Technical Evaluation Report™

TER 2307-05

Power Pro® Structural Wood Screws for Truss to Wall Connections

The Hillman™ Group

Products:

Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES SECTION: 06 00 90 - Wood and Plastic Fastenings

1 Innovative Products Evaluated[1,2]

1.1 Power Pro® LumberTite® Structural Wood Screws

1.2 Power Pro® TimberTite® Structural Wood Screws

1.3 Power Pro® Structural Lag Screws

2 Applicable Codes and Standards[3,4]

2.1 *Codes*

2.1.1 *IBC—15, 18, 21: International Building Code®*

2.1.2 *IRC—15, 18, 21: International Residential Code®*

2.2 *Standards and Referenced Documents*

2.2.1 *AISI S904: Standard Test Method for Determining the Tensile and Shear Strength of Steel Screws*

2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

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

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

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

2.2.6 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

2.2.7 *AWC TR 12: General Dowel Equations for Calculating Lateral Connection Values*

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1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 **Federal Regulation Definition.** 24 CFR 3280.2 "Listed or certified" means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner. **International Building Code (IBC) Definition of Listed.** Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose Listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. **IBC Definition of Labeled**. Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

3 This Listing is a code defined research report, which is also known as a duly authenticated report, provided by an approved agency (see IBC Section 1703.1) and/or an approved source (see IBC Section 1703.4.2). An approved agency is "approved" when it is ANAB accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory). A professional engineer is "approved" as an approved source when that professional engineer is properly licensed to transact engineering commerce. Where sealed by a professional engineer, it is also a duly authenticated report certified by an approved source. (i.e., Registered Design Professional). DrJ is an ANAB accredited product certification body.

4 Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

3 Performance Evaluation

3.1 Tests, test reports, research reports, duly authenticated reports and related engineering evaluations are defined as intellectual property and/or trade secrets and protected by Defend Trade Secrets Act 2016 (DTSA).[5]

3.2 Testing and/or inspections conducted for this TER were performed an ISO/IEC 17025 accredited testing laboratory,[6] an ISO/IEC 17020 accredited inspection body,[7] which are internationally recognized accreditations through International Accreditation Forum (IAF), and/or a licensed Registered Design Professional (RDP).

3.3 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws were evaluated using their tested allowable design values as an alternate means of attaching wood trusses, drag struts and rafters to the top of the wall below to provide uplift and lateral load resistance. The following conditions were evaluated:

3.3.1 Withdrawal strength of Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws for use as an alternative to toenail connections, metal hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.

3.3.2 Shear strength of Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws for use as an alternative to toenail connections, hurricane and seismic clips/straps or nails in shear (lateral) loaded applications either parallel or perpendicular to wood grain.

3.3.3 Head pull through strength of Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws for use as an alternative to toenail connections, hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.

3.4 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws were evaluated as an alternate means of attaching wall bottom plates to the rim board. The fasteners were evaluated under the following conditions:

3.4.1 Shear strength to resist shear (lateral) loads applied parallel to the bottom plate and rim board.

3.5 Any building code and/or accepted engineering evaluations (i.e. research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDPs / approved sources. DrJ is qualified[8] to practice product and code compliance services within its scope of accreditation and engineering expertise, respectively.

3.6 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope, which are also its areas of professional engineering competence.

3.7 Any regulation specific issues not addressed in this section are outside the scope of this TER.

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[5] https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90. Given our professional duty to inform, please be aware that whoever, with intent to convert a trade secret (TS), that is related to a product or service used in or intended for use in interstate or foreign commerce, to the economic benefit of anyone other than the owner thereof, and intending or knowing that the offense will, injure any owner of that trade secret, knowingly without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys such information; shall be fined under this title or imprisoned not more than 10 years, or both. Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. As the National Society of Professional Engineers states, "Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve." Therefore, to protect intellectual property (IP) and TS, and to achieve compliance with public records and trade secret legislation, requires approval through the use of Listings, certified reports, technical evaluation reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

[6] Internationally recognized accreditations are performed by members of the International Accreditation Forum (IAF). Accreditation Body and Regional Accreditation Group Members of IAF are admitted to the IAF MLA only after a stringent evaluation of their operations by a peer evaluation team, which is charged to ensure that the applicant complies fully with both international standards and IAF requirements. Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.

[7] Ibid.

[8] Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

4 Product Description and Materials

4.1 The innovative products evaluated in this TER are shown in Figure 1, Figure 2 and Figure 3.

Figure 1. LumberTite® Fasteners

Figure 2. TimberTite® Fasteners

Figure 3. Structural Lag Screws

4.2 *General*

4.2.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws are partially threaded, self-drilling, dowel-type fasteners that are manufactured using standard cold-forming processes and are subsequently heat-treated and coated with a proprietary coating comprising of a zinc layer and an organic topcoat.

4.2.1.1 LumberTite® fasteners are Torx-driven screws with an integrated washer.

4.2.1.2 TimberTite® fasteners are $^{5}/_{16}$″ hex-driven screws with an integrated washer.

4.2.1.3 Structural Lag Screws are Torx-driven screws with a flattened truss head.

4.3 *Fastener Material*

4.3.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws are made of hardened carbon steel.

4.4 *Corrosion Resistance*

4.4.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws may be used where screws are required to exhibit corrosion resistance when exposed to adverse environmental conditions, which are subject to the limitations of this report. Power Pro® screws have been evaluated for use in wood treated with ACQ-D preservatives with a retention of 0.40 pcf (6.4 kg/m^3) and may be used as an alternative to hot-dip galvanized fasteners in wood treated with preservatives or less corrosive effects meeting ASTM A153, Class D (IBC Section 2304.10.6 and IRC Section R317.3).

4.4.2 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws have a proprietary coating, which may be used as an alternative to the protection provided by code-approved hot-dipped galvanized coatings meeting ASTM A153, Class D (IBC Section 2304.10.6 and IRC Section R317.3).

