



CERTIFICATION



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Technical Evaluation Report

TER 2104-03

CH Machine Connector Plates

CH Machine Inc.

Product:

CH20 and CH18 Truss Plates

Issue Date:

February 1, 2022

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Subject to Renewal:

April 1, 2023



COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

SECTION: 06 05 23.17 – Wood Framing Metal Connectors

SECTION: 06 17 53 - Shop-Fabricated Wood Trusses

1 PRODUCT EVALUATED¹

1.1 CH20 and CH18 Truss Plates

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—15, 18, 21: International Building Code®*
- 2.1.2 *IRC—15, 18, 21: International Residential Code®*
- 2.1.3 *FBC-B—17, 20: Florida Building Code – Building⁴*
- 2.1.4 *FBC-R—17, 20: Florida Building Code – Residential⁴*

2.2 Standards and Referenced Documents

- 2.2.1 *ASTM A653: Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process*
- 2.2.2 *ASTM A879: Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface*
- 2.2.3 *TPI 1: National Design Standard for Metal-plate-connected Wood Truss Construction*

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

² Unless otherwise noted, all references in this TER are from the 2021 version of the codes and the standards referenced therein. This material, design, or method of construction also complies with the 2000-2018 versions of the referenced codes and the standards referenced therein.

³ All terms defined in the applicable building codes are italicized.

⁴ All references to the *FBC-B* and *FBC-R* are the same as the 2018 *IBC* and 2018 *IRC*, respectively, unless otherwise noted in the supplement at the end of this document.

3 PERFORMANCE EVALUATION

- 3.1 CH20 and CH18 were evaluated to determine:
 - 3.1.1 Structural performance under load conditions for use as a metal plate connector for wood trusses in accordance with IBC Section 2306.1 and TPI 1
 - 3.1.2 Tensile strength and effectiveness ratio in accordance with TPI 1
 - 3.1.3 Shear strength and effectiveness ratio in accordance with TPI 1
- 3.2 Overall truss design is outside the scope of this TER.
- 3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.4 Any engineering evaluation conducted for this TER was performed within DrJ's ANAB accredited ICS code scope and/or the defined professional engineering scope of work on the dates provided herein.

4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 The product evaluated in this TER is shown in Figure 1.

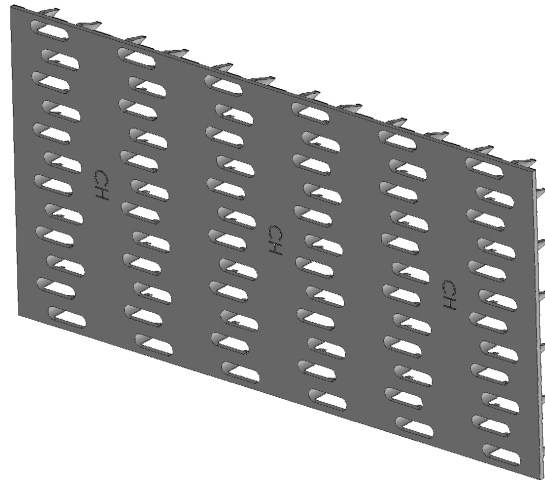


FIGURE 1. CH METAL PLATE CONNECTOR

- 4.2 CH20 and CH18 are flat, light gauge galvanized steel plates that use integral teeth to transmit lateral loads between wood truss members.
 - 4.2.1 CH20 is manufactured from galvanized steel sheets complying with ASTM A653, SS Grade 40 with a G60 galvanized coating, or 30Z30Z Electrolytic Zinc coating in accordance with ASTM A879.
 - 4.2.1.1 The minimum uncoated thickness of each steel sheet is 0.034".
 - 4.2.1.2 CH20 has eight (8) teeth per square inch that are 0.35" long, 0.125" wide, and punched perpendicular to the plane of the plate.
 - 4.2.2 CH18 is manufactured from galvanized steel sheets complying with ASTM A653, SS Grade 40 with a G60 galvanized coating, or 30Z30Z Electrolytic Zinc coating in accordance with ASTM A879.
 - 4.2.2.1 The minimum uncoated thickness of each steel sheet is 0.045".
 - 4.2.2.2 CH18 has eight (8) teeth per square inch that are 0.35" long, 0.125" wide, and punched perpendicular to the plane of the plate.

5 APPLICATIONS

5.1 General

- 5.1.1 CH20 and CH18 can be used to connect wood truss members and support the lateral resistance of both vertical and horizontal loads when used in accordance with this TER and the applicable code.
- 5.1.2 Unless otherwise noted, adjustment of the allowable design values for duration of load shall be in accordance with the applicable code.

