Technical Evaluation Report
TER 1506-20
QuickTie™ System (QTS) Portal Frame with Hold-Downs (PFH)

QuickTie™ Products, Inc.

Product:
QuickTie™ System (QTS) Portal Frame with Hold-Downs (PFH)

Issue Date:
July 8, 2015
Revision Date:
September 5, 2019
Subject to Renewal:
April 1, 2020
1. Product Evaluated:
   1.1. QuickTie™ System (QTS) Portal Frame with Hold-Downs (PFH)
   1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjcertification.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjcertification.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.
   1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found here) and covered by an IAF MLA Evaluation per the Purpose of the MLA (as an example, see letter to ANSI from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other IAF MLA Signatory Countries and have their products readily approved by authorities having jurisdiction using DrJ’s ANSI accreditation.
   1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in IBC Section 1703. Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI’s scope of accreditation. For a list of accredited agencies, visit ANSI’s website. For more information, see drjcertification.org.
   1.5. Requiring an evaluation report from a specific private company (i.e. ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
   1.6. DrJ’s code compliance work:
       1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
       1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer’s seal DrJ takes professional responsibility for its specified scope of work.
2. Applicable Codes and Standards:¹
   2.2. 2012, 2015 and 2018 International Residential Code (IRC)
   2.3. 2014 and 2017 Florida Building Code (FBC)
   2.4. 2012 North Carolina Building Code (NCBC), with Supplements through June 2014
   2.5. AISC 360 – Specification for Structural Steel Buildings
   2.6. AISI S100 – North American Specification for the Design of Cold-formed Steel Structural Members
   2.7. ANSI/AWC NDS® – National Design Specification® (NDS®) for Wood Construction
   2.8. ASCE/SEI 19 – Structural Applications of Steel Cables for Buildings
   2.9. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures
   2.11. ASTM A1023/A1023M – Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
   2.13. ASTM A284 – Specification for Low and Intermediate Tensile Strength Carbon-Silicon Steel Plates for Machine Parts and General Construction
   2.15. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

3. Performance Evaluation:
   3.1. Performance for use in buildings of light-frame construction and masonry is in accordance with the codes listed in Section 2.
   3.2. Compliance for use in buildings assigned to Seismic Design Categories A through E.
   3.3. Compliance for use in buildings located where the design wind speed is less than or equal to 170 mph, in accordance with ASCE 7-05, and 215 mph, in accordance with ASCE 7-10 and 7-16.
   3.4. Compliance for use as an alternative to the Portal Frame with Hold-Downs (PFH) detail as prescribed in IRC Section R602.10.6.2².
   3.5. Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

4. Product Description and Materials:
   4.1. QTS Description
      4.1.1. The QTS is a wall anchoring system for conventional light-frame construction and masonry projects that involve a Registered Design Professional (RDP).
      4.1.2. The QTS provides a continuous load path from the top of the wall to the foundation by resisting and transferring wind uplift and/or laterally applied loads that result in overturning uplift forces.

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2018 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2015 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any see Section 8.
² 2015 IRC Section R602.10.6.2 decreases strap-type hold-downs from 4,200 lb. to 3,500 lb.
4.1.3. The QTS consists of a wire rope with threaded studs swaged to each end.

4.1.3.1. Primary Connection:

4.1.3.1.1. QuickTie™ cables with threaded bottoms will be connected to the foundation via an embedded anchor bolt cast in place. The QuickTie™ cable will be attached to the anchor bolt by a mechanical coupling.

4.1.3.1.2. The other threaded stud is extended vertically within the interior wood stud wall to the top of the wall, inserted through a hole drilled through the wood top plate(s) and attached to a steel plate and nut placed on the top surface of the very top plate on the wall. The nut is then tightened to post-tension the QTS.

4.1.3.2. Alternative Connection:

4.1.3.2.1. The end of the QuickTie™ cable with longer threads and no plate washers, will be connected to the foundation via a formed or drilled hole in the foundation. The hole is filled with epoxy and the QuickTie™ cable is inserted into the hole and left to set.

4.1.3.2.2. The other threaded stud is extended vertically within the interior wood stud wall to the top of the wall, inserted through a hole drilled through the wood top plate(s) and attached to a steel plate and nut placed on the top surface of the very top plate on the wall. The nut is then tightened to post-tension the QTS.

4.1.3.3. Trusses, headers and bottom plates are connected with Quick Connectors to provide distribution of load through the QTS to the foundation.

4.1.4. Where one QuickTie™ cable does not provide sufficient capacity, multiple cables of the same type may be installed to increase the pre-stressing force and transfer of accumulated loads to the foundation.

