Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report No: 2102-03

Issue Date: July 18, 2022

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CAMO® Truss Screws Used in Beam and Wall Connections

Trade Secret Report Holder:

National Nail® Corporation dba CAMO®

Phone: 800-968-6245 Website: www.nationalnail.com or www.camofasteners.com

CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

Section: 06 00 90 - Wood and Plastic Fastenings

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

1 Innovative Products Evaluated[1]

1.1 CAMO Series Structural Truss Screws:

1.1.1 #14 x 4$^1/_2$" Truss Screw

1.1.2 #14 x 6" Truss Screw

1.1.3 #14 x 6" Easy Inspection Hi-Vis Pink Truss Screw

2 Product Description and Materials

2.1 The innovative products evaluated in this report are shown in **Figure 1** through **Figure 3**.

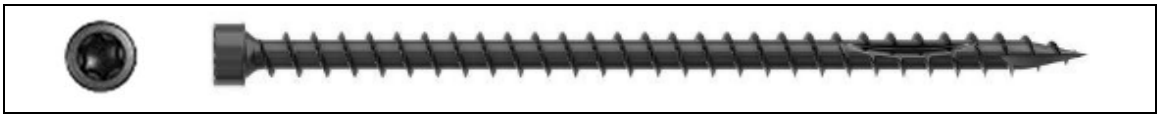


Figure 1. CAMO Series #14 x 4$^1/_2$" Truss Screw, PROTECH Black Coloration



Figure 2. CAMO Series #14 x 6" Truss Screw, PROTECH Ultra 4 Tan Coloration

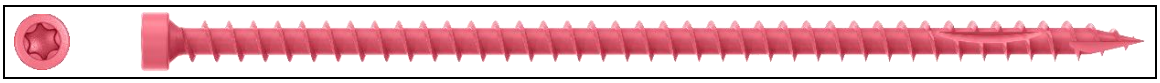


Figure 3. CAMO Series #14 x 6" Truss Screw, Easy Inspection Hi-Vis Pink Coloration

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2.2 *Product Description*

2.2.1 CAMO Series Structural Truss Screws are fully threaded fasteners with a cylindrical, star driven head with a tapered underside.

2.2.2 CAMO Series Structural Truss Screws are available with a variety of coatings including proprietary coating systems designated as PROTECH Ultra 4, PROTECH, and Easy Inspection Hi-Vis Pink coatings. PROTECH Ultra 4, PROTECH, and Easy Inspection Hi-Vis Pink coatings meet the requirements of ASTM G198 for Hot-Dip Galvanized with a coating weight in compliance with ASTM A153, Class D.

2.2.3 CAMO Series #14 x 6" Truss Screws are available with a tan-colored PROTECH Ultra 4 and Easy Inspection Hi-Vis Pink coatings. CAMO Series #14 x $4^1/_2$" Truss Screws are available with a black PROTECH coating.

2.3 *Fastener Material*

2.3.1 CAMO Series Structural Truss Screws are made of hardened carbon steel grade 10B18, 1022, or 10B21 wire conforming to ASTM A510, and/or Grade 17MnB3 or 19MnB4 wire conforming to DIN 1654 using standard cold-forming processes.

2.3.2 Fasteners are subsequently heat-treated and then coated with PROTECH Ultra 4, PROTECH, or Easy Inspection Hi-Vis Pink.

2.4 *Fastener Specifications*

2.4.1 The fasteners evaluated in this report are set forth in **Table 1**.

Table 1. Fastener Specifications[1]

Fastener Designation	Head[6]				Length[2] (in)		Diameter (in)			Bending Yield Strength,[4] F_{yb} (psi)	Allowable Steel Strength (lbf)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener	Thread[3]	Shank	Minor	Major		Tensile	Shear[5]
#14 x $4^1/_2$" Truss Screw	Cylinder Head	T30 Star Drive	0.335	0.217	4.5	Full	0.156	0.156	0.241	189,000	1,175	820
#14 x 6" Truss Screw					6.0							

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

1. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.
2. Fastener length is measured from the topside of the head to the tip.
3. Thread length includes tapered tip.
4. Bending yield strength, or F_{yb}, is determined in accordance with ASTM F1575 using minor thread diameter when fastener is tested in threaded section.
5. Shear strength is determined in accordance with AISI S904 using minor thread diameter when fastener is tested in threaded section.
6. Fasteners with PROTECH Ultra 4, PROTECH, and Easy Inspection Hi-Vis Pink coatings are recognized for use in pressure-preservative-treated wood as specified in Sections 2.5 and 2.6, subject to the Conditions of Use in Section 12.

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2.5 *Corrosion Resistance*

2.5.1 CAMO Series Structural Truss Screws may be used where screws are required to exhibit corrosion resistance when exposed to adverse environmental conditions and/or in chemically treated wood, which is subject to the limitations of this report and are alternatives to hot-dip galvanized screws with a coating weight in compliance with ASTM A153, Class D.

2.5.2 CAMO Series Structural Truss Screws have a proprietary PROTECH Ultra 4, PROTECH, or Easy Inspection Hi-Vis Pink coating, which are equivalent to the protection provided by code-approved hot-dip galvanized coatings meeting ASTM A153, Class D (IBC Section 2304.10.6 and IRC Section R304.3[2]) when recognized for use by the American Wood Protection Association (AWPA) in untreated wood and Ground Contact – General Use pressure treated wood for exterior, freshwater, general construction applications (i.e., Ground Contact – General Use AWPA UC1 through UC4A).

2.5.3 CAMO Series Structural Truss Screws, having the proprietary PROTECH Ultra 4, PROTECH, or Easy Inspection Hi-Vis Pink, also meet the requirements for use in chemically treated wood in accordance with ASTM G198.

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

2.6.1 CAMO Series Structural Truss Screws, with the proprietary coating, are recognized for use in PPT lumber provided the conditions set forth by the PPT lumber manufacturer be met, including appropriate strength reductions.

2.7 *Fire-Retardant Treated (FRT) Wood Applications*

2.7.1 CAMO Series Structural Truss Screws, with the proprietary coating, are recognized for use in FRT lumber provided the conditions set forth by the FRT lumber manufacturer be met, including appropriate strength reductions.

2.8 *Wood Material*

2.8.1 Solid sawn wood main and side members connected using CAMO Series Structural Truss Screws shall consist of lumber species or species combinations having an assigned specific gravity as given in the respective tables of this report.

2.8.2 Structural Composite Lumber (SCL) (e.g., LVL, LSL, PSL, etc.), connected using CAMO Series Structural Truss Screws shall be recognized in evaluation reports having published equivalent specific gravities for dowel-bearing strength and withdrawal resistance.

2.9 As needed, review material properties for design in **Section 6** and the regulatory evaluation in **Section 8**.

3 Definitions[3]

3.1 New Materials[4] are defined as building materials, equipment, appliances, systems, or methods of construction, not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[5] The design strength and permissible stresses shall be established by tests[6] and/or engineering analysis.[7]

3.2 Duly authenticated reports[8] and research reports[9] are test reports and related engineering evaluations that are written by an approved agency[10] and/or an approved source.[11]

3.2.1 This report utilizes intellectual property and/or trade secrets to create public domain material properties for commercial end-use.

3.2.1.1 This report protects confidential Intellectual Property and trade secrets under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[12]

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3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is accredited and listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional, hereinafter RDP) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[13]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body, and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[14] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[15] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[16] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[17]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory. Therefore, recognition of certificates and validation statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope shall be approved.[18] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[19] and can be used in any country that is an MLA signatory found at this link: https://iaf.nu/en/recognised-abs/

3.9 Approval equity is a fundamental commercial and legal principle.[20]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[21]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured local jurisdictions: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, St. Louis County, Texas Department of Insurance, and Wichita.[22]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured states: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[23]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[24] and Part 3280[25] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Regulations*

4.2.1 *IBC – 18, 21, 24: International Building Code®*

4.2.2 *IRC – 18, 21, 24: International Residential Code®*

4.2.3 *FBC-B—20, 23: Florida Building Code[26] – Building (FL 41741)*

4.2.4 *FBC-R—20, 23: Florida Building Code[26] – Residential (FL 41741)*

4.2.5 *CBC — 22, 25: California Building Code[27] (Title 24, Part 2)*

4.2.6 *CRC — 22, 25: California Residential Code[27] (Title 24, Part 2.5)*

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4.2.7 *LABC—20, 23 Los Angeles Building Code*

4.2.8 *LARC—20, 23: Los Angeles Residential Code*

4.3 *Standards*

4.3.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear of Screws*

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

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

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

4.3.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*

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

4.3.7 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

4.3.8 *ASTM G198: Standard Test Method for Determining the Relative Corrosion Performance of Driven Fasteners in Contact with Treated Wood*

5 Listed[28]

5.1 Equipment, materials, products, or services included in a List published by a nationally recognized testing laboratory (e.g., CBI), an approved agency (e.g., CBI and DrJ), and/or an approved source (e.g., DrJ), or other organization(s) concerned with product evaluation (e.g., DrJ), that maintains periodic inspection (e.g., CBI) 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.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 CAMO Series Structural Truss Screws are used in the construction of walls that meet the requirements of IBC Section 2308 or IRC Section R602 for the following applications:

6.1.1 CAMO Series Structural Truss Screws are used to attach minimum $1^1/_2$" thick wood trusses, rafters, floor joists, or floor trusses to wood walls, see **Section 6.7** for allowable design loads for top plate to roof truss/rafter/joist connections. See **Section 6.8** for allowable design loads for bottom plate to floor truss/joist connection.

6.1.2 CAMO Series Structural Truss Screws are used to attach studs to top plates or bottom plates see **Section 6.9** and **Section 6.10**, respectively, for allowable design loads.

6.1.3 CAMO Series Structural Truss Screws are used to attach bottom plates to rim boards in the construction of walls, see **Section 6.11** for allowable design loads.

6.1.4 CAMO Series #14 x 6" Truss Screws are used to attach deck joists to minimum 2-ply deck beams, see **Section 6.12** for allowable design loads.

6.1.5 CAMO Series #14 x 6" Truss Screws are used to attach posts to deck beams, see **Section 6.13** for allowable design loads.

6.1.6 CAMO Series #14 x 6" Truss Screws are used to attach knee braces to posts, see **Section 6.14** for allowable design loads.

6.2 Allowable design loads are applicable to fasteners installed in accordance with **Section 9**.

6.3 At a minimum, walls shall consist of a double top plate installed in accordance with IBC Section 2308.9.2 or IRC Section R602.3.2.

6.3.1 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 2308.9.2 or IRC Section R602.3.2 be met.

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6.4 CAMO Series Structural Truss Screws are used in buildings or structures requiring structural design for wind loads in accordance with IBC Section 1609 or wind design in accordance with IRC Section R301.2.1.

6.5 CAMO Series Structural Truss Screws are used in buildings or structures requiring structural design for earthquake loads in accordance with IBC Section 1613 or seismic design in accordance with IRC Section R301.2.2.

6.6 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).

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

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

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

6.7.3 Allowable design loads are applicable to fasteners installed in accordance with **Section 9** in double top plate applications.

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

Fastener	Minimum Penetration into Truss/Rafter/Joist[1] (in)	Top Plate(s)	Fastener Angle to Vertical[7]	Allowable Loads[2,3,4,5,6] (lbf)								
				HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
				Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	2 1/2	Double	22.5°	790	255	255	1,175	305	305	1,175	330	330
			0°	1,175	255	255	1,175	305	305	1,175	330	330

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

1. Wood truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of truss, rafter, or floor joist 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 1.6 factor for Load Duration increase for wind and seismic. No further increases permitted. Reduce design values for other conditions as applicable.
6. See **Figure 4** for load directions. See **Figure 5** and **Figure 6** for installation details.
7. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal) or 0° (See **Figure 5** and **Figure 6**). For installation between 20° and 30°, design values for 22.5° may be used.

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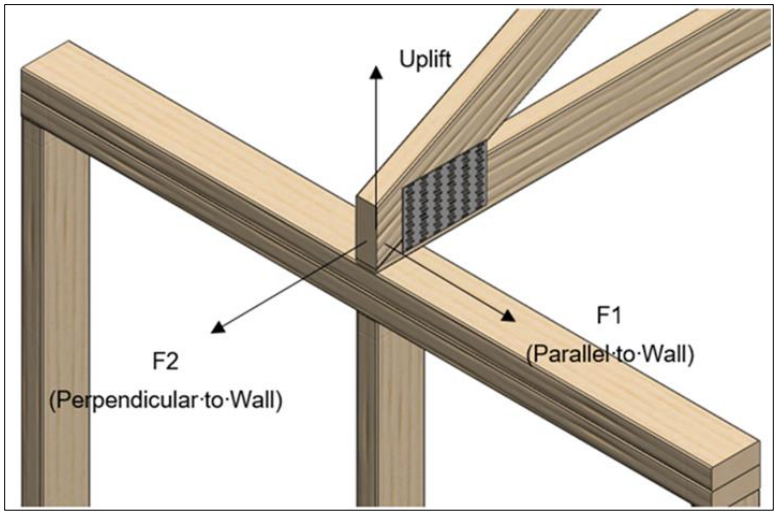


Figure 4. Allowable Uplift and Lateral Loads for Fasteners in Truss/Rafter/Joist to Top Plate Connections

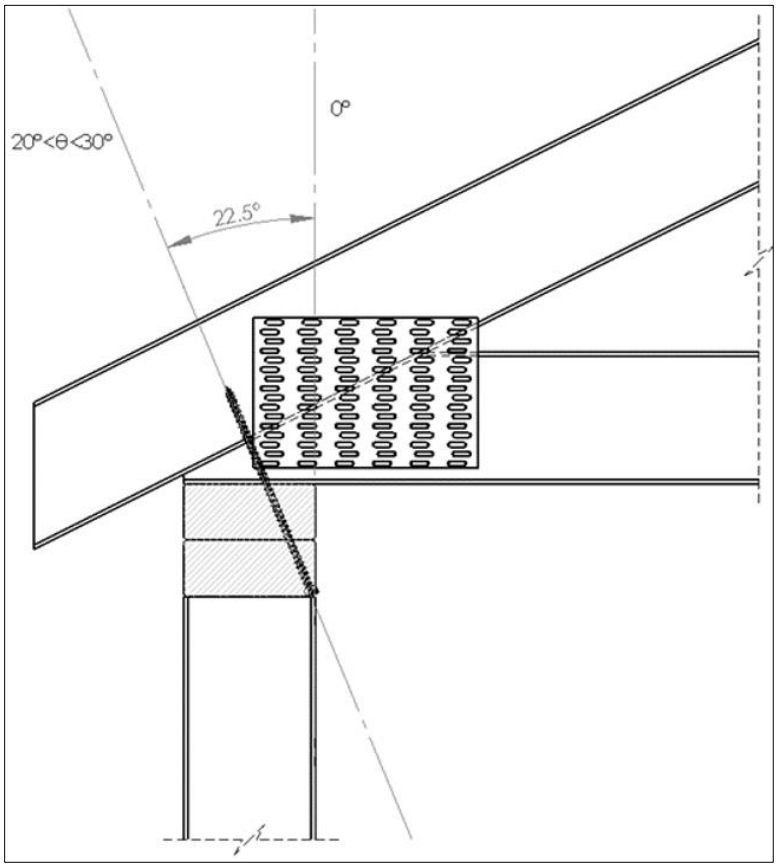


Figure 5. Installation of Fasteners at an Angle in Double Top Plate to Truss/Rafter/Joist Applications

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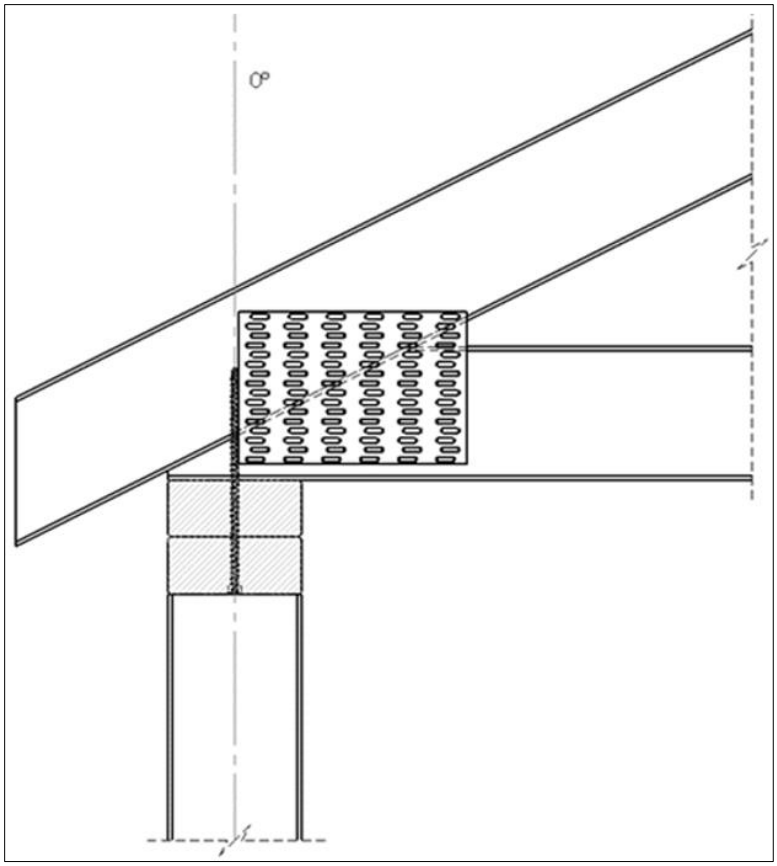


Figure 6. Installation of Fasteners in Double Top Plate Perpendicular to Truss/Rafter/Joist Applications

6.8 *Allowable Design Loads – Floor Truss/Joist to Bottom Plate Connection*

6.8.1 Allowable design loads for uplift and lateral resistance for floor truss/joist to bottom plate connections are provided in **Table 3**.

