ICC-ES Evaluation Report

ESR-2762

Reissued January 2024

Subject to renewal January 2025

This report also contains:

- FBC Supplement

- LABC Supplement

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES **Section: 06 17 53—Shop-Fabricated Wood Trusses**	**REPORT HOLDER: SIMPSON STRONG-TIE COMPANY INC.**	**EVALUATION SUBJECT: SIMPSON STRONG-TIE® METAL CONNECTOR PLATES AND HINGE PLATE CONNECTORS FOR WOOD TRUSSES**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, and 2009 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, and 2009 *International Residential Code®* (IRC)

For evaluation for compliance with codes adopted by the *Los Angeles Department of Building and Safety* (LADBS), see ESR-2762 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

Simpson Strong-Tie® metal connector plates (AS 20, AS 20HS, AS 18, AS 18S, AS 18S6 and AS 18S5) are used as joint connectors for metal-plate-connected wood roof and floor trusses. Simpson Strong-Tie® hinge plate connectors (ASHP) are used as joint connectors for end-to-end sheathed truss chord members in prefabricated wood trusses complying with IBC Section 2303.4 and IRC Sections R502.11 and R802.10.

3.0 DESCRIPTION

3.1 AS 20:

Simpson Strong-Tie AS 20 metal connector plates are staggered-tooth metal plates manufactured from minimum No. 20 gage [0.0356 inch (0.904 mm) total thickness] steel complying with ASTM A653, SS Grade 40 with a minimum G60 galvanization coating [0.0005 inch on each side (0.013 mm)] and having a base-metal thickness of 0.0346 inch (0.879 mm). Each plate has eight teeth per square inch, and each tooth is 0.375 inch (9.5 mm) long. The teeth are punched in pairs and formed at right angles to the face of the parent metal so that two teeth per hole occur along the length. The spacing along the longitudinal direction of each punched slot is 1 inch (25.4 mm) on center, and the pairs are spaced 0.25 inch (6.35 mm) on center along the width of the plate. Alternating rows of teeth are staggered 0.125 inch (3.18 mm) from adjacent rows. See Figure 1.

3.2 AS 20HS:

Simpson Strong-Tie AS 20HS metal connector plates are staggered-tooth metal plates manufactured from minimum No. 20 gage [0.0345 inch (0.876 mm) total thickness] steel complying with ASTM A653, HSLAS Grade 60 with a minimum G60 galvanization coating [0.0005 inch (0.013 mm)] and having a minimum base-metal thickness of 0.0335 inch (0.851 mm). Each plate has six teeth per square inch, and each tooth is 0.375 inch (9.5 mm) long. The teeth are punched in pairs and formed at right angles to the face of the parent metal so that two teeth per hole occur along the length. The spacing along the longitudinal direction of each punched slot is 1 inch (25.4 mm) on center, and the pairs are spaced 0.25 inch (6.35 mm) on center and grouped in sets of three with every fourth row removed along the width of the plate. Alternating rows of teeth are staggered 0.125 inch (3.18 mm) from adjacent rows. See Figure 5.

3.3 AS 18:

Simpson Strong-Tie AS 18 metal connector plates are staggered-tooth metal plates manufactured from minimum No. 18 gage [0.0466 inch (1.184 mm) total thickness] steel complying with ASTM A653, HSLAS Grade 60 with a minimum G60 galvanization coating [0.0005 inch on each side (0.013 mm)] and having a base-metal thickness of 0.0456 inch (1.158 mm). Each plate has eight teeth per square inch, and each tooth is 0.375 inch (9.5 mm) long. The teeth are punched in pairs and formed at right angles to the face of the parent metal so that two teeth per hole occur along the length. The spacing along the longitudinal direction of each punched slot is 1 inch (25.4 mm) on center, and the pairs are spaced 0.25 inch (6.35 mm) on center along the width of the plate. Alternating rows of teeth are staggered 0.125 inch (3.18 mm) from adjacent rows. See Figure 2.