4.5 *Pressure-Preservative Treated (PPT) Wood Applications*

4.5.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws having the proprietary coating are recognized for use in PPT lumber provided the conditions set forth by the PPT lumber manufacturer are met, including appropriate strength reductions.

4.6 *Fire Retardant Treated (FRT) Wood Applications*

4.6.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws having the proprietary coating are recognized for use in FRT lumber provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions. The wood must also meet the NDS requirements for dry service conditions.

4.7 *Wood Members*

4.7.1 Solid sawn wood members connected using Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws shall consist of lumber species or species combinations having a specific gravity of 0.42 to 0.55.

4.7.2 Structural composite lumber (i.e., LVL, LSL, PSL, etc.) connected with Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws shall be recognized in evaluation reports having published equivalent specific gravities for lateral and withdrawal resistance.

4.8 *Fastener Specifications*

4.8.1 Table 1 lists the dimensions and mechanical properties of Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws that are evaluated in this TER.

Table 1. Fastener Specifications

Fastener Name	Nominal Diameter (in)	Length[1] (in)	Thread Length[2] (in)	Head Diameter[3] (in)	Unthreaded Shank Diameter (in)	Thread Diameter (in)		Nominal Bending Yield (psi)	Tensile Strength (lbf)	
						Minor	Major		ASD	LFRD
Power Pro® LumberTite® Screws	1/4	4 1/2	2.00	0.610	0.174	0.155	0.239	180,000	780	1,170
		6								
Power Pro® TimberTite® Screws	1/4	4	2.00	0.460	0.174	0.155	0.239	180,000	780	1,170
		6								
Power Pro® Structural Lag Screws	1/4	4	2.38	0.540	0.174	0.155	0.239	180,000	780	1,170
		6								

SI: 1 in = 25.4 mm, 1 psi = 0.00689 MPa, 1 lbf = 4.448 N

1. Measured from the underside of the head to the tip
2. Includes tip.
3. Nominal diameter of the washer head.

5 Applications

5.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws in this TER are used in construction of walls that meet the requirements of IBC Section 2308 or IRC Section R602 for the following applications:

5.1.1 To attach minimum 1 1/2" thick wood trusses, or rafters to wood walls.

5.1.2 To attach bottom plates to rim boards in the construction of walls.

5.2 See Section 5.8 and 5.9 for allowable design loads.

5.3 Allowable design loads are applicable to fasteners installed in accordance with Figure 5 through Figure 9, and Section 6.

5.4 Walls shall consist of a double top plate designed in accordance with IBC Section 2308.5.2 or IRC Section R602.3.2.

5.4.1 A single top plate is permitted to be used as an alternative to a double top plate provided that the provisions specified in IBC Section 2308.5.2 or IRC Section R602.3.2 are met.

5.5 The Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws in this TER are used in buildings requiring wind design in accordance with IBC Section 1609 or IRC Section R301.2.1.

5.6 The Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws in this TER are used in buildings requiring seismic design in accordance with IBC Section 1613 or IRC Section R301.2.2.

5.7 To maintain a continuous uplift load path, connections in the same area must be stacked on the same side of the wall (i.e., rafter to top plate connection and top plate to stud connection).

5.8 *Allowable Design Loads – Truss/Rafter/Joist to Top Plate Connection*

5.8.1 Allowable design loads for uplift and lateral resistance for truss, rafter, and joist to top plate connections are provided in Table 2 and Table 3.

5.8.2 Loads parallel to the wall are labeled F1 and loads perpendicular to the wall are labeled F2. See Figure 4 for load directions.

5.8.3 Allowable design loads are applicable to fasteners installed in accordance with Figure 5 and Figure 6 for double top plate wall configurations, and Figure 7 and Figure 8 for single top plate wall configurations.

5.8.3.1 Additional installation details are provided in Section 6.

Table 2. Allowable Uplift & Lateral Loads for Fasteners in Truss/Rafter to Double Top Plate Connections

Fastener	Fastener Length (in)	Fastener Angle to Vertical	Min. Penetration into Truss/Rafter (in)	Allowable Loads[2,3,4,5,6,7] (lbf)								
				HF/SPF (0.42)			DF-L (0.50)			SP (0.55)		
				Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
LumberTite®	4 1/2	0°	1.50	200	225	225	270	290	290	270	320	320
	6	22.5°	2.75	375	250	250	515	290	290	515	320	320
		0°	3.00	395	250	250	540	290	290	540	320	320
TimberTite®	4	0°	1.00	130	185	185	180	230	230	180	260	260
	6	22.5°	2.75	375	250	250	515	290	290	515	320	320
		0°	3.00	395	250	250	540	290	290	540	320	320
Structural Lag Screw	4	0°	1.00	130	185	185	180	230	230	180	260	260
	6	22.5°	2.75	495	250	250	635	290	290	635	320	320
		0°	3.00	520	250	250	665	290	290	665	320	320

SI: 1 in = 25.4 mm, 1 lbf = 4.448 N

1. Wood truss or rafter members shall be a minimum of 2" nominal thickness. Design of truss or rafter is by others.
2. Equivalent specific gravity of Structural Composite Lumber (SCL) shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
3. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for a specific gravity of 0.42. For wood species with an assigned specific gravity between 0.50 and 0.55, use the tabulated values for a specific gravity of 0.50. For wood species with an assigned specific gravity greater than 0.55, use the tabulated values for a specific gravity of 0.55.
4. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
5. Includes C_d = 1.6 load duration increase factor for wind and seismic. No further increases permitted. Reduce design values for other load durations as applicable.
6. See Figure 4 for load directions. See Figure 5 through Figure 9 for installation details.
7. Fasteners can be installed at an upward angle from the vertical of 20° to 30° (22.5° is optimal; see Figure 5) or 0° (see Figure 6). For installation between 20° and 30°, design values for 22.5° may be used.
8. No further duration of load increases permitted.