6.8.2 See **Figure 7** for load directions. Loads parallel to the wall are labeled F1 and loads perpendicular to the wall are labeled F2.

6.8.3 Allowable design loads are applicable to fasteners installed in accordance with **Section 9** in double top plate applications.

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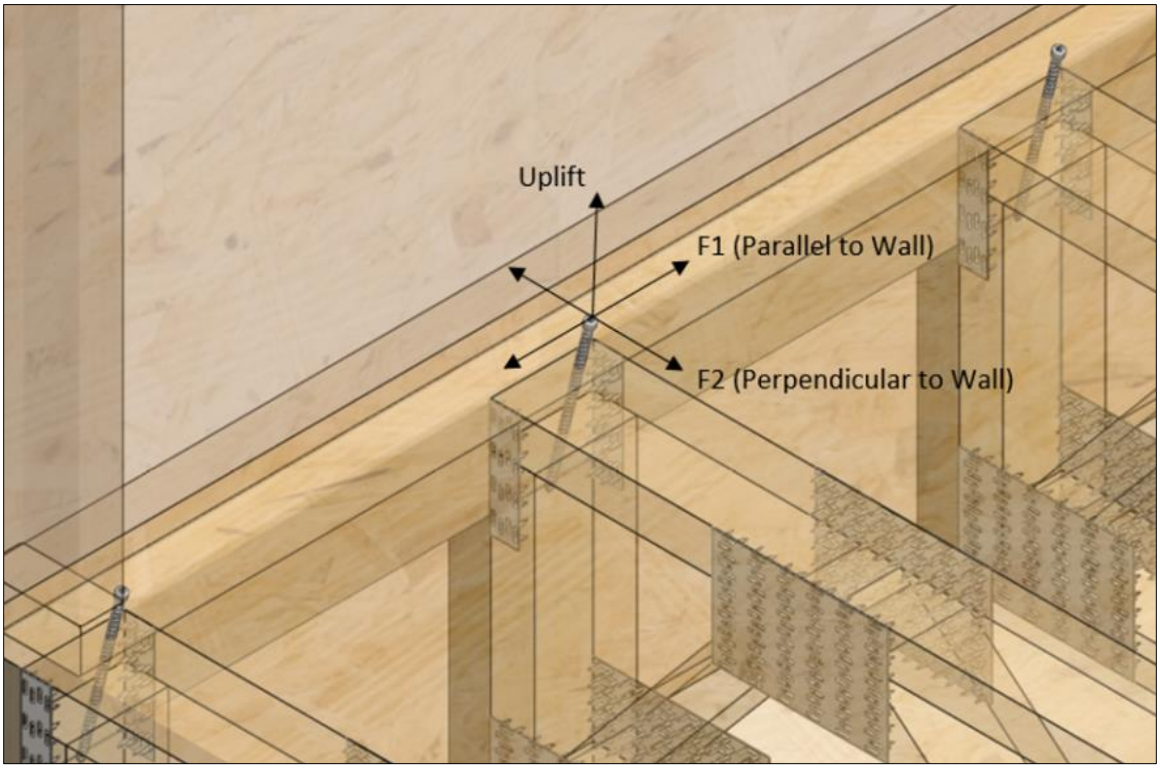


Figure 7. F1 and F2 Loads

Table 3. Allowable Uplift and Lateral Loads for Fasteners in Bottom Plate to Floor Truss/Joist Connections

Fastener	Minimum Penetration into Floor Truss/ Joist[1] (in)	Fastener Angle to Vertical	Allowable Loads[2,3,4,5,6] (lbf)								
			HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
			Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	2 1/2	4° - 14°[7]	565	245	245	855	305	305	855	330	330
#14 x 4 1/2"	1 1/2	20° - 30°[8]	365	160	160	550	190	190	550	205	205
		0°[9]	355	155	155	535	190	190	535	205	205

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

1. Wood truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of truss, rafter, or floor joist is by others.
2. Equivalent specific gravity of 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 1.6 factor for Load Duration increase for wind and seismic. No further increases permitted. Reduce design values for other conditions as applicable.
6. F1 load direction is parallel to the wall. F2 load direction is perpendicular to the wall.
7. Install fastener at an upward angle from the vertical of 4° to 14° (See **Figure 8**, 14° is shown).
8. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal and shown in **Figure 9**).
9. Install fastener perpendicular to the bottom plate into the floor truss/joist (See **Figure 10**).

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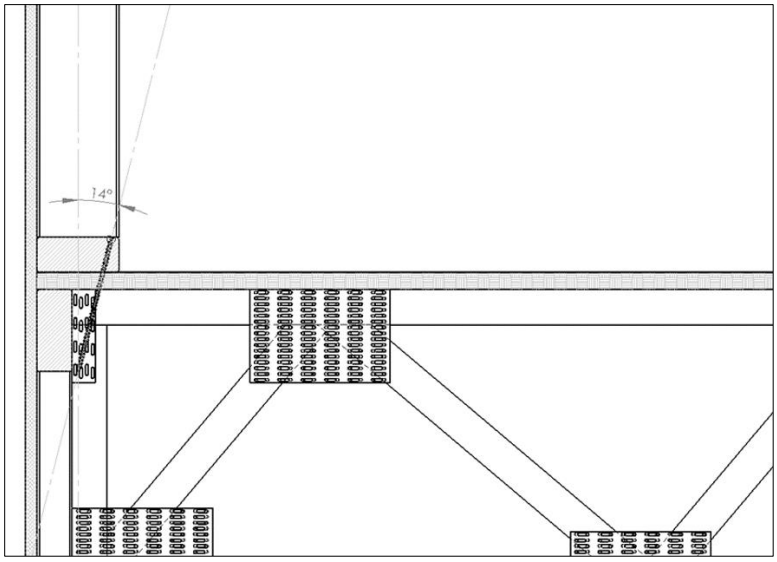


Figure 8. Installation of #14 x 6" Truss Screws at an Angle in Bottom Plate to Floor Truss/Joist Applications

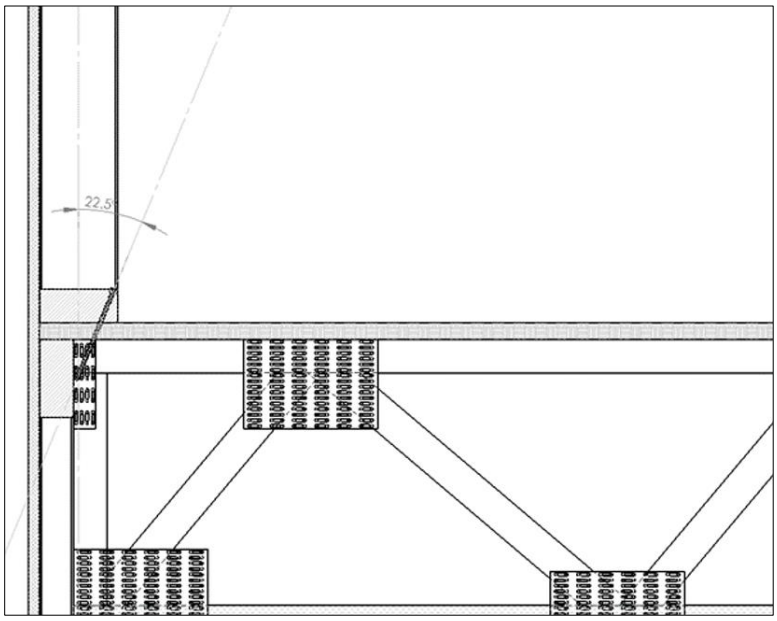


Figure 9. Installation of #14 x $4^1/_2$" Truss Screws at an Angle in Bottom Plate to Floor Truss/Joist Applications

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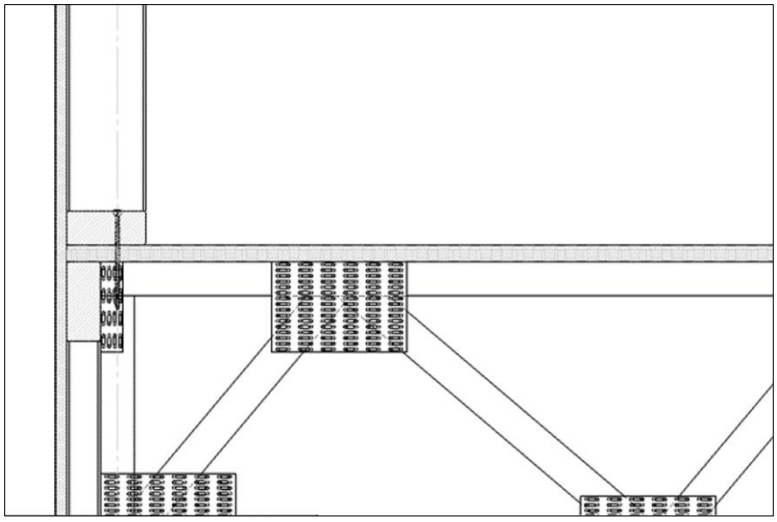


Figure 10. Perpendicular Installation of #14 x 4$^{1}/_{2}$" Truss Screws in Bottom Plate to Floor Truss/Joist Applications

6.9 *Allowable Design Loads – Stud to Top Plate Connection*

6.9.1 Allowable design loads for uplift and lateral resistance in stud to top plate connections are presented in **Table 4**.

6.9.1.1 Walls shall consist of a double top plate designed in accordance with IBC Section 2308.9.3.2 or IRC Section R602.3.2.

6.9.1.1.1 A single top plate is permitted to be used as an alternative to a double top plate, provided that the additional provisions specified in the IBC Section 2308.9.3.2 or IRC Section R602.3.2 be met.

6.9.2 Installation details for stud to top plate connections are shown in **Figure 11** through **Figure 18**.

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Table 4. Allowable Uplift and Lateral Loads for Fasteners in Stud to Top Plate Connections

Fastener	Top Plate Configuration	Fastener Angle to Vertical	Number of Fasteners	Allowable Loads[1,2,3,4,5,6] (lbf)								
				HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
				Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	Double	22.5°[7]	1[8]	790	260	260	1,175	300	300	1,175	330	330
			2[9]	1,580	520	520	2,350	600	600	2,350	660	660
			3[10]	2,370	780	780	3,525	900	900	3,525	990	990
		0°[11]	1	1,165	175	175	1,175	205	205	1,175	220	220
			2	2,330	350	350	2,350	410	410	2,350	440	440
#14 x 4 1/2"	Single	22.5°[7]	1[8]	380	200	200	565	245	245	565	280	280
			2[9]	760	400	400	1,130	490	490	1,130	560	560
			3[10]	1,140	600	600	1,695	735	735	1,695	840	840
		0°[11]	1	750	165	165	1,135	205	205	1,135	220	220
			2	1,505	330	330	2,270	405	405	2,270	440	440

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

1. Wood stud and top plate members shall be a minimum of 2" nominal thickness.
2. SCL may be used provided that the equivalent specific gravity 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. A load duration factor, C_D, of 1.6 has been applied. Loads may be adjusted using the adjustment factors from NDS Section 11.3, where applicable. No further increase is allowed.
6. Loads presented are per stud connection.
7. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal) or 0°. For installation between 20° and 30°, design values for 22.5° may be used.
8. Applicable to installation in the wide face or narrow face of the stud. See **Figure 11** and **Figure 15**.
9. Both fasteners installed in the wide face. See **Figure 12** and **Figure 16**.
10. Two fasteners installed in the wide face, 1/2" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side (see **Table 11** for additional spacing of fasteners). See **Figure 13** and **Figure 17**.
11. Fastener(s) installed in the wide face of the top plates into the stud. ***Note:*** End grain factor has been applied. See **Figure 14** and **Figure 18**.

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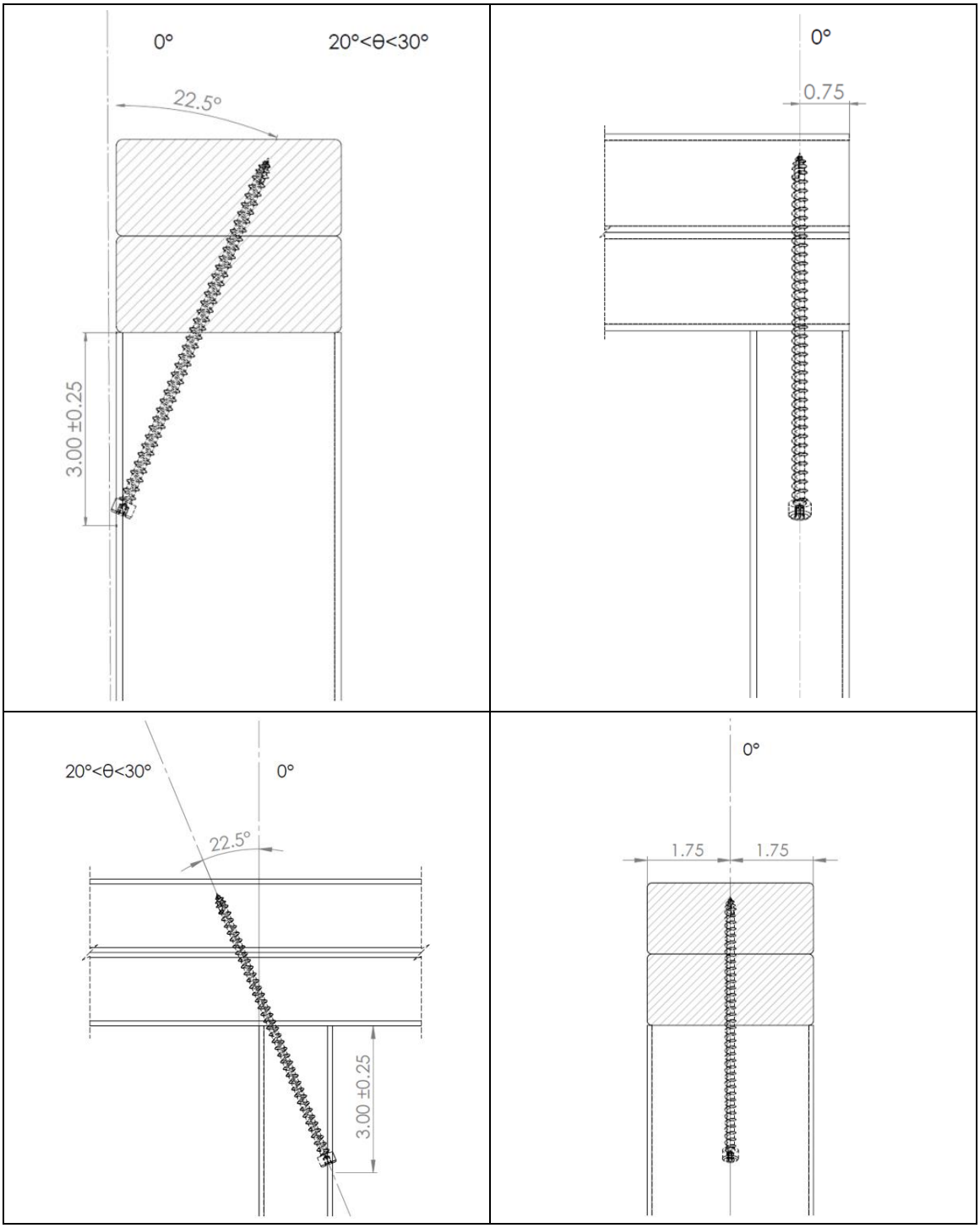