3.4 AS 18S:

Simpson Strong-Tie AS 18S metal connector plates are staggered-tooth metal plates manufactured from minimum No. 18 gage [0.0466 inch (1.184 mm) total thickness] steel complying with ASTM A653 HSLAS Grade 60 with a minimum G90 galvanized coating [0.00076 inch (0.019 mm) on each side] and having a base-metal thickness of 0.0456 inch (1.158 mm). Each tooth is 0.375 inch (9.5 mm) long. The teeth are punched in pairs and formed at right angles to the face of the parent metal so that two teeth per hole occur along the length. The spacing along the longitudinal direction of each punched slot is 1 inch (25.4 mm) on center.

3.4.1 AS 18S6: Each plate has six teeth per square inch. The punched slots are spaced a minimum of 0.25 inch apart and are grouped in sets of three and four as shown in Figure 3.

3.4.2 AS 18S5: Each plate has five teeth per square inch. The punched slots are spaced a minimum of 0.25 inch apart and are grouped in sets of two and three as shown in Figure 4.

3.5 ASHP:

Simpson Strong-Tie ASHP Hinge Plate Connectors are manufactured from minimum No. 18 gage [0.0460 inch (1.168 mm) total thickness] steel complying with ASTM A653, SS Grade 40 with a minimum G90 galvanized coating [0.00076 inch (0.019 mm) on each side] and having a minimum base-metal thickness of 0.0445 inch (1.130 mm). The Hinge Plate Connector consists of two $2^3/_8$" x $5^3/_8$" (60 mm by 137 mm) plates overlapping by approximately $2^3/_8$" (60 mm). Each plate of the connector is comprised of approximately 2.0" x 3.0" (51 mm x 76 mm) area of teeth that are 0.375 inch (9.5 mm) long. The teeth are punched in pairs and formed at right angles to the face of the parent metal so that two teeth per hole occur along the length. The spacing along the longitudinal direction of each punched slot is approximately 1 inch (25.4 mm) on center, and the pairs are spaced 0.25 inch (6.35 mm) on center along the length of the plate. Alternating rows of teeth are staggered 0.125 inch (3.18 mm) from adjacent rows. See Figure 6.

4.0 DESIGN AND INSTALLATION

4.1 General:

The design, manufacture and installation of wood trusses employing the metal connector plates and hinge plate connectors must comply with IBC Section 2303.4 and IRC Section R502.11 or R802.10, as applicable. All truss plates are pressed into the wood for the full depth of their teeth by hydraulic-platen embedment presses, multiple roller presses that use partial embedment followed by full-embedment rollers, or combinations of partial embedment roller presses and hydraulic-platen embedment presses that feed trusses into a stationary finish roller press. Trusses must be assembled within the tolerances provided by the Truss

Plate Institute (TPI) Quality Criteria for the Manufacture of Metal Plate Connected Wood Trusses, shown as Chapter 3 in ANSI/TPI 1, National Design Standard for Metal Plate Connected Wood Truss Construction.

4.2 ASHP Hinge Plate Connectors must be installed in pairs in the 180-degree position on opposite faces of truss chord members, which must be composed of sawn wood lumber with a minimum specific gravity of 0.42. The maximum allowable gap between the ends of the connected wood members at the ASHP hinge plate connector must be 1 inch (25.4 mm).

4.3 Design Values:

4.3.1 AS20, AS 20HS, AS 18, AS 18S, AS 18S6 and AS 18S5: Allowable design values for Simpson Strong-Tie AS 20, AS 20HS, AS 18, AS 18S, AS 18S6 and AS 18S5 metal connector plates to be used in the design of metal-plate-connected wood roof and floor trusses are shown in Tables 1 and 2 of this report. Allowable design values are applicable when the connection is made with identical plates on opposite sides of the joint.