4.2. QuickTie™ System Materials

4.2.1. QuickTie™ QT(L) wood frame connectors (note that the “L” indicates length in feet): galvanized aircraft wire rope, $\frac{3}{16}”$ diameter, $\frac{5}{16}”$ diameter. Threaded studs in the following sizes are swaged onto each end of the wire rope:

4.2.1.1. Primary Connection – Cast-In-Place Anchor Bolts

4.2.1.1.1. QTB(L) Blue $\frac{3}{16}”$ diameter wire rope

4.2.1.1.1.1. Top: $3/8” \times 6\frac{1}{4}”$ with $4”$ of threads; Bottom: $3/8” \times 3\frac{1}{4}”$ with $1”$ of threads

4.2.1.1.2. QTO(L) Orange $\frac{5}{16}”$ diameter wire rope

4.2.1.1.2.1. Top: $5/8” \times 6\frac{3}{4}”$ with $3\frac{3}{8}”$ of threads; Bottom: $5/8” \times 4\frac{1}{8}”$ with $1”$ of threads

4.2.1.2. Alternative Connection – Epoxy

4.2.1.2.1. QTB(L) Blue $\frac{3}{16}”$ diameter wire rope

4.2.1.2.1.1. Top: $3/8” \times 6\frac{1}{4}”$ with $4”$ of threads; Bottom: $3/8” \times 6\frac{3}{4}”$ with $4”$ of threads

4.2.1.2.2. QTO(L) Orange $\frac{5}{16}”$ diameter wire rope

4.2.1.2.2.1. Top: $5/8” \times 6\frac{3}{4}”$ with $3\frac{3}{8}”$ of threads; Bottom: $5/8” \times 8\frac{3}{4}”$ with $6\frac{3}{8}”$ of threads

4.2.2. Individual wires are 0.030” diameter, or smaller, with minimum $F_u = 268,000$ psi. The length varies in 1” increments from 2” to 60’.

4.2.3. Steel Plate Washers: Washers are made from the following materials:

4.2.3.1. $2\frac{1}{4}” \times 2\frac{1}{4}” \times \frac{3}{16}”$ ASTM A36, A283/284 or A570 steel plate, with a minimum yield strength of 33 ksi and a minimum ultimate strength of 45 ksi (QTB[L] Blue $\frac{3}{16}”$ diameter wire rope)

4.2.3.2. $3” \times 3” \times 1/4”$ ASTM A36, A283/284 or A570 steel plates, with a minimum yield strength of 33 ksi and a minimum ultimate strength of 45 ksi (QTO[L] Orange $\frac{5}{16}”$ diameter wire rope)
4.2.4. **Tension Indicator Device**: Tension Indicator Devices (TIDs) are made from the following materials:

4.2.4.1. Blue: *ASTM A653*, Grade 33 structural steel, 14 gauge, min. thickness 0.0821", painted.

4.2.4.2. Orange: *ASTM A653*, Grade 33 structural steel, 10 gauge, min. thickness 0.1419", painted.

4.2.5. **Nuts**

4.2.5.1. 3/8" Grade 2 Hex Nuts (QTB[L] Blue 3/16" diameter wire rope)

4.2.5.2. 5/8" Grade 2 Hex Nuts (QTO[L] Orange 5/16" diameter wire rope)

4.2.6. **Portal Frame with Hold-Downs (PFH)**

4.2.6.1. **QTB(L) Blue (5/16" aircraft wire rope)**: 5/16" diameter, 7x19, hot-dipped, galvanized steel wire with a minimum nominal strength of 4,200 lbs. per *ASTM A1023/A1023M*. Individual wires in the wire rope are galvanized with a minimum of 0.10 ounces per square foot of uncoated wire surface (see Figure 1).

![Figure 1: QuickTie™ Part Detail – QTB(L) Blue 3/16" Diameter](image)

4.2.6.2. **QTO(L) Orange (5/16" aircraft wire rope)**: 5/16" diameter, 7x19, hot-dipped, galvanized steel wire with a minimum nominal strength of 9,800 lbs. per *ASTM A1023/A1023M*. Individual wires in the wire rope are galvanized with a minimum of 0.10 ounces per square foot of uncoated wire surface (see Figure 2).

![Figure 2: QuickTie™ Part Detail – QTO(L) Orange 5/16" Diameter](image)
5. Applications:

5.1. Installation (General)

5.1.1. The QTS shall be installed in accordance with the manufacturer’s published installation instructions and this TER. In the event of a conflict between the manufacturer’s installation instructions and this TER, the more restrictive shall govern.

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

5.2. Design

5.2.1. Table 1 lists the maximum allowable tensile loads (based on Allowable Stress Design, ASD basis) of the QTS.

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Cable Diameter (in)</th>
<th>Ultimate Tensile Capacity (lbs)</th>
<th>Allowable Tensile Capacity(^1) (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTB(X) Blue</td>
<td>(\frac{3}{16})</td>
<td>4,200</td>
<td>1,910</td>
</tr>
<tr>
<td>QTO(X) Orange</td>
<td>(\frac{5}{16})</td>
<td>9,800</td>
<td>4,455</td>
</tr>
</tbody>
</table>

\(^1\) Allowable loads determined in accordance with ASCE 19 and a safety factor of 2.2.

5.2.1.1. Multiple QuickTie™ cables of the same type may be used together to apply pre-stressing force, where one QuickTie™ cable is not sufficient.