Figure 11. Stud to Top Plate – 22.5° (Angle),
One #14 x 6" Truss Screw Options

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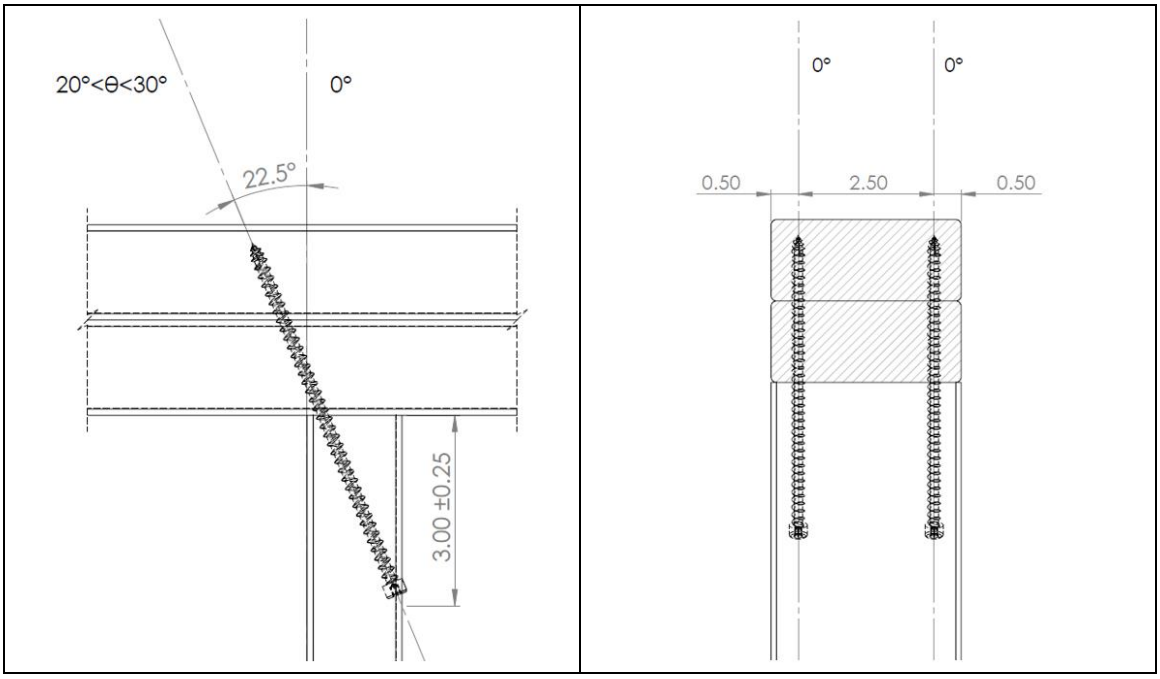


Figure 12. Stud to Top Plate – 22.5° (Angle),
Two #14 x 6" Truss Screws Install Option

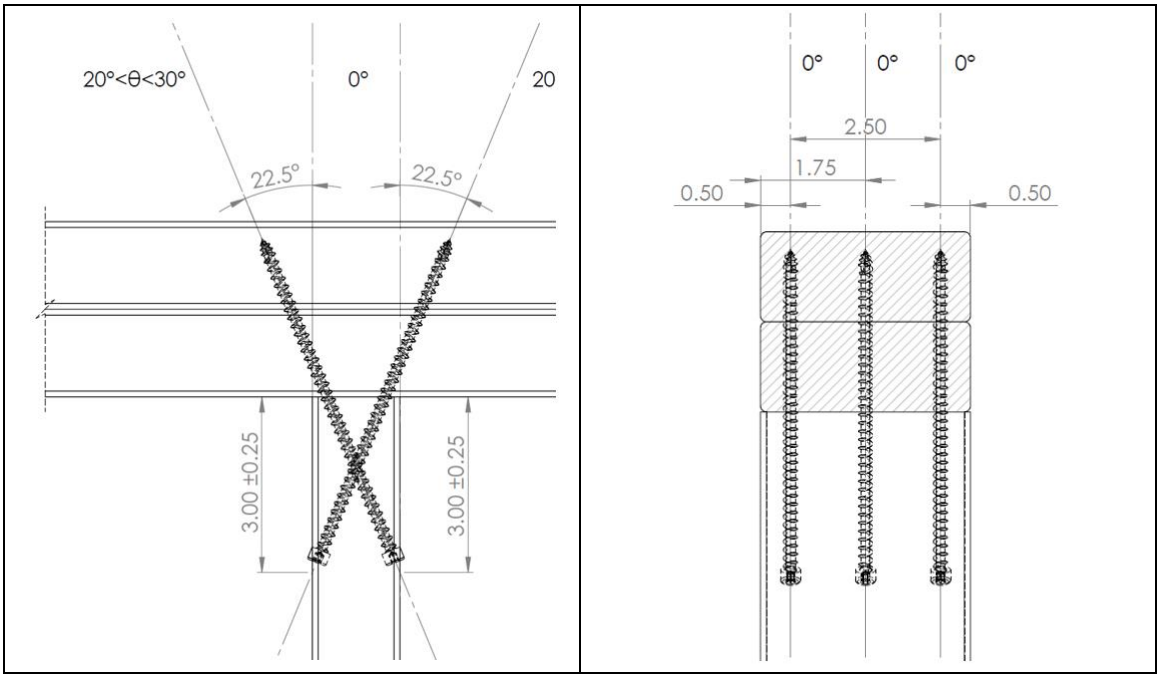


Figure 13. Stud to Top Plate – 22.5° (Angle),
Three #14 x 6" Truss Screws Install Option

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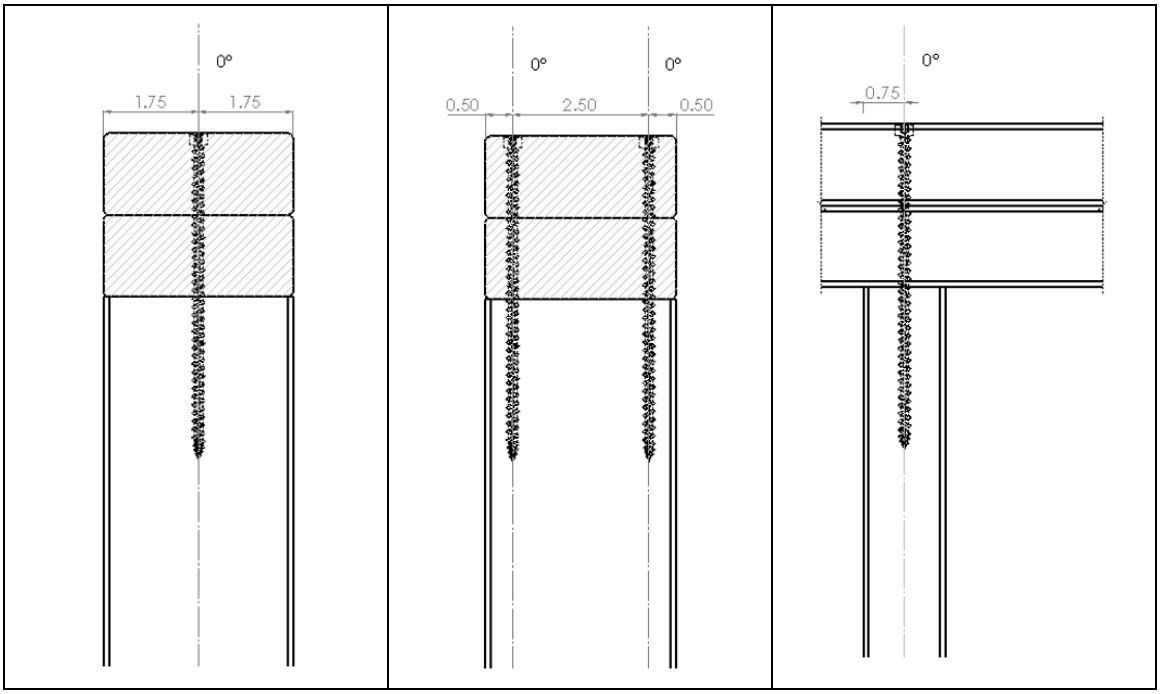


Figure 14. Stud to Top Plate – 0° (Perpendicular) Install Options

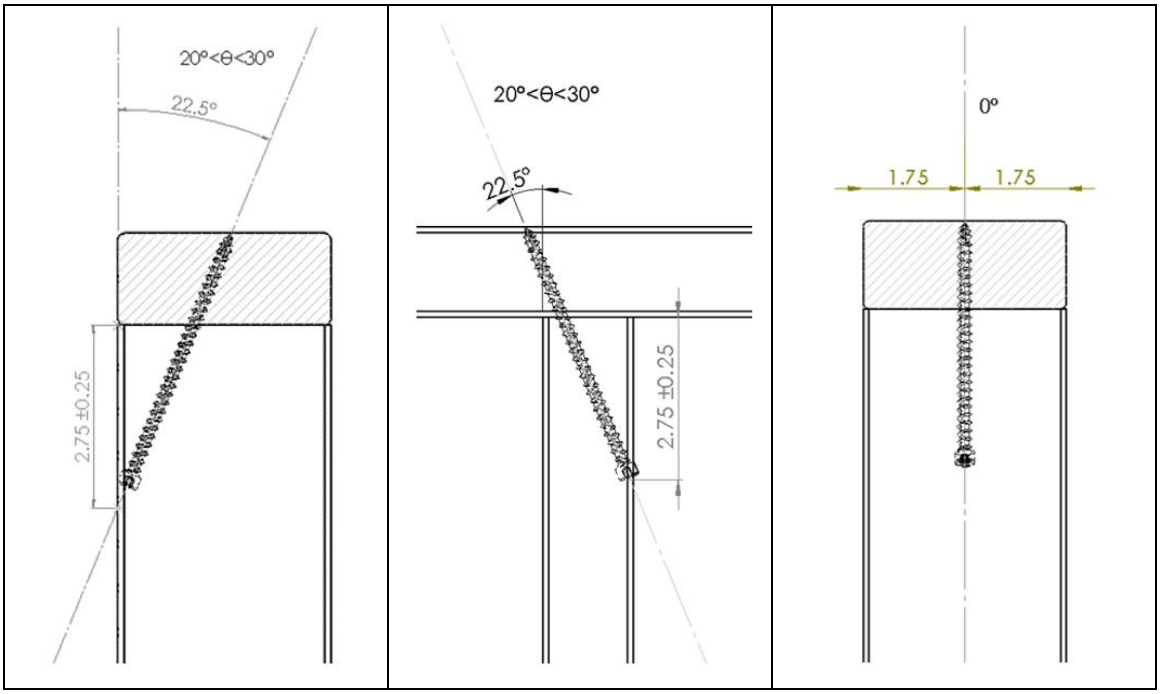


Figure 15. Stud to Top Plate – 22.5° (Angle),
One #14 x 4½" Truss Screw Options

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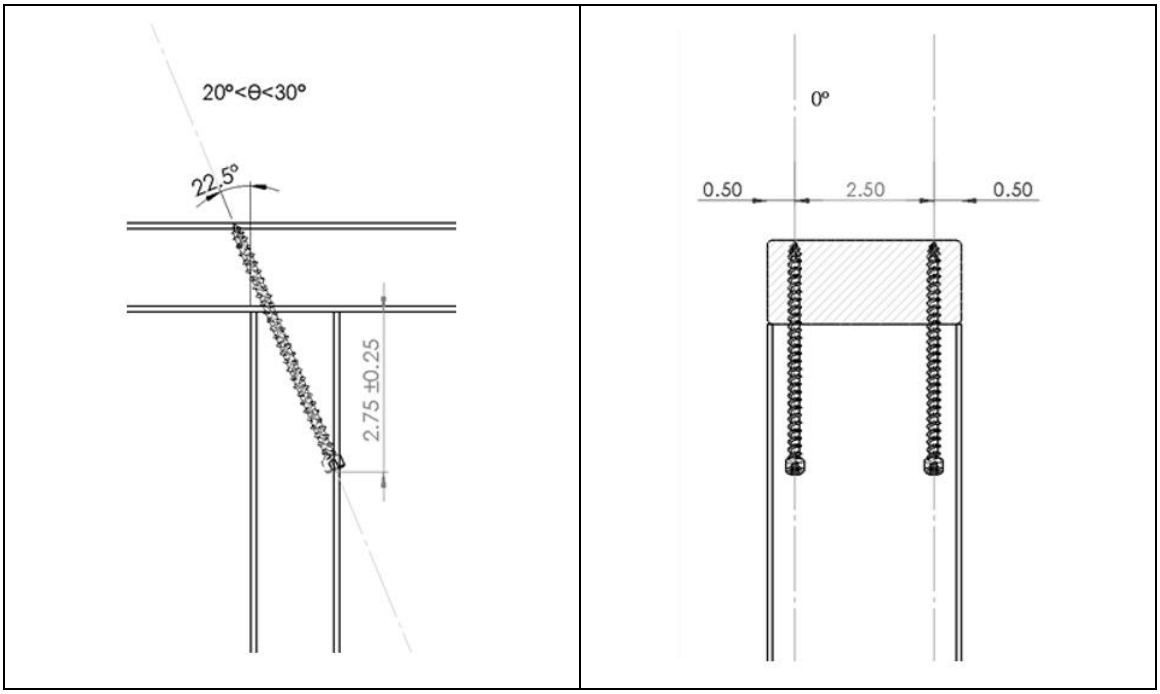


Figure 16. Stud to Top Plate – 22.5° (Angle),
Two #14 x 4$^1/_2$" Truss Screws Install Option

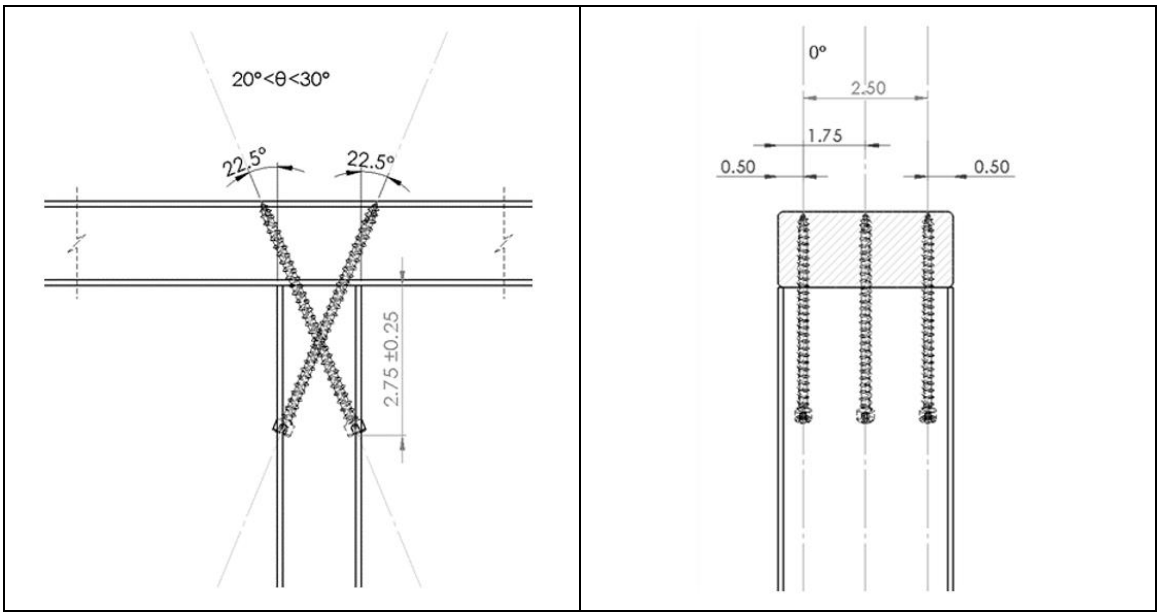


Figure 17. Stud to Top Plate – 22.5° (Angle),
Three #14 x 4$^1/_2$" Truss Screws Install Option

