Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report No: 2104-02

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Connectors for Wood Construction

Trade Secret Report Holder:

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CSI Designations:

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

1 Innovative Products Evaluated[1]

1.1 CH Machine Connectors:

1.1.1 Tie Clip Connectors: CH01, CH01-02, CH02, CH09, CH11

1.1.2 Angle Connectors: CH10

1.1.3 Face Mount Joist Hangers: CH12, CH12B, CH13, CH13B, CH14, CH14B

1.1.4 Hurricane and Seismic Tie Connectors: CH21, CH26

1.1.5 Post Cap/Base Connectors: CH22, CH25

1.1.6 Tension Strap Connectors: CH27A, CH27B

2 Product Description and Materials

2.1 *Materials*

2.1.1 *Steel:*

2.1.1.1 The CH Machine Connectors listed in **Section 1.1** are manufactured from ASTM A653 Grade 40, G60 galvanized structural steel (F_u = 55 ksi, F_y = 40 ksi).

2.1.2 *Supporting Wood Members:*

2.1.2.1 CH Machine Connectors are used to connect sawn or engineered lumber.

2.1.2.1.1 Sawn and engineered lumber shall have a minimum specific gravity (or equivalent specific gravity for engineered lumber) of 0.42.

2.1.2.2 Supporting wood member thickness shall be equal to or greater than the length of the fasteners specified in the applicable design table in **Section 6**, or as required by wood member design, whichever is greater.

2.1.2.3 The lumber used with CH Machine Connectors shall be in dry condition, i.e., lumber with a moisture content of less than or equal to nineteen percent (19%) for sawn lumber and less than sixteen percent (16%) for engineered lumber.

2.1.2.4 For installation in engineered lumber, the minimum allowable nail spacing, end, and edge distances shall be as required by the engineered lumber manufacturer evaluation report.

2.1.3 *Fasteners:*

2.1.3.1 Size and quantity of fasteners used with CH Machine Connectors shall be per the appropriate table in **Section 6**.

2.1.3.2 Fasteners shall meet the minimum requirements of **Table 1**.

Table 1. Minimum Fastener Requirements

Designation	Bending Yield Strength, F_{yb} (psi)
#8 Screw	100,000
0.131" Nail	100,000
0.148" Nail	90,000
0.162" Nail	90,000
SI: 1 in = 25.4 mm, 1 psi = 0.00689 MPa	

2.2 *Tie Clip Connectors*

2.2.1 CH01, CH01-02, CH02, CH09, and CH11 are tie clip connectors intended to connect wood trusses, rafters or joists to wall top plate(s). The tie clip connectors resist uplift loads and forces applied parallel and perpendicular to the wall top plate.

2.2.2 CH01 and CH01-02 are $1^{7}/_{16}$" wide by 6" long and are manufactured from 18-gauge steel (minimum thickness 0.045").

2.2.3 CH02 is $1^{9}/_{16}$" wide by $4^{5}/_{8}$" long and is manufactured from 18-gauge steel (minimum thickness 0.045").

2.2.4 CH09 is $1^{1}/_{4}$" wide by 12" long and is manufactured from 16-gauge steel (minimum thickness 0.060").

2.2.5 CH011 is $1^{1}/_{4}$" wide by 16" long and is manufactured from 16-gauge steel (minimum thickness 0.060").

2.2.6 The tie clip connectors are shown in **Figure 1** and **Figure 2**. Fastening schedules and allowable loads are provided in **Table 2** in **Section 6**.