4.3.2 ASHP: Allowable design values for Simpson Strong-Tie metal ASHP Hinge Plate Connectors are shown in Table 3. Imposed forces at the joint and internal stresses within the truss containing the joint must be determined using a structural model with a pin at the hinge joint location. The design load of the ASHP connector, due to combined shear and axial loads, must not exceed the Hankinson formula as follows:

$$F_e \leq P_e$$

where,

F_e = $(F_a^2 + F_v^2)^{0.5}$; Imposed combined shear and axial load, lbf.

P_e = $(P_a \times P_v)/((P_a \times (\sin \Theta)^2 + (P_v \times (\cos \Theta)^2))$; Allowable combined shear and axial load, lbf.

F_a = Imposed axial force, lbf

F_v = Imposed shear force, lbf

P_a = Allowable axial force, lbf (in compression or tension corresponding to axial force)

P_v = Allowable shear load, lbf

Θ = Angle between F_e and the length of the plate

5.0 CONDITIONS OF USE:

The Simpson Strong-Tie metal connector plates and hinge plate connectors for wood trusses described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 This evaluation report and the manufacturer's published installation instructions, when required by the code official, must be submitted at the time of permit application.

5.2 Installation must comply with this report, the manufacturer's published installation instructions, and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.3 Each application for a building permit, where these metal connector plates and hinge plate connectors are to be used, must be accompanied by calculations, details and other documentation showing that the design, manufacture and proposed installation conforms with the requirements of the applicable code. Design and calculations must be prepared and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 This report establishes allowable design values only. For items not covered by this report, such as truss design, fabrication, quality assurance and inspection, refer to ANSI/TPI 1, engineering drawings and the applicable code.

5.5 The applied design values used in the design of trusses using Simpson Strong-Tie metal connector plates, must not exceed the allowable lateral resistance, tension and shear values listed in Tables 1 and 2 of this report. Load combination reductions must be in accordance with the applicable code.

5.6 All lumber used in the fabrication of trusses using Simpson Strong-Tie metal connector plates and hinge plate connectors must be graded in compliance with the applicable building code, and must have a moisture content not exceeding 19 percent at the time of assembly. Wet service factors from ANSI/TPI 1 Section 6.4.6 must be applied to the table values when the lumber moisture content exceeds 19 percent. Allowable values shown in the tables of this report are not applicable to metal connector plates embedded in either fire-retardant-treated lumber or preservative-treated lumber.

5.7 Metal connector plates and hinge plate connectors must be installed in pairs, on opposite faces of truss members.

5.8 Galvanized G60 and G90 metal connector plates and hinge plate connectors subject to corrosive environments must be protected in accordance with ANSI/TPI 1 Section 6.5.

5.9 Design of diaphragms is beyond the scope of this evaluation report.

5.10 Conditions of Use for ASHP Hinge Plate Connectors Only:

5.10.1 The applied design values used in the design of trusses using Simpson Strong-Tie ASHP hinge plate connectors must not exceed the values listed in Table 3 of this report. Load combination must be in accordance with the applicable code. No adjustments for duration of load are permitted.

5.10.2 The final installation of the ASHP hinge plate connectors is limited to the applications of the connector plates installed in pairs to truss chord members, where the plates are oriented in the 180-degree position in the final installation of the trusses. The ASHP hinge plate connector must be installed with a maximum 1-inch gap (25.4 mm) between the truss chord members. Installation in other configurations is beyond the scope of this report.

5.10.3 Use of Hinge Plate Connectors is limited to prefabricated trusses. Field installation is prohibited. Compliance with the IBC Section 2303.4 or the IRC Sections R502.11 and R802.10, as applicable, is required.

5.10.4 Allowable compression design value in Table 3 is valid for applications where lateral translation across the joint is prevented by the installation of a single piece of sheathing continuous across the joint and connected to each chord member at the joint by a nail penetrating through the sheathing and into the chord section at a location no more than 3 inches from the chord end at the hinged joint, or by other special measures specified by the building designer and acceptable to the code official. In all applications, the building designer shall not rely upon the ASHP hinge plate connector for transfer of any loads in the direction perpendicular to the plane of the truss, such as for design of load transfer at joints of unblocked diaphragms.