5.2 Truss Plate Connection Allowable Design Values

- 5.2.1 CH20 and CH18 are allowed for use as truss plate connectors for wood trusses in accordance with the applicable allowable design values listed in Table 1.

TABLE 1. CH PLATE ALLOWABLE DESIGN VALUES

CH Plate	Wide Face or Narrow Face ¹	Lumber Species ^{2,3} (SG)	Allowable Design Value (psi/plate)			
			Orientation ⁴			
			AA	EA	AE	EE
CH20	Wide	SPF (0.42)	210	180	130	130
		SP (0.55)	235	190	160	175
	Narrow	SPF (0.42)	180	150	110	110
		SP (0.55)	210	175	165	165
CH18	Wide	SPF (0.42)	185	165	125	130
		SP (0.55)	220	185	175	180
	Narrow	SPF (0.42)	140	140	115	110
		SP (0.55)	165	160	140	155

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa

- Wide face denotes that the CH plate is connected to the face grain of each member. Narrow face denotes that the CH plate is connected to the side grain of each member.
- Wood truss members shall have a minimum specific gravity, SG, of that listed in this table.
- Wood truss members and overall truss design shall be designed by others and shall be of adequate size, species, and grade to resist design loads and requirements in accordance with the applicable building code.
- Orientation refers to both the plate's slot orientation to the load and the load's orientation to grain.
 - AA denotes that the plate's slots are parallel to load and the load is parallel to grain (see Figure 2, showing the wide face connection).
 - EA denotes that the plate's slots are perpendicular to load and the load is parallel to grain (see Figure 2, showing the wide face connection).
 - AE denotes that the plate's slots are parallel to load and the load is perpendicular to grain (see Figure 3, showing the wide face connection).
 - EE denotes that the plate's slots are perpendicular to load and the load is perpendicular to grain (see Figure 3, showing the wide face connection).

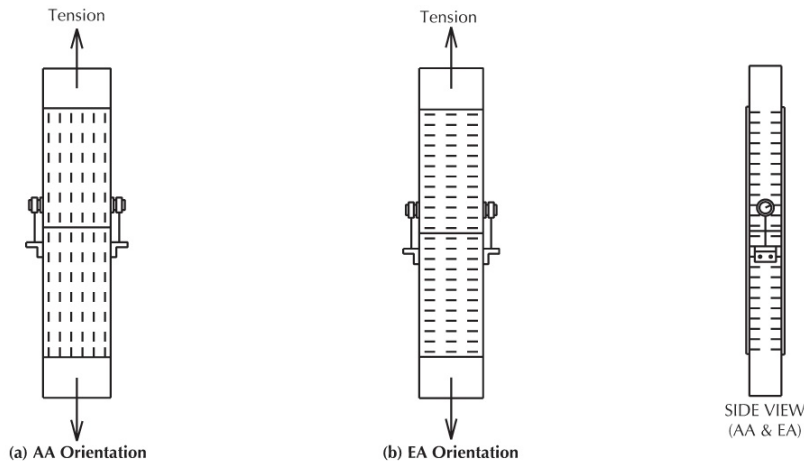


FIGURE 2. AA AND EA ORIENTATIONS (TPI 1 FIGURE 5.2-3)

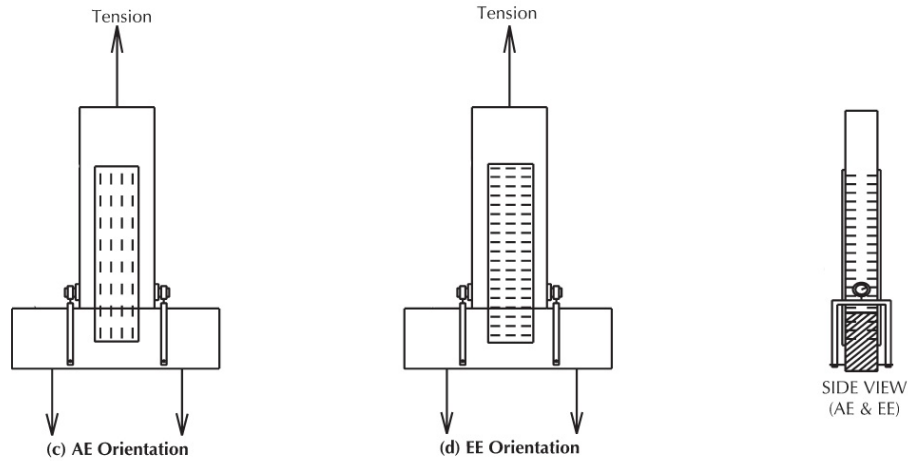


FIGURE 3. AE AND EE ORIENTATIONS (TPI 1 FIGURE 5.2-3)

