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RESEARCH REPORT: RR 25828
(CSI# 06 05 23)

BASED UPON IAPMO EVALUATION
SERVICE REPORT NO. 0143

REEVALUATION DUE

Date: November 1, 2012

Issued Date: October 1, 2011

Code: 2011 LABC

GENERAL APPROVAL - Technical Modification- Simpson Strong-Tie – Bolt Style Hold Down Connectors – HD2A, HD5, HD7, HD9, HD12, HD19, HD3B, HD5B, HD7B, and HD9B.

DETAILS

The above assemblies and/or products are approved when in compliance with the description, use, identification and findings of IAPMO ES Report Number 0143, issued June 2009, revised August 31, 2011, of the IAPMO Evaluation Services. The report, in its entirety, is attached and made part of this general approval subject to the following conditions:

The parts of Evaluation Report No. 0143 marked with an asterisk have been deleted or revised by the Los Angeles City Building Department from this approval.

The approval is subject to the following conditions:

1. Hold-down Devices Used as Anchorage of Structural Walls: The values shown in Tables A and B of this report may be used in repair, retrofit and new construction of concrete tilt-up and masonry wall anchorage (in tension) for the connection with horizontal wood diaphragm.
2. Hold-down Devices Used in Light-Frame Shear Walls Sheathed with Wood Structural Panels: For hold-down devices used in shear walls, a 25% reduction of the allowable loads specified in Table 1 of the IAPMO ES evaluation report shall be taken in accordance with 2305.5 of the 2011 City of Los Angeles Building Code.

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Simpson Strong-Tie

Re: Simpson Strong-Tie - Bolt Style Hold Down Connectors – HD2A, HD5, HD7, HD9, HD12, HD19, HD3B, HD5B, HD7B, and HD9B.

3. HDB, HD and HDA hold-down anchors are approved to anchor vertical wood members to foundations or to other vertical wood members.
4. The tabulated allowable loads shall not be increased for duration of loading.
5. Calculations demonstrating that the applied loads are less than the allowable loads described in this report shall be submitted to the plan check Engineer at the time of permit application. The calculations shall be prepared by a Civil or Structural Engineer registered in the State of California
6. Fasteners and connected wood members must be in compliance, respectively, with Sections 3.2.2 and 3.2.3 of Report Number 0143
7. Bolt capacity shall be verified where the wood species is other than Douglas Fir Larch (specific gravity of 0.50).
8. Use of connectors with fire-retardant-treated or preservative- lumber must be in accordance with Section 3.2.3.3 of Report Number 0143. Use of fasteners with fire-retardant-treated or preservative- lumber must be in accordance with Section 3.2.3 of Report Number 0143 Fasteners for pressure-preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel.
9. Special inspection for seismic resistance shall be conducted in accordance with the Section 1707.3 of the 2011 Los Angeles City Building Code.
10. Special inspection for anchor bolts in concrete or masonry shall be conducted in accordance with Sections 1704.4 and 1704.5 of the 2011 Los Angeles City Building Code.

DISCUSSION

The technical modification is to add HDB series hold-downs to the approval and update allowable load values of the HD2A series hold-down devices used in light-frame shear walls.

The report is in compliance with the 2011 Los Angeles City Building Code.

The approval is based on tests in accordance with ICC ES Acceptance Criteria for Hold-downs (Tie-downs) Attached to Wood Members (AC 155) effective July 1, 2010.

This general approval will remain effective provided the Evaluation Report is maintained valid and unrevised with the issuing organization. Any revision to the report must be submitted to this Department for review with appropriate fee to continue the approval of the revised report.

Simpson Strong-Tie

Re: Simpson Strong-Tie - Bolt Style Hold Down Connectors – HD2A, HD5, HD7, HD9, HD12, HD19, HD3B, HD5B, HD7B, and HD9B.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this Approval have been met in the project in which it is to be used.

WILLIAM STUTSMAN, Chief
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Attachment: IAPMO ES Report Number 0143 (11 Pages)

Simpson Strong-Tie

Re: Simpson Strong-Tie - Bolt Style Hold Down Connectors – HD2A, HD5, HD7, HD9, HD12, HD19, HD3B, HD5B, HD7B, and HD9B.

Table A: Allowable Loads of HD Series Hold-downs Used as Wall Anchorage Connections in Horizontal Diaphragm-to-Wall Assemblies in the City of Los Angeles per 2011 LABC Chapters 16, 91 & 96