5.10.5 Materials and general design considerations shall be in accordance with Chapter 6 of ANSI/TPI 1, truss member design procedures shall be in accordance with Chapter 7 of ANSI/TPI 1, and metal connector plate joint design shall be in accordance with Chapter 8 of ANSI/TPI 1.

5.10.6 Due to the rotation provided at the joint of the ASHP hinge plate connectors, the truss design must be modeled with a pin at the hinge joint location. In the final installed condition, shear loads must be applied within the plane of the hinge plate, at a 90-degree angle to the long axis.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the National Design Standard for Metal-plate-connected Wood Truss Construction, ANSI/TPI 1-2002, 2007 and 2014.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Metal Hinge Plate Connectors for Wood Trusses (AC283), dated November 2015 (editorially revised January 2021).

6.3 Quality documentation in accordance with the ICC-ES Acceptance Criteria for Quality Documentation (AC10).

7.0 IDENTIFICATION

7.1 Each Simpson Strong-Tie metal truss connector plate is identified by the product stamp embossed into the surface of the plate as shown in the table below. Additionally, boxes containing the Simpson Strong-Tie metal connector plates are identified with the name of the manufacturer (Simpson Strong-Tie), the product name as shown in the table below and the evaluation report number (ESR-2762).

Model	Product Name[1]	Product Stamp[2]
AS 20	AS(size)	AS≠20
AS 20	AS90(size)	AS≠20G
AS 20HS	AS60(size)HS	AS≠20HS
AS 20HS	AS90(size)HS	AS≠20HSG
AS 18	AS18(size)	AS≠18HS
AS 18	AS9018(size)	AS≠18HSG
AS 18	AS902018(size)	AS≠18HSG
AS 18	AS2018(size)	AS≠18HS
AS 18S5	AS9018(size)S5	AS≠18S
AS 18S5	AS902018(size)S5	AS≠18S
AS 18S6	AS9018(size)S6	AS≠18S
AS 18S6	AS902018(size)S6	AS≠18S
ASHP	n/a	ASHP

Note 1: Some models include a suffix to indicate a packaging type.
Note 2: “G” and “HS” notation designates a G90 coating and high strength steel, respectively.

7.2 The report holder’s contact information is the following:

SIMPSON STRONG-TIE COMPANY INC.
5956 WEST LAS POSITAS BOULEVARD
PLEASANTON, CALIFORNIA 94588
(800) 999-5099
www.strongtie.com

TABLE 1—ALLOWABLE WIDE FACE LATERAL RESISTANCE DESIGN VALUES OF METAL CONNECTOR PLATES[1, 2, 3] (lb/in.²/PLATE)

CONNECTOR PLATE DESIGNATION	LUMBER SPECIES	SG[4]	AA	EA	AE	EE
AS 20 & AS 18	Douglas Fir–Larch	0.50	248	194	168	167
	Douglas Fir–Larch North	0.49	247	190	164	164
	Hem-Fir	0.43	217	167	144	144
	Spruce- Pine-Fir	0.42	211	170	154	136
	Southern Yellow Pine	0.55	246	195	186	185
AS 20HS	Douglas Fir–Larch	0.50	120	121	77	86
	Douglas Fir–Larch North	0.49	119	119	75	84
	Hem-Fir	0.43	105	104	66	74
	Spruce- Pine-Fir	0.42	102	102	64	72
	Southern Yellow Pine	0.55	120	122	81	87
AS 18S6	Douglas Fir–Larch	0.50	158	145	-	-
	Douglas Fir–Larch North	0.49	158	145	-	-
	Hem-Fir	0.43	148	135	-	-
	Spruce- Pine-Fir	0.42	145	132	-	-
	Southern Yellow Pine	0.55	158	145	-	-
AS 18S5	Douglas Fir–Larch	0.50	165	154	-	-
	Douglas Fir–Larch North	0.49	165	154	-	-
	Hem-Fir	0.43	149	144	-	-
	Spruce- Pine-Fir	0.42	145	141	-	-
	Southern Yellow Pine	0.55	165	154	-	-

For **SI:** 1lb/in.² = 6.9 kPa.

