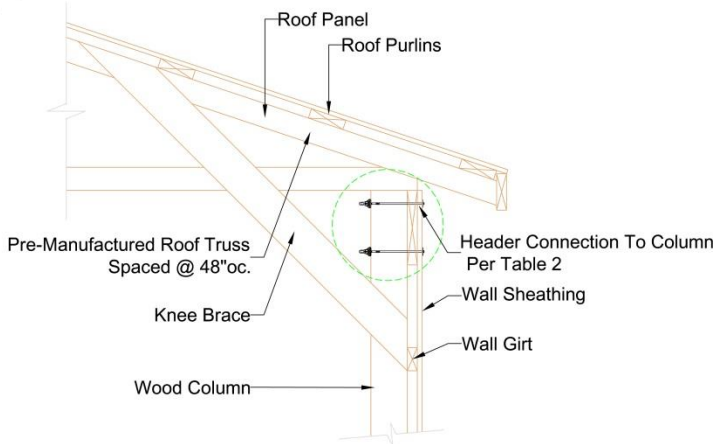

Figure 2: ThruLOK™ Screw Bolt Fastening System – Roof to Header Detail

Single Shear – Truss Bearing on One Header to One Column					
Number of 8" ThruLOKs/Beam					
Building Width (ft) Including 1' Overhang Each End	**Species** (Pressure Treated)	**Truss Spacing (ft)**	**Loading (Snow + BC Live + BC Dead) PSF**		
			20+10+5 = **35**	30+10+5 = **45**	40+10+5 = **55**
24	Hem-Fir	4	4	6	6
	Douglas-Fir		4	4	6
	Mixed Southern Yellow Pine		4	4	6
28	Hem-Fir	4	6	6	8
	Douglas-Fir		4	6	6
	Mixed Southern Yellow Pine		4	6	6
32	Hem-Fir	4	6	8	8
	Douglas-Fir		6	6	8
	Mixed Southern Yellow Pine		4	6	6
36	Hem-Fir	4	6	8	–
	Douglas-Fir		6	6	8
	Mixed Southern Yellow Pine		6	6	8
40	Hem-Fir	4	6	8	–
	Douglas-Fir		6	8	–
	Mixed Southern Yellow Pine		6	6	8
44	Hem-Fir	4	8	–	–
	Douglas-Fir		6	8	–
	Mixed Southern Yellow Pine		6	8	–
48	Hem-Fir	4	8	–	–
	Douglas-Fir		8	8	–
	Mixed Southern Yellow Pine		6	8	–
52	Hem-Fir	4	8	–	–
	Douglas-Fir		8	–	–
	Mixed Southern Yellow Pine		8	8	–

1. Fastener designs were evaluated under *NDS* wet service (also known as wet-use) conditions to account for the effects of higher header and/or post moisture content.
2. Lumber used shall be either treated Southern Pine, treated Hem-Fir or treated Douglas Fir.

Table 2: Single Shear – One Header to One Column

5.2. Figure 3 and Table 3 show the number of ThruLOK™ fasteners required to resist the shear of one header on one side of a single column and another header on the opposite side of the column, where both headers are connected to the column with ThruLOK™ fasteners.

5.2.1. Table 3 shows the number of ThruLOK™ fasteners needed for various snow loading conditions.

5.2.2. For the header configuration shown in Figure 3, it is assumed that the interior header will receive 75% of the load and the exterior header will receive 25% of the load.