Hold-down Model No.	Fasteners			Minimum Wood Member Thickness (in.) ⁶	Allowable Tension Loads for Designs per Chapter 16		Allowable Tension Loads for Designs per Chapter 91 & 96	
	Anchor Bolt Dia (in.)	Wood MBR Bolts			Load (lbs)	Governing Load Case	Load (lbs)	Governing Load Case
		QTY	Dia (in.)					
HD2A	5/8	2	5/8	1.5	1,655	b	1,040	b
				2.5	1,870	b	1,045	b
				3	1,640	b	920	b
				3.5	1,895	b	1,265	b
HD5	3/4	2	3/4	1.5	1,905	b	1,385	b
				2.5	3,145	b	1,575	b
				3	2,260	b	1,330	b
				3.5	3,980	b	2,475	b
HD7	1-1/8	3	7/8	4.5	3,720	b	2,125	b
				3	4,660	a	2,705	b
				3.5	4,660	a	3,915	a
				4.5	4,660	a	3,915	a
HD9	1-1/8	3	1	6x4	4,660	a	3,915	a
				3	5,815	b	3,070	b
				3.5	8,220	b	3,865	b
				4.5	8,390	a	4,835	b
HD12	1-1/8	4	1	5.5	8,390	a	7,050	a
				3.5	7,225	b	3,555	b
				4.5	9,180	b	5,545	b
				5.5	8,610	b	4,130	b
HD19 ⁽⁵⁾	1-1/8	5	1	7.25	6,550	b	3,175	b
				5.5 ⁽⁷⁾	10,680	a	5,135	b
	1-1/4	5	1	7.25	8,595	b	4,315	b
				5.5 ⁽⁷⁾	7,405	b	3,785	b
				7.25	11,135	b	4,865	b
				5.5 ⁽⁷⁾	16,270	a	9,925	b

- For hold-down dimensions, refer to Table 1 of IAPMO ES ER 0143
- The wood member must be sized for the load carrying capacity.
- Loads shall not be increased for short-term duration.
- Anchor bolt type, length, and embedment to specified by designer
- HD19 requires a standard cut washer, conforming to Section 4.1.1 of IAPMO ES report, to be installed between the anchor bolt nut and the seat of the hold-down when a 1 1/8" diameter anchor bolt is used.
- Wood structural member(s) shall have a minimum width of 3 1/2 and be a minimum Grade No. 2 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading, unless otherwise noted
- Wood structural member(s) shall have a minimum width of 5 1/2 and be a minimum Grade No. 2 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading, unless otherwise noted
- Wood structural member(s) shall have a minimum width of 5 1/2 and be a minimum Grade No. 1 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading, unless otherwise noted

Legend of Governing Criteria

a = avg ultimate load value on steel jig / (3 x 1.4) [for Chapter 16] or avg ultimate load value on steel jig / (5) [for Chapters 91 & 96]
 b = avg deflection on wood assembly at 3/8" / 3 [for Chapter 16] or avg deflection on wood assembly at 3/8" / 5 [for Chapters 91 & 96]
 c = the fastener value in accordance with 2011 LABC

Simpson Strong-Tie

Re: Simpson Strong-Tie - Bolt Style Hold Down Connectors – HD2A, HD5, HD7, HD9, HD12, HD19, HD3B, HD5B, HD7B, and HD9B.

Table B: Allowable Loads of HDB Series Hold-downs Used as Wall Anchorage Connections in Horizontal Diaphragm-to-Wall Assemblies in the City of Los Angeles per 2011 LABC Chapters 16, 91 & 96

Hold-down Model No.	Fasteners			Minimum Wood Member Thickness (in.) ⁵	Allowable Tension Loads for Designs per Chapter 16		Allowable Tension Loads for Designs per Chapter 91 & 96	
	Anchor Bolt Dia (in.)	Wood MBR Bolts			Load (lbs)	Governing Load Case	Load (lbs)	Governing Load Case
		QTY	Dia (in.)					
HD3B	5/8	2	5/8	1.5	1,420	b	750	b
				2.5	1,955	b	1,250	b
				3	2,815	a	1,960	c
HD5B	5/8	2	3/4	2.5	3,660	b	2,135	b
				3	3,660	b	2,135	b
				3.5	3,980	b	2,245	b
HD7B	7/8	3	3/4	3	5,620	a	2,955	b
				3.5	5,620	a	2,955	b
				3.5	6,045	b	3,680	b
HD9B	7/8	3	7/8	4.5	5,505	b	2,225	b
				7.25	5,505	b	2,225	b

1. For hold-down dimensions, refer to Table 2 of IAPMO ES ER 0143
2. The wood member must be sized for the load carrying capacity.
3. Loads shall not be increased for short-term duration.
4. Anchor bolt type, length, and embedment to be specified by designer
5. Wood structural member(s) shall have a minimum width of $3\frac{1}{2}$ " and be a minimum of No. 2 with specific gravity of 0.50.

Legend of Governing Criteria

- a = lowest ultimate load value on steel jig / (3 x 1.4) [for Chapter 16] or lowest ultimate load value on steel jig / (5) [for Chapters 91 & 96]
 b = avg deflection on wood assembly at 3/8" / 3 [for Chapter 16] or avg deflection on wood assembly at 3/8" / 5 [for Chapters 91 & 96]
 c = the fastener value in accordance with 2011 LABC



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DIVISION: 06—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY, INC.
5956 WEST LAS POSITAS BOULEVARD
PLEASANTON, CALIFORNIA 94588
(800) 925-5099
www.strongtie.com

EVALUATION SUBJECT:

SIMPSON STRONG-TIE BOLT HOLD-DOWNS

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes

- 2009 International Building Code® (IBC)
- 2009 International Residential Code® (IRC)
- 2006 International Building Code® (IBC)
- * • ~~2006 International Residential Code® (IRC)~~

1.2 Evaluated in accordance with

- ICC-ES AC155, effective July 2010

1.3 Property evaluated

- Structural

2.0 USES

Simpson Strong-Tie bolt hold-down connectors are used as wood framing anchorage, such as to connect wood posts to concrete foundations or to connect an upper-story wood post to a lower-story supporting wood post, in accordance with the 2009 IBC Sections 2304.9.3, 2305.1, 2308.9.3.1, 2308.9.3.2, AF&PA SDPWS-2008 (Special Design Provisions for Wind and Seismic) Sections 4.3.6.4.2 and 4.3.6.1.2 (the 2006 IBC Sections 2304.9.3, 2305.1, 2305.3.2, 2305.3.7, 2305.3.8.2.4, and 2308.9.3.1). As required by IBC Section 1604.8.1 and 1604.8.2, the hold-down connectors are used as anchorage of concrete and masonry walls to structural wood elements to provide lateral support for the walls.