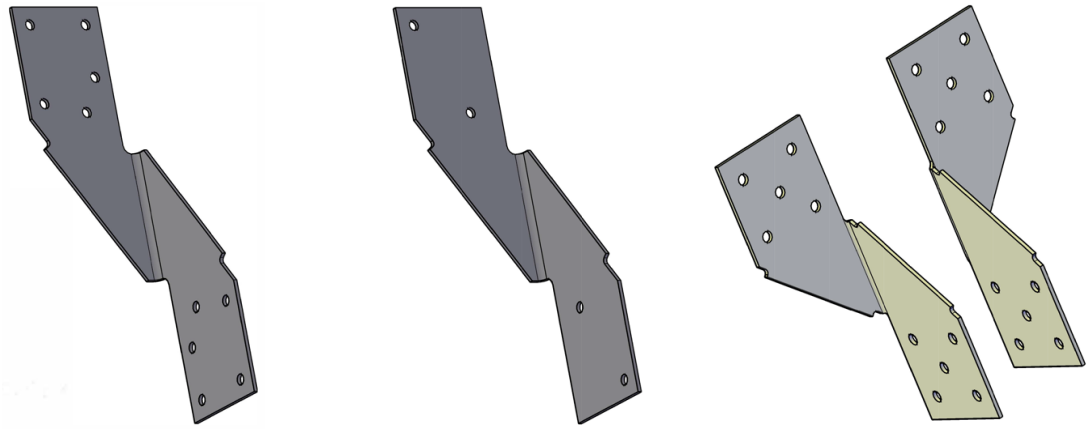


Figure 1. CH01, CH01-02, and CH02 Tie Clip Connectors

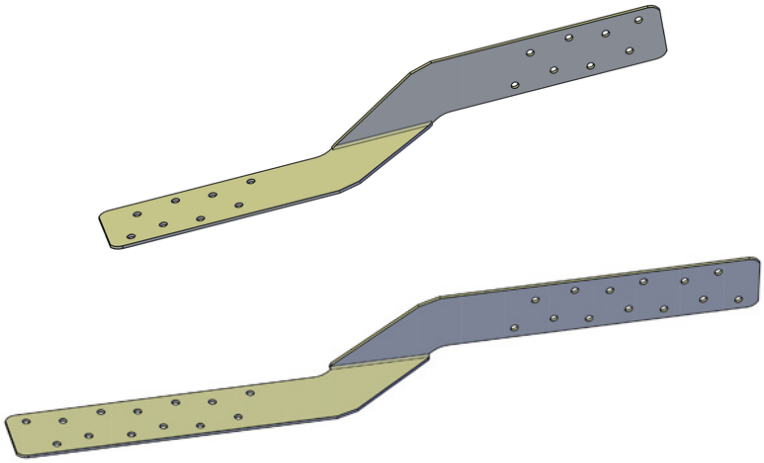


Figure 2. CH09 and CH11 Tie Clip Connectors

2.3 *Angle Connectors*

2.3.1 CH10 is a $2^{3}/_{4}$" wide-angle connector with sides 2" wide by $1^{1}/_{2}$" long, and is manufactured from 18-gauge steel (minimum thickness 0.045"). The CH10 resists uplift and lateral forces.

2.3.2 CH10 is shown in **Figure 3**. Fastening schedules and allowable loads are provided in **Table 3** in **Section 6.**

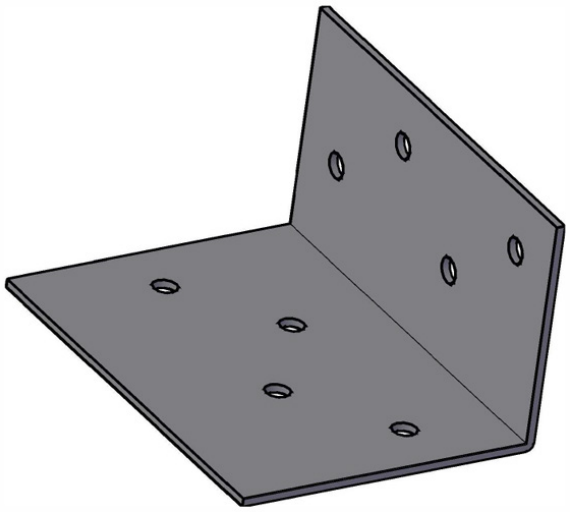


Figure 3. CH10 Angle Connector

2.4 *Face Mount Joist Hangers*

2.4.1 CH12, CH12B, CH13, CH13B, CH14, and CH14B are face mount joist hangers intended to connect 2 x 6, 2 x 8 and 2 x 10 joists, respectively, to headers. CH12, CH13, and CH14 are manufactured from 20-gauge steel (minimum thickness 0.034"). CH12B, CH13B, and CH14B are manufactured from 18-gauge steel (minimum thickness 0.045").

2.4.1.1 CH12 and CH12B are $4^{23}/_{32}$" in height with a $1^{1}/_{2}$" x $1^{9}/_{16}$" seat.

2.4.1.2 CH13 and CH13B are $6^{23}/_{32}$" in height with a $1^{1}/_{2}$" x $1^{9}/_{16}$" seat.

2.4.1.3 CH14 and CH14B are $8^{23}/_{32}$" in height with a $1^{1}/_{2}$" x $1^{9}/_{16}$" seat.

2.4.2 The face mount joist hangers are shown in **Figure 4**. Fastening schedules and allowable loads are provided in **Table 4** in **Section 6**.