5.2.1.2. Allowable loads are based on the published strength of the cables per ASTM 1023A using a safety factor of 2.2.

5.2.1.3. Construction documents shall include the information required by ASCE 19 Section 2.

5.2.2. Portal Frame with Hold-Downs (PFH)

5.2.2.1. Use of Method PFH shall be in accordance with IRC Section R602.10.6.2 and Figure R602.10.6.2 except that Figure 3 shall be used to construct the PFH.

5.2.2.2. The maximum allowable tensile loads (based on Allowable Stress Design, ASD basis) of the QTS are presented in Table 1.
5.2.2.3. Two QuickTie™ Orange cables will be used to meet the required two (2) 3,500-lb. hold-downs, with one (1) QuickTie™ Orange on each side of the pier. QuickTie™ Blue cables will be used on the non-pier end of the portal frame where only a single 1,000-lb. hold-down is required. The detail below using QTS is considered equivalent to the Method PFH detail of the IRC (see Figure 3).

Figure 3: Design for Portal Frame with QuickTie™ Cables
6. Installation:
   6.1. Installation shall comply with the manufacturer’s installation instructions and this TER. In the event of a conflict between the manufacturer’s installation instructions and this TER, the more restrictive shall govern.

7. Test and Engineering Substantiating Data:
   7.1. Test Reports for Evaluation of QuickTie™ (QT) System and Quick Connectors for QT Assembly’s Tension Load Strength and Elongation Properties (Pre-load and 30+ Day Relaxation), by SBC Research Institute (SBCRI) under contract with Qualtim, Inc.
   7.2. Engineering calculations and Allowable Load Verification Reports on the QuickTie™ System (QTS) for Allowable Design Loads, prepared by Qualtim, Inc.
   7.3. Engineering report for QuickTie™ used in a portal frame application, prepared by Qualtim, Inc.
   7.4. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
   7.5. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
   7.6. 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.
   7.7. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms to DrJ’s procedure for acceptance of data from approved sources.
   7.8. DrJ’s responsibility for data provided by approved sources conforms to IBC Section 1703 and any relevant professional engineering law.
   7.9. Where appropriate, DrJ’s analysis is based on design values that have been codified into law through codes and standards (e.g., IRC, WFCM, IBC, SDPWS, NDS®, ACI®, AISI, PS 20, PS 2, etc.). This includes review of code provisions and any related test data that aids 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, concrete, etc), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8. Findings:
   8.1. Data and engineering analysis review has found that the QTS and PFH, as described in this TER, conform to that specified in the code references listed in Section 2.
   8.2. QTS and PFH are approved for use in Seismic Design Categories A through E.
   8.3. QTS and PFH are approved for use where the maximum wind speed is not more than 170 mph, in accordance with ASCE 7-05, and 215 mph, in accordance with ACSE 7-10 and 7-16.
   8.4. IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.9 are similar) states:

   104.11 Alternative materials, design and methods of construction and equipment. 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, not less than the equivalent of that prescribed in this code. ... Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons the alternative was not approved.
8.5. This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:

8.5.1. No known variations

8.6. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ’s professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

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

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

9.3. 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 Building Designer (e.g., Owner, Registered Design Professional, etc.).

9.3.1. Design loads on the QTS and Quick Connectors are determined based on the most critical load combination resulting from the load combinations in IBC Section 1605.3.1.

9.4. Loads applied shall not exceed those recommended by the manufacturer as defined in this TER.

9.5. Structural framing members (e.g., wood, masonry, concrete, steel, etc.) connected with the QTS and Quick Connectors shall be designed in accordance with the requirements of their specific design standards/specifications as referenced in the building code adopted by the jurisdiction in which the project is to be constructed.

9.6. Each QTS and/or PFH shipment shall contain the manufacturer’s installation instructions. A copy of the installation instructions must be available at the jobsite at all times during installation.

9.7. The QTS shall be installed by contractors trained and certified by QuickTie™ Products, Inc.

9.8. Each QTS and Quick Connectors that are exposed directly to weather, or subject to salt corrosion in coastal areas, as determined by the local building official, shall be protected in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.

9.9. Design

9.9.1. Building Designer Responsibility

9.9.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with IBC Section 107 and IRC Section R106.

9.9.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with IBC Section 1603 and IRC Section R301.

9.9.2. Construction Documents

9.9.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

9.10. Responsibilities

9.10.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.

9.10.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.

9.10.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ’s professional scope of work.
9.10.4. This product is manufactured under a third-party quality control program in accordance with IBC Section 104.4 and 110.4 and IRC Section R104.4 and R109.2.

9.10.5. 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, and the TER shall be reviewed for code compliance by the Building Official.

9.10.6. 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 Building Official’s inspection and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10. Identification:

10.1. QTS PFH described in this TER is identified by a label on the board or packaging material bearing the manufacturer’s name, product name, TER number (1506-20), and other information to confirm code compliance.

10.2. Additional technical information can be found at quicktieproducts.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.