When regulated under the IRC, the hold-down connectors may also be used when their tabulated load exceeds that required by the IRC or when an engineered design is submitted in accordance with Section R301.1.3 of the IRC, or in alternate braced wall panels per 2009 IRC Sections R502.2.2.3, R602.10.1.4.1(2), R602.10.3.2, R602.10.3.3, R602.10.4.4, and R602.10.5.3 ~~and in the 2006 IRC~~ *
~~Sections R602.10.6.1 or R602.10.6.2~~ . In addition, the hold-down connectors may be used as anchorage of concrete and masonry walls to structural wood elements to provide lateral support for the walls in accordance with Section R606.12.2.3, R611.9.1 of the 2009 IRC ~~or R606.12.2.2, R611.8.2.1 of the 2006~~ *
~~IRC~~.

3.0 DESCRIPTION

3.1 Product Information

3.1.1 HDA Bolt Hold-down: The HDA bolt hold-down consist of a steel strap with bolt holes used to connect the hold-down to the wood member. The lowest bolt in the wood member is seven-bolt diameters from the end of the wood member, designed to obtain full load value, if the hold-down is placed flush onto the sill plate. The HDA has a load transfer plate, installed in the seat element. This eliminates the need for an anchor bolt washer. It is die-formed from No. 12 gage galvanized steel and the base plate component is manufactured from No. 7 gage galvanized steel. See Figure 1, Table 1, and Table 3 for product dimensions, required fasteners and allowable loads.

3.1.2 HD Bolt Hold-downs: The HD bolt hold-downs consist of a main structural steel component with pre-punched holes along their side for installation of bolts used to connect the hold-down to the wood member. They have a factory welded load transfer plate at the base with a pre-punched hole for an anchor rod or bolt. The HD5 and HD7 are required to be installed raised off the sill plate to ensure the lowest bolt in the wood member is seven bolt diameters from the end of the wood member to obtain full load value. Whereas, the HD9, HD12, and HD19 hold-downs have a tapered leg that extends below the base and that positions the first bolt in the wood member seven bolt diameters from the end of the wood member. The HD5 body is die-formed from No. 7 gage steel.



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The HD7, HD9, HD12 and HD19 bodies are formed from No. 3 gage steel. The base plate component is manufactured from No. 3 gage steel for the HD5, ⁵/₁₆ inch thick for the HD7 and ³/₈ inch thick for the HD9, HD12, and HD19. See Figure 1, Table 1, and Table 3 for product dimensions, required fasteners and allowable loads.

3.1.3 HDB Bolt Hold-downs: HD3B hold-down is single-piece formed hold-down consisting of a steel strap with a four-ply formed seat element for an anchor bolt. The straight-strap portion has a pre-punched bolt holes for installation of bolts used to connect the hold-down to wood member. The HD3B is die-formed from No. 12 gage galvanized steel. HD5B, HD7B and HD9B bolt hold-downs consist of a main structural steel component with pre-punched holes for installation of bolt fastener used to connect the hold-down to the wood member. The steel crossbars and a washer plate at the base with a pre-punched hole for an anchor rod or bolt. HD5B and HD7B bodies are formed from No. 10 gage galvanized steel. The crossbars are steel bar stock 3/8-inch –thick-by ³/₄-inch deep, and the washers are formed from 3/16-inch-thick steel plate. Whereas HD9B body is formed from No. 7 gage galvanized steel and its crossbars are 3/8-inch –thick-by 1-inch deep. The washer for HD9B is formed using 3/8-inch-thick steel plate. Reference Figure 2, Table 2 and Table 3 for product dimensions, required fasteners and allowable loads.

3.2 Materials

3.2.1 Steel: The HDA and HDB hold-downs described in this report are manufactured from ASTM A 653, SS, Grade 33 galvanized steel having a minimum yield strength, F_y , of 33,000 psi (227 MPa) and a minimum ultimate tensile strength, F_u , of 45,000 psi (310 MPa). The HD hold-downs body and HD5, HD5B, and HD7B base plate are fabricated from ASTM A 1011, SS, Grade 33 steel having a minimum yield strength of 33,000 psi (227 MPa) and a minimum ultimate strength of 52,000 psi (359 MPa). The HD7, HD9, HD12, HD19, and HD9B base plates are manufactured from ASTM A 36 steel having a minimum yield strength of 36,000 psi (248 MPa) and a minimum ultimate strength of 58,000 psi (400 MPa). Base metal thicknesses for the bolt hold-downs in this report are as follows:

