

ICC-ES Evaluation Report

ESR-2330

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings
REPORT HOLDER:
**SIMPSON STRONG-TIE COMPANY INC.
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(800) 925-5099
www.strongtie.com**
EVALUATION SUBJECT:
SIMPSON STRONG-TIE® SCREW HOLD-DOWN CONNECTORS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code*® (IBC)
- * ■ 2015, 2012, 2009 and ~~2006~~ *International Residential Code*® (IRC)
- * ■ ~~2013 Abu Dhabi International Building Code (ADIBC)†~~

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Property evaluated:

Structural

2.0 USES

Simpson Strong-Tie® screw 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 2015 IBC Section 2304.10.3, 2305.1, 2305.3, 2308.6.5.1 and 2308.6.5.2; 2012, 2009 and 2006 IBC Sections [2304.9.3](#), [2305.1](#), [2305.3](#), [2308.9.3.1](#), and [2308.9.3.2](#); and 2015 AWC SDPWS Section 4.3.6.4.2; and 2008 AF&PA SDPWS Sections [4.3.6.4.2](#) and [4.3.6.1.2](#); and are used as anchorage of concrete and masonry walls to structural wood elements to provide lateral support for the walls as required by IBC Section [1604.8](#). The hold-down connectors may also be used in structures regulated under the IRC, when an engineered design is submitted in accordance with Section [R301.1.3](#) of the IRC; or when used in accordance with the prescriptive provisions of 2015 IRC Section R507.2.4; 2012 IRC Section [R507.2.3](#); 2015 and 2012 IRC Sections [R602.10.2.2.1](#), [R602.10.6.1](#), [R602.10.6.2](#), [R602.10.6.5](#) and [R602.10.7](#); or 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](#).

3.0 DESCRIPTION

3.1 General:

3.1.1 HDU Hold-downs: HDU hold-downs consist of a main structural steel component with prepunched holes for installation of SDS wood screws used to connect the hold-down to the wood member, and a base plate component that provides a seat for an anchor rod/bolt nut, as shown in [Figure 1](#). The body of the HDU2, HDU4 and HDU5 hold-downs is formed from No. 14 gage galvanized steel; the HDU8 and HDU11 bodies are formed from No. 10 gage galvanized steel; and the HDU14 body is formed from No. 7 gage galvanized steel. The base plate component for all HDU hold-downs is formed from No. 3 gage galvanized steel. See [Table 1A](#) for HDU hold-down dimensions and fastener requirements.

3.1.2 HDQ8 and HHDQ Hold-downs: The HDQ8 hold-down consists of a main structural steel component with prepunched holes for installation of SDS wood screws used to connect the HDQ8 hold-down to the wood member, and steel crossbars and a washer for an anchor rod/bolt nut, as shown in [Figure 2A](#). The HHDQ11 and HHDQ14 hold-downs also have a main structural steel component with pre-drilled holes for SDS wood screws used to connect HHDQ hold-downs to the wood member, and have a factory-welded load transfer plate at its base for an anchor rod or bolt. The HDQ8 body is formed from No. 7 gage galvanized steel, and its crossbars are formed from ³/₈-inch-thick-by-1-inch-deep (9.5 mm by 25.4 mm) steel bar stock, and the washers are formed from ³/₈-inch-thick (9.5 mm) steel plate. The HHDQ bodies are formed from No. 7 gage steel, and the load transfer plates are ¹/₂-inch-thick (12.7 mm) steel plate. See [Table 2A](#) for HDQ8 and HHDQ hold-down dimensions and fastener requirements. See [Figure 2B](#) for typical installations of the HDQ8 and HHDQ hold-downs.