Table 3. Allowable Uplift & Lateral Loads for Fasteners in Truss/Rafter to Single Top Plate Connections

Fastener	Fastener Length (in)	Fastener Angle to Vertical	Min. Penetration into Truss/Rafter (in)	Allowable Loads[2,3,4,5,6,7,8] (lbf)								
				HF/SPF (0.42)			DF-L (0.50)			SP (0.55)		
				Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
LumberTite®	4 1/2	22.5°	2.88	220	240	240	280	290	290	280	320	320
		0°	3.00	210	240	240	270	290	290	270	320	320
	6	22.5°	4.38	220	240	240	280	290	290	280	320	320
		0°	4.50	210	240	240	270	290	290	270	320	320
TimberTite®	4	22.5°	2.38	220	240	240	280	290	290	280	320	320
		0°	2.50	210	240	240	270	290	290	270	320	320
	6	22.5°	4.38	220	240	240	280	290	290	280	320	320
		0°	4.50	210	240	240	270	290	290	270	320	320
Structural Lag Screw	4	22.5°	2.38	270	240	240	345	290	290	345	320	320
		0°	2.50	260	240	240	335	290	290	335	320	320
	6	22.5°	4.38	270	240	240	345	290	290	345	320	320
		0°	4.50	260	240	240	335	290	290	335	320	320

SI: 1 in = 25.4 mm, 1 lbf = 4.448 N

1. Wood truss or rafter members shall be a minimum of 2" nominal thickness. Design of truss or rafter is by others.
2. Equivalent specific gravity of structural composite lumber (SCL) shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
3. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for a specific gravity of 0.42. For wood species with an assigned specific gravity between 0.50 and 0.55, use the tabulated values for a specific gravity of 0.50. For wood species with an assigned specific gravity greater than 0.55, use the tabulated values for a specific gravity of 0.55.
4. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
5. Includes C_d = 1.6 load duration increase factor for wind and seismic. No further increases permitted. Reduce design values for other load durations as applicable.
6. See Figure 4 for load directions. See Figure 5 through Figure 9 for installation details.
7. Fasteners can be installed at an upward angle from the vertical of 20° to 30° (22.5° is optimal; see Figure 7) or 0° (see Figure 8). For installation between 20° and 30°, design values for 22.5° may be used.
8. No further duration of loads increases permitted.

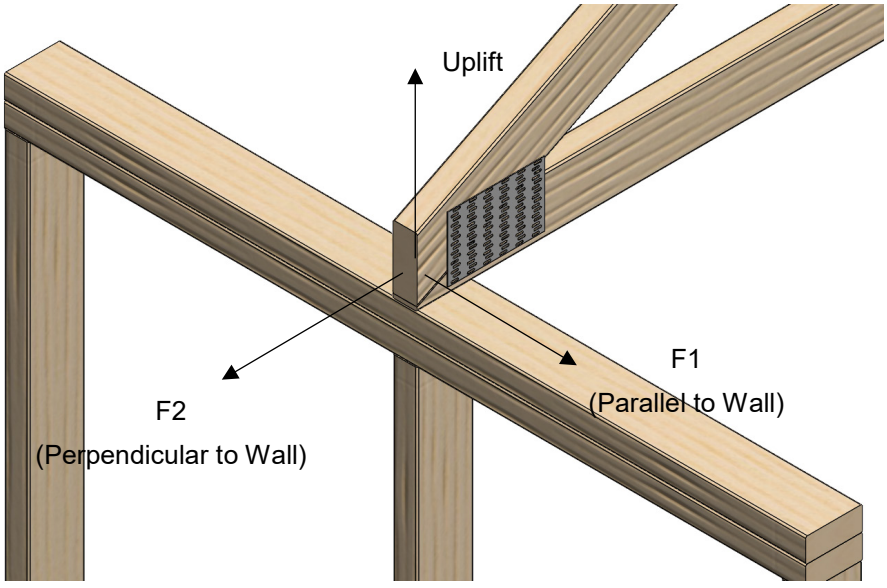

Figure 4. Uplift and Lateral Load Orientations

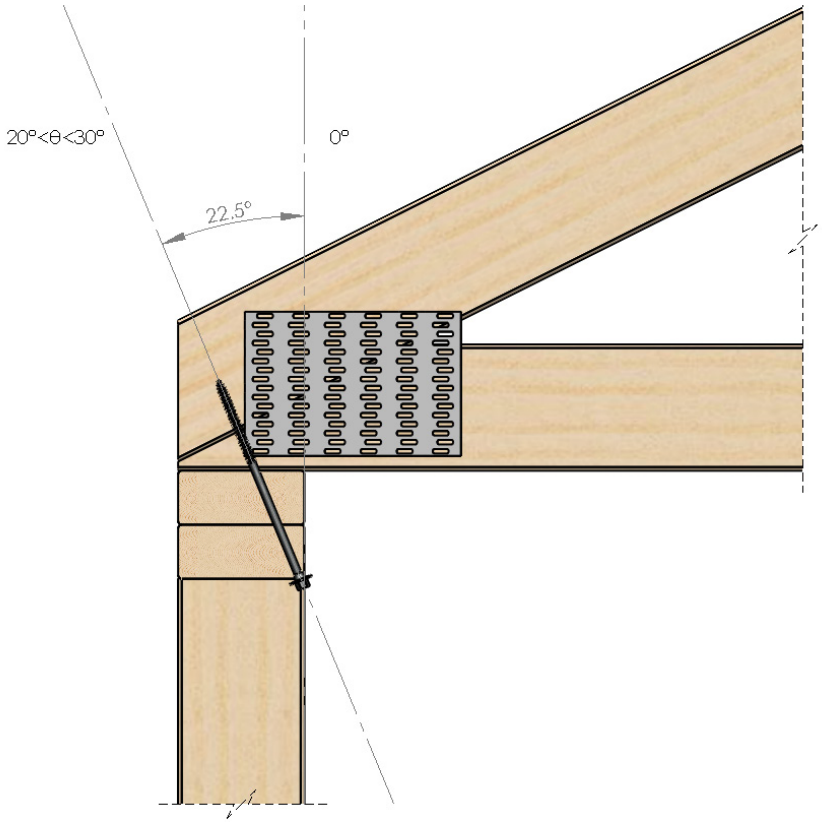

Figure 5. Installation of Fasteners at an Angle in Double Top Plate to Truss/Rafter Applications