GAGE	BASE METAL THICKNESS (in.)
3/8 inch	0.3600
5/16 inch	0.2975
No. 3	0.2285
3/16 inch	0.1775
No. 7 (A 653)	0.1715
No. 7 (A 1011)	0.1705
No. 10	0.1275
No. 12	0.0975

For SI: 1 inch = 25.4 mm

The HDA hold-downs have a minimum G90 zinc coating specification per ASTM A 653. Some models may also be available with either a G185 zinc coating (indicated by model numbers ending in the letter Z) or with a batch hot-dipped galvanized coating with a minimum specified coating weight of 2.0 ounces of zinc per square foot of surface area (600 g/m²), total for both sides in accordance with ASTM A 123 (indicated by model numbers ending with the letters HDG). Model numbers do not list the Z or HDG ending in this report, but the information shown is applicable. The HD series bolt hold-downs have a painted finish.

The holder of this report (Simpson Strong-Tie Company) or the lumber treater should be notified for recommendations on minimum corrosion resistance of steel connectors in contact with the specific proprietary preservative treated or fire retardant treated lumber.

3.2.2 Wood: When the hold-down are used, the wood members must be either sawn lumber or engineered lumber having a minimum specific gravity of 0.50 (minimum equivalent specific gravity of 0.50 for engineered lumber), and having a maximum moisture content of 19 percent (16 percent for engineered lumber). The minimum wood member thickness (depth) is specified in Table 1 and Table 2.

3.2.3 Fasteners

3.2.3.1 Bolts: Machine bolts must comply with ANSI/ASME Standard B18.2.1 and with ASTM A 307. The minimum bending yield strength, (F_{yb}), of the bolt must be 45,000 psi (310 MPa).

3.2.3.2 Threaded Anchor Rods: As a minimum,

threaded steel anchor rods must comply with ASTM A36 or ASTM F1554, Grade 36.

3.2.3.3 Preservative-treated and fire-retardant-treated wood:

Fasteners used in contact with preservative-treated or fire-retardant-treated lumber must comply with IBC Section 2304.9.5 or 2009 IRC Section R317.3 (~~2006 IRC Section R319.3~~), as applicable. The report holder or lumber treater should be notified for recommendations on minimum corrosion resistance and connection capacities of fasteners used with the specific proprietary preservative-treated or fire-retardant treated lumber.

4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 Hold-Down Assembly: As shown in Table 1 and Table 2 of this report, the allowable loads are for hold-down assemblies consisting of the following components: (1) hold-down device; (2) an anchor bolt/rod attached to the seat of the device; (3) a wood member, having minimum specified dimensions and properties; (4) quantity and size of fasteners used to attach the hold-down device to the wood member; and, in one case as noted, (5) a standard cut washer (Type A plain steel washer (W)) with dimensions conforming to ASME B18.22.1. As shown in the product tables of this report, the allowable loads are based on allowable stress design (ASD). It includes the load duration factor, C_D , corresponding with the applicable loads in accordance with the National Design Specification (NDS) for Wood Construction.

Story drifts of the structure must be determined in accordance with Section 12.8.6 of ASCE 7-05 where design load combinations include earthquake loads or effects. The deflection of a shear wall restrained from overturning by hold-downs installed in conformity with this report may be calculated using Equation 23-2 shown in 2009 IBC Section 2305.3 (2006 IBC Section 2305.3.2), or Equation 4.3-1 shown in Section 4.3.2 of ANSI/AF&PA SDPWS (2009 IBC SDPWS-2008 and 2006 IBC SDPWS-2005). The total deflection values, Δ_{all} and Δ_s , at ASD-level and strength-level forces, respectively, for hold-down assemblies shown in Tables 1 and Table 2 of this report, include all sources of hold-down device rotation and extension, and anchor rod elongation where the length of the anchor rod is a maximum of 6

inches (152 mm) for the HDA and HDB hold-down and a maximum of 8 inches (203 mm) for the HD series hold-downs. The addition of the hold-down anchor rod elongation to the total elongation (deflection) of the hold-down assembly needs to be evaluated when the actual diameter, length or ASTM steel specification of the anchor rod differs from that shown in this report. When hold-downs are used in series, the cumulative deformation of all hold-downs within that series should be accounted for.

The symbol Δ_s as used in this report refers to the symbol d_a in section 2305.3.2 and 2305.3 of the IBC and to the symbol Δ_a in Section 4.3.2 of ANSI/AF&PA SDPWS-2005 and SDPWS-2008.

Tabulated allowable loads are for hold-downs connected to wood used under constantly dry interior conditions, and where sustained temperatures are 100°F (37.8°C) or less.

The allowable loads shown in Table 1 and Table 2 of this report must be adjusted by the wet service factor, C_m , specified in the NDS, when hold-down are fastened to wood having a moisture content greater than 19 percent (16 percent for engineered lumber), or where wet service is anticipated.

The allowable loads shown in Table 1 and Table 2 in this report must be adjusted by the temperature factor, C_t , specified in the NDS when hold-down are fastened to wood that will experience sustained exposure to temperatures, exceeding 100°F (37.8°C),

The design of wood members fastened to bolt hold-down devices must consider combined stresses due to axial tension and flexural bending induced by eccentricity in the connection. Stresses shall be evaluated at the critical net section.