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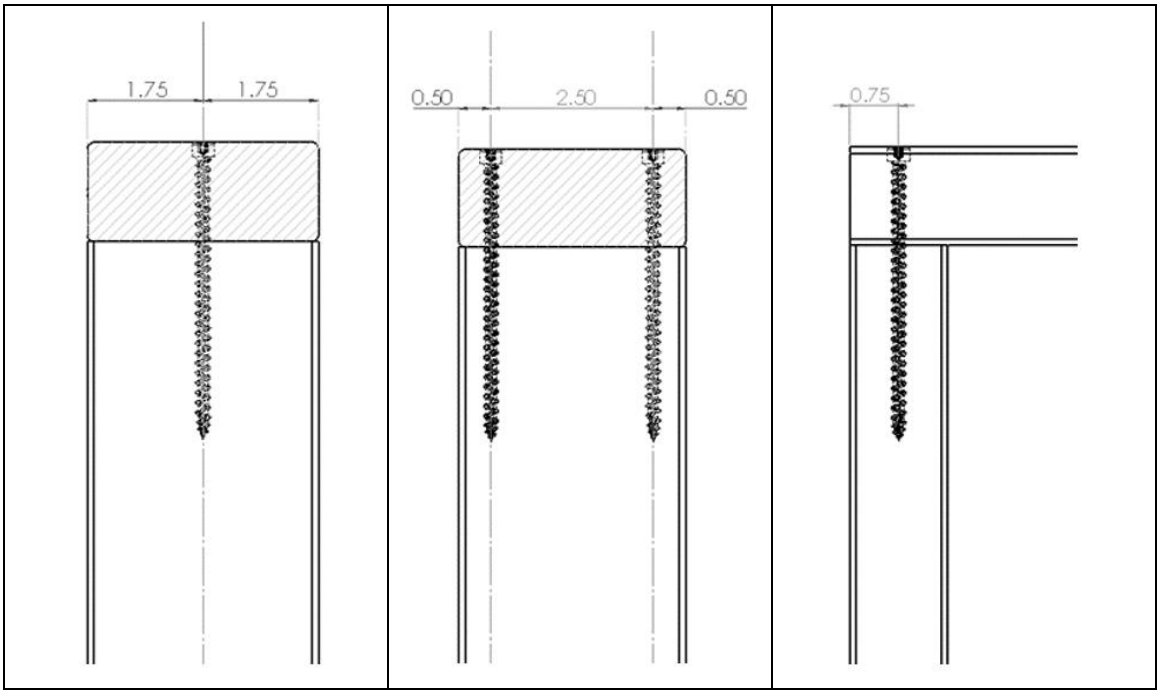


Figure 18. Stud to Top Plate – 0° (Perpendicular) Install Options

6.10 *Allowable Design Loads – Stud to Bottom Plate Connection*

6.10.1 Allowable design loads for uplift and lateral resistance in stud to bottom plate connections are presented in **Table 5**.

6.10.1.1 Walls shall consist of a bottom plate designed in accordance with IBC Section 2308.9.3.1 or IRC Section R602.3.4.

6.10.2 Installation details for stud to bottom plate connections are shown in **Figure 19** through **Figure 26**.

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Table 5. Allowable Uplift and Lateral Loads for Fasteners in Stud to Bottom Plate Connections

Fastener	Fastener Angle to Vertical	Number of Fasteners	Allowable Loads[1,2,3,4,5,6] (lbf)								
			HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
			Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	22.5°[7]	1	430	210	210	660	265	265	660	300	300
	4° - 14°[8]	1[9]	450	215	215	700	275	275	700	315	315
		2[10]	900	430	430	1,400	550	550	1,400	630	630
		3[11]	1,350	645	645	2,100	825	825	2,100	945	945
	0°[12]	1	750	165	165	1,135	205	205	1,135	220	220
		2	1,500	330	330	2,270	405	405	2,270	440	440
#14 x 4 1/2"	22.5°[7]	1[13]	380	200	200	565	245	245	565	280	280
		2[14]	760	400	400	1,130	490	490	1,130	560	560
		3[15]	1,140	600	600	1,695	735	735	1,695	840	840
	0°[12]	1	750	165	165	1,135	205	205	1,135	220	220
		2	1,505	330	330	2,270	405	405	2,270	440	440

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

1. Wood stud and top plate members shall be a minimum of 2" nominal thickness.
2. SCL may be used provided that the equivalent specific gravity 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. A load duration factor, C_D, of 1.6 has been applied. Loads may be adjusted using the adjustment factors from NDS Section 11.3, where applicable. No further increase allowed.
6. Loads presented are per stud connection. For connections with more than one screw that will be fastened on the same side of the wood member, fastener spacing listed in **Table 11** shall be followed.
7. Install fastener at a downward angle from the vertical of 20° to 30° (22.5° is optimal) into the narrow face of the stud. For installation between 20° and 30°, design values for 22.5° may be used. See **Figure 19**.
8. Install fastener(s) at a downward angle from the vertical of 4° to 14° into the wide face of the stud.
9. Applicable to installation in the wide face. See **Figure 20**.
10. Both fasteners installed in the wide face. See **Figure 21**.
11. Two fasteners installed in the wide face, 1/2" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side, as shown in **Figure 22**.
12. Fastener(s) installed in the wide face of the top plates into the stud. ***Note:*** End grain factor has been applied. See **Figure 23**.
13. Applicable to installation in the wide face or narrow face of the stud. Install fastener at a downward angle from the vertical of 20° to 30° (22.5° is optimal) into the narrow face of the stud. For installation between 20° and 30°, design values for 22.5° may be used. See **Figure 24**.
14. Both fasteners installed in the wide face. See **Figure 25**.
15. Two fasteners installed in the wide face, 1/2" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side, as shown in **Figure 26**.

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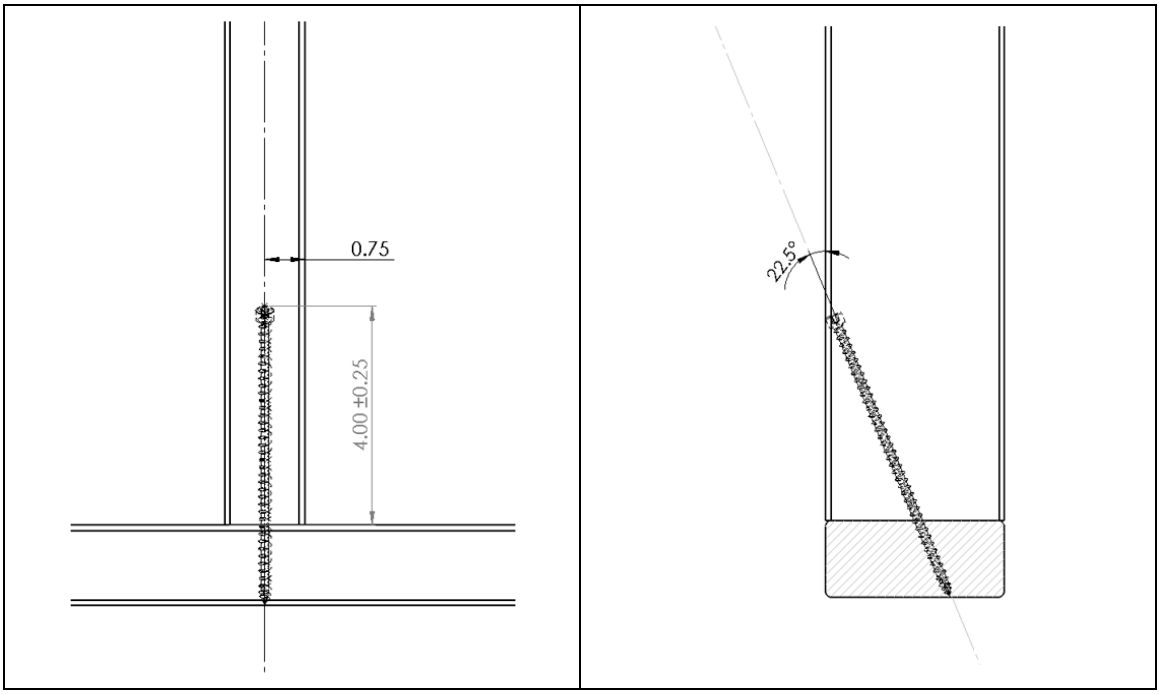


Figure 19. Stud to Bottom Plate – 22.5° (Angle),
One #14 x 6" Truss Screw Option

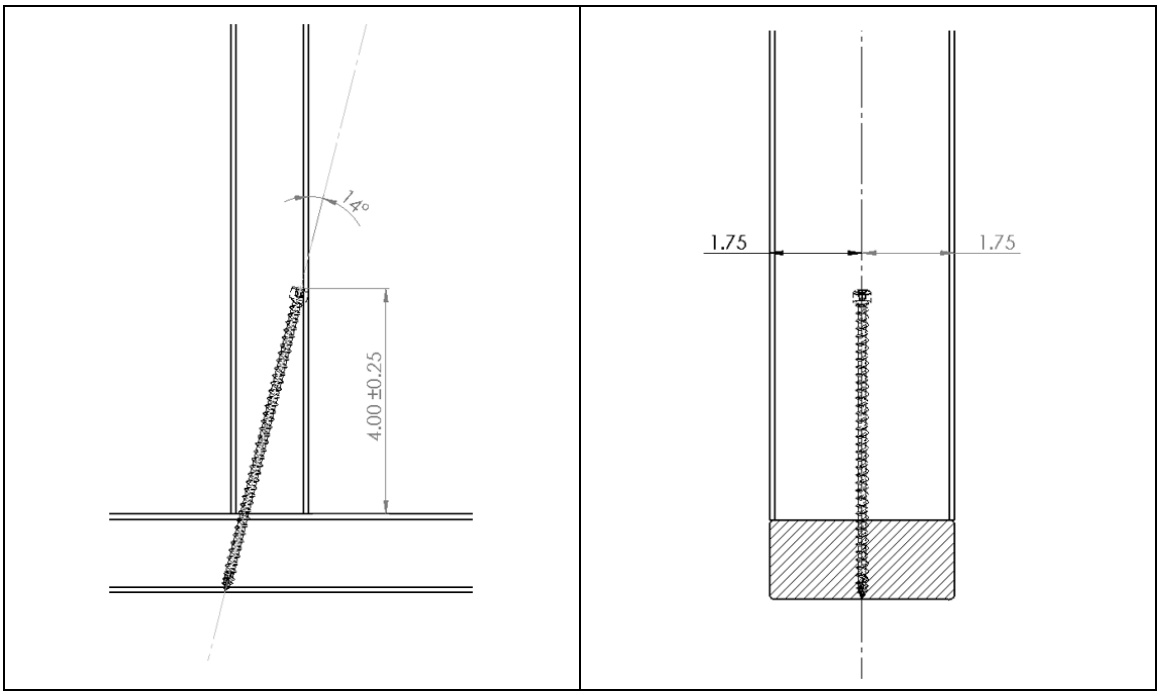


Figure 20. Stud to Bottom Plate – 14° (Angle),
One #14 x 6" Truss Screw Option

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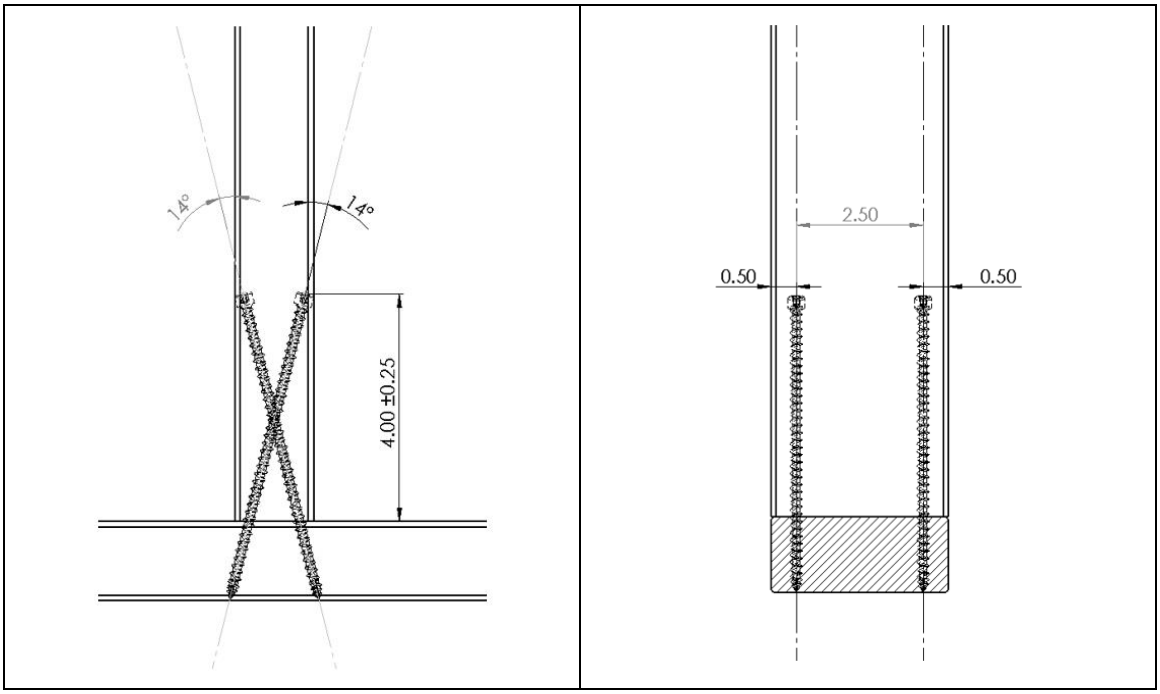


Figure 21. Stud to Bottom Plate – 4°-14° (Angle),
Two #14 x 6" Truss Screws Install Option

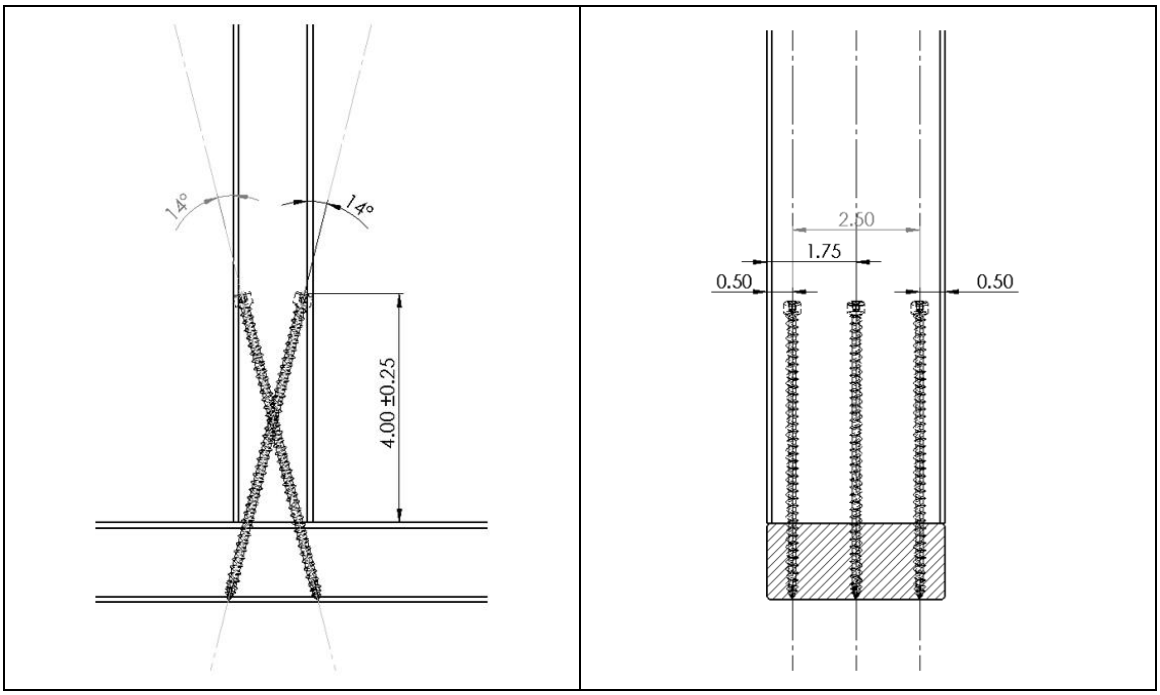


Figure 22. Stud to Bottom Plate – 4° - 14° (Angle),
Three #14 x 6" Truss Screws Install Option