[1]Tooth holding units = psi for a single plate (double for plates on both faces when applying to area on only one face). To achieve values, plates of equal size must be installed on opposite sides of the joint with the teeth oriented in the same direction.
[2]AA = Plate parallel to load, wood grain parallel to load.
EA = Plate perpendicular to load, wood grain parallel to load.
AE = Plate parallel to load, wood grain perpendicular to load.
EE = Plate perpendicular to load, wood grain perpendicular to load.
[3]All truss plates are pressed into the wood for the full depth of their teeth by hydraulic-platen embedment presses, multiple roller presses that use partial embedment followed by full-embedment rollers, or combinations of partial embedment roller presses and hydraulic-platen presses that feed trusses into a stationary finish roller press.
[4]Specific gravity.

TABLE 2—ALLOWABLE TENSION AND SHEAR DESIGN VALUES OF METAL CONNECTOR PLATES[1]

PROPERTY FORCE DIRECTION	CONNECTOR PLATE									
	AS 20		AS 20HS		AS 18		AS 18S6		AS 18S5	
	Efficiency	Pounds/ inch/Pair of Connector Plates	Efficiency	Pounds/ inch/Pair of Connector Plates	Efficiency	Pounds/ inch/Pair of Connector Plates	Efficiency	Pounds/ inch/Pair of Connector Plates	Efficiency	Pounds/ inch/Pair of Connector Plates
Tension Values in Accordance with Section 5.4.4.2 of TPI 1 (Minimum Net Section over the Joint)										
Tension @ 0º	0.51	901	0.60	1484	0.50	1728	0.61	2108	0.65	2246
Tension @ 90º	0.51	901	0.42	1026	0.50	1728	0.50	1728	0.50	1728
Shear Values										
Shear at 0º	0.57	671	0.44	654	0.58	1336	0.58	1336	0.58	1336
Shear at 30º	0.72	848	0.64	949	0.66	1521	0.66	1521	0.66	1521
Shear at 60º	0.82	966	0.72	1064	0.75	1728	0.75	1728	0.75	1728
Shear at 90º	0.46	542	0.37	546	0.50	1152	0.50	1152	0.50	1152
Shear at 120º	0.50	589	0.38	559	0.46	1060	0.46	1060	0.46	1060
Shear at 150º	0.57	671	0.31	455	0.52	1198	0.52	1198	0.52	1198

For **SI:** 1 lbf/inch = 0.175 n/mm, 1 inch = 25.4 mm.

[1]Minimum coated thickness for 20 gage is 0.0356 inch (0.904 mm) and for 18 gage is 0.0466 inch (1.184 mm). Minimum coating thickness for G60 is 0.0010 inch (0.025 mm), total, for both sides in accordance with Section 6.3.4.1.3 of ANSI/TPI 1 2007 and 2014.

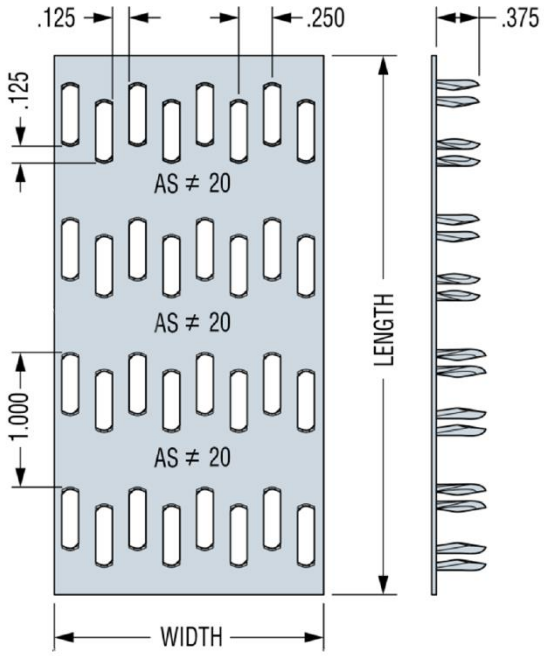

FIGURE 1—AS 20 CONNECTOR PLATE (DIMENSION IN INCHES)