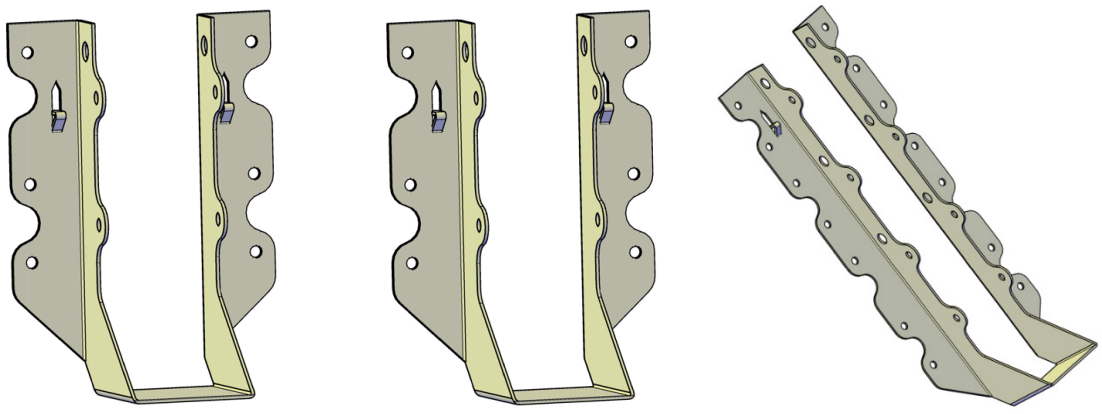


Figure 4. CH12/CH12B, CH13/CH13B and CH14/CH14B Face Mount Joist Hangers

2.5 *Hurricane and Seismic Tie Connector*

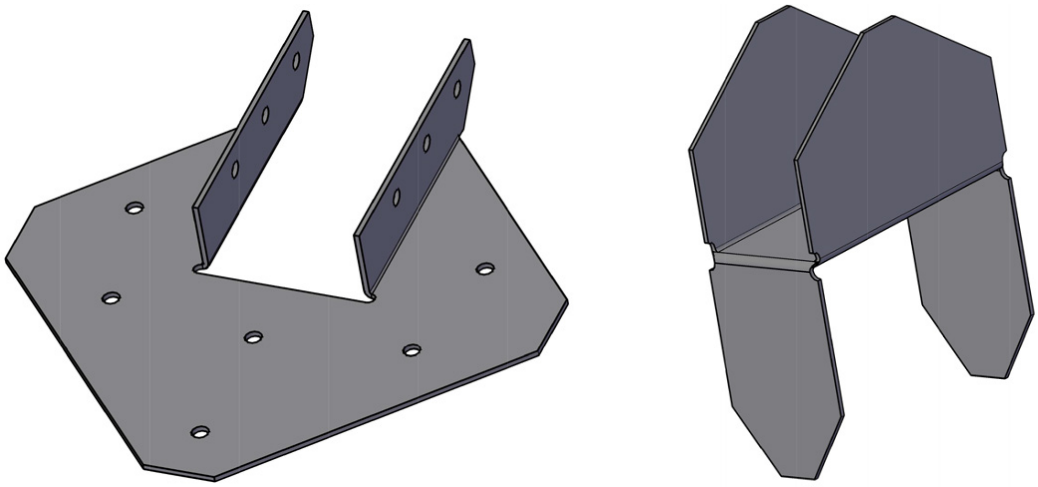
2.5.1 CH21 and CH26 are hurricane and seismic tie connectors intended to attach wood trusses, rafters, or joists to wall top plates. The CH21 and CH26 resist uplift loads and forces applied parallel and perpendicular to the wall top plate.

2.5.2 CH21 and CH26 are manufactured from 18-gauge steel (minimum thickness 0.045").

2.5.3 CH21 is a diamond-shaped tie connector ($4^{1}/_{4}$" x $4^{1}/_{4}$" measured square) with a $2^{3}/_{4}$" long and $1^{9}/_{16}$" wide slot in the top middle of the diamond shape.

2.5.4 CH26 is $4^{15}/_{16}$" in height ($2^{5}/_{16}$" high upper portion, $2^{5}/_{8}$" high lower portion), $1^{5}/_{8}$" in depth, and $3^{9}/_{16}$" wide.

2.5.5 CH21 and CH26 are shown in **Figure 5**. Fastening schedules and allowable loads are provided in **Table 5** in **Section 6**.



CH 21 **CH26**

Figure 5. CH21 and CH26 Hurricane and Seismic Tie Connectors

2.6 *Post Cap/Base Connectors*

2.6.1 CH22 and CH25 post cap/base connectors are intended to attach wood posts to wood supporting members.

2.6.2 CH22 and CH25 are manufactured from 18-gauge steel (minimum thickness 0.045").

2.6.3 CH22 is $3^{9}/_{16}$" wide, $2^{9}/_{16}$" high and $5^{1}/_{2}$" deep.

2.6.4 CH25 is $3^{1}/_{2}$" wide, $2^{1}/_{2}$" high and $3^{3}/_{8}$" deep.

2.6.5 The post base connectors are shown in **Figure 6**. Fastening schedules and allowable loads are provided in **Table 6** in **Section 6**.

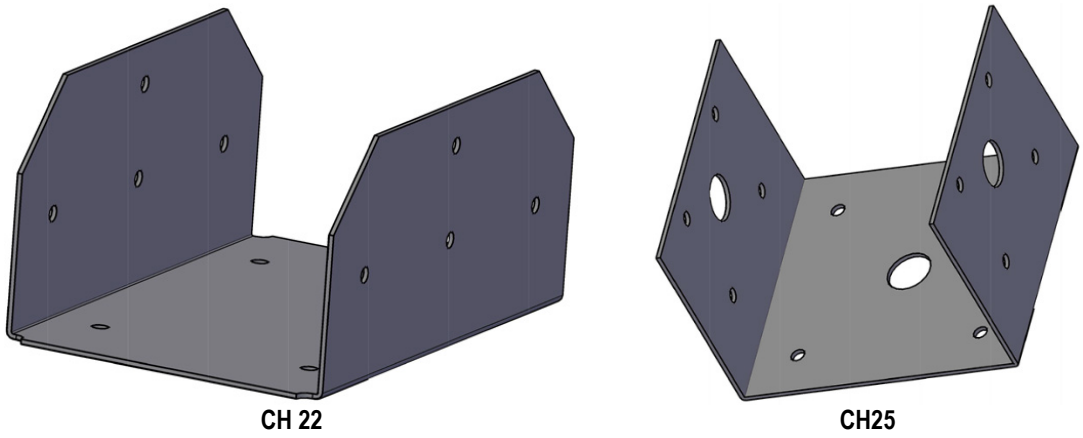


Figure 6. CH22 and CH25 Post Cap/Base Connectors

2.7 *Tension Strap Connectors*

2.7.1 The straps are manufactured from $1^{1}/_{4}$" wide steel and come in various lengths ranging from 9" to 30".

2.7.2 CH27A is manufactured from 20-gauge steel (minimum thickness 0.034").

2.7.3 CH27B is manufactured from 18-gauge steel (minimum thickness 0.045").

2.7.4 CH27A and CH27B tension strap connectors are shown in **Figure 7**. Fastening schedules and allowable loads are provided in **Table 7** in **Section 6**.