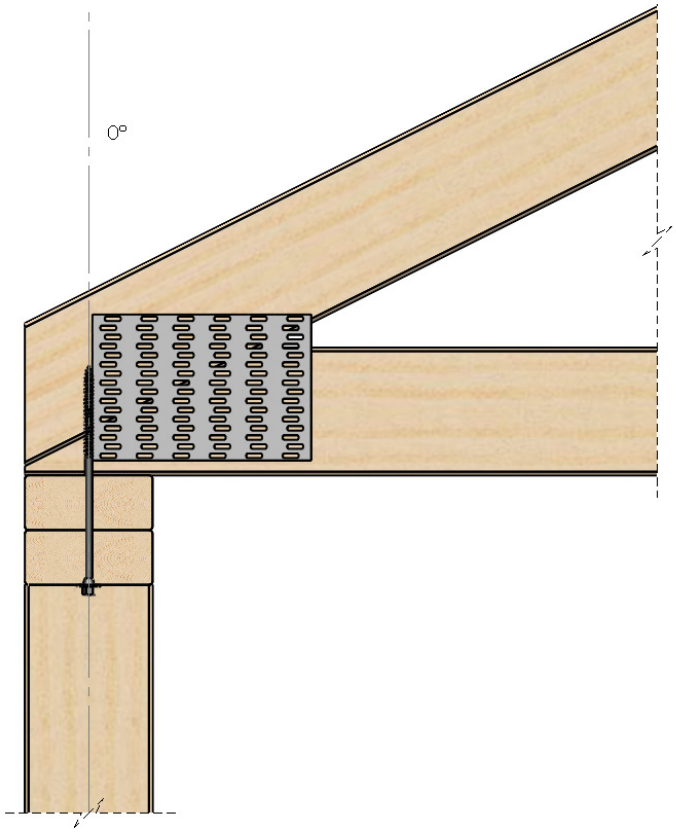

Figure 6. Installation of Fasteners in Double Top Plate Perpendicular to Truss/Rafter/Joist Applications

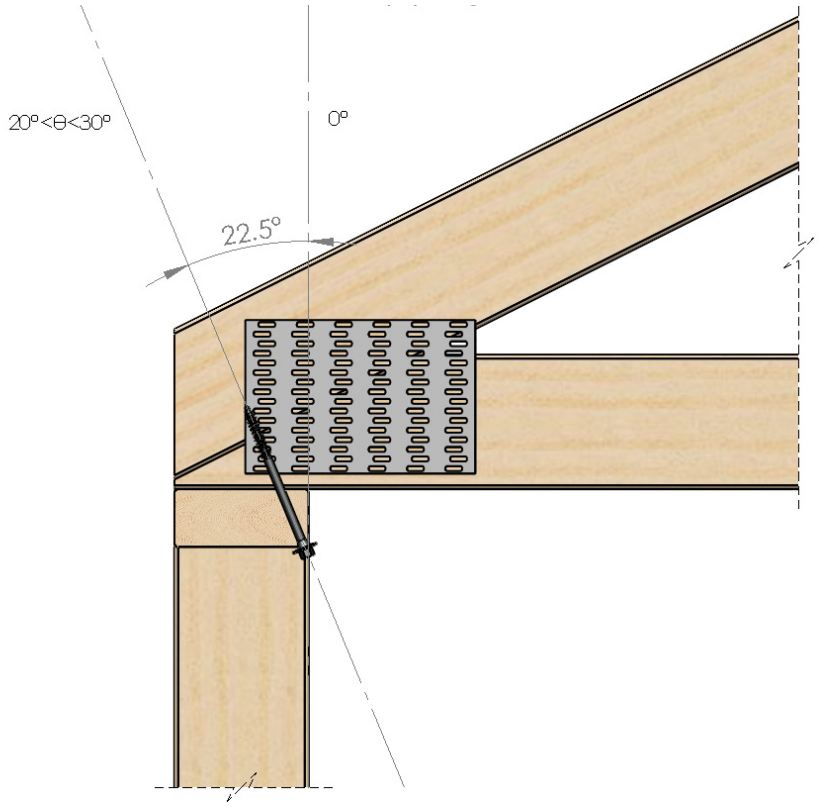

Figure 7. Installation of Fasteners at an Angle in Single Top Plate to Truss/Rafter Applications

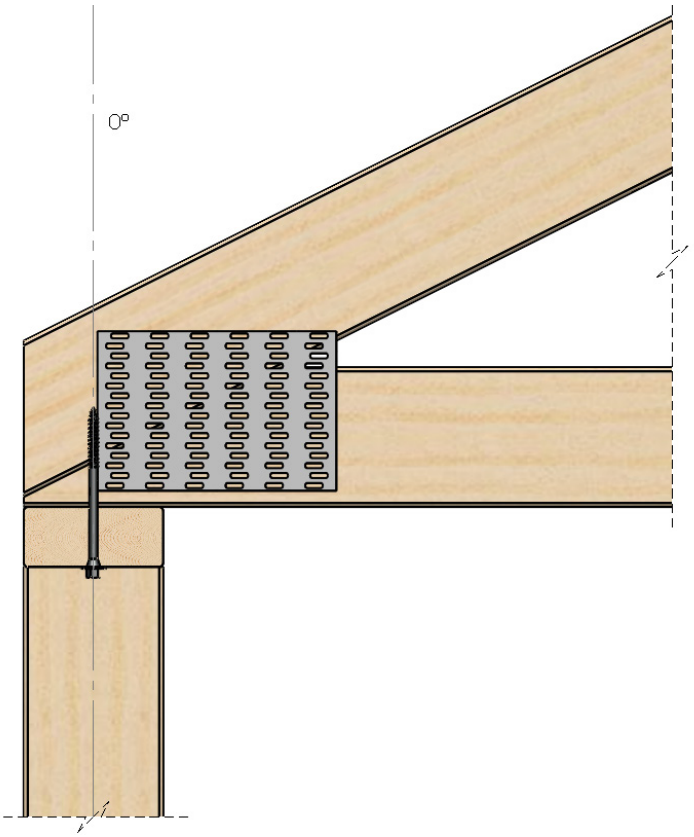

Figure 8. Installation of Fasteners in Single Top Plate Perpendicular to Truss/Rafter/Joist Applications

5.9 *Allowable Design Loads – Bottom Plate to Rim Board Connection*

5.9.1 Allowable design loads for lateral resistance parallel to grain in bottom plate to rim board connections are provided in Table 4. The connection configuration is shown in Figure 9.