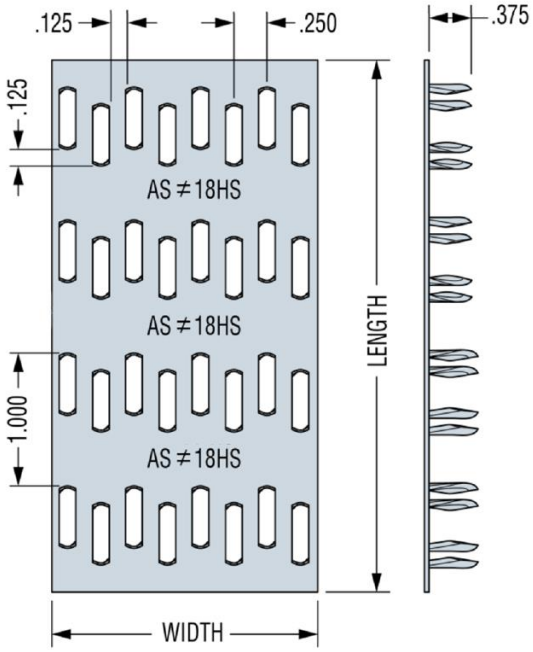

FIGURE 2—AS 18 CONNECTOR PLATE (DIMENSION IN INCHES)

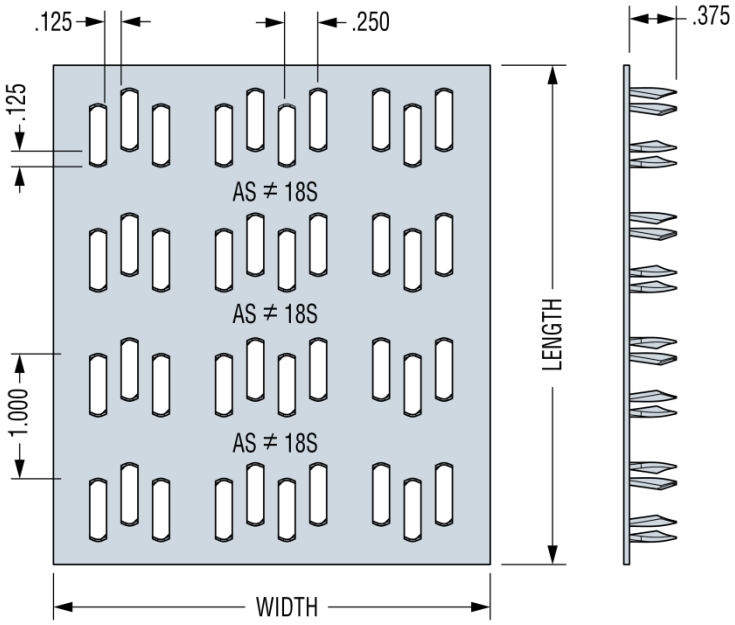

FIGURE 3—AS 18S6 CONNECTOR PLATE (DIMENSION IN INCHES)