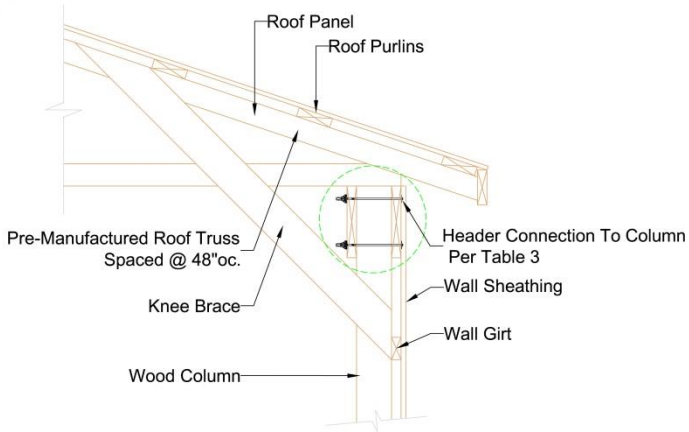

Figure 3: ThruLOK™ Screw Bolt Fastening System – Roof to Header Detail

Two-Beam Shear – Truss Bearing on Two Headers Connected to One Column					
Number of 9½" ThruLOKs/Beam					
Building Width (ft) Including 1' Overhang Each End	**Species** (Pressure Treated)	**Truss Spacing (ft)**	Loading (Snow + **TC Dead** + BC Dead) PSF		
			20+10+5 = **35**	30+10+5 = **45**	40+10+5 = **55**
24	Hem-Fir	4	4	4	6
	Douglas-Fir		4	4	4
	Mixed Southern Yellow Pine		4	4	4
28	Hem-Fir	4	4	6	6
	Douglas-Fir		4	4	6
	Mixed Southern Yellow Pine		4	4	4
32	Hem-Fir	4	4	6	6
	Douglas-Fir		4	4	6
	Mixed Southern Yellow Pine		4	4	6
36	Hem-Fir	4	6	6	8
	Douglas-Fir		4	6	6
	Mixed Southern Yellow Pine		4	6	6
40	Hem-Fir	4	6	6	8
	Douglas-Fir		4	6	8
	Mixed Southern Yellow Pine		4	6	6
44	Hem-Fir	4	6	8	8
	Douglas-Fir		6	6	8
	Mixed Southern Yellow Pine		4	6	8
48	Hem-Fir	4	6	8	–
	Douglas-Fir		6	6	8
	Mixed Southern Yellow Pine		6	6	8
52	Hem-Fir	4	6	8	–
	Douglas-Fir		6	8	8
	Mixed Southern Yellow Pine		6	6	8

1. Fastener designs were evaluated under *NDS* wet service (also known as wet-use) conditions to account for the effects of higher header and/or post moisture content.
2. Lumber used shall be either treated Southern Pine, treated Hem-Fir or treated Douglas Fir.