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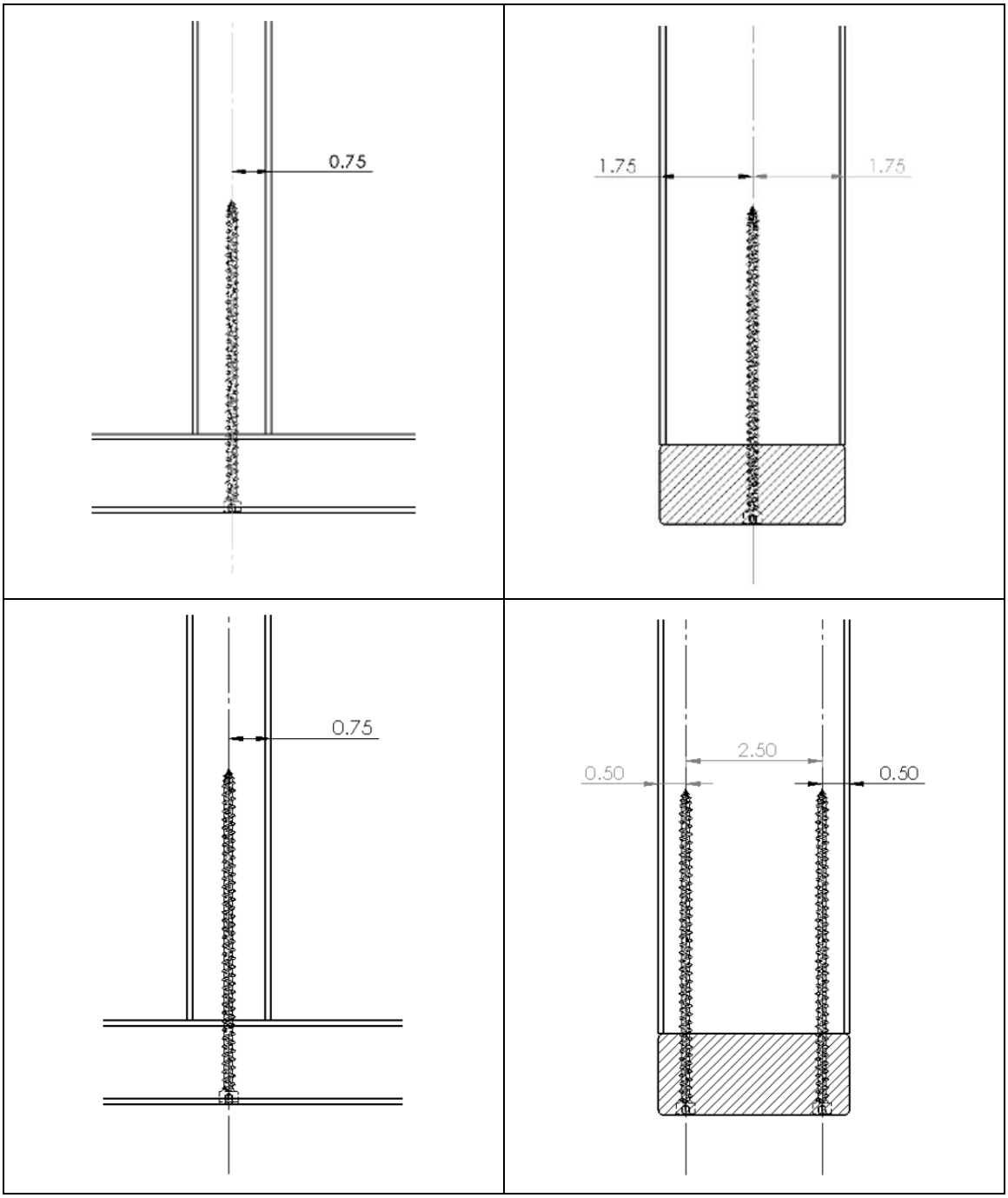


Figure 23. Stud to Bottom Plate – 0° (Perpendicular) Install Options

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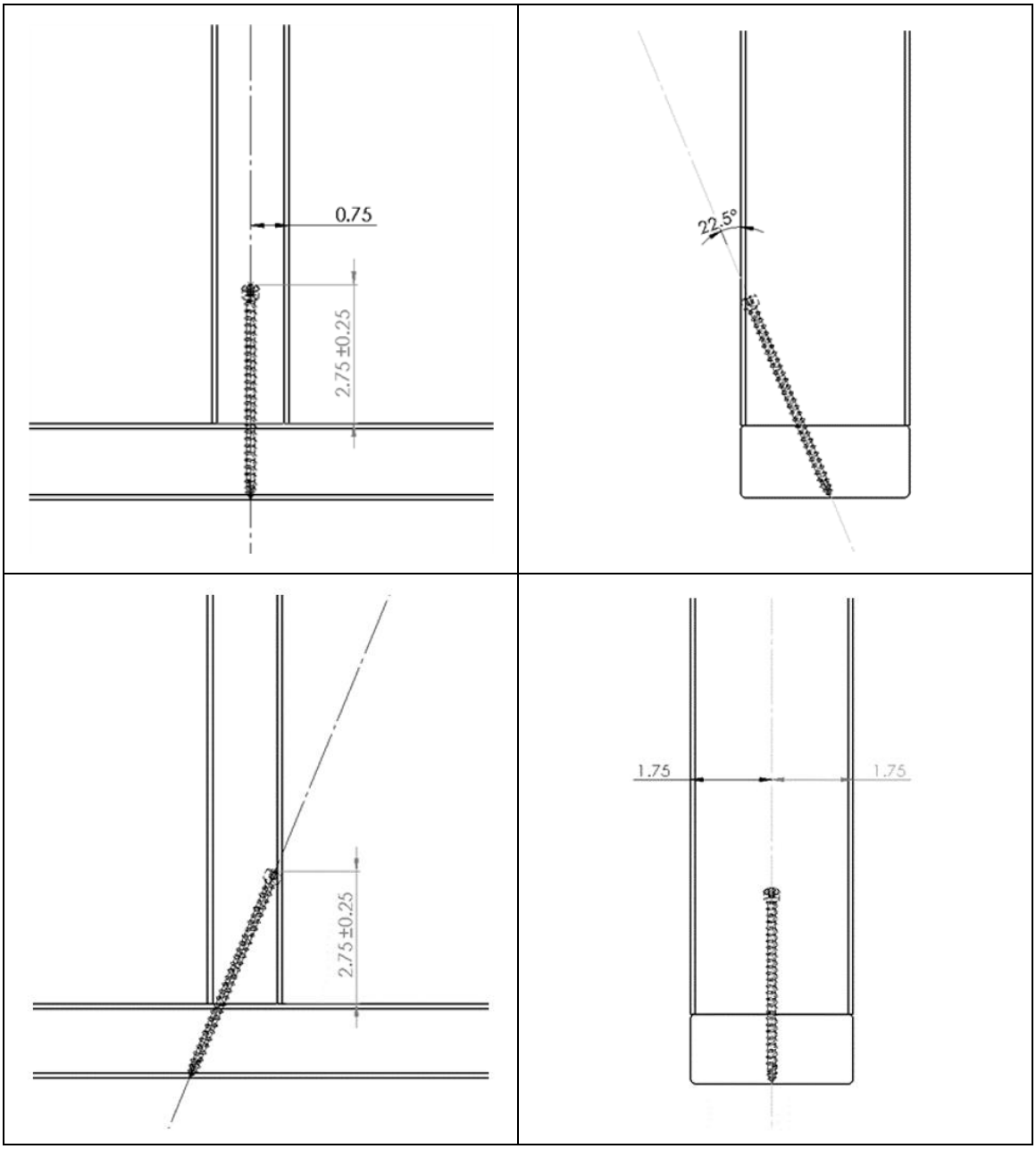


Figure 24. Stud to Bottom Plate – 22.5° (Angle),
One #14 x 4$^{1}/_{2}$" Truss Screw Option

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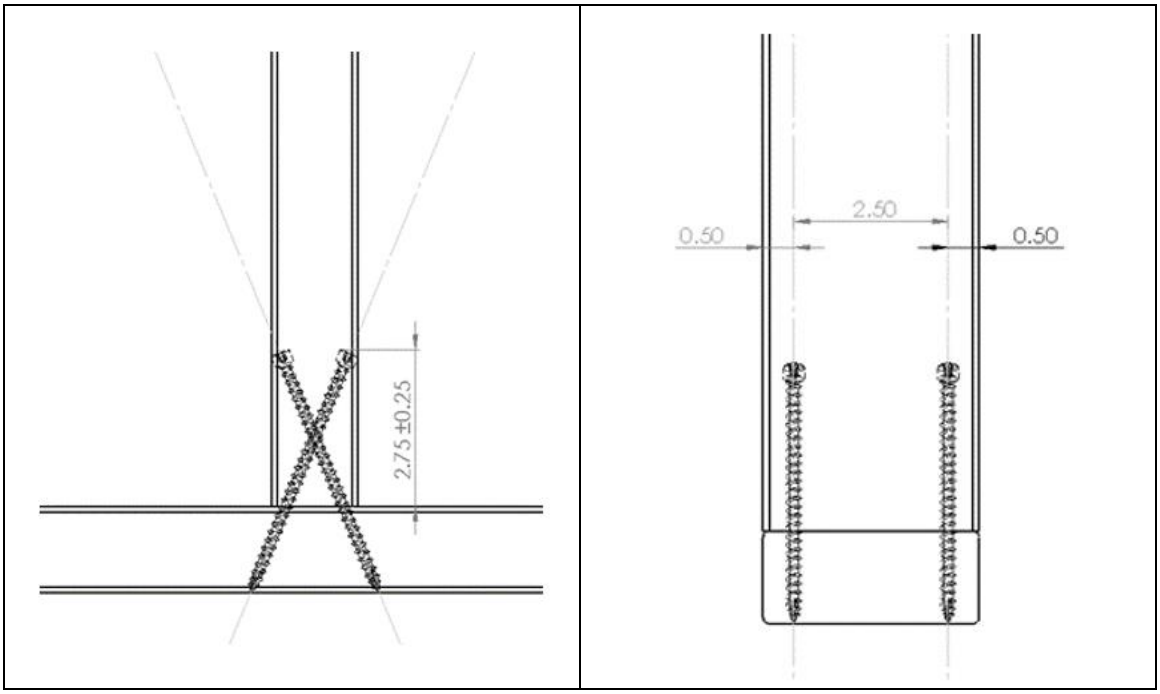


Figure 25. Stud to Bottom Plate – 22.5° (Angle),
Two #14 x 4$^{1}/_{2}$" Truss Screws Install Option

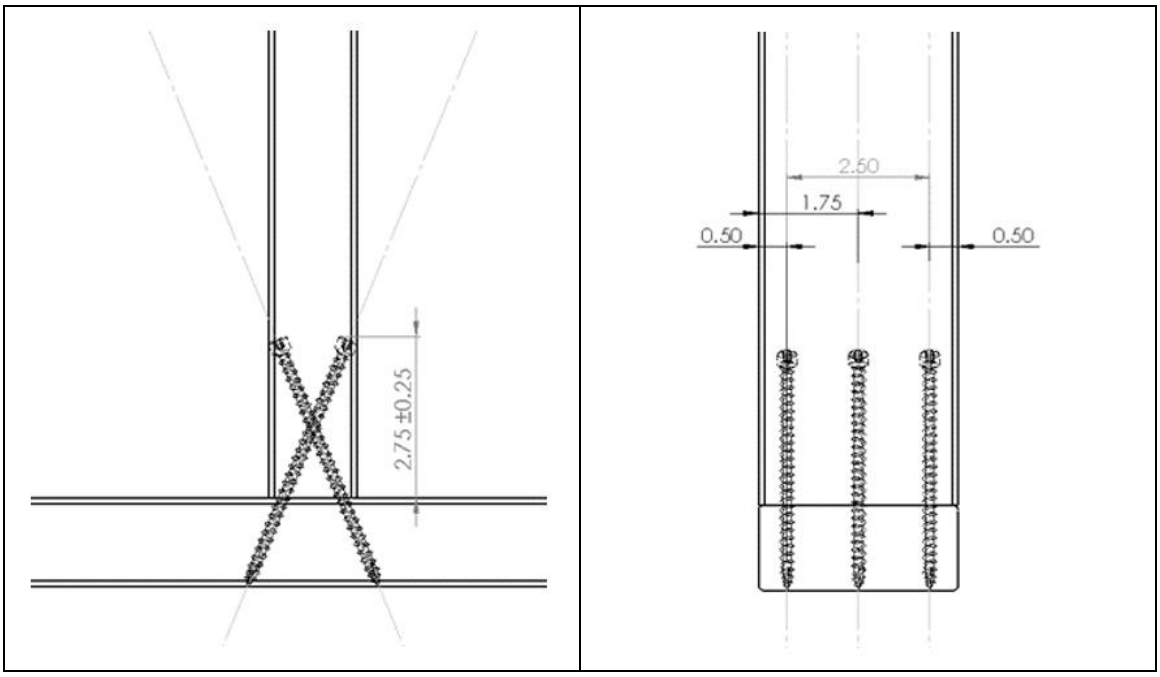


Figure 26. Stud to Bottom Plate – 22.5° (Angle),
Three #14 x 4$^{1}/_{2}$" Truss Screws Install Option

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6.11 *Allowable Design Loads – Bottom Plate to Rim Board/Ribbon Board Connection*

6.11.1 Allowable design loads for lateral resistance parallel to grain and uplift in bottom plate to rim board/ribbon board connections are provided in **Table 6** and **Table 7**. The connection configuration is presented in **Figure 27**.

6.11.1.1 A Wood Structural Panel (WSP) up to $1^1/_8$" thick is permitted between the rim board/ribbon board and the bottom plate, so long as it is independently fastened to the rim board/ribbon board per the building code, and the minimum $2^1/_2$" screw penetration for the #14 x 6" Truss Screw be met.

6.11.1.2 Double bottom plates are permitted so long as they are independently fastened per the building code and the minimum $2^1/_2$" screw penetration for the #14 x 6" truss screw be met.

6.11.2 Allowable design loads are applicable to fasteners installed in accordance with **Section 9**.

Table 6. Allowable Shear Loads Parallel to Grain for Bottom Plate to Rim Board Connections[1,2,3] (lbf)

Fastener	Minimum Nominal Bottom Plate Thickness	Minimum Penetration into Rim Board (in)	Rim Board Species (Specific Gravity)								
			2x HF/SPF (0.42)			2x DF-L or $1^1/_4$" LVL/LSL (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)
#14 x 6"	2x	$2^1/_4$	155	175	180	160	190	195	165	195	205
#14 x $4^1/_2$"											

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. Tabulated loads are based on a Load Duration factor of C_D = 1.00. Loads may be increased for Load Duration per the NDS.