4.1.2 Hold-Down Devices Used as Anchorage of Structural Walls:

Allowable steel strengths are detailed in Table 3 for the HDA, HDB and HD hold-down devices. The values are for the steel anchorage device independent of the bolts used to attach the hold-down to the wood member and anchor rod. The values are used when designing structural wall anchorage in accordance with Section 12.10 and 12.11.2 of ASCE 7-05. The hold-down assembly strengths in Table 1 and Table 2 are to be used for wall anchorage in accordance with 2009 IRC



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Sections R606.12.2.3, R611.9.1 of 2006 IRC
* ~~Sections R606.12.2.2 and R611.8.2.1.~~

4.1.3 Anchorage to Concrete or Masonry: A registered design professional, in accordance with Chapters 19 or 21 of the IBC must determine the adequate embedment length and anchorage details, including edge and end distances as applicable, for design of anchorage to concrete and masonry structural members.

In accordance with Section 1912 of the IBC, where design load combinations include earthquake loads or effects, the design strength of anchorage to concrete must be determined, except for detached one-and two-family dwellings assigned to Seismic Design Category A, B or C, or located where the mapped short-period spectral response acceleration, S_s , is less than 0.4g.

4.2 Installation: Installation of the Simpson Strong-Tie hold-down connectors must be in accordance with the manufacturer's published installation instructions and this evaluation report. Where a conflict exists between this report and the manufacturers published installation instructions, this report shall prevail.

4.3 Special Inspection:

4.3.1: A statement of special inspection shall be prepared by the registered design professional in responsible charge, and submitted to the code official for approval when required by Section 1705 of the 2009 IBC. A quality assurance plan shall be submitted to the code official for approval when required by Sections 1705 or 1706 of the 2006 IBC.

4.3.2: Periodic special inspection shall be conducted when the HDA, HDB, HD series hold-downs are components within the main wind-force-resisting system of structures constructed in areas listed in IBC Section 1706.1 (Section 1705.4 for the 2006 IBC). Special inspection requirements do not apply to structures, or portions thereof, that qualify for exception under IBC Section 1704.1, 1704.4, 1706.2 or 1706.3 (Section 1704.1 and 1704.4 for the 2006 IBC).

4.3.3: Periodic special inspection shall be conducted in accordance with the applicable sections of Section

1707 when the HDA, HDB, HD series hold-downs are components within the seismic-force-resisting system of structures constructed in Seismic Design Category C, D, E or F. Special inspection requirements do not apply to structures, or portions thereof, that qualify for exception under IBC Section 1704.1, 1704.4, 1705.3, 1707.3 or 1707.4.

4.3.4: For installations under the IRC, special inspection is not normally required. However, for an engineered design where calculations are required to be signed by a registered design professional, periodic special inspection requirements and exemptions are as stated in Sections 4.3.1 and 4.3.2 as applicable for installations under the IRC.

5.0 CONDITIONS OF USE

The Simpson Strong-Tie bolt hold-down connectors detailed in this report comply with, or are acceptable alternatives to what is specified in those codes listed in Section 1.0 of this report subject to the following conditions:

5.1 The hold-downs must be manufactured, identified and installed in concurrence with the manufacturer's published installation instructions and this report. During installation, a copy of the instructions must be available at the jobsite at all times.

5.2 Calculations must be submitted to the code official showing compliance with this report. A registered design professional must prepare the calculations where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Adjustment factors must be considered, where applicable, as noted in Section 4.1 and the applicable codes.

5.4 Connected wood members and fasteners must comply, respectively, with Sections 3.2.2 and 3.2.3 of this report.

5.5 Use of hold-down connectors with fire-retardant-treated or preservative-treated lumber must be in accordance with Section 3.2.1 of this report. Use of fasteners with fire-retardant-treated or preservative-treated lumber must be in accordance with Section 3.2.3.3 of this report.



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5.6 Anchorage to masonry structural members or concrete must be designed in accordance with Section 4.1.3 of this report.

5.7 Wood member design is the responsibility of the registered design professional.

6.0 EVIDENCE SUBMITTED

Data in accordance with ICC-ES Acceptance Criteria for Hold-Downs (Tie-Downs) Attached to Wood Members (AC155) effective July 1, 2010, inclusive of tests and calculations. Test results are from laboratories in compliance with ISO/IEC 17025.

7.0 IDENTIFICATION

The products described in this report are identified with a die-stamped label indicating the name of the manufacturer (Simpson Strong-Tie), the model number, and the number of the index evaluation report (ER-102) which identifies products recognized in this report.