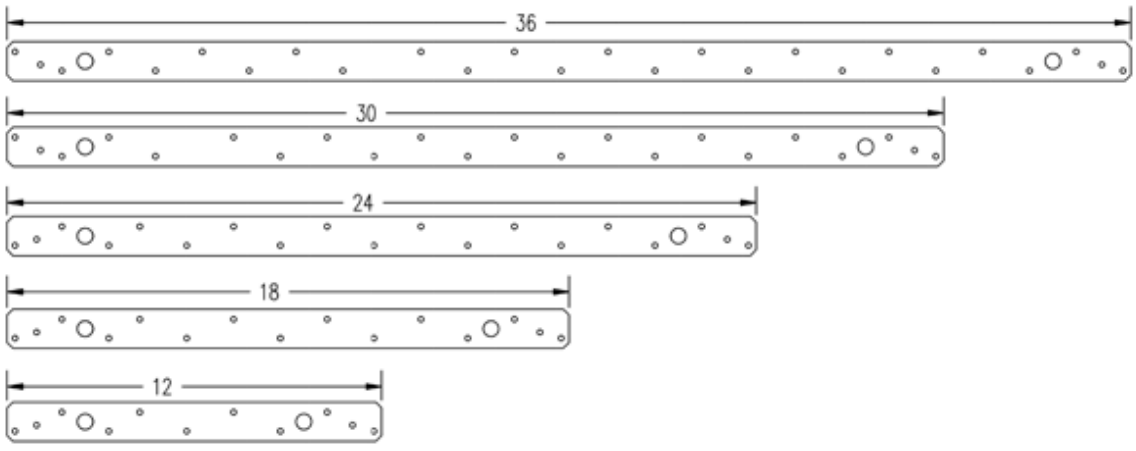


Figure 7. CH27A and CH27B Tension Strap Connectors

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

3 Definitions[2]

3.1 New Materials[3] 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.[4] The design strength and permissible stresses shall be established by tests[5] and/or engineering analysis.[6]

3.2 Duly authenticated reports[7] and research reports[8] are test reports and related engineering evaluations that are written by an approved agency[9] and/or an approved source.[10]

3.2.1 These reports utilize 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 secretes under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[11]

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.[12]

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[13] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[14] 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[15] 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.[16]

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.[17] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[18] 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.[19]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[20]

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, Texas Department of Insurance, and Wichita.[21]

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.[22]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[23] and Part 3280[24] 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 *Standards*

4.2.1 *AISI S100: North American Specification for the Design of Cold-Formed Steel Structural Members*

4.2.2 *ANSI/AISC 360: Specification for Structural Steel Buildings*

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

4.2.4 *ASTM A370: Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

4.2.5 *ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*

4.2.6 *ASTM D7147: Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers*

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

4.3 *Regulations*

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

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

4.3.3 *FBC-B—20, 23: Florida Building Code[25] – Building (FL 41045)*

4.3.4 *FBC-R—20, 23: Florida Building Code[25] – Residential (FL 41045)*

5 Listed[26]

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

6.1.1 CH Machine Connectors are used to resist uplift, lateral, and/or gravity loads imposed on different connections in light-frame wood construction.

6.1.2 Allowable loads for CH Machine Connectors were derived using testing and calculations in accordance with ASTM D7147 per IBC Section 2303.5, IBC Section 2304.10.4,[27] and IRC Section R301.1.3.

6.1.3 The RDP for the project shall determine which type of connector is appropriate, using the tables in **Section 6**.

6.1.4 Tabulated allowable loads in **Section 6** apply to wood used in dry conditions and where sustained temperatures are 100° F.

6.1.4.1 When connectors are installed in conditions where they are exposed to temperatures exceeding 100° F, the allowable loads shall be adjusted by the applicable temperature factor (C_t) specified in the NDS.

6.1.4.2 When connectors are installed in wood having a moisture content of greater than nineteen percent (19%), sixteen percent (16%) for engineered wood products or where wet service conditions are expected over the life of the connector, the allowable loads shall be adjusted by the wet service factor (C_M) specified in the NDS.

6.2 *Tie Clip Connectors*

6.2.1 Allowable loads and fastener schedules for tie clips (CH01, CH01-02, CH02, CH09, and CH11) are provided in **Table 2**.