Table 7. Allowable Uplift Loads for Bottom Plate to Rim Board Connections[1,2,3] (lbf)

Fastener	Minimum Nominal Bottom Plate Thickness	Minimum Penetration into Rim Board (in)	Rim Board Species (Specific Gravity)								
			2x HF/SPF (0.42)			2x DF-L or $1^1/_4$" LVL/LSL (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)
#14 x 6"	2x	$2^1/_4$	355	430	430	355	535	535	355	535	535
#14 x $4^1/_2$"											

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. Tabulated loads are based on a Load Duration factor of C_D = 1.00. Loads may be increased for Load Duration per the NDS.

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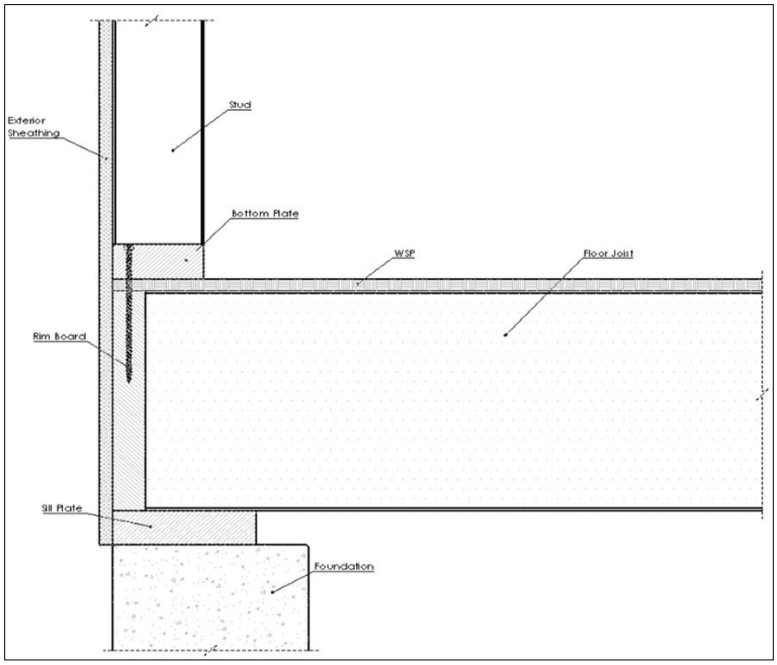


Figure 27. Fastener in Bottom Plate to Rim Board Connection

6.12 *Allowable Design Loads – Joist to 2-Ply Beam Deck Connection*

6.12.1 The Joist to Beam Deck Connections are designed using the values shown in **Table 8**.

6.12.2 Installation for the Joist to Beam Deck Connection is shown in **Figure 28**.

Table 8. Allowable Uplift and Lateral Loads for Fasteners in Joist to Beam Connections

Fastener	Minimum Penetration into Truss/Rafter/Joist[1] (in)	Fastener Angle to Vertical[7]	Allowable Loads[2,3,4,5,6] (lbf)								
			HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
			Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	2½	22.5°	550	180	180	940	210	210	940	230	230

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

1. Joist members shall be a minimum of 2" nominal thickness. Design of joist is by others.
2. Equivalent specific gravity of 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 equal to or 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 1.6 duration of load increase for wind and seismic and 0.7 wet service factor. No further duration of load increases permitted. Reduce design values for other load durations as applicable.
6. See **Figure 28** for installation details.
7. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal). For installation between 20° and 30°, design values for 22.5° may be used.

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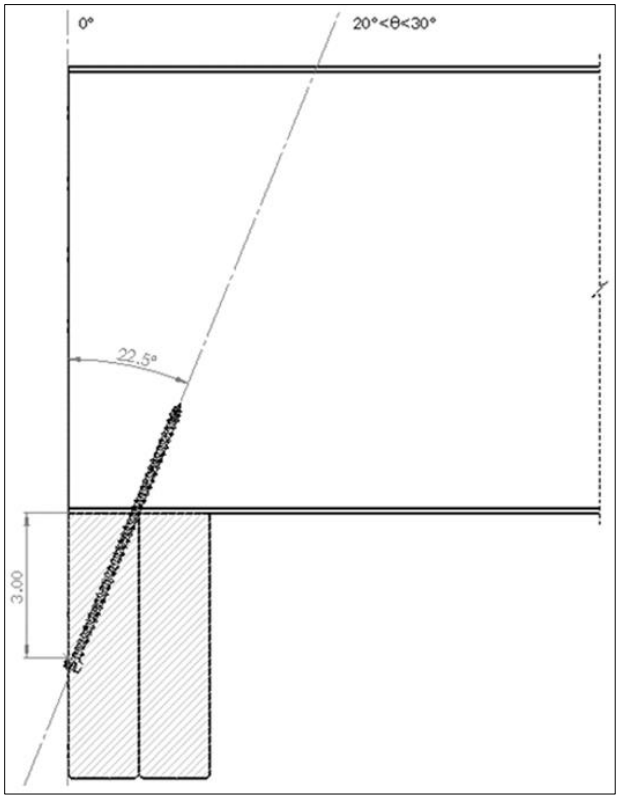


Figure 28. Joist to Beam - Deck Connection

6.13 *Allowable Design Loads – Post to Beam Connection*

6.13.1 The Post to Beam Deck Connections are designed using the values shown in **Table 9**.

Table 9. Allowable Uplift and Lateral Loads for Fasteners in Post to Beam Connections

Fastener	Minimum Post Size	Beam Size[1]	Fastener Angle to Vertical[7]	Total Number Fasteners	Allowable Loads[2,3,4,5,6] (lbf)								
					HF/SPF (0.42)			DF-L/SCL (0.50)			SP (0.55)		
					Uplift	F1	F2	Uplift	F1	F2	Uplift	F1	F2
#14 x 6"	4x4	Double 2x	14°[8]	4	3,100	1,020	1,020	4,700	1,220	1,220	4,700	1,320	1,320
			22.5°	2	1,580	510	510	2,350	610	610	2,350	660	660
	6x6	Triple 2x	22.5°	3	2,370	765	765	3,525	915	915	3,525	990	990
			22.5°	6	4,740	1,530	1,530	7,050	1,830	1,830	7,050	1,980	1,980

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

1. Beam members shall be a minimum of 2" nominal thickness. Design of beams is by others.
2. Equivalent specific gravity of 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 equal to or 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 1.6 duration of load increase for wind and seismic and 0.7 wet service factor. No further duration of load increases permitted. Reduce design values for other load durations as applicable.
6. See **Figure 29** through **Figure 32** for installation details.
7. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal). For installation between 20° and 30°, design values for 22.5° may be used.
8. Install fastener at an upward angle from the vertical of 4° to 14°. For installation between 4° and 14°, design values for 14° may be used.

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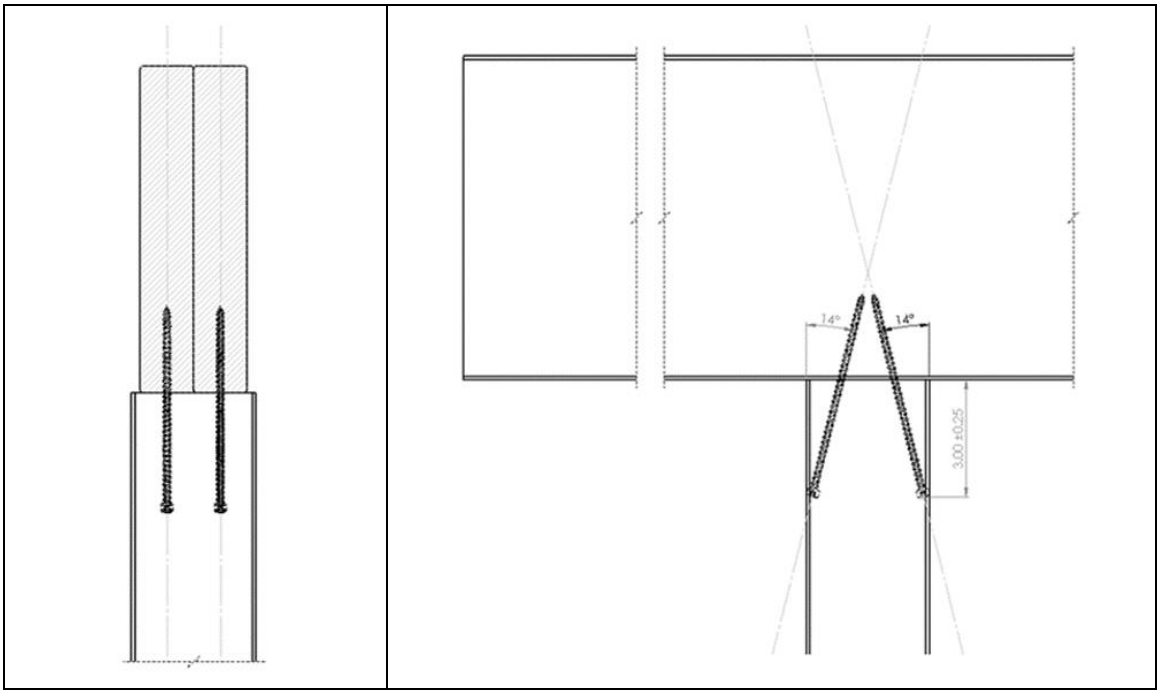


Figure 29. Post to 2-Ply Beam - Deck Connection

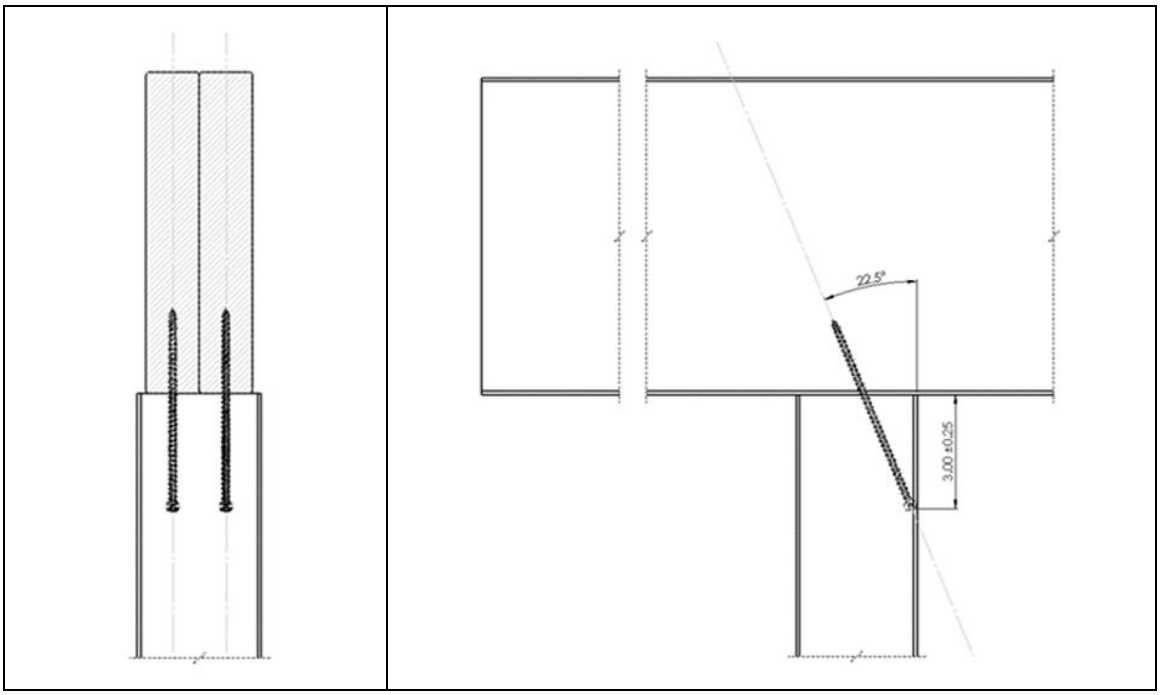


Figure 30. Post to 2-Ply Beam - Deck Connection

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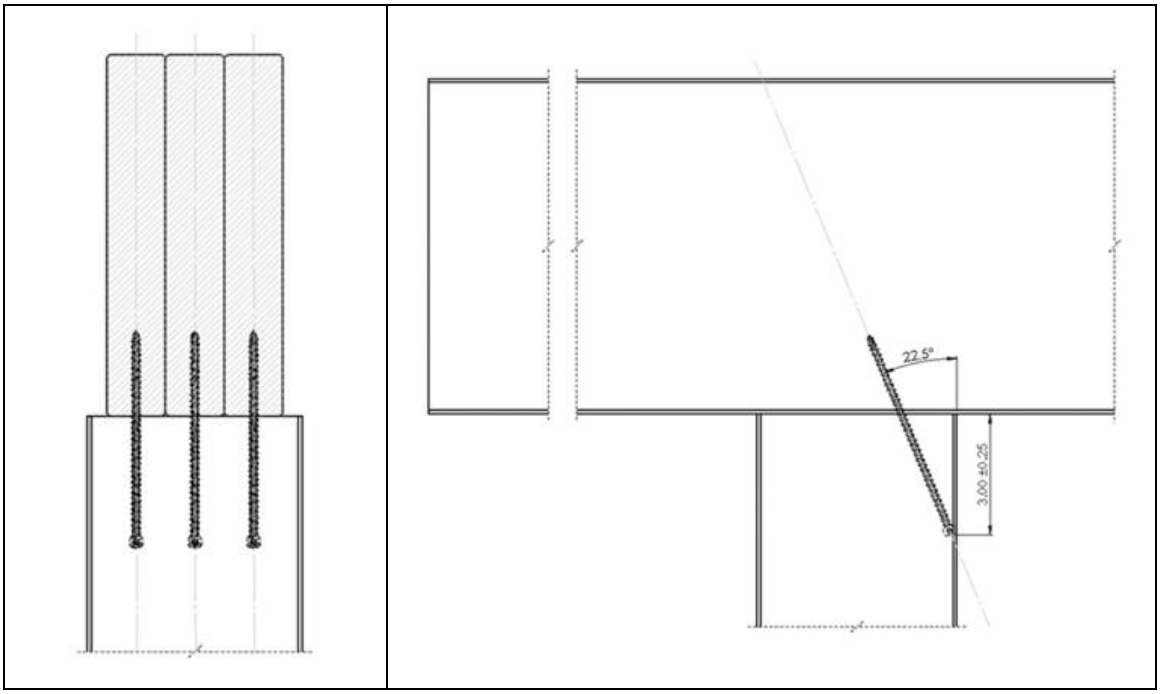


Figure 31. Post to 3-Ply Beam - Deck Connection

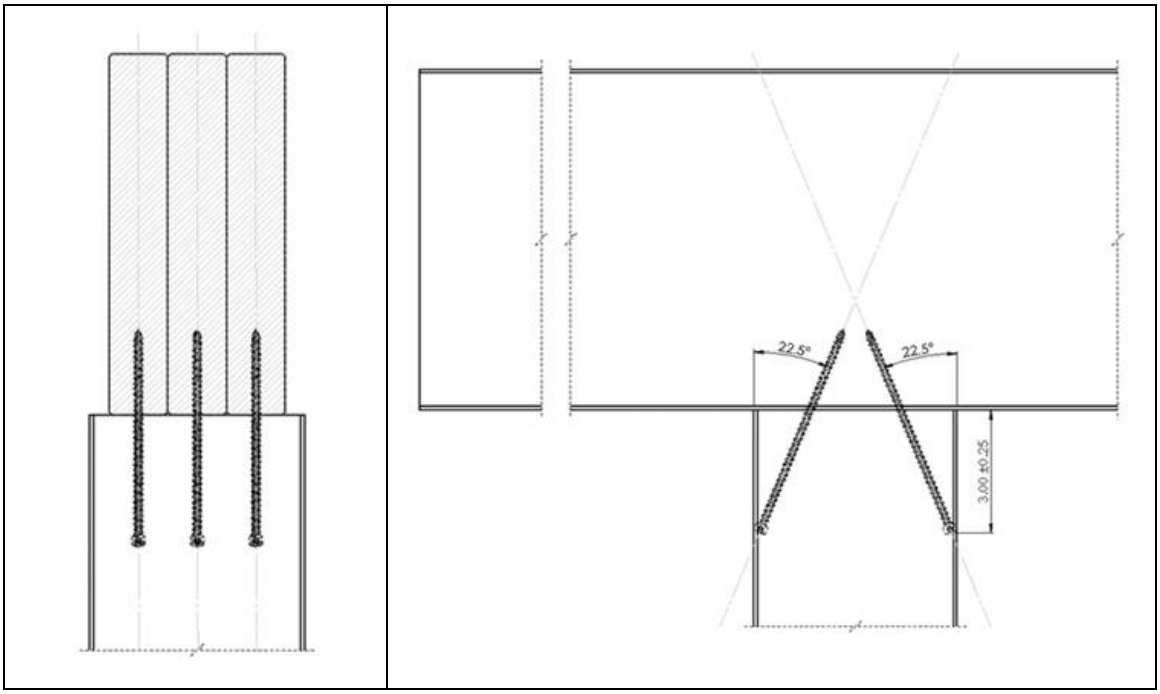


Figure 32. Post to 3-Ply Beam - Deck Connection

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6.14 *Allowable Design Loads – Knee Brace to Post Connection*

6.14.1 Allowable lateral design loads for a knee brace to post connection using #14 x 6" Truss Screws are shown in **Table 10**. Details are shown in **Figure 33** and **Figure 34**.