Table 3: Double Shear – Two Headers to One Column

5.3. Figure 4 and Table 4 provide the required edge and end distances for this application.

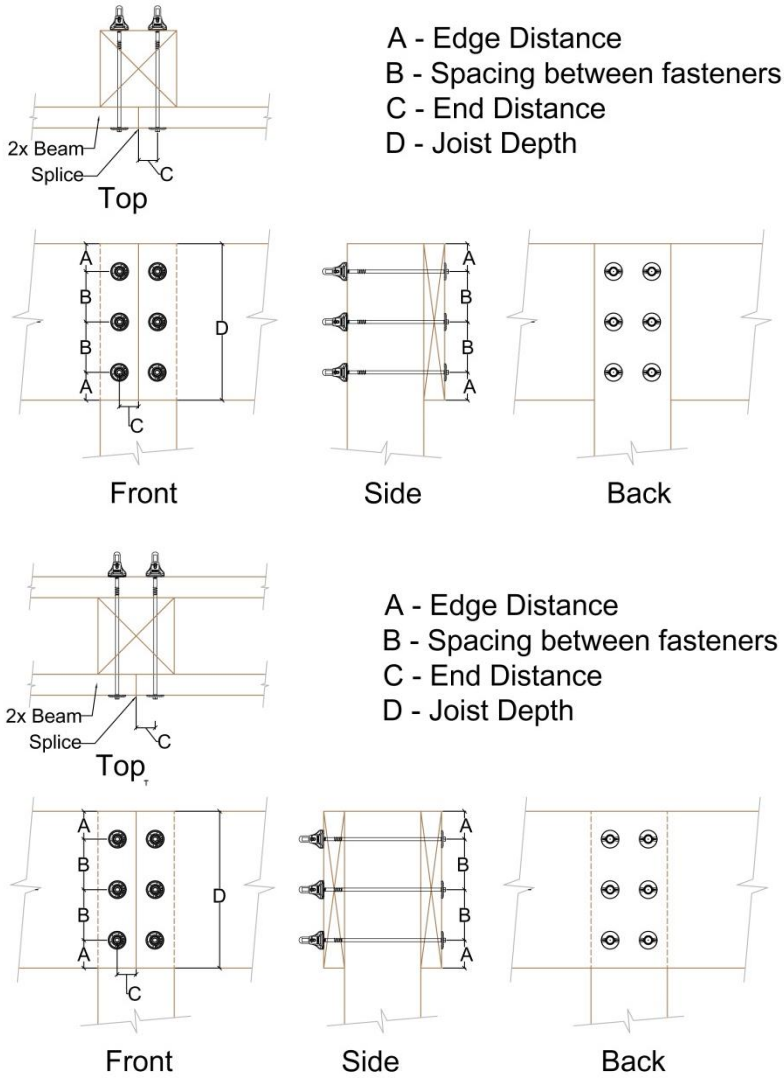

Figure 4: ThruLOK™ Screw Bolt Fastening System – Spacing Requirements

Fastener	Beam Size	Number of Fasteners	Beam Member		Fastener Spacing (in)
			Edge Distance (in)	End Distance (in)	
8" & 9½" ThruLOK™	2x8	4	2	1⅜	3¼"
		6			1⅝"
	2x10	4	2	1⅜	5¼"
		6			2⅝"
		8			1¾"
	2x12	4	2	1⅜	5⅝"
		6			3⅝"
		8			2½"

1. Fastener designs were evaluated under *NDS* wet service (also known as wet-use) conditions to account for the effects of higher header and/or post moisture content.
2. Lumber used shall be either treated Southern Pine, treated Hem-Fir or treated Douglas Fir.

Table 4: Fastener Edge & End Distance and Spacing for the ThruLOK™ Fasteners Evaluated in this TER

6. Installation:

6.1. General

6.1.1. The following installation instructions provide the general method of installing the FastenMaster ThruLOK™ Screw Bolt Fastening System for use with the specific applications as described in Section 5.

6.1.2. Place the ThruLOK™ washer on the ThruLOK™ screw with the teeth of the washer facing away from the head of the fastener (toward the threads of the fastener).

6.1.3. Using a high-torque, ½" variable-speed drill (18V if cordless) with a $^{5}/_{16}$" hex-head driver bit, drive the ThruLOK™ through the framing until the washer and hex head are just above the wood surface (approximately $^{1}/_{4}$"), and the point of the screw protrudes out of the other side of the connection.