IAPMO #0143

Director of Evaluation Services

EVALUATION REPORT



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TABLE 1 — ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDA AND HD BOLT HOLD-DOWN ASSEMBLIES^{1,2,3,4}

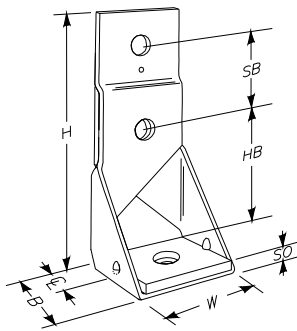
MODEL NO.	DIMENSIONS (in.)							FASTENERS			MINIMUM WOOD MEMBER THK ¹¹ (in.)	ALLOWABLE TENSION LOADS ⁵ , P _{all} (lbs) C _D =1.6	DISPLACEMENT ^{6,7} Δ, (in.)	
	HB ¹⁰	SB	W	H	B	SO	CL	ANCHOR BOLT DIA. (in.)	WOOD MBR BOLTS ⁹				Δ _{all}	Δ _s
									QTY.	DIA. (in.)				
HD2A	4 ⁹ / ₁₆	2½	2¼	8	2 ⁹ / ₁₆	¾	1 ⁷ / ₁₆	⅝	2	⅝	1½	1,900	0.142	0.195
											2½	2455	0.146	0.207
											3	2455	0.158	0.223
											3½	2475	0.151	0.219
HD5	5¼	3	2⅝	6¾	3½	3¼	2⅝	¾	2	¾	1½	2,405	0.153	0.198
											2½	3,835	0.153	0.197
											3	4,055	0.178	0.250
											3½	4,875	0.157	0.250
											4½	5,010	0.159	0.234
HD7	6⅝	3½	3½	11¼	3¾	2⅝	2⅝	1⅞	3	⅞	3	6,600	0.151	0.200
											3½	6,600	0.098	0.149
											4½	6,600	0.103	0.144
											5½	6,600	0.112	0.157
HD9	7	4	3½	16½	4 ⁷ / ₁₆	3¾	2⅝	1⅞	3	1	3	8,810	0.159	0.192
											3½	10,330	0.143	0.179
											4½	12,185	0.154	0.215
											5½	12,185	0.108	0.162
HD12	7	4	3½	20 ⁵ / ₁₆	4 ⁷ / ₁₆	3¾	2⅝	1⅞	4	1	3½	11,775	0.171	0.244
											4½	13,335	0.177	0.250
											5½	14,295	0.184	0.250
											4½ ¹²	14,475	0.192	0.250
											7¼	15,435	0.194	0.250
											5½ ¹²	15,510	0.162	0.227
HD19 ⁸	7	4	3½	24½	4 ⁷ / ₁₆	3¾	2⅝	1⅞	5	1	7¼	16,735	0.191	0.250
								5½ ¹²			16,775	0.200	0.250	
								7¼			19,360	0.180	0.249	
								5½ ¹²			18,550	0.133	0.198	
								5½ ¹³			19,070	0.137	0.207	

SI: 1 inch = 25.4 mm, 1 lbs = 4.45 N.

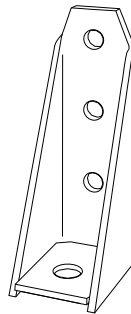
1. Tabulated allowable loads are for a hold-down assembly consisting of the hold-down device attached to a wood structural member(s) with the fasteners as specified in Table 1.
2. The allowable loads for the hold-down assemblies are established on the allowable stress design (ASD) and include the load duration factor, C_D = 1.6, corresponding with wind/earthquake loading in accordance with the NDS. No further increase is allowed. Reduce where other load durations govern.
3. Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report. Anchorage to concrete or masonry walls shall be in accordance with Section 4.1.2 of this report.

4. The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads related with the tabulated Δ_s deformations.
5. Tabulated displacement values, Δ_{all} and Δ_s , for hold-down assemblies include all sources of hold-down assembly elongation, such as hold-down device extension and rotation fastener slip, and anchor rod elongation, at ASD-level and strength level forces respectively.
6. Elongation of the hold-down anchor rod must be calculated when the actual unbraced length is greater than 6 inches for the HD2A hold-down, or greater than 8 inches for the HD series hold-downs, or the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report. In lieu of calculating the elongation of the hold-down anchor rod for hold-downs raised 6" to 18" above the concrete for the HD2A and 8" to 18" for the HD series, it is permitted to add an additional anchor rod elongation of 0.01 to the tabulated hold-down deflection.
7. HD19 requires a standard cut washer, conforming to Section 4.1.1 of this report, to be installed between the anchor bolt nut and the seat of the hold-down when a 1 1/8" diameter anchor bolt is used.
8. The hold-down bolts attaching the hold-down to the wood member shall be in accordance with Section 3.2.3.1 of this report and they each shall have a minimum of a standard cut washer installed between the wood post and the nut.
9. HB is the required minimum distance from the end of the post to the center of the first post bolt hole. End distance may be increased as necessary for installation. Tension values are valid for hold-downs installed flush to, or raised off of, the sill plate provided that the minimum HB distance is maintained.
10. Wood structural member(s) shall have a minimum width of 3½" and be a minimum Grade No. 2 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading, unless otherwise noted.
11. Wood structural member(s) shall have a minimum width of 5½" and be a minimum Grade No. 2 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading.
12. Wood structural member(s) shall have a minimum width of 5½" and be a minimum Grade No. 1 with specific gravity of 0.50 to satisfy NDS Appendix E for tension loading.