Table 10. Allowable Lateral Loads for Fasteners in Knee Brace to Post Connections[1,3]

Fastener	Nominal Post Size (in)	Nominal Brace Size (in)	Allowable Loads (lbf) – Lateral[2]		
			SPF (0.42)	DF/SCL (0.50)	SP (0.55)
			F1 and F2		
#14 x 6"	4 x 4	4 x 4	335	400	435
	6 x 6	6 x 6	335	400	435

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

1. For dimensional lumber beams, beam and post were assumed to be of the same species.
2. Tabulated loads are based on a Load Duration factor of C_D = 1.00, and a Wet Service factor of C_M = 0.7. Loads may be adjusted for Load Duration per the NDS.
3. Use screw spacing shown in **Table 11**.

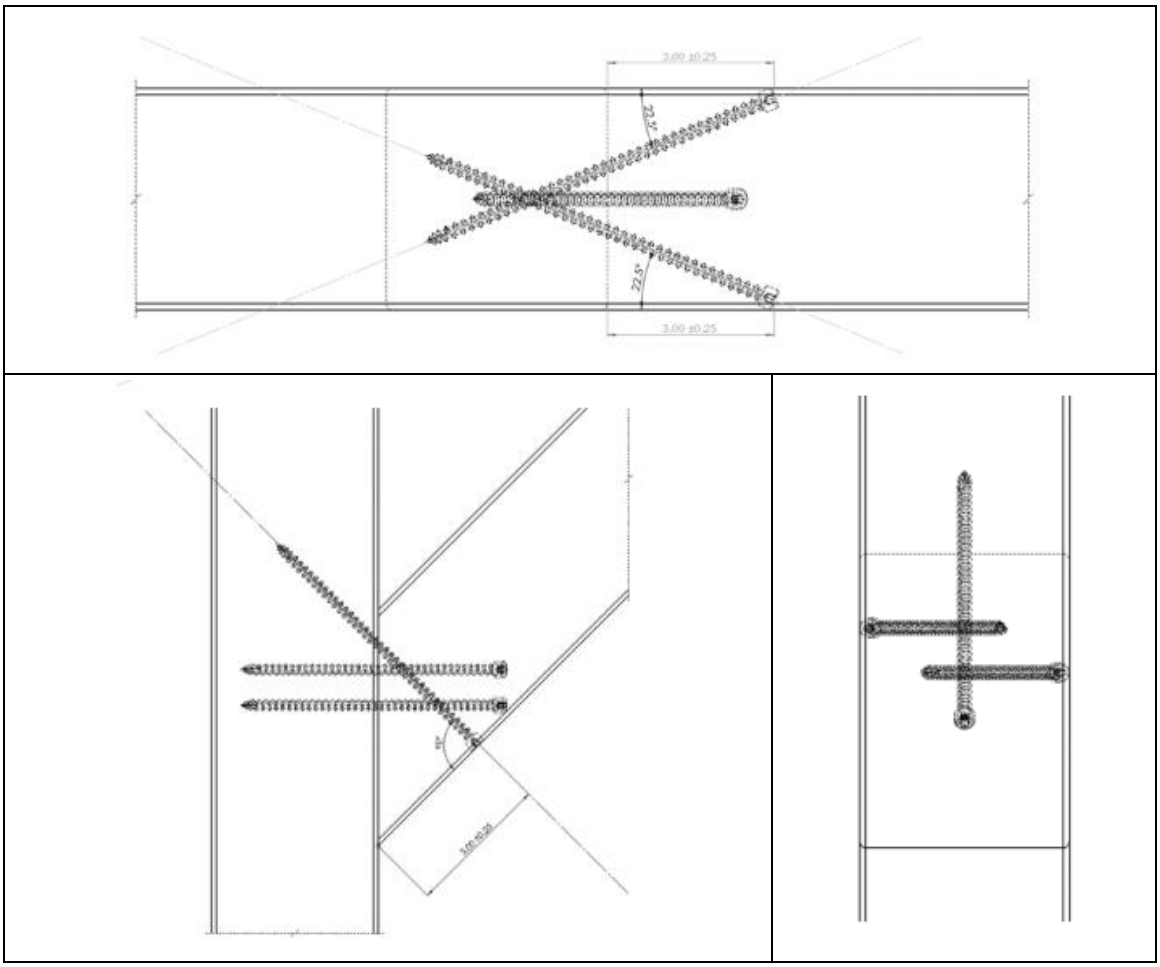


Figure 33. 4 x 4 Diagonal Brace Connection Using CAMO Series #14 x 6 Truss Screws

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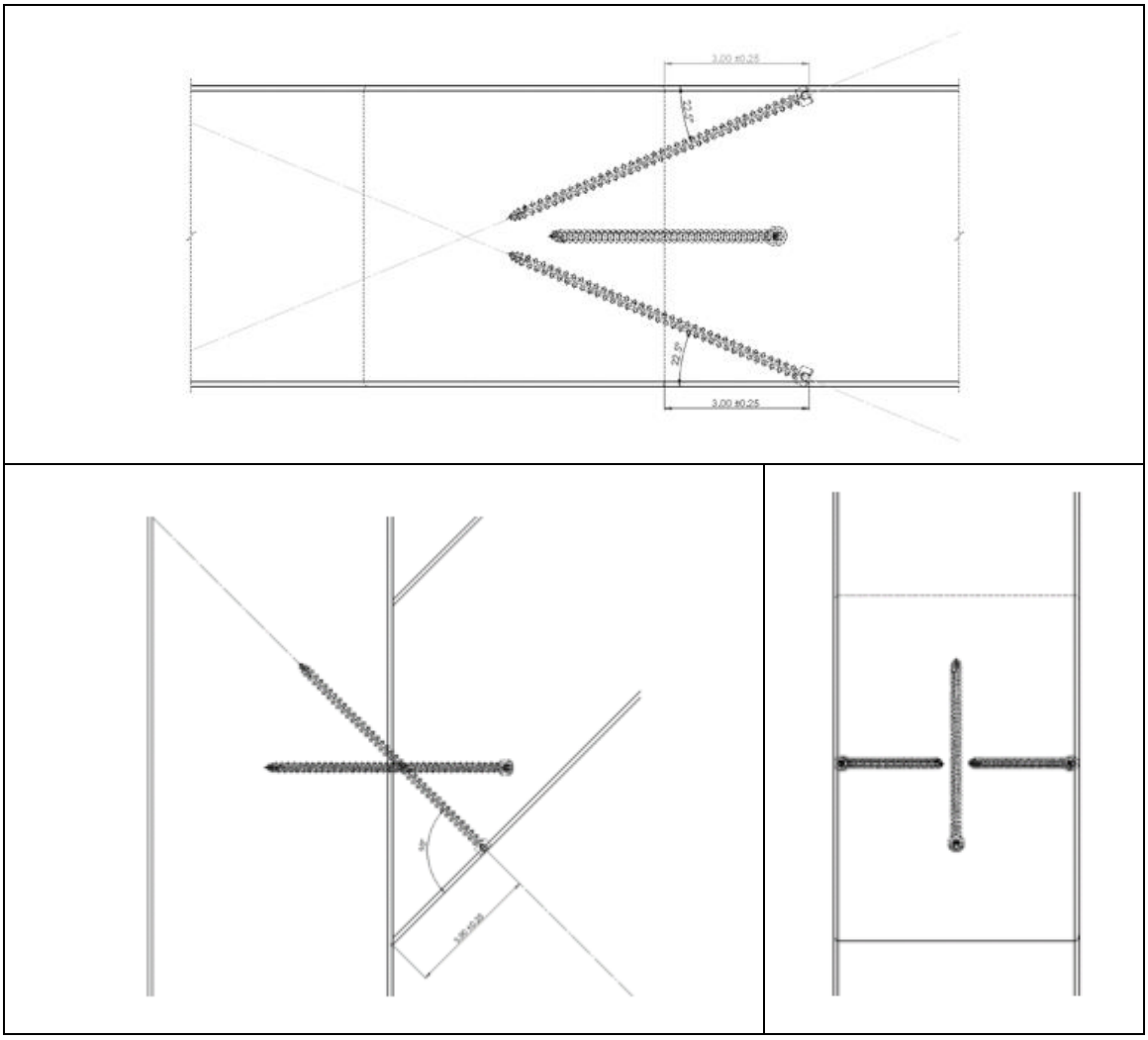


Figure 34. 6 x 6 Diagonal Brace Connection using CAMO Series #14 x 6" Truss Screws

6.15 Where it is anticipated that loads will be applied to a single fastener simultaneously in more than one direction, additional evaluation is required to account for the combined effect of these loads using accepted engineering practice.

6.16 Alternative techniques shall be permitted in accordance with accepted engineering practice and experience. These provisions for the use of alternative materials, designs, and methods of construction are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed herein. This includes, but is not limited to, the following areas of engineering: mechanics of materials, structures, building science, and fire science.

7 Certified Performance[29]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[30]

7.2 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.[31]

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8 Regulatory Evaluation and Accepted Engineering Practice

8.1 CAMO Series Structural Truss Screws comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 CAMO Series Structural Truss Screws were evaluated as an alternative means of attaching:

8.1.1.1 Metal plate connected wood trusses, rafters, or floor joists to the tops of walls to provide uplift and lateral load resistance.

8.1.1.2 Metal plate connected wood trusses or floor joists to the bottom of walls to provide uplift and lateral load resistance.

8.1.1.3 Wood studs to wall top/bottom plate to provide uplift and lateral resistance.

8.1.1.4 Wall bottom plates to the rim board/ribbon board to provide uplift and lateral load resistance.

8.1.1.5 Beam to post and joist to beam provide uplift and lateral load resistance.

8.1.1.6 Knee brace to post/beam to provide lateral load resistance.

8.1.2 Where applicable, evaluation consisted of the following:

8.1.2.1 Withdrawal and head pull-through strength for use as an alternative to toenail connections, metal hurricane, and seismic clip/straps or nails in tension (uplift) load applications.

8.1.2.2 Shear strength for use as an alternative to toenail connections, hurricane and seismic clip/straps, or nails in shear (lateral) load applications either parallel or perpendicular to wood grain.

8.1.2.3 Shear strength to resist shear (lateral and uplift) loads applied parallel or perpendicular to the wood grain.

8.1.3 Corrosion resistance was evaluated in accordance with ASTM B117, ASTM G85, and ASTM G198.

8.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this report.

8.3 Any building code, regulation and/or accepted engineering evaluations (e.g., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[32] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[33] respectively.

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

9 Installation

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

9.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

9.3 *General Guidelines*

9.3.1 Fasteners shall be installed with a $^{1}/_{2}$" (12.7 mm), low rpm/high torque electric drill (450 rpm).

9.3.2 Fasteners shall be installed with manufacturer-supplied bits.

9.3.3 Fasteners shall be installed with the topside of the head flush to the surface of the wood member. Fasteners shall not be overdriven.

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

9.3.5 Lead holes are not required but may be used where lumber is prone to splitting.

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9.3.6 Installer shall use appropriate/required personal protection equipment during installation and must not place fasteners in mouth.

9.3.7 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

Table 11. Minimum Spacing, Edge Distance, and End Distance Requirements[1,2]

Connection Geometry	Minimum Spacing/Distance (in)
	#14 Truss Screw
Edge Distance – Load in any direction	1/2
End Distance – Load in any direction	2 3/8
Spacing between Fasteners in a Row – Parallel to grain	2 3/8
Spacing between Fasteners in a Row – Perpendicular to grain	1 5/8
Spacing between Rows of Fasteners – In-line	7/8
Spacing between Rows of Fasteners – Staggered	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 of Fasteners – Staggered*" apply where the fasteners in adjacent rows are offset by one half of the "*Spacing between Fasteners in a Row*".

9.4 *Truss/Rafter/Joist to Top Plate Connection*

9.4.1 Install CAMO Series Structural Truss Screws 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 shall be installed at an upward angle from the vertical of 20° to 30° (see **Figure 5**), and shall penetrate the wood truss, rafter or joist within 1/4" of the centerline. Fasteners located between studs may be installed at a 0° angle, as shown in **Figure 6**.

9.4.1.1 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.

9.4.1.2 Minimum penetration for truss/rafter/joist to top plate connections is 2 1/2".

9.5 *Floor Truss/Joist to Bottom Plate Connection*

9.5.1 Install CAMO Series Structural Truss Screws downward through the wall bottom plates and into the center of the floor truss or joist.

9.5.1.1 The CAMO Series #14 x 6" Truss Screws shall be installed at a downward angle from the vertical of 4° to 14° (see **Figure 8**) and shall penetrate the wood truss, rafter or joist within 1/4" of the centerline. Minimum penetration into the floor truss/joist is 1 1/2".

9.6 *Stud to Top Plate Connection*

9.6.1 *Angle (Toenail) Installation:*

9.6.1.1 Install CAMO Series Structural Truss Screws upward through the centerline of wall studs or wood structural framing member at the specified distance from the end of the stud and into the top plate(s).

9.6.1.2 Fastener shall be installed at an upward angle from the vertical of 20° to 30° within 1/4" of the centerline of the stud.

9.6.1.2.1 See **Figure 11**, **Figure 12**, and **Figure 13** for CAMO Series #14 x 6" Truss Screws.

9.6.1.2.2 See **Figure 15**, **Figure 16**, and **Figure 17** for CAMO Series #14 x 4 1/2" Truss Screws.

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9.6.1.3 Starting from the specified end distances shown in **Figure 10** through **Figure 13**, or **Figure 15** through **Figure 17**, drive the fastener until the bottom surface of the fastener head fully bears against stud (see **Figure 35**).

9.6.1.4 When desired, the fastener can be driven until the fillet edge of the fastener head is tangent to the surface of the wood member.

9.6.2 *Perpendicular Installation:*

9.6.2.1 Install CAMO Series Structural Truss Screws downward through the top plate(s) and into the wall studs (see **Figure 14** and **Figure 18**). Fastener shall be within 1/4" of the centerline of the stud.