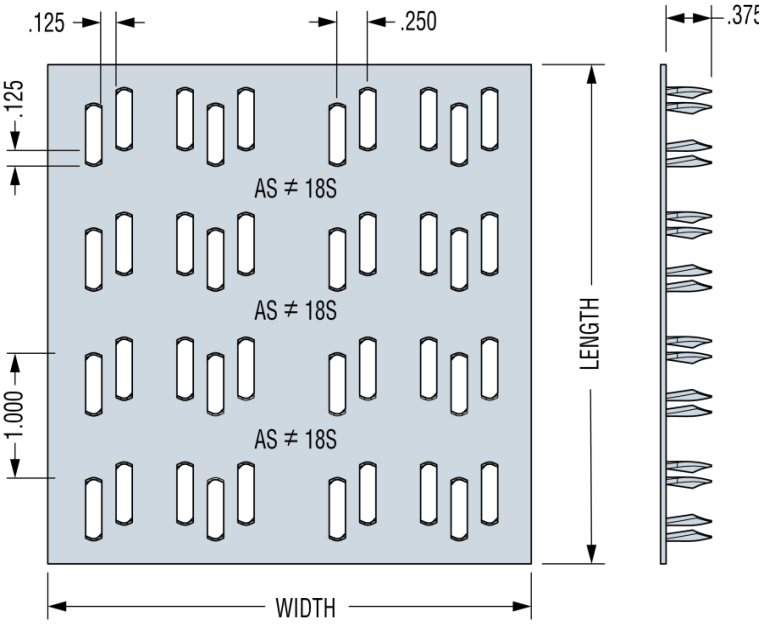

FIGURE 4—AS 18S5 CONNECTOR PLATE (DIMENSION IN INCHES)

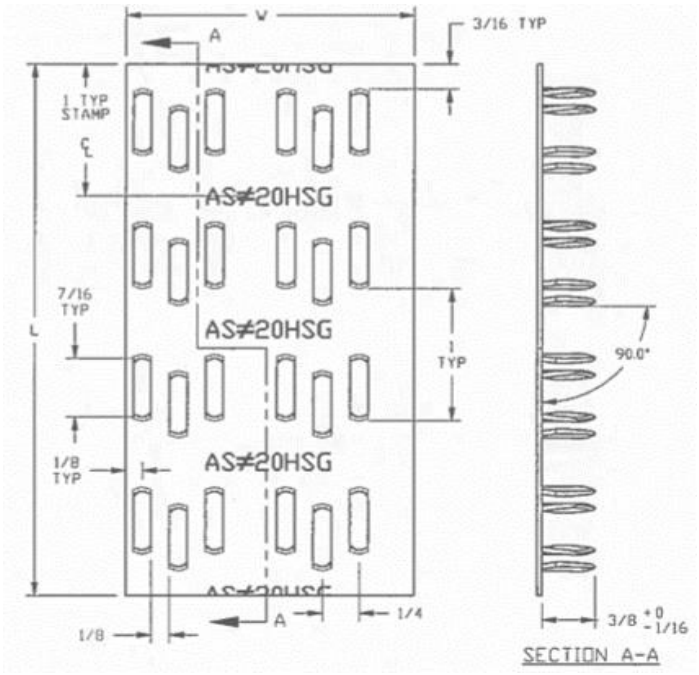

FIGURE 5—AS 20HS CONNECTOR PLATE (DIMENSION IN INCHES)

TABLE 3—HINGE PLATE CONNECTOR ALLOWABLE LOADS

PROPERTY	ALLOWABLE DESIGN VALUE (lbf)[1,2]
Shear (P_V)	683
Tension (P_T)	1083
Compression (P_C)	1083

For **SI:** 1 lbf/inch = 0.175 n/mm, 1 inch = 25.4 mm.

[1]Allowable design values are for metal hinge plates installed in pairs.
[2]Design values were determined using SPF lumber.