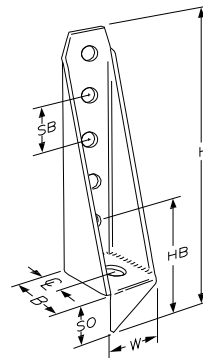
FIGURE 1 – HDA AND HD BOLT HOLD-DOWNS



HD2A



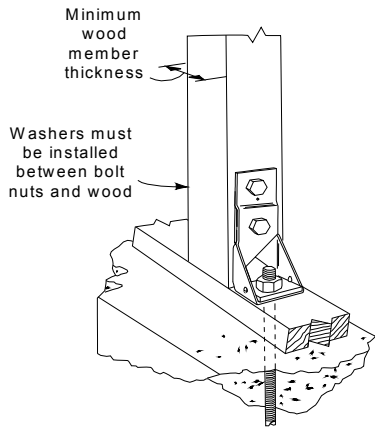
HD7
(HD5 Similar)



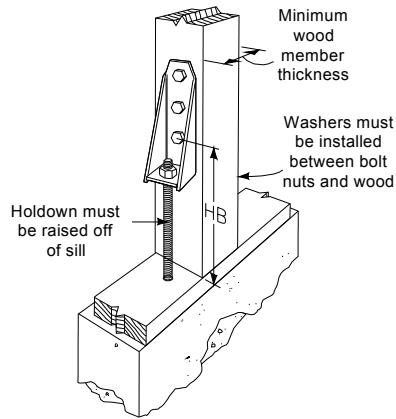
HD19
(HD9 and HD12 Similar)

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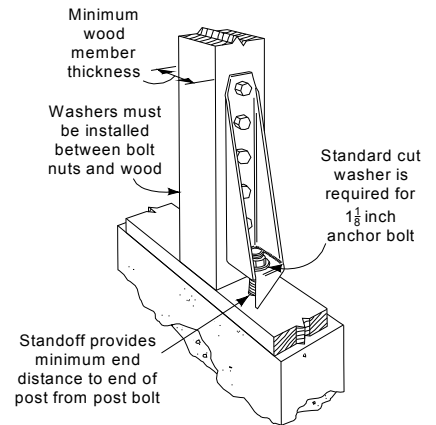
FIGURE 1 – HDA AND HD BOLT HOLD-DOWNS (CON'T)



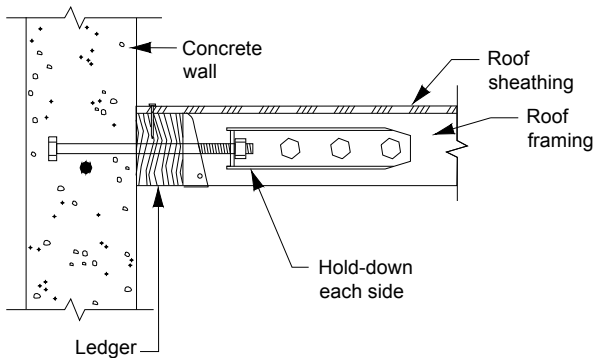
HD2A Vertical Installation



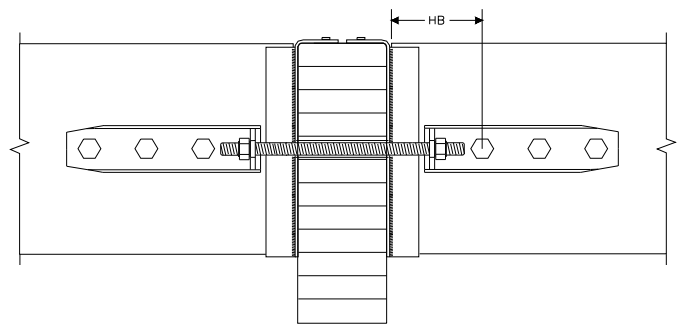
HD7 Vertical Typical Installation (HD5 Similar)



HD19 Vertical Typical Installation (HD9 and HD12 Similar)



HD7 Horizontal Typical Installation (HD5 Similar)



HD7 Horizontal Purlin Installation (HD5 Similar)

EVALUATION REPORT



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TABLE 2 — ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDB BOLT HOLD-DOWN ASSEMBLIES^{1,2}

MODEL NO.	DIMENSIONS (in.)							FASTENERS			MINIMUM WOOD MEMBER THK ⁸ (in.)	ALLOWABLE TENSION LOADS ³ P _{all} (lbs.) C _D =1.6	DISPLACEMENT ^{4,5} Δ, (in.)	
	HB	SB	W	H	B	SO	CL	ANCHOR BOLT DIA (in.)	WOOD MEMBER BOLTS				Δ _{all}	Δ _s
									QTY.	DIA. (in.)				
HD3B	4½	2½	2½	7⅞	2	¾	1½	⅝	2	⅝	1½	1,895	0.156	0.207
											2½	2,525	0.169	0.250
											3	3,130	0.120	0.239
HD5B	5¼	3	2½	9⅜	2½	2	1¼	⅝	2	¾	2½	3,750	0.129	0.181
											3	4,505	0.156	0.223
											3½	4,935	0.150	0.202
HD7B	5¼	3	2½	12⅜	2½	2	1¼	⅞	3	¾	3	6,645	0.142	0.198
											3½	7,310	0.154	0.238
HD9B	6⅞	3½	2⅞	14	2½	2⅞	1¼	⅞	3	⅞	3½	7,740	0.159	0.250
											4½	9,920	0.178	0.238
											7¼	10,035	0.179	0.241

SI: 1 inch = 25.4 mm, 1 lbs = 4.45 N.