5.9.1.1 A Wood Structural Panel (WSP) up to $1^1/_8$" thick is permitted between the rim board and the bottom plate, so long as it is independently fastened to the rim board per the building code and the minimum 2" screw penetration is met.

5.9.1.2 Double bottom plates are permitted so long as they are independently fastened per the building code and the minimum 2" screw penetration is met.

5.9.2 Allowable design loads are applicable to fasteners installed in accordance with Figure 9 and Section 6.6.

Table 4. Allowable Shear Loads Parallel to Grain for Bottom Plate to Rim Board Connections

Fastener	Min. Nominal Bottom Plate Thickness (in)	Min. Penetration into Rim Board (in)	Allowable Shear Loads, Parallel to Grain (lbf)[1,2,3]								
			Rim Board Species (Specific Gravity)								
			2x HF/SPF (0.42)			2x DF-L or $1^1/_4$" SCL (0.50)			2x SP (0.55)		
			Bottom Plate Species (Specific Gravity)								
			HF/SPF (0.42)	DF-L (0.50)	SP (0.55)	HF/SPF (0.42)	DF-L (0.50)	SP (0.55)	HF/SPF (0.42)	DF-L (0.50)	SP (0.55)
LumberTite®	2	2.0	150	165	175	160	180	190	165	190	200
TimberTite®											
Structural Lag Screw											

SI: 1 in = 25.4 mm, 1 lbf = 4.448 N

1. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for a specific gravity of 0.42. For wood species with an assigned specific gravity between 0.50 and 0.55, use the tabulated values for a specific gravity of 0.50. For wood species with an assigned specific gravity greater than 0.55, use the tabulated values for a specific gravity of 0.55.
2. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
3. See Figure 4 for load directions. See Figure 5 through Figure 9 for installation details.
4. Tabulated loads are based on a load duration factor of C_D = 1.0. Loads may be increased for load duration per NDS.

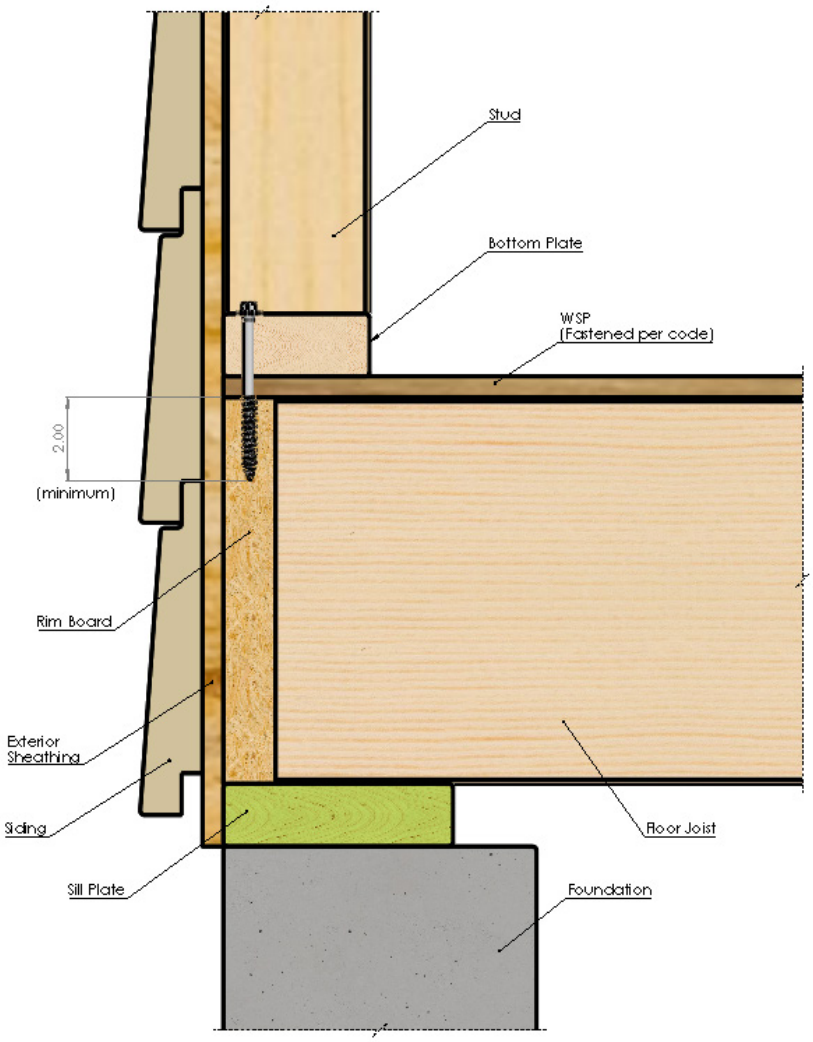

Figure 9. Fastener in Bottom Plate to Rim Board Connection

5.10 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science, and fire science.

6 Installation

6.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this TER and the applicable building code.

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

6.3 *General Installation Procedure*

6.3.1 Fasteners shall be installed with a 1/2" (12.7 mm), low rpm/high torque electric drill (450 rpm).

6.3.2 Fasteners shall be installed with the bottom side of the flat region of the head flush to the surface of the wood member. Fasteners shall not be overdriven.