Table 2. Allowable Loads and Fastener Schedules for Tie Clip Connectors[1,2]

Part Number	Minimum Gauge Thickness (in)	Load Orientation	Fasteners				Allowable Loads[4,5] (lb)					
							Wood Species (Specific Gravity)					
			Top Plate		Truss/Rafter		SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Fastener	Qty	Fastener	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH01	0.045 (18-gauge)	Uplift	#8 x 1¼" Screw	5	#8 x 1¼" Screw	5	505	680	470	630	405	540
		Lateral – F1					215	230	170	180	110	115
		Lateral – F2					130	130	100	100	65	65
		Uplift	0.131" x 1½" Nail	5	0.131" x 1½" Nail	5	525	835	485	770	415	665
		Lateral – F1					270	430	210	335	135	220
		Lateral – F2					130	130	100	100	65	65
CH01-02	0.045 (18-gauge)	Uplift	#8 x 1¼" Screw	2	#8 x 1¼" Screw	2	200	270	190	250	160	215
		Lateral – F1					85	90	70	70	45	45
		Lateral – F2					50	50	40	40	25	25
		Uplift	0.131" x 1½" Nail	2	0.131" x 1½" Nail	2	210	335	195	310	165	265
		Lateral – F1					110	170	85	135	55	90
		Lateral – F2					50	50	40	40	25	25
CH02	0.045 (18-gauge)	Uplift	#8 x 1¼" Screw	5	#8 x 1¼" Screw	5	400	400	400	400	350	350
		Lateral – F1					160	160	125	125	80	80
		Lateral – F2					185	185	160	160	100	100
		Uplift	0.131" x 1½" Nail	5	0.131" x 1½" Nail	5	400	400	400	400	350	350
		Lateral – F1					160	160	125	125	80	80
		Lateral – F2					185	185	160	160	100	100
CH09[3]	0.060 (16-gauge)	Uplift	#8 x 1¼" Screw	6	#8 x 1¼" Screw	6	630	935	580	870	505	755
		Lateral – F1					90	90	70	70	45	45
		Lateral – F2					95	95	75	75	45	45
		Uplift	0.131" x 1½" Nail	6	0.131" x 1½" Nail	6	645	1,035	600	960	520	830
		Lateral – F1					90	90	70	70	45	45
		Lateral – F2					95	95	75	75	45	45

Table 2. Allowable Loads and Fastener Schedules for Tie Clip Connectors[1,2]

Part Number	Minimum Gauge Thickness (in)	Load Orientation	Fasteners				Allowable Loads[4,5] (lb)					
							Wood Species (Specific Gravity)					
			Top Plate		Truss/Rafter		SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Fastener	Qty	Fastener	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH11[3]	0.060 (16-gauge)	Uplift	#8 x 1 1/4" Screw	6	#8 x 1 1/4" Screw	6	630	935	580	870	505	755
		Lateral – F1					90	90	70	70	45	45
		Lateral – F2					95	95	75	75	45	45
		Uplift	0.131" x 1 1/2" Nail	6	0.131" x 1 1/2" Nail	6	645	1,035	600	960	520	830
		Lateral – F1					90	90	70	70	45	45
		Lateral – F2					95	95	75	75	45	45

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Uplift loads shown are for a single connector.
2. F1 and F2 loads shown are for a single connector. See **Figure 8** for more detail.
3. Only six nails are required on each side of the CH09 and CH11 to obtain tabulated loads. Nails shall be placed in the six holes closest to the twist in the connector (i.e., the bottom six holes on the truss/rafter and the top six holes on the top plate).
4. The tabulated loads are valid for clips installed on the inside or the outside of the wall. However, to maintain a continuous load path for uplift connections in close proximity to one another, such as truss-to-plate and plate-to-stud, clips should be installed on the same side of the wall.
5. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.

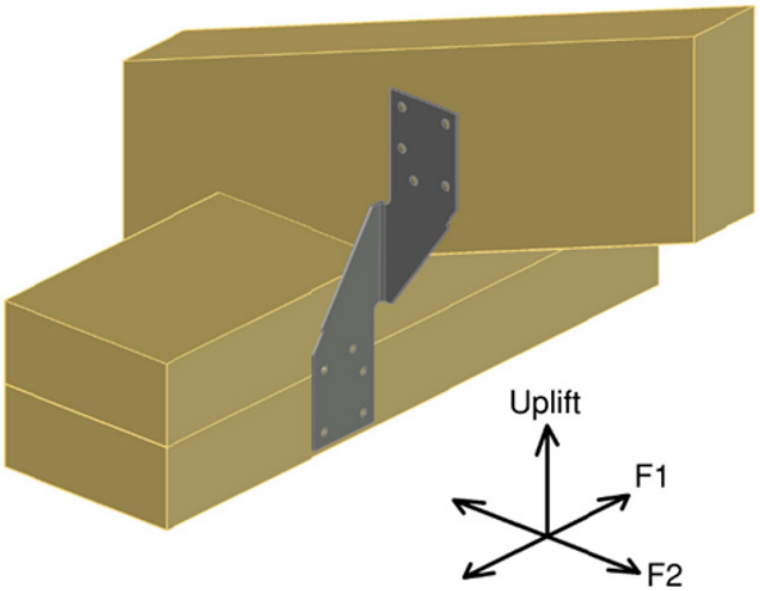


Figure 8. Tie Clip Load Orientations

6.3 *Angle Connectors*

6.3.1 Allowable loads and fastener schedules for CH10 are provided in **Table 3**.

Table 3. Allowable Loads and Fastener Schedule for Angle Connectors

Part Number	Minimum Gauge Thickness (in)	Load Orientation[3]	Fasteners				Allowable Loads[1,2] (lb)					
							Wood Species (Specific Gravity)					
			Plate		Stud		SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Nail	Qty	Nail	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH10	0.045 (18-gauge)	Lateral – F1	0.148" x 1½"	4	0.148" x 1½"	4	425	425	370	370	240	240
		Lateral – F2					525	525	485	485	420	420

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Two CH10 connectors (one on each side of stud) are required to achieve tabulated allowable loads.
2. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.
3. F1 direction is parallel to wall line. F2 direction is perpendicular to wall line. See **Figure 9** for more detail.