6.1.4. Thread the ThruLOK™ nut onto the point of the fastener and hand tighten the nut until it is flush with the wood.

6.1.5. Tighten the screw with the drill-driver.

6.1.6. The point of the fastener must engage in the ThruLOK™ nut to the "MIN" line or beyond (see Figure 1).

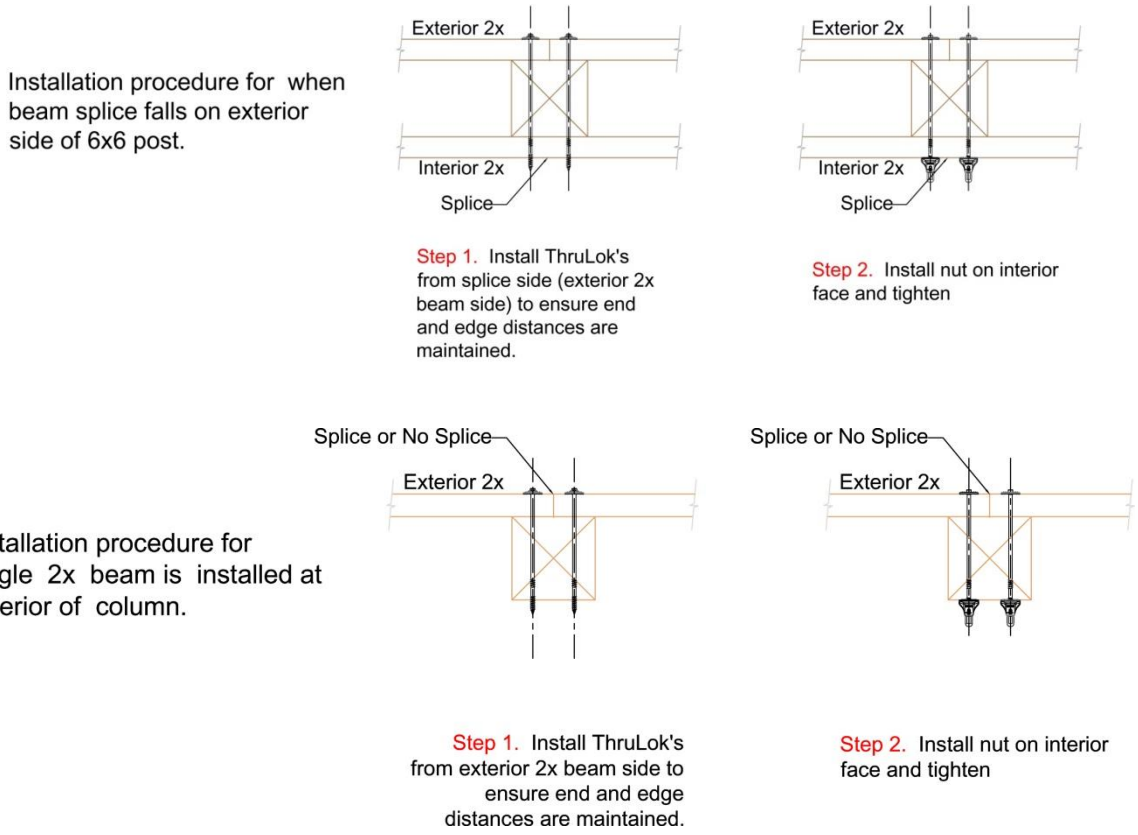

Figure 5a: Installation of Truss Bearing on Exterior Side of 6x6 Post

Installation procedure for when beam splice falls on interior side of 6x6 post.

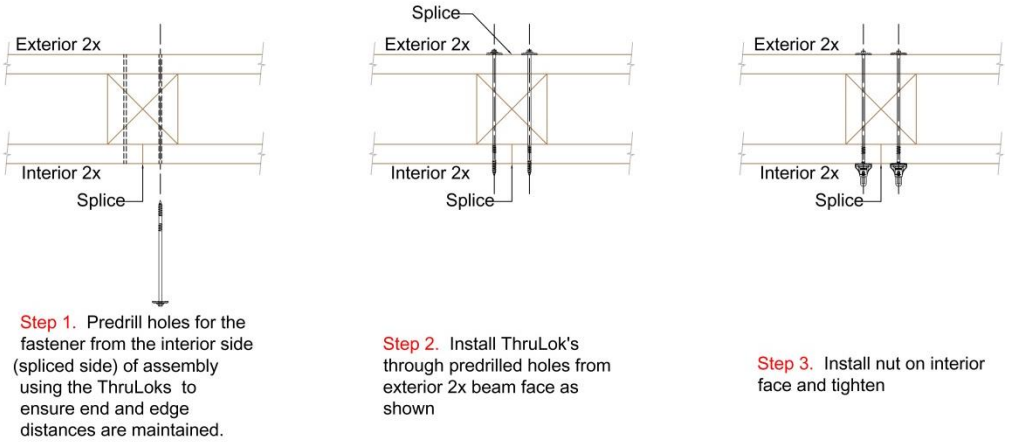

Figure 5b: Installation of Truss Bearing on Interior Side of 6x6 Post

6.1.7. A copy of the manufacturer's published installation instructions shall be available at all times on the jobsite during installation.

6.1.2. The instructions within this TER govern, if there are any conflicts between the manufacturer's instructions and this TER.

7. Test and Engineering Substantiating Data:

7.1. Test reports and data supporting the ThruLOK™ Screw Bolt Fastening System structural properties and application specifications include:

7.1.1. University Of Montana Wood Science Laboratory, *Determination of Lateral Withdrawal Strength of OMG ThruLOK® Fasteners Based on Specific Gravity and Grain Orientation of ACQ Treated Lumber*, UMWSL Project # 2010101-1.

7.1.2. ICC-ES *ESR-1078* for additional ThruLOK™ fastener performance information and design values.

7.1.3. Engineering analysis and calculations by Qualtim, August, 2013.

7.2. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.

7.2.1. DrJ does not assume responsibility for the accuracy of data provided by testing facilities, but relies on each testing agency's accuracy and accepted engineering procedures, experience, and good technical judgment.

7.3. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through the codes and standards (e.g., *IRC*, *WFCM*, *IBC*, *SDPWS*, etc.), to undertake the review of test data that is comparative or shows equivalency to an intended end-use application.