6.3.3 Fasteners shall not be struck with a hammer during installation.

6.3.4 Lead holes are not required but may be used where lumber is prone to splitting using the provisions in the NDS.

6.4 *Spacing, Edge Distance and End Distance*

6.4.1 1/4″ Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws spacing, edge distance and end distances shall be as specified in Table 5.

Table 5. Screw Spacing, Edge Distance, and End Distance Requirements[1,2]

Connection Geometry	Minimum Spacing (in)
Edge Distance –Load in any direction	1/2
End Distance – Load parallel to grain, towards end	2 5/8
End Distance – Load perpendicular to grain, away from end	1 3/4
End Distance – Load perpendicular to grain	1 3/4
Spacing between Fasteners in a Row – Parallel to grain	2 5/8
Spacing between Fasteners in a Row – Perpendicular to grain	1 3/4
Spacing between Rows of Fasteners – In-line	7/8
Spacing between Rows of Fasteners – Staggered[2]	1/2

SI: 1 in = 25.4 mm

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.
2. Values for "Spacing between Rows or Fasteners-Staggered" apply where the screws in adjacent rows are offset by one-half of the "Spacing between Fasteners in a Row".

6.5 *Truss/Rafter to Top Plate Connection*

6.5.1 Select a Power Pro® fastener listed in Table 2 and Table 3.

6.5.2 Install fasteners upward through the wall top plates or wood structural framing member at the bottom corner of the top plate(s) and into the center of the wood truss or rafter. The fastener should be installed at an upward angle from the vertical of 20° to 30° (Figure 5 and Figure 7) and should penetrate the wood truss, rafter, or joist within 1/4″ of the centerline.

6.5.3 Trusses/rafters located between studs may be installed at a 0° angle (Figure 6 and Figure 8).

6.5.3.1 Bearing distances between trusses/rafters and studs shall be within the provisions specified in IBC Section 2308.5.3.2 and IRC Section R602.3.2.

6.5.3.2 If the wood truss, rafter or floor joist is located directly over a top plate splice, offset the fastener 1/4″ to one side of the splice. Note that the splice may be in either top plate.

6.6 *Bottom Plate to Rim Board Connection*

6.6.1 Select a Power Pro® fastener with a length sufficient to fully embed at least 2.0″ into the rim board.

6.6.2 Install fasteners downward and perpendicular to the face of the wall bottom plate, a minimum of 1/2" from the outside face of the wall, through the plate and into the rim board (Figure 9).

7 Substantiating Data

7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

7.1.1 Connection design value calculations by DrJ Engineering, LLC in accordance with NDS and accepted engineering practice, and

7.1.2 Properties for Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws from approved sources.

7.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies (i.e., ANAB accredited agencies), approved sources (i.e., RDPs), and/or professional engineering regulations. Accuracy of external test data and resulting analysis is relied upon.

7.3 Where pertinent, testing and/or engineering analysis is based upon provisions that have been codified into law through state or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ's engineering practice may use a code-adopted provision as the control sample. A control sample versus a test sample establishes a product as being equivalent to the code-adopted provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

7.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, Listings, certified reports, duly authenticated reports from approved agencies, and research reports prepared by approved agencies and/or approved sources provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this TER, may be dependent upon published design properties by others.

7.5 Testing and engineering analysis: The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[9]

7.6 Where additional condition of use and/or code compliance information is required, please search for Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws on the DrJ Certification website.

8 Findings

8.1 As delineated in Section 3, Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws have performance characteristics that were tested and/or meet pertinent standards and are suitable for use pursuant to its specified purpose.

8.2 When used and installed in accordance with this TER and the manufacturer installation instructions, Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws shall be approved for the following applications:

8.2.1 An acceptable means of attaching metal plate connected wood trusses, joists or rafters to the tops of walls to provide uplift and lateral load resistance due to wind and seismic forces as provided in Table 2 and Table 3.

8.2.2 An acceptable means of attaching wall bottom plate to rim board to provide lateral load resistance parallel to the bottom plate as provided in Table 4.

8.3 Unless exempt by state statute, when Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws are to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

8.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from The Hillman™ Group.

[9] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition.

8.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10[10] are similar) in pertinent part 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. 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.

8.6 **Approved**:[11] Building codes require that the building official shall accept duly authenticated reports[12] or research reports[13] from approved agencies and/or approved sources (i.e., licensed RDP) with respect to the quality and manner of use of new products, materials, designs, services, assemblies, or methods of construction.

8.6.1 Acceptance of an approved agency, by a building official, is performed by verifying that the agency is accredited by a recognized accreditation body of the International Accreditation Forum (IAF).

8.6.2 Acceptance of a licensed RDP, by a building official, is performed by verifying that the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.

8.6.3 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved, as denial without written reason deprives a protected right to free and fair competition in the marketplace.

8.7 DrJ is an engineering company, employs RDPs and is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131.

8.8 Through ANAB accreditation and the IAF Multilateral Agreements, this TER can be used to obtain product approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*." IAF specifically says, "*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope*."[14]

9 Conditions of Use

9.1 Material properties shall not fall outside the boundaries defined in Section 3.

9.2 As defined in Section 3, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

9.3 As listed herein, Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws shall not be used:

9.3.1 In sawn lumber with moisture contents of greater than nineteen percent (19%).

9.3.2 In SCL members with moisture content greater than sixteen percent (16%).

[10] 2018 IFC Section 104.9

[11] Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[12] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1

[13] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2

[14] https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise

9.4 As listed herein, Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws can be used in:

9.4.1 Chemically (pressure preservatives and fire-retardants) treated wood with no limitations with respect to moisture content of the treated wood.

9.4.1.1 Section 9.3.1 and Section 9.3.2 shall still be followed.

9.4.2 Untreated wood with no limitation with respect to moisture content of the untreated wood.

9.5 When installed in preservative-treated wood or fire-retardant treated wood, connections shall be designed using the treatment manufacturer reductions for connections.

9.6 For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practices. When the capacity of a connection is controlled by fastener strength rather than wood strength, the metal strength value shall be not increased by the adjustment factors specified in the NDS.