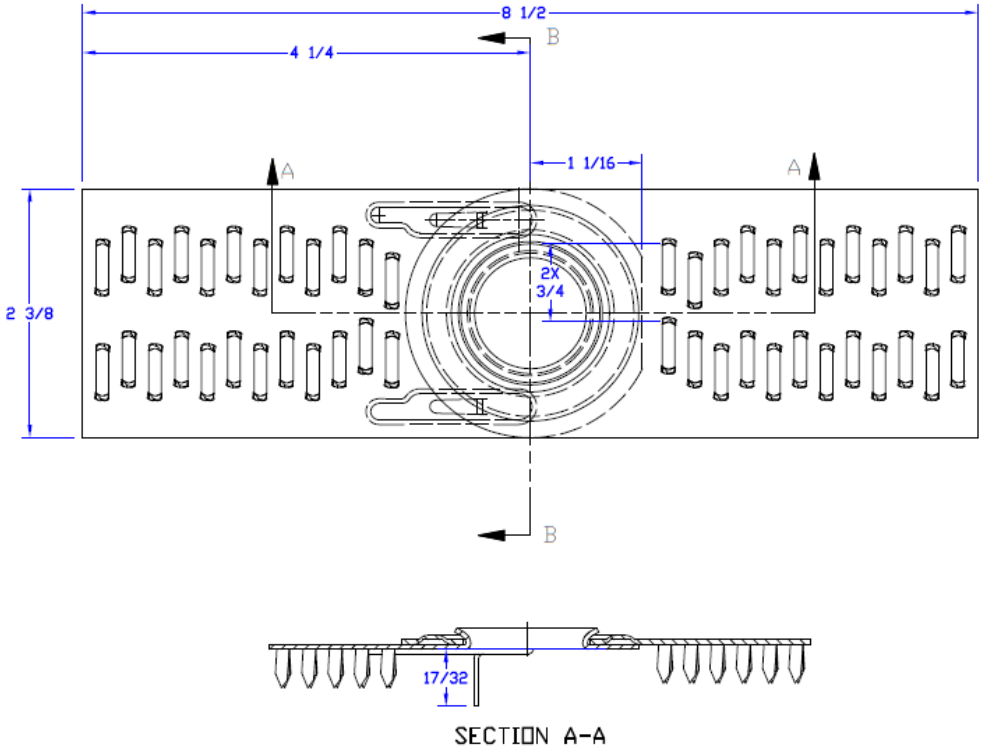

FIGURE 6—ASHP HINGE PLATE CONNECTOR (DIMENSION IN INCHES)

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 53—Shop-Fabricated Wood Trusses

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY INC.

EVALUATION SUBJECT:

SIMPSON STRONG-TIE® METAL CONNECTOR PLATES AND HINGE PLATE CONNECTORS FOR WOOD TRUSSES

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Simpson Strong-Tie® metal connector plates and hinge plate connectors for wood trusses, described in ICC-ES evaluation report ESR-2762, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Simpson Strong-Tie® metal connector plates and hinge plate connectors for wood trusses, described in Sections 2.0 through 7.0 of the evaluation report ESR-2762, comply with LABC Chapter 23, and LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Simpson Strong-Tie® metal connector plates and hinge plate connectors for wood trusses described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-2762.
- The design, installation, conditions of use and identification are in accordance with the 2021 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-2762.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, and LARC Section R802, as applicable.
- The design, manufacture, and installation of trusses employing the truss metal connector plates and hinge plate connectors must comply with applicable LABC and ANSI/TPI 1 provisions, such as TPI 1 Chapter 8 provisions for heel joints and provisions for loads applied at an angle with respect to lumber grain.
- Teeth of metal connector plates and hinge plate connectors within $^1/_2$-inch of the ends of truss wood members must be considered ineffective to carry any load.
- Under the LARC, an engineered design in accordance with the LARC section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report ESR-2762, reissued January 2024.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 53—Shop-Fabricated Wood Trusses

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY INC.

EVALUATION SUBJECT:

SIMPSON STRONG-TIE® METAL CONNECTOR PLATES AND HINGE PLATE CONNECTORS FOR WOOD TRUSSES

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Simpson Strong-Tie® Metal Connector Plates and Hinge Plate Connectors for Wood Trusses, described in ICC-ES evaluation report ESR-2762, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Simpson Strong-Tie® Metal Connector Plates and Hinge Plate Connectors for Wood Trusses, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-2762, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential.* The design must be in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2762 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or *Florida Building Code—Residential,* as applicable.

Use of the Simpson Strong-Tie® Metal Connector Plates and Hinge Plate Connectors for Wood Trusses has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* with the following condition:

- For connections subject to uplift, the connection must be designed for no less than 700 pounds (3114 N).

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report ESR-2762, reissued January 2024.