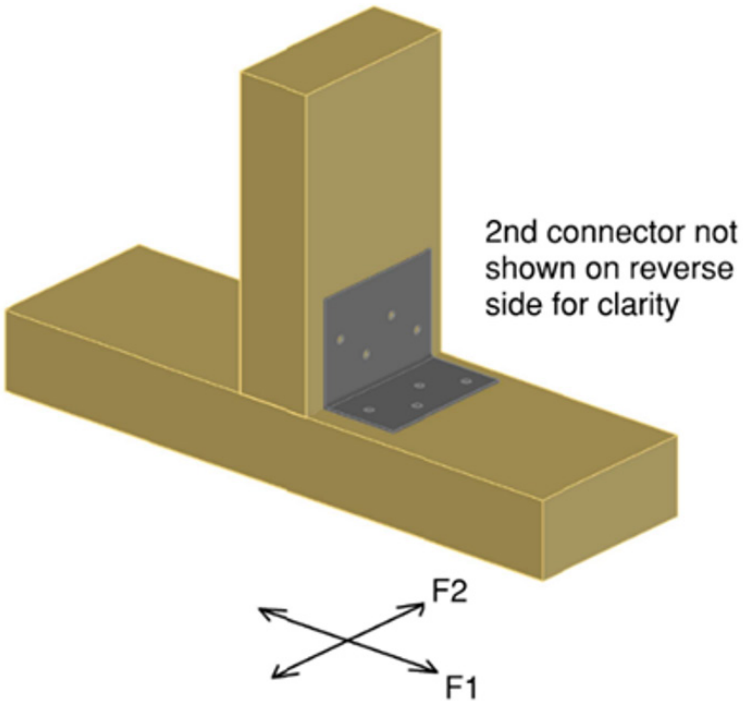


Figure 9. Angle Connector Load Orientations

6.4 *Face Mount Joist Hangers*

6.4.1 Allowable loads and fastener schedules for face mount joist hangers (CH12, CH12B, CH13, CH13B, CH14, and CH14B) are provided in **Table 4**.

Table 4. Allowable Loads and Fastener Schedules for Face Mount Joist Hangers

Part Number	Minimum Gauge Thickness (in)	Fasteners				Allowable Loads[1] (lb)											
						Wood Species (Specific Gravity)											
						SP (0.55)				DF-L (0.50)				HF/SPF (0.42)			
						Load Duration Factor, C_D											
		Joist		Header		Gravity		Uplift[2]		Gravity		Uplift[2]		Gravity		Uplift[2]	
		Nail	Qty	Nail	Qty	1.0	1.15	1.25	1.6	1.0	1.15	1.25	1.6	1.0	1.15	1.25	1.6
CH12	0.034 (20-gauge)	0.131" x 1½"	4	0.131" x 1½"	6	620	710	725	660	570	655	670	610	490	505	505	525
CH12B	0.045 (18-gauge)		4		6	625	710	725	670	580	655	670	620	490	505	505	535
CH13	0.034 (20-gauge)		6		10	955	1,000	1,010	990	850	895	900	915	680	690	690	790
CH13B	0.045 (18-gauge)		6		10	1,045	1,140	1,145	1,005	965	1,015	1,020	930	775	780	780	800
CH14	0.034 (20-gauge)		8		14	1,290	1,290	1,290	1,320	1,130	1,130	1,130	1,220	870	870	870	1,050
CH14B	0.045 (18-gauge)		8		14	1,465	1,565	1,565	1,340	1,350	1,370	1,370	1,235	1,055	1,055	1,055	1,065

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.
2. Allowable uplift loads are for wind or earthquake loading (C_D=1.6), and no further increases are allowed. The allowable uplift load shall be reduced where other load durations govern.

6.5 *Hurricane and Seismic Tie Connectors*

6.5.1 Allowable loads and fastener schedules for CH21 and CH26 are provided in **Table 5**.

Table 5. Allowable Loads and Fastener Schedules for Hurricane and Seismic Tie Connectors

Part Number	Minimum Gauge Thickness (in)	Load Orientation	Fasteners				Allowable Loads[3] (lb)					
							Wood Species (Specific Gravity)					
			Top Plates		Truss/Rafter		SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Nail	Qty	Nail	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH21	0.045 (18-gauge)	Uplift	0.131" x 2½"	4	0.131" x 1½"	5	420	500	390	460	335	400
		Lateral – F1[1]					315	330	275	275	175	175
		Lateral – F2[2]					165	165	155	155	105	105
CH26	0.045 (18-gauge)	Uplift	0.131" x 2½"	8	0.131" x 1½"	8	765	765	710	710	610	610
		Lateral – F1[1]					590	590	545	545	455	455
		Lateral – F2[2]					650	650	600	600	500	500

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Loading in the F1 direction indicates shear forces parallel to the plane of the wall, one side of the connection to the truss/rafter in withdrawal. See **Figure 10** for more detail.
2. Loading in the F2 direction indicates shear forces perpendicular to the plane of the wall, connection to top plate in withdrawal. See **Figure 11** for more detail.
3. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.