9.7 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:

9.7.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice, and, when prepared by an approved source, shall be approved when signed and sealed.

9.7.2 This TER and the installation instructions shall be submitted at the time of permit application.

9.7.3 These innovative products have an internal quality control program and a third-party quality assurance program.

9.7.4 At a minimum, these innovative products shall be installed per Section 6 of this TER.

9.7.5 The review of this TER, by the AHJ, shall be in compliance with IBC Section 104 and IBC Section 105.4.

9.7.6 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.

9.7.7 The application of these innovative products in the context of this TER are dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2 and any other regulatory requirements that may apply.

9.8 The approval of this TER by the AHJ shall comply with IBC Section 1707.1, where legislation states in pertinent part, "*the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11*", all of IBC Section 104, and IBC Section 105.4.

9.9 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 (i.e., owner or RDP).

9.10 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.

10 Identification

10.1 The innovative products listed in Section 1.1 through Section 1.3 are identified by a label on the board or packaging material bearing the manufacturer name, product name, TER number, and other information to confirm code compliance.

10.2 Additional technical information can be found at www.hillmangroup.com.

11 Review Schedule

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

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

12 Approved for Use Pursuant to US and International Legislation Defined in Appendix A

12.1 Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws are included in this TER published by an approved agency that is concerned with evaluation of products or services, maintains periodic inspection of the production of listed materials or periodic evaluation of services, and whose TER Listing states either that the material, product, or service meets identified standards or has been tested and found suitable for a specified purpose. This TER meets the legislative intent and definition of being acceptable to the AHJ.

Appendix A

1 Legislation that Authorizes AHJ Approval

1.1 **Fair Competition**: State legislatures have adopted Federal regulations for the examination and approval of building code referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:

1.1.1 Advance Innovation,

1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and

1.1.3 Benefit consumers through lower prices, better quality, and greater choice.

1.2 **Adopted Legislation**: The following local, state, and federal regulations affirmatively authorize Power Pro® LumberTite®, Power Pro® TimberTite® Structural Wood Screws, and Power Pro® Structural Lag Screws to be approved by AHJs, delegates of building departments, and/or delegates of an agency of the federal government:

1.2.1 Interstate commerce is governed by the Federal Department of Justice to encourage the use of innovative products, materials, designs, services, assemblies and/or methods of construction. The goal is to "protect economic freedom and opportunity by promoting free and fair competition in the marketplace."

1.2.2 Title 18 US Code Section 242 affirms and regulates the right of individuals and businesses to freely and fairly have new products, materials, designs, services, assemblies and/or methods of construction approved for use in commerce. Disapproval of alternatives shall be based upon non-conformance with respect to specific provisions of adopted legislation, and shall be provided in writing stating the reasons why the alternative was not approved, with reference to the specific legislation violated.

1.2.3 The federal government and each state have a public records act. In addition, each state also has legislation that mimics the federal Defend Trade Secrets Act 2016 (DTSA),[15] where providing test reports, engineering analysis and/or other related IP/TS is subject to prison of not more than 10 years[16] and/or a $5,000,000 fine or 3 times the value of[17] the Intellectual Property (IP) and Trade Secrets (TS).

1.2.3.1 Compliance with public records and trade secret legislation requires approval through the use of listings, certified reports, Technical Evaluation Reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.

1.2.4 For new materials[18] that are not specifically provided for in any building code, the design strengths and permissible stresses shall be established by tests, where suitable load tests simulate the actual loads and conditions of application that occur.

1.2.5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design using accepted engineering practice.[19]

1.2.6 The commerce of approved sources (i.e., registered PEs) is regulated by professional engineering legislation. Professional engineering commerce shall always be approved by AHJs, except where there is evidence, provided in writing, that specific legislation has been violated by an individual registered PE.

1.2.7 The AHJ shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in IBC Section 104.11.[20]

[15] http://www.drjengineering.org/AppendixC and https://www.drjcertification.org/cornell-2016-protection-trade-secrets.

[16] https://www.law.cornell.edu/uscode/text/18/1832#:~:text=imprisoned%20not%20more%20than%2010%20years

[17] https://www.law.cornell.edu/uscode/text/18/1832#:~:text=Any%20organization%20that,has%20thereby%20avoided

[18] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706.2

[19] IBC 2021, Section 1706.1 Conformance to Standards

[20] IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General

1.3 **Approved**[21] **by Los Angeles**: The Los Angeles Municipal Code (LAMC) states in pertinent part that the provisions of LAMC are not intended to prevent the use of any material, device, or method of construction not specifically prescribed by LAMC. The Department shall use Part III, Recognized Standards in addition to Part II, Uniform Building Code Standards of Division 35, Article 1, Chapter IX of the LAMC in evaluation of products for approval where such standard exists for the product or the material and may use other approved standards, which apply. Whenever tests or certificates of any material or fabricated assembly are required by Chapter IX of the LAMC, such tests or certification shall be made by a testing agency approved by the Superintendent of Building to conduct such tests or provide such certifications. The testing agency shall publish the scope and limitation(s) of the listed material or fabricated assembly.[22] The Superintendent of Building roster of approved testing agencies is provided by the Los Angeles Department of Building and Safety (LADBS). The Center for Building Innovation (CBI) Certificate of Approval License is TA24945. Tests and certifications found in a CBI Listing are LAMC approved. In addition, the Superintendent of Building shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the California Building Code (CBC) Section 1707.1.[23]

1.4 **Approved by Chicago**: The Municipal Code of Chicago (MCC) states in pertinent part that an Approved Agency is a Nationally Recognized Testing Laboratory (NRTL) acting within its recognized scope and/or a certification body accredited by the American National Standards Institute (ANSI) acting within its accredited scope. Construction materials and test procedures shall conform to the applicable standards listed in the MCC. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material, service, design, assembly and/or method of construction not specifically provided for in the MCC. This technical data shall consist of research reports from approved sources (i.e., MCC defined Approved Agencies).