9.6.2.2 Drive the fastener until the bottom of the head is flush with the surface of the outermost top plate.

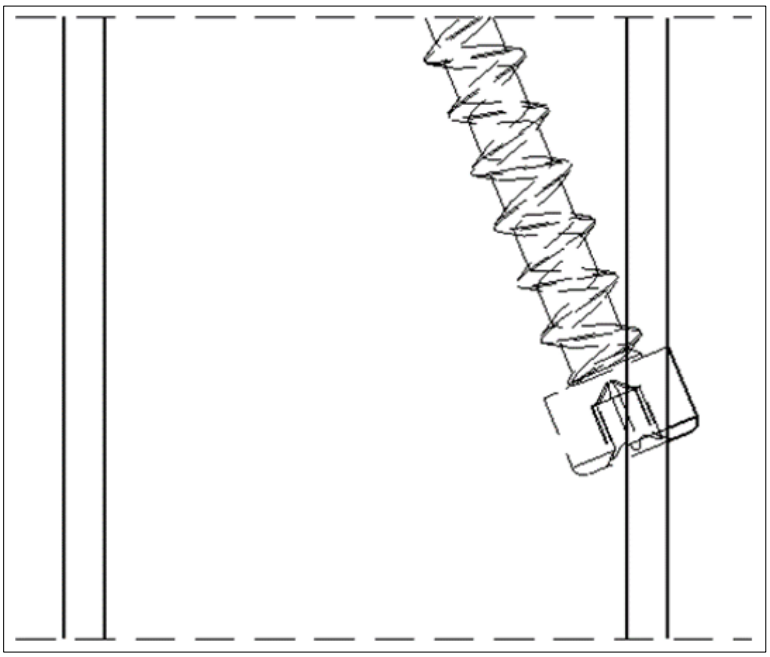


Figure 35. Diagram Showing Fastener Head Fully Bearing Against Stud

9.7 *Stud to Bottom Plate Connection*

9.7.1 *Angle (Toenail) Installation:*

9.7.1.1 Install CAMO Series Structural Truss Screws downward through the centerline of wall stud or wood structural framing member within the specified distances from the end of the stud and into the bottom plate.

9.7.1.2 *For CAMO Series #14 x 6" Truss Screws:*

9.7.1.2.1 Fasteners shall be installed at a downward angle from the vertical of 20° to 30° into the narrow face (see **Figure 19**) and within 1/4" of the centerline of the stud, or shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 20**) and within 1/4" of the centerline of the stud.

9.7.1.2.2 For multiple fasteners, the CAMO Series #14 x 6" Truss Screws shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 21** and **Figure 22**) of the stud while upholding the fastener spacing provided in **Table 11**.

9.7.1.2.3 Starting from the specified end distances shown in **Figure 19** through **Figure 22** (at a minimum), drive the fastener until the bottom surface of the fastener head fully bears against the stud (see **Figure 35**).

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9.7.1.3 *For CAMO Series #14 x 4 1/2" Truss Screws:*

9.7.1.3.1 Fasteners shall be installed at a downward angle from the vertical of 20° to 30° into the narrow or wide face (see **Figure 24**) and within 1/4" of the centerline of the stud.

9.7.1.3.2 For multiple fasteners, the CAMO Series #14 x 4 1/2" Truss Screws shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 25** and **Figure 26**) of the stud while upholding the fastener spacing provided in **Table 11**.

9.7.1.3.3 Starting from the specified end distances shown in **Figure 24** through **Figure 26** (at a minimum), drive the fastener until the bottom surface of the fastener head fully bears against stud (see **Figure 35**).

9.7.2 *Perpendicular Installation:*

9.7.2.1 Install CAMO Series Structural Truss Screws upward through the bottom plates and into the wall studs (see **Figure 23**).

9.7.2.1.1 Fastener shall be within 1/4" of the centerline of the stud.

9.7.2.1.2 Drive the fastener until the bottom of the head is flush with the surface of the outermost top plate.

9.8 *Bottom Plate to Rim Board/Ribbon Board Connection*

9.8.1 Install CAMO Series Structural Truss Screws 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/ribbon board (see **Figure 27**).

9.8.2 Minimum penetration for truss/rafter/joist to bottom plate is 2 1/2".

9.9 *Joist to Beam Connection*

9.9.1 Install CAMO Series #14 x 6" Truss Screws upward through the deck beam and into the center of the joist. The fastener shall be installed at an upward angle from the vertical of 20° to 30° (see **Figure 28**) and shall penetrate the deck joist within 1/4" of the centerline. Install fasteners away from the end of the joist.

9.9.2 If the deck joist is located directly over a beam splice, offset the fastener to one side of the splice.

9.9.3 Minimum penetration for deck joist to deck beam connections is 2 1/2".

9.10 *Post to Beam Connection*

9.10.1 Install CAMO Series #14 x 6" fasteners upward through the post and into the center of each 2x member of the deck beam.

9.10.1.1 Fasteners shall be installed at an upward angle from the vertical of 4° to 14° (see **Figure 29**), and shall penetrate the beam within 1/4" of the centerline. Install fasteners away from the end of the joist.

9.10.1.2 Fasteners shall be installed at an upward angle from the vertical of 20° to 30° (see **Figure 30** through **Figure 32**), and shall penetrate the beam within 1/4" of the centerline. Install fasteners away from the end of the joist.

9.10.1.3 If the deck joist is located directly over a beam splice, offset the fastener to one side of the splice.

9.10.2 Minimum penetration for deck joist to deck beam connections is 2 1/2".

9.11 *Knee Brace to Post Connection*

9.11.1 Knee brace is installed to post with one CAMO Series #14 x 6" Truss Screw at the bottom, one into the front and one into the back of the diagonal brace (See **Figure 33** and **Figure 34**).

9.11.2 For the screws that are driven into the sides of the knee brace, it is permitted to drive the fastener until the bottom of the head is flush with the surface of the wood member as shown in **Figure 35**, or drive the fastener until the top of the head is flush with the surface of the wood member.

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10 Substantiating Data

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

10.1.1 Connection design value calculations by DrJ Engineering, LLC in accordance with the NDS and accepted engineering practices.

10.1.2 Mechanical properties for CAMO Series Structural Truss Screws from Report Number 2102-01.

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources, and/or an RDP. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

10.4 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, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 *Testing and Engineering Analysis*

10.5.1 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.[34]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for CAMO Series Structural Truss Screws on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, CAMO Series Structural Truss Screws have performance characteristics that were tested and/or meet applicable regulations. In addition, they are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, CAMO Series Structural Truss Screws shall be approved for the following applications:

11.2.1 An acceptable means of attaching metal plate connected wood trusses or floor joists to the top/bottom of walls to provide uplift and lateral load resistance due to wind and seismic forces as provided in **Table 2** and **Table 3**.

11.2.2 An acceptable means of attaching studs to top/bottom plate in accordance with **Table 4** and **Table 5**.

11.2.3 An acceptable means of attaching wall bottom plate to rim board/ribbon board to provide lateral load and uplift resistance parallel to the bottom plate as provided in **Table 6** and **Table 7**.

11.2.4 An acceptable means of attaching joists to beams in accordance with **Table 8**.

11.2.5 An acceptable means of attaching posts to beams in accordance with **Table 9**.

11.2.6 An acceptable means of attaching knee braces to posts/beams in accordance with **Table 10**.

11.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from National Nail Corporation.

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11.4 IBC Section 104.2.3[35] (IRC Section R104.2.2[36] and IFC Section 104.2.3[37] are similar) in pertinent part state:

> **104.2.3 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 is not specifically prohibited by this code and has been approved.

11.5 **Approved:**[38] Building regulations require that the building official shall accept duly authenticated reports.[39]

11.5.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.5.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.5.3 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. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.6 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB Accredited Product Certification Body – Accreditation #1131.

11.7 Through the IAF Multilateral Arrangement (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[40]

12 Conditions of Use

12.1 As defined in **Section 6**, 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.

12.2 Allowable loads reflect dry service conditions except for **Table 8** through **Table 10**, where wet service is considered.

12.3 Sawn lumber members shall have a moisture content no greater than nineteen percent (19%) as specified in NDS Section 4.1.4.

12.4 Structural Composite Lumber (SCL) members shall have a moisture content no greater than sixteen percent (16%) as specified in NDS Section 8.1.4.

12.4.1 Where SCL is specified in this report, the designated SCL product shall have a published equivalent specific gravity that meets or exceeds the specified specific gravity.

12.5 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this report.

12.6 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:

12.6.1 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.

12.6.2 This report and the installation instructions shall be submitted at the time of permit application.

12.6.3 At a minimum, these innovative products shall be installed per **Section 9**.

12.6.4 The review of this report by the AHJ shall comply with IBC Section 104.2.3.2 and IBC Section 105.3.1.

12.6.5 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.7.2, IBC Section 110.4, IBC Section 1703, IRC Section R104.7.2, and IRC Section R109.2.

12.6.6 The application of these innovative products in the context of this report is 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.

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12.7 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, *"the building official shall make, or cause to be made, the necessary tests and investigations; or 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 104.2.3"*, all of IBC Section 104, and IBC Section 105.3.

12.8 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.9 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 CAMO Series Structural Truss Screws (#14 x 4$^{1}/_{2}$" Truss Screw, #14 x 6" Truss Screw, and #14 x 6" Easy Inspection Hi-Vis Pink Truss Screw), as listed in **Section 1.1**, are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

13.2 Additional technical information can be found at www.camofasteners.com/products/screws/structural-screws/truss-screws.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

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Issue Date: July 18, 2022
Supplement Revision Date: August 19, 2025
Subject to Renewal: October 1, 2027

FBC Supplement to Report Number 2102-03

REPORT HOLDER: National Nail® Corporation

1 Evaluation Subject

1.1 CAMO Series Structural Truss Screws:

1.1.1 #14 x 4 1/2" Truss Screw

1.1.2 #14 x 6" Truss Screw

1.1.3 #14 x 6" Easy Inspection Hi-Vis Pink Truss Screw

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show CAMO Series Structural Truss Screws, recognized in Report Number 2102-03, have also been evaluated for compliance with the codes listed below as adopted by the Florida Building Commission.

2.2 *Applicable Code Editions*

2.2.1 *FBC-B—20, 23: Florida Building Code – Building (FL41741)*

2.2.2 *FBC-R—20, 23: Florida Building Code – Residential (FL41741)*

3 Conclusions

3.1 CAMO Series Structural Truss Screws, described in Report Number 2102-03, comply with the FBC-B and FBC-R and are subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the FBC-B and FBC-R applicable to this report, they are listed here:

3.2.1 FBC-B Section 104 is reserved.

3.2.2 FBC-B Section 110.4 is reserved and replaces IBC Section 110.4.

3.2.3 FBC-B Section 104.6 is reserved and replaces IBC Section 104.4.

3.2.4 FBC-B Section 104.11 replaces IBC Section 104.2.3 and Section 104.2.3.2.

3.2.5 FBC-B Section 105.3 replaces IBC Section 105.3.

3.2.6 FBC-B Section 105.3.1 replaces IBC Section 105.3.1.

3.2.7 FBC-B Section 110.3 replaces IBC Section 110.3.

3.2.8 FBC-B Section 1613 is reserved and replaces IBC Section 1613.

3.2.9 FBC-B Section 1707.1 replaces IBC Section 1707.1.

3.2.10 FBC-B Section 2304.10.5 replaces IBC Section 2304.10.6.

3.2.11 FBC-B Section 2306.1 replaces IBC Section 2306.1.

3.2.12 FBC-B Section 2306.3 replaces IBC Section 2306.3.

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3.2.13 FBC-B Section 2308 is reserved and replaces IBC Section 2308, IBC Section 2308.9.2, IBC Section 2308.9.3.1 and IBC Section 2308.9.3.2.

3.2.14 FBC-R Section R104 and Section R109 are reserved.

3.2.15 FBC-R Section R301.2.1 replaces IRC Section R301.2.1.

3.2.16 FBC-R Section R301.2.2 is reserved and replaces IRC Section R301.2.2.

3.2.17 FBC-R Section R317.3 replaces IRC Section R304.3.

3.2.18 FBC-R Section R602 replaces IRC Section R602.

3.2.19 FBC-R Section R602.3.2 is reserved and replaces IRC Section R602.3.2.

3.2.20 FBC-R Section R602.3.4 is reserved and replaces IRC Section R602.3.4.

4 Conditions of Use

4.1 CAMO Series Structural Truss Screws, described in Report Number 2102-03, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 2102-03.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of FBC-B Chapter 16 and Chapter 17, as applicable.

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Issue Date: July 18, 2022
Supplement Revision Date: February 16, 2026
Subject to Renewal: October 1, 2027

CBC and CRC Supplement to Report Number 2102-03

REPORT HOLDER: National Nail® Corporation

1 Evaluation Subject

1.1 CAMO Series Structural Truss Screws:

1.1.1 #14 x 4 1/2" Truss Screw

1.1.2 #14 x 6" Truss Screw

1.1.3 #14 x 6" Easy Inspection Hi-Vis Pink Truss Screw

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show CAMO Series Structural Truss Screws, recognized in Report Number 2102-03 have also been evaluated for compliance with the codes listed below.

2.2 *Applicable Code Editions*

2.2.1 *CBC — 22, 25: California Building Code (Title 24, Part 2)*

2.2.2 *CRC — 22, 25: California Residential Code (Title 24, Part 2.5)*

3 Conclusions

3.1 CAMO Series Structural Truss Screws, described in Report Number 2102-03, comply with the CBC and CRC and are subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the CBC and CRC applicable to this report, they are listed here:

3.2.1 CBC Section 104.11 replaces IBC Section 104.2.3 and IBC Section 104.2.3.2.

3.2.2 CBC Section 104.7 replaces IBC Section 104.7.2.

3.2.3 CBC Section 1707.1 replaces IBC Section 1707.1.

3.2.4 CBC Section 2308 replaces IBC Section 2308.

3.2.5 CRC Section R104.4 replaces IRC Section R104.7.2.

3.2.6 CRC Section R104.11 replaces IRC Section R104.2.2.

3.2.7 CRC Section R301.2.2 replaces IRC Section R301.2.2.

4 Conditions of Use

4.1 CAMO Series Structural Truss Screws, described in Report Number 2102-03, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 2102-03.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of CBC and CRC, as applicable.

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Notes

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

2 2021 IRC Section R317.3

3 Capitalized terms and responsibilities are defined pursuant to the applicable building code, applicable reference standards, the latest edition of TPI 1, the NDS, AISI S202, US professional engineering law, Canadian building code, Canada professional engineering law, Qualtim External Appendix A: Definitions/Commentary, Qualtim External Appendix B: Project/Deliverables, Qualtim External Appendix C: Intellectual Property and Trade Secrets, definitions created within Design Drawings and/or definitions within Reference Sheets. Beyond this, terms not defined shall have ordinarily accepted meanings as the context implies. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

4 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1702

5 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3

6 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.2:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests

7 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.1:~:text=Conformance%20to%20Standards-,The%20design%20strengths%20and%20permissible%20stresses,-of%20any%20structural

8 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20make%2C%20or%20cause%20to%20be%20made%2C%20the%20necessary%20tests%20and%20investigations%3B%20or%20the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.2.3.

9 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4.2

10 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_agency

11 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_source

12 https://www.law.cornell.edu/uscode/text/18/1832 (b) 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. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

13 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

14 https://www.cbitest.com/accreditation/

15 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.1:~:text=directed%20to%20enforce%20the%20provisions%20of%20this%20code

16 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3 AND https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#105.3.1

17 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

18 https://iaf.nu/en/about-iaf-mla/#:~:text=Once%20an%20accreditation%20body%20is%20a%20signatory%20of%20the%20IAF%20MLA%2C%20it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

19 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

20 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

21 Unless otherwise noted, the links referenced herein use un-amended versions of the 2024 International Code Council (ICC) 2024 International Code Council (ICC) model codes as foundation references. Mississippi versions of the IBC 2024 and the IRC 2024 are un-amended. This material, product, design, service and/or method of construction also complies with the 2000-2012 versions of the referenced codes and the standards referenced therein. As pertinent to this technical and code compliance evaluation, CBI and/or DrJ staff have reviewed any state or local regulatory amendments to assure this report is in compliance.

22 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

23 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

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

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

26 All references to the FBC-B and FBC-R are the same as the 2024 IBC and 2024 IRC unless otherwise noted in the Florida Supplement at the end of this report.

27 All references to the CBC and CRC are the same as the 2024 IBC and 2024 IRC unless otherwise noted in the California Supplement at the end of this report.

28 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#listed AND https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#labeled

29 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4

30 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

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[31] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

[32] 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.

[33] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

[34] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition: https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[35] 2021 IBC Section 104.11

[36] 2021 IRC Section R104.11

[37] 2018: https://up.codes/viewer/wyoming/ifc-2018/chapter/1/scope-and-administration#104.9 AND 2021: https://up.codes/viewer/wyoming/ibc-2021/chapter/1/scope-and-administration#104.11

[38] 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 (https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#201.4) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[39] https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

[40] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.

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