- The allowable loads for the hold-down assemblies are based on allowable stress design (ASD) and include the load duration factor, C_D = 1.6, corresponding with wind/earthquake loading in accordance with the NDS. No further increase is allowed. Reduce where other load durations govern.
- Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report. Anchorage to concrete or masonry walls shall be in accordance with Section 4.1.2 of this report.
- The tabulated allowable (ASD) tension loads shall be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ_s deformations.
- Tabulated displacement values, Δ_{all} and Δ_s, for hold-down assemblies include all sources of hold-down assembly elongation, such as fastener slip, hold-down device extension and rotation, and 6" of anchor rod elongation, at ASD-level and strength level forces respectively.
- Elongation of the hold-down anchor rod must be calculated when the actual unbraced length is greater than 6 inches, or the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report. In lieu of calculating the elongation of the hold-down anchor rod for hold-downs raised 6" to 18" above the concrete, it is permitted to add an additional anchor rod elongation of 0.01" to the tabulated hold-down deflection.
- The hold-down bolts attaching the hold-down to the wood member shall be in accordance with Section 3.2.3.1 of this report and they each shall have a minimum of a standard cut washer installed between the wood post and the nut.
- Allowable Tension loads are valid for hold-downs installed flush to, or raised off of, the sill plate.
- Wood structural member(s) shall have a minimum width of 3½ and be a minimum Grade No. 2 with specific gravity of 0.50

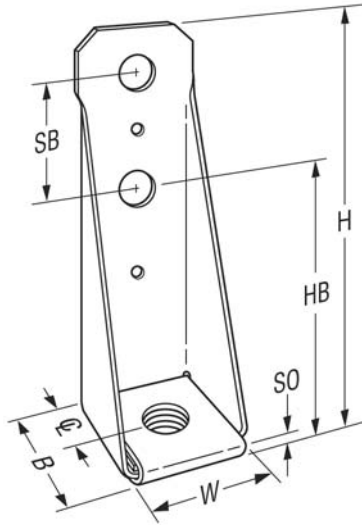
Report Number: 0143

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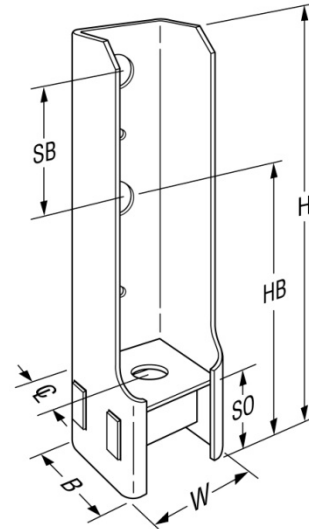
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Revised: 08/31/2011

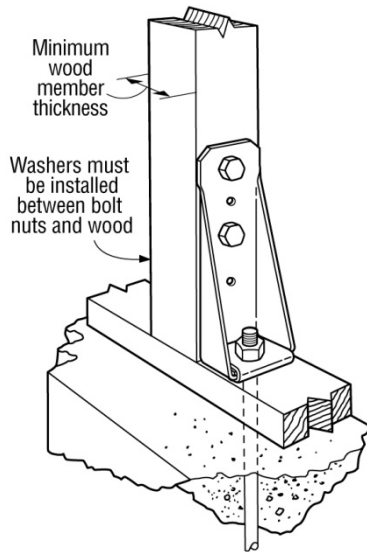
FIGURE 2 – HDB BOLT HOLD-DOWNS



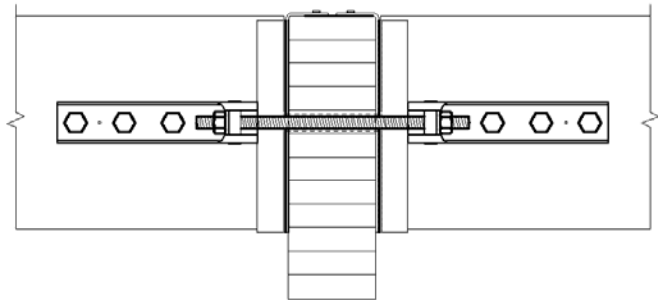
HD3B



HD5B
(HD7B, HD9B Similar)



HD3B
Vertical
Installation



HD7B Horizontal
Purlin Installation

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TABLE 3 — ALLOWABLE STEEL STRENGTH FOR HDA, HDB, AND HD BOLT HOLD-DOWN CONNECTORS¹

MODEL NO.	ASD STEEL STRENGTH (lbs.)
HD2A	4,375
HD3B	3,940
HD5B	6,700
HD7B	8,330
HD9B	11,290
HD5	6,190
HD7	6,600
HD9	12,185
HD12	15,510
HD19 ² (1½" A.B)	21,965
HD19 (1¼" A.B)	23,630

SI: 1 inch = 25.4 mm, 1 lbs = 4.45 N.

1. Steel strengths are provided when designing per Section 12.10 and 12.11.2 of ASCE 7.
2. HD19 requires a standard cut washer, conforming to Section 4.1.1 of this report, to be installed between the anchor bolt nut and seat of hold-down when a 1½" diameter anchor bolt is used.