5.3 Tension Design Values and Effectiveness Ratios

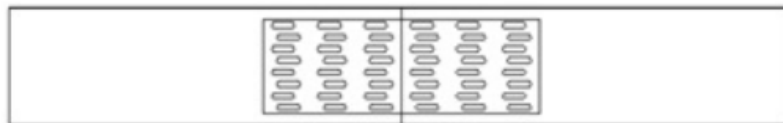
5.3.1 CH20 and CH18 have allowable tension design values and effectiveness ratios as listed in Table 2.

TABLE 2. CH PLATE ALLOWABLE TENSION DESIGN VALUES AND EFFECTIVENESS RATIOS

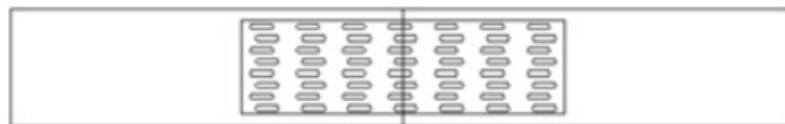
CH Plate	Orientation ¹	Allowable Design Value (pli)	Tensile Effectiveness Ratio ³
CH20	0° (AA)	495	0.453
	90° (EA)	470	0.431
	0° (AA, Non-Standard joint ²)	623	0.570
CH18	0° (AA)	564	0.500
	90° (EA)	571	0.507
	0° (AA, Non-Standard joint ²)	662	0.588

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 pli = 0.175 N/mm

- Orientation refers to the plate's slot orientation to the load (0° is parallel to the plate's slots, 90° is perpendicular to the plate's slots), given tension loading is parallel to grain.
 - AA denotes that the plate's slots are parallel to load and the load is parallel to grain (see Figure 2 and Figure 4).
 - EA denotes that the plate's slots are perpendicular to load and the load is parallel to grain (see Figure 2).
- Non-Standard joints denote full metal plate cross-sectional area across the wood member's joint plane (see Figure 4).
- Tensile Effectiveness Ratio, R_t , is defined in TPI 1 as: $R_t = \frac{F_{tp}}{F_{tc}}$, where F_{tp} is the plate's ultimate tensile strength for the given orientation and F_{tc} is the theoretical ultimate tensile strength of the matched solid metal control specimen.



Non-standard test joint for steel tension parallel to slots (solid steel cross-section over the joint line)



Standard test joint for steel tension parallel to slots (minimum cross-section over the joint line)

FIGURE 4. NON-STANDARD AND STANDARD JOINTS (TPI 1 FIGURE 5.4-4)

5.4 Shear Design Values and Effectiveness Ratios

5.4.1 CH20 and CH18 have allowable shear design values as listed in Table 3.

TABLE 3. CH PLATE ALLOWABLE SHEAR DESIGN VALUES AND EFFECTIVENESS RATIOS

CH Plate	Plate Angle ¹	Allowable Design Value (pli)	Shear Effectiveness Ratio ²
CH20	0°	344	0.51
	30°	394	0.58
	60°	484	0.72
	90°	316	0.47
	120°	288	0.43
	150°	297	0.44
CH18	0°	442	0.62
	30°	472	0.66
	60°	619	0.87
	90°	451	0.63
	120°	345	0.48
	150°	372	0.52

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 pli = 0.175 N/mm

1. Plate angle is measured from the vertical.

2. Shear Strength Effectiveness Ratio, R_s , is defined in *TPI 1* as: $R_s = \left(\frac{F_{sp}}{F_{sc}} \right) = \frac{F_{sp}}{0.577 \times F_{tc}}$, where F_{sp} is the plate's ultimate shear stress for the given orientation, F_{sc} is the theoretical ultimate shear stress of the matched solid metal control specimen, and F_{tc} is the average ultimate tensile stress.

5.5 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

6 INSTALLATION

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

6.2 Installation Procedure

6.2.1 Wood trusses connected with CH20 or CH18 shall be assembled in accordance with Chapter 3 of *TPI 1* and *IBC Section 2303.4*, *IRC Section R502.11*, or *IRC Section R802.10*.

6.2.2 Single plate installation is not allowable. Install CH20 or CH18 in corresponding pairs on opposite faces of truss member joints.