7.3.1. DrJ does not assume responsibility for the accuracy of any code-adopted design values but relies upon their accuracy for engineering evaluation.

7.3.2. DrJ also relies on the fact that manufacturers of code-adopted products stand behind the legally established design values that have been created by the associations that publish code-defined design values for a given commodity product.

7.3.3. DrJ evaluates all equivalency testing and related analysis using this code-defined engineering foundation.

8. Findings:

8.1. When used in accordance with this TER and the manufacturer's installation instructions, the FastenMaster ThruLOK™ Screw Bolt Fastening System meets the requirements for fastening roof headers to columns for the conditions specified in Table 2 and Table 3.

8.2. *IBC* Section 104.11 specifically states:

> The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code.

9. Conditions of Use:

9.1. The ThruLOK™ Screw Bolt Fastening System covered by this TER shall be subject to the following conditions:

9.1.1. This TER and the installation instructions, when required by a code official, shall be the time of permit application.

9.1.2. Installation shall comply with this TER and the manufacturer's installation instructions. In the event of a conflict between this TER and the manufacturer's installation instructions, this report shall govern.

9.1.3. Fastener designs were evaluated under *NDS* wet service (also known as wet-use) conditions to account for the effects of higher header and/or post moisture content.

9.1.4. Lumber used shall be either treated Southern Pine, treated Hem-Fir or treated Douglas Fir.

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

9.1.6. See ICC-ES *ESR-1078* for addition information and design values for the FastenMaster ThruLOK™ fasteners.

9.1.7. Manufacturer's installation instructions shall be followed as provided in Section 6 and at fastenmaster.com/details/product/thrulok-screw-bolt-fastening-system.html.

9.1.8. The ThruLOK™ series fasteners are produced by OMG, Inc.'s facility located in Agawam, Massachusetts.

9.1.9. The fasteners are identified by the designation "ThruLOK™" on the packaging. The head of the ThruLOK™ fastener is marked with an "FT" followed by a number corresponding to the length of the fastener.

9.1.9.1. The packaging shall include OMG's name and address, fastener size, third-party inspection agency, ICC-ES Report number, and this TER number.

9.1.10. The ThruLOK™ series fasteners are produced under a quality control program subject to periodic inspections in accordance with IBC Section 1703.5.2.

9.2. Design

9.2.1. Building Designer

9.2.1.1. The Construction Documents shall be prepared by a Building Designer for the Building and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show, in detail, conformance to the building code.

9.2.1.2. The Construction Documents shall provide information sufficiently accurate and reliable to be used for facilitating the supply of ThruLOK™ Screw Bolt Fastening System and shall provide the following:

9.2.1.2.1. The location, direction and magnitude of all dead, live and lateral loads applicable to ThruLOK™ Screw Bolt Fastening System and any other loads that are going to be applied to ThruLOK™ Screw Bolt Fastening System.

9.2.2. Design loads shall not exceed the allowable loads as defined in this TER.

9.2.3. Construction Documents

9.2.3.1. Construction Documents shall be submitted to the Building Official for approval prior to construction.

9.2.3.2. Construction Documents shall contain the plans, specifications and details needed for the Building Official to approve such documents.

10. Identification:

10.1. Each ThruLOK™ Screw Bolt Fastening System described in this TER is identified by a label on the packaging material bearing the manufacturer's name, product name, label of the third-party inspection agency, 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 report, visit drjengineering.org.

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

Appendix A:
TERs Are Comparable to, Compatible with, and Equivalent to the Purpose of an ICC-ES ESR

1. Technical Evaluation Reports (TERs), drafted and maintained by DrJ (professional engineering firm and ISO/IEC 17065 applicant through ANSI/ACLASS), assess how specific products comply with the provisions of the building code. DrJ is a code-defined "approved source," and DrJ employs professional engineers and follows state professional engineering rules and regulations.

2. TERs are comparable to, compatible with, and equivalent to the purpose of an ICC Evaluation Service (ICC-ES) Evaluation Service Reports (ESRs).[2]

2.1. ICC Evaluation Service does not provide an engineer's seal on any of its ESRs.

2.2. Furthermore, the ICC-ES Evaluation Report Purpose is defined as follows[3]:

ICC EVALUATION SERVICE

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

ICC EVALUATION SERVICE, LLC,
RULES OF PROCEDURE FOR EVALUATION REPORTS

1.0 PURPOSE

These rules set forth procedures governing ICC Evaluation Service, LLC (ICC-ES), issuance and maintenance of evaluation reports on building materials and products, methods of construction, prefabricated building components, and prefabricated buildings.