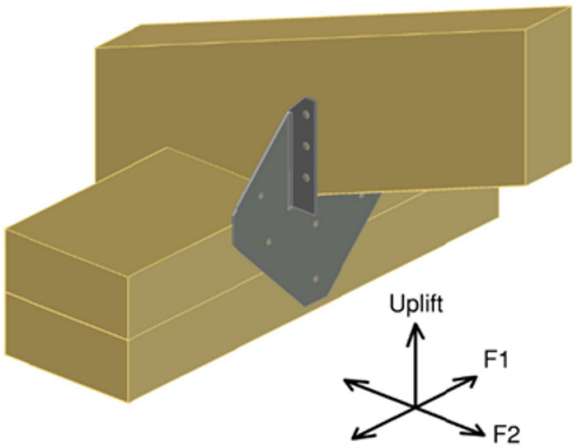


Figure 10. CH21 Load Orientations

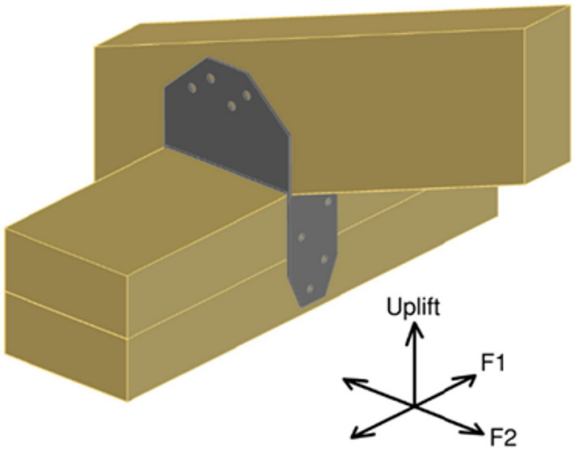


Figure 11. CH26 Load Orientations

6.6 *Post Cap/Base Connectors*

6.6.1 Allowable loads and fastener schedules for post cap/base connections (CH22 and CH25) are provided in **Table 6**.

Table 6. Allowable Loads and Fastener Schedules for Post Cap/Base Connectors

Part Number	Minimum Gauge Thickness (in)	Load Orientation[2]	Fasteners				Allowable Loads[1] (lb)					
							Wood Species (Specific Gravity)					
			Post		Substrate		SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Nail	Qty	Nail	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH22	0.045 (18-gauge)	Uplift	0.162" x 3½"	8	0.162" x 3½"	4	660	715	520	630	335	410
		Lateral – F1					600	810	555	810	480	765
		Lateral – F2					600	830	555	830	480	755
CH25	0.045 (18-gauge)	Uplift	0.162" x 3½"	8	0.162" x 3½"	4	555	555	490	490	320	320
		Lateral – F1					600	720	555	665	480	570
		Lateral – F2					600	745	555	745	480	675

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.
2. F1 direction is parallel to substrate member. F2 direction is perpendicular to substrate member. See **Figure 12** for more detail.

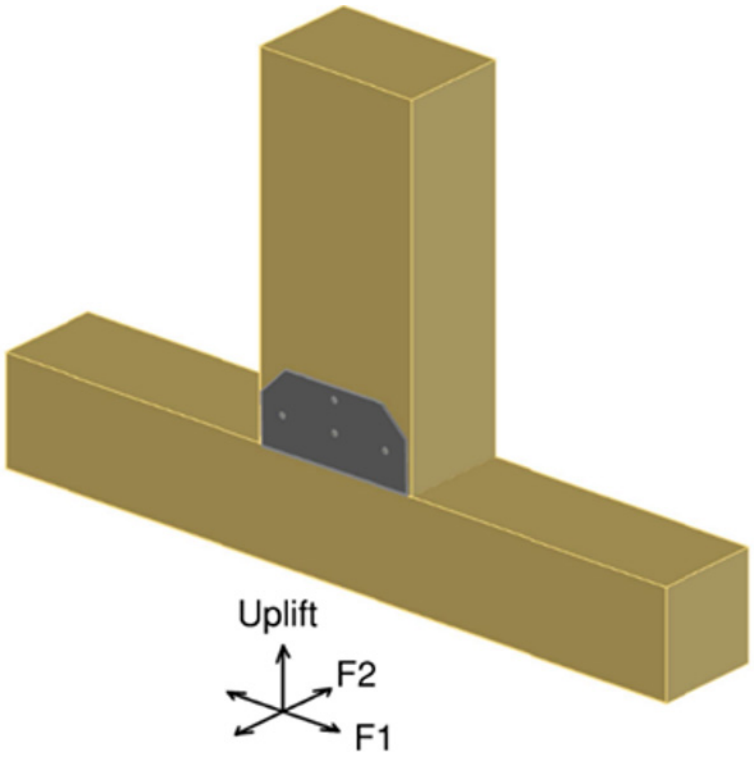


Figure 12. Post Cap/Base Load Orientations

6.7 *Tension Strap Connectors*

6.7.1 Allowable loads and fastener schedules for tension straps (CH27A and CH27B) are provided in **Table 7**.

Table 7. Allowable Tension Loads and Fastener Schedules for Tension Strap Connectors