1.5 **Approved by New York City**: The NYC Building Code 2022 (NYCBC) states in pertinent part that an approved agency shall be deemed[24] an approved testing agency via ISO/IEC 17025 accreditation, an approved inspection agency via ISO/IEC 17020 accreditation, and an approved product evaluation agency via ISO/IEC 17065 accreditation. Accrediting agencies, other than federal agencies, must be members of an internationally recognized cooperation of laboratory and inspection accreditation bodies subject to a mutual recognition agreement[25] (i.e., ANAB, International Accreditation Forum (IAF), etc.).

1.6 **Approved by Florida**: Statewide approval of products, methods, or systems of construction shall be approved, without further evaluation, by 1) A certification mark or listing of an approved certification agency, 2) A test report from an approved testing laboratory, 3) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, from an approved product evaluation entity; 4) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a professional engineer or architect, licensed in Florida. For local product approval, products or systems of construction shall demonstrate compliance with the structural wind load requirements of the Florida Building Code (FBC) through one of the following methods; 1) A certification mark, listing, or label from a commission-approved certification agency indicating that the product complies with the code; 2) A test report from a commission-approved testing laboratory indicating that the product tested complies with the code; 3) A product-evaluation report based upon testing, comparative or rational analysis, or a combination thereof, from a commission-approved product evaluation entity which indicates that the product evaluated complies with the code; 4) A product-evaluation report or certification based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a Florida professional engineer or Florida registered architect, which indicates that the product complies with the code; 5) A statewide product approval issued by the Florida Building Commission. The Florida Department of Business and Professional Regulation (DBPR) website provides a listing of companies certified as a Product Evaluation Agency (i.e., EVLMiami 13692), a Product Certification Agency (i.e., CER10642), and as a Florida Registered Engineer (i.e., ANE13741).

[21] See Section 8 for the distilled building code definition of **Approved**

[22] Los Angeles Municipal Code, SEC. 98.0503. TESTING AGENCIES

[23] https://up.codes/viewer/california/ca-building-code-2022/chapter/17/special-inspections-and-tests#1707.1

[24] New York City, The Rules of the City of New York, § 101-07 Approved Agencies

[25] New York City, The Rules of the City of New York, § 101-07 Approved Agencies

1.7 **Approved by Miami-Dade County (i.e., Notice of Acceptance [NOA])**: A Florida statewide approval is an NOA. An NOA is a Florida local product approval. By Florida law, Miami-Dade County shall accept the statewide and local Florida Product Approval as provided for in Florida legislation 553.842 and 553.8425.

1.8 **Approved by New Jersey**: Pursuant to Building Code 2018 of New Jersey in IBC Section 1707.1 General,[26] it states: "In the absence of approved rules or other approved standards, the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the administrative provisions of the Uniform Construction Code (N.J.A.C. 5:23)".[27] Furthermore N.J.A.C 5:23-3.7 states: Municipal approvals of alternative materials, equipment, or methods of construction. **(a) Approvals**: Alternative materials, equipment, or methods of construction shall be approved by the appropriate subcode official provided the proposed design is satisfactory and that the materials, equipment, or methods of construction are suitable for the intended use and are at least the equivalent in quality, strength, effectiveness, fire resistance, durability and safety of those conforming with the requirements of the regulations. 1. A field evaluation label and report or letter issued by a nationally recognized testing laboratory verifying that the specific material, equipment, or method of construction meets the identified standards or has been tested and found to be suitable for the intended use, shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. 2. Reports of engineering findings issued by nationally recognized evaluation service programs, such as, but not limited to, the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress International (SBCCI), the International Code Council (ICC), and the National Evaluation Service, Inc., shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. The New Jersey Department of Community Affairs has confirmed that technical evaluation reports, from any accredited entity listed by ANAB, meets the requirements of item 2 given that the listed entities are no longer in existence and/or do not provide "reports of engineering findings".

1.9 **Approved by the Code of Federal Regulations Manufactured Home Construction and Safety Standards**: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[28] and Part 3280,[29] the Department encourages innovation and the use of new technology in manufactured homes. The design and construction of a manufactured home shall conform with the provisions of Part 3282 and Part 3280 where key approval provisions in mandatory language follow: 1) "All construction methods shall be in conformance with accepted engineering practices"; 2) "The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur."; and 3) "The design stresses of all materials shall conform to accepted engineering practice."

1.10 **Approval by US, Local, and State Jurisdictions in General**: In all other local and state jurisdictions, the adopted building code legislation states in pertinent part that:

1.10.1 For new materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests.[30]

1.10.2 For innovative alternative products, materials, designs, services and/or methods of construction, in the absence of approved rules or other approved standards…the building official shall accept duly authenticated reports (i.e., listing and/or research report) from approved agencies with respect to the quality and manner of use of new materials or assemblies.[31] A building official approved agency is deemed to be approved via certification from an accreditation body that is listed by the International Accreditation Forum[32] or equivalent.

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[26] https://up.codes/viewer/new_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1

[27] https://www.nj.gov/dca/divisions/codes/codreg/ucc.html

[28] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

[29] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[30] IBC 2021, Section 1706 Design Strengths of Materials, 1706.2 New Materials. Adopted law pursuant to IBC model code language 1706.2.

[31] IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General. Adopted law pursuant to IBC model code language 1707.1.

[32] Please see the ANAB directory for building official approved agencies.

1.10.3 The design strengths and permissible stresses of any structural material…shall conform to the specifications and methods of design of accepted engineering practice performed by an approved source.[33] An approved source is defined as a PE subject to professional engineering laws, where a research and/or a technical evaluation report certified by a PE, shall be approved.

1.11 **Approval by International Jurisdictions**: The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements:

1.11.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,

1.11.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.

1.11.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

1.11.4 **Approved**: The purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories to the MLA, and subsequently acceptance of accredited certification and validation/verification statements in many markets based on one accreditation for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.

[33] IBC 2021, Section 1706 Design Strengths of Materials, Section 1706.1 Conformance to Standards Adopted law pursuant to IBC model code language 1706.1.