ICC-ES evaluation reports assist those enforcing model codes in determining whether a given subject complies with those codes. An evaluation report is not to be construed as representing a judgment about aesthetics or any other attributes not specifically addressed in the report, nor as an endorsement or recommendation for use of the subject of the report. Approval for use is the prerogative and responsibility of the Code Official; ICC-ES does not intend to assume, nor can ICC-ES assume, that prerogative and responsibility.

2.3. ICC ESR Disclaimer[4]:

ICC-ES Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

[2] ICC Evaluation Service, LLC and the ICC-ES Evaluation Reports logo are registered trademarks of ICC-ES.
[3] See the "ICC-ES Rules of Procedure" at www.icc-es.org/pdf/rules_evalrpts.pdf.
[4] Page 1 footer of each ICC-ES report that can be found at www.icc-es.org/reports/index.cfm.

3. DrJ Sealed Engineering

3.1. DrJ engineers have undertaken the rigorous engineering and analysis work to determine the subject of this report's compliance with the codes and standards referenced in Section 2.

3.2. DrJ work:

3.2.1. Complies with accepted engineering procedures, experience and good technical judgment.

3.2.2. Is the work of an independent person, firm or corporation who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

3.3. A Technical Evaluation Report generated by DrJ is in all "code-compliance-evaluation-processing" respects equivalent to an ICC-ES ESR, as ICC-ES defines its approach, with one material difference.

3.3.1. DrJ will seal all TERs, as needed, so that responsibility for the work is well-defined.

3.3.2. The DrJ responsibility statement is identical to that provided in ICC-ES ESRs.

> DrJ (drjengineering.org) research reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by DrJ express or implied as to any finding or other matter in this report or as to any product covered by this report.

Appendix B:
Legal Aspects of Product Approval

1. Product Approval

1.1. In general, the model and local codes provide for the use of alternative materials, designs and methods of construction by having a legal provision that states something similar to:

> The provisions of this code/law are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code/law, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the compliance official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code/law, and that the material, design, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code/law.

1.2. In concert with preserving "free and unfettered competition as the rule of trade", should this alternative material, design or method of construction not be approved, the building official shall respond in writing, stating the specific reasons for non-code-compliance and/or for non-professional engineering regulation compliance.

> Congress passed the first antitrust law, the Sherman Act, in 1890 as a "comprehensive charter of economic liberty aimed at preserving free and unfettered competition as the rule of trade." In 1914, Congress passed two additional antitrust laws: the Federal Trade Commission Act, which created the FTC, and the Clayton Act. With some revisions, these are the three core federal antitrust laws still in effect today.
>
> …Yet for over 100 years, the antitrust laws have had the same basic objective: to protect the process of competition for the benefit of consumers, making sure there are strong incentives for businesses to operate efficiently, keep prices down, and keep quality up….
>
> The Sherman Act outlaws "every contract, combination, or conspiracy in restraint of trade," and any "monopolization, attempted monopolization, or conspiracy or combination to monopolize." For instance, in some sense, an agreement between two individuals to form a partnership restrains trade, but may not do so unreasonably, and thus may be lawful under the antitrust laws. On the other hand, certain acts are considered so harmful to competition that they are almost always illegal.
>
> The penalties for violating the Sherman Act can be severe. Although most enforcement actions are civil, the Sherman Act is also a criminal law, and individuals and businesses that violate it may be prosecuted by the Department of Justice.[5]

2. Legal Validity of this TER

2.1. This TER is a code-defined (e.g., *2009 IBC* and *IRC* Section 104.11.1 and *2009 IBC* Section 1703.4.2) "research report" that provides supporting data to assist in the approval of materials, designs or assemblies not specifically provided for in this code.

2.2. Therefore, this TER is a valid research report from a professional engineering company that complies with the code definition of "approved source." If required by the authority having jurisdiction, this TER can also be sealed to comply with professional engineering laws and regulations.

[5] http://www.ftc.gov/bc/antitrust/antitrust_laws.shtm