Part Number	Minimum Gauge Thickness (in)	Strap Length (in)	Number of Nails Each End of Strap		Allowable Tension Loads[1,2] (lb)					
					Wood Species (Specific Gravity)					
					SP (0.55)		DF-L (0.50)		HF/SPF (0.42)	
			Type	Qty	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6	C_D = 1.0	C_D = 1.6
CH27A	0.034 (20-gauge)	9	0.148" x 2½"	4	500	680	460	630	395	540
		12		5	620	740	575	680	495	585
		18		7	620	740	575	680	495	585
		24		9	620	740	575	680	495	585
		30		11	620	740	575	680	495	585
CH27B	0.045 (18-gauge)	9	0.148" x 2½"	4	505	755	465	695	400	600
		12		5	630	880	580	815	500	705
		18		7	630	880	580	815	500	705
		24		9	630	880	580	815	500	705
		30		11	630	880	580	815	500	705

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. CH27A and CH27B steel straps are only rated to resist tension loads and are not rated for compression or lateral loads.
2. Allowable loads shall be selected based on the load duration as permitted by the applicable building code.

6.8 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.

7 Certified Performance[28]

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.[29]

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.[30]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 CH Machine Connectors comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 This report evaluates the CH Machine Connectors for the following:

8.1.1.1 Structural performance of connectors under uplift, lateral, and gravity load conditions.

8.1.1.2 Performance for use in buildings of light-frame construction in accordance with the codes listed in **Section 4**.

8.2 Any building code, regulation and/or accepted engineering evaluations (i.e., 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[31] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[32] respectively.

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

8.4 Any regulation specific issues not addressed in this section are outside the scope of this report.

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*

9.3.1 Connectors shall be attached to framing using the fasteners as specified in the applicable tables in **Section 6**.

9.3.2 Surfaces of the connector shall be installed flush against the substrate or structural member.

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 Tensile strength testing in accordance with ASTM A370

10.1.2 Gravity, uplift, and lateral load testing in accordance with ASTM D7147 and DrJ Engineering calculations in accordance with the NDS

10.1.3 Bending yield testing in accordance with ASTM F1575

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.[33]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for CH Machine Connectors on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, CH Machine Connectors 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, CH Machine Connectors shall be approved for the following applications:

11.2.1 Use where the design values listed in **Section 6** meet the requirements of the building design.

11.3 Unless exempt by state statute, when CH Machine Connectors 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.

11.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from CH Machine, Inc.

11.5 IBC Section 104.2.3[34] (IRC Section R104.2.2[35] and IFC Section 104.2.3[36] 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.

11.6 **Approved:**[37] Building regulations require that the building official shall accept duly authenticated reports.[38]

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

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

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

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

11.8 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.[39]

12 Conditions of Use

12.1 Material properties shall not fall outside the boundaries defined in **Section 6**.

12.2 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.

12.3 Loads applied shall not exceed those recommended by the manufacturer or as defined in this report.

12.4 Use of CH Machine Connectors in contact with fire-retardant treated wood or pressure-preservative treated wood is outside the scope of this report.

12.5 Structural framing members connected with the connectors listed in **Section 1.1** shall be designed in accordance with the requirements of their specific design standards/specifications as referenced in the building code adopted by the jurisdiction in which the project is to be constructed.

12.6 Each of the CH Machine Connectors that is exposed directly to weather or subject to salt corrosion in coastal areas, as determined by the local building official, shall be protected in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.

12.7 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:

12.7.1 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.

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

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

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

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

12.7.6 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.

12.7.7 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.

12.8 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.

12.9 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).

12.10 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 The innovative products 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.chmachineinc.com.

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.

Issue Date: July 29, 2021
Subject to Renewal: October 1, 2026

FBC Supplement to Report Number 2104-02

REPORT HOLDER: CH Machine, Inc.

1 Evaluation Subject

1.1 CH Machine Connectors:

1.1.1 Tie Clip Connectors: CH01, CH01-02, CH02, CH09, CH11

1.1.2 Angle Connectors: CH10

1.1.3 Face Mount Joist Hangers: CH12, CH12B, CH13, CH13B, CH14, CH14B

1.1.4 Hurricane and Seismic Tie Connectors: CH21, CH26

1.1.5 Post Cap/Base Connectors: CH22, CH25

1.1.6 Tension Strap Connectors: CH27A, CH27B

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show CH Machine Connectors, recognized in Report Number 2104-02, 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 (FL 41045)*

2.2.2 *FBC-R—20, 23: Florida Building Code – Residential (FL 41045)*

3 Conclusions

3.1 CH Machine Connectors, described in Report Number 2104-02, 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 1707.1 replaces IBC Section 1707.1.

3.2.9 FBC-B Section 2303.5 replaces IBC Section 2303.5.

3.2.10 FBC-B Section 2304.10.3 replaces IBC Section 2304.10.4.

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.

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

3.2.14 FBC-R Section R301.1.3 replaces IRC Section R301.1.3.

4 Conditions of Use

4.1 CH Machine Connectors, described in Report Number 2104-02, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 2104-02.

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

Notes

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

2 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.

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

4 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

5 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

6 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

7 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.

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

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

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

11 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.

12 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/

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

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

15 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

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

17 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

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

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

20 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.

21 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

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

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

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

25 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.

26 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

27 2018 IBC Section 2304.10.3

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

29 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

[30] 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

[31] 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.

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

[33] 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

[34] 2021 IBC Section 104.11

[35] 2021 IRC Section R104.11

[36] 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

[37] 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.

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

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