6.2.3 CH20 and CH18 must be pressed into wood for the full depth of the teeth by a hydraulic-platen press, multiple roller presses (partial embedment followed by full embedment presses), or combinations of hydraulic-platen presses and/or roller presses that feed into a stationary finish roller press.



7 SUBSTANTIATING DATA

- 7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:
- 7.1.1 Truss plate connector testing for lateral resistance in accordance with *TPI 1*
 - 7.1.2 Truss plate connector testing for tensile strength in accordance with *TPI 1*
 - 7.1.3 Truss plate connector testing for shear strength in accordance with *TPI 1*
- 7.2 Information contained herein is the result of testing and/or data analysis by sources which conform to IBC Section 1703 and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.
- 7.3 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through state or local adoption of codes and standards. The providers of the codes and standards are legally responsible for their content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes a product as being equivalent to that prescribed in this code in quality, strength, effectiveness, fire resistance, durability, and safety. Where the accuracy of the provisions provided herein is reliant upon the published properties of materials, DrJ relies upon the grade mark, grade stamp, mill certificate, and/or test data provided by material suppliers to be minimum properties. DrJ analysis relies upon these properties to be accurate.

8 FINDINGS

- 8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product listed in Section 1.1 is approved for the following:
- 8.1.1 Use as a metal plate connector for wood truss construction in accordance with IBC Section 2306.1
- 8.2 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this TER, they are listed here.
- 8.2.1 No known variations
- 8.3 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
- 8.3.1 Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.
- 8.4 Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the building official. DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs RDPs.
- 8.5 Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – “certified once, accepted everywhere.”
- 8.6 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10⁵ are similar) states:

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code...Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

⁵ 2018 IFC Section 104.9

9 CONDITIONS OF USE

- 9.1 This TER establishes allowable metal connector plate design values only. The design values (lateral resistance values, effective tension strength ratios, and effective shear resistance ratios) used in the design of wood trusses using CH20 or CH18 must not exceed those listed in Table 1, Table 2, or Table 3 of this TER.
- 9.2 All lumber used in the fabrication of wood trusses connected with CH20 or CH18 shall be graded in accordance with the applicable building code and shall have a moisture content not in excess of 19%.
- 9.3 CH20 and CH18 must be installed in corresponding pairs on opposite faces of truss member joints.
- 9.4 Trusses assembled using CH plates shall be in accordance with the tolerances provided for in with ANSI/TPI 1, Chapter 3.
- 9.5 Allowable loads shown on Tables 1-3 have not been adjusted for use in preservative treated or fire-retardant treated lumber. Allowable value shall be adjusted in accordance with the treatment manufacturer's product evaluation report. If this information is not in the report, contact the treatment manufacturer for this information.
- 9.6 Where required by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.
- 9.7 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.8 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (e.g., owner or RDP).
- 9.9 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.10 This product has an internal quality control program and a third-party quality assurance program in accordance with IBC Section 104.4 and Section 110.4 and IRC Section R104.4 and Section R109.2.
- 9.11 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent.
- 9.12 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.13 The implementation of this TER for this product is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections required by IBC Section 110.3, and any other code or regulatory requirements that may apply.

10 IDENTIFICATION

- 10.1 The product listed in Section 1.1 is identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at chmachineinc.com.

11 REVIEW SCHEDULE

- 11.1 This TER is subject to periodic review and revision. For the most recent version, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.

Issue Date: February 1, 2022
Subject to Renewal: April 1, 2023

FBC Supplement to TER 2104-03

REPORT HOLDER: CH Machine Inc.

1 EVALUATION SUBJECT

1.1 CH20 and CH18 Truss Plates

2 PURPOSE AND SCOPE

2.1 Purpose

2.1.1 The purpose of this Technical Evaluation Report (TER) supplement is to show CH20 and CH18 Truss Plates, recognized in TER 2104-03, has 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—17, 20: Florida Building Code – Building*

2.2.2 *FBC-R—17, 20: Florida Building Code – Residential*

3 CONCLUSIONS

3.1 CH20 and CH18 Truss Plates, described in TER 2104-03, comply with the *FBC-B* and *FBC-R* and is 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 TER, they are listed here.

3.2.1 *FBC-B* Section 104.4 and Section 110.4 are reserved.

3.2.2 *FBC-R* Section R104 and Section R109 are reserved.

4 CONDITIONS OF USE

4.1 CH20 and CH18 Truss Plates, described in TER 2104-03, must comply with all of the following conditions:

4.1.1 All applicable sections in TER 2104-03

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