3.1.3 DTT2 Hold-down: The DTT2 hold-down consists of a single-piece formed structural steel component with prepunched holes for installation of SDS wood screws used to connect the hold-down to the wood member as shown in [Figure 3](#). The DTT2 is formed from No. 14 gage galvanized steel. One steel, plain (flat), standard plate (W) washer conforming to [ASTM F844](#) and [ASME B18.22.1](#), Type A, with a ¹/₈-inch (35 mm) outer diameter, is provided with the DTT2 hold-down, and must be installed between the nut and the seat of the hold-down. See [Table 3](#) for product dimensions, required fasteners and allowable loads.

3.1.4 HDC10 Concentric Hold-downs: HDC10 concentric hold-downs consist of a main structural U-shaped steel component with prepunched holes for

installation of SDS wood screws used to connect the hold-down to the wood member, and an aluminum support base component with a hole for a $\frac{7}{8}$ -inch-diameter (22.2 mm) anchor bolt used to connect the hold-down to the concrete as shown in [Figure 4](#). The body of the HDC10 hold-downs is formed from No. 10 gage galvanized steel. The aluminum base is die cast from aluminum alloy. One steel, plain (flat), SAE narrow (N) washer conforming to [ASTM F844](#) and [ASME B18.22.1](#), Type A, with a $\frac{3}{4}$ -inch (44.5 mm) outer diameter, is provided with the HDC10 hold-down, and must be installed between the nut and the bottom of the U-shaped steel component of the hold-down. See [Tables 4A](#) and [4B](#) for product dimensions, required fasteners and allowable loads.

3.2 Materials:

3.2.1 Steel: The bodies of the HDU, HDQ8, and HDC10 hold-downs are fabricated from [ASTM A653](#), SS, Grade 33, galvanized steel, having a minimum yield strength, F_y , of 33,000 psi (227 MPa) and a minimum tensile strength, F_u , of 45,000 psi (310 MPa). The load transfer base plates of the HDU series hold-downs is fabricated from [ASTM A1011](#), SS, Grade 33 steel, having a minimum yield strength, F_y , of 33,000 psi (227 MPa) and a minimum ultimate strength, F_u , of 52,000 psi (359 MPa). The crossbars and the load transfer washer for the HDQ8 hold-down are fabricated from No. 1018 carbon steel complying with [SAE J403](#), and having a minimum yield strength, F_y , of 54,000 psi (371 MPa) and a minimum tensile strength, F_u , of 64,000 psi (440 MPa). The support base of the HDC10 hold-downs is die cast aluminum.

The bodies of the HHDQ hold-downs are fabricated from [ASTM A1011](#), SS, Grade 33 steel, having a minimum yield strength, F_y , of 33,000 psi (227 MPa) and a minimum ultimate strength, F_u , of 52,000 psi (359 MPa). The load transfer plates for the HHDQ hold-downs are formed from [ASTM A36](#) steel, having a minimum yield strength, F_y , of 36,000 psi (248 MPa) and a minimum tensile strength, F_u , of 58,000 psi (399 MPa). The DTT2 hold-down is formed from [ASTM A653](#), SS designation, Grade 33 steel.

The galvanized bodies of the HDU, HDQ8, DTT2, and HDC10 hold-downs have a minimum G90 zinc coating in accordance with [ASTM A653](#). Some models may also be available with either a G185 zinc coating (denoted by model numbers ending in the letter Z) or with a batch hot-dipped galvanized coating (denoted by model numbers ending with the letters HDG) with a minimum specified coating weight of 2.0 ounces of zinc per square foot of surface area (600 g/m^2), total for both sides in accordance with [ASTM A123](#). Model numbers shown in this report do not list the -Z or -HDG suffix, but the information shown applies. The HHDQ hold-downs have a painted finish. HDU base plates and HDQ8 washers and crossbars have a minimum [ASTM B633](#), SC 1, Type I electro galvanized coating.

The lumber treater or the report holder (Simpson Strong-Tie Company) should be contacted for recommendations on minimum corrosion resistance protection of steel hold-down connectors in contact with the specific proprietary preservative-treated or fire-retardant treated lumber. The use of hold-downs in contact with preservative-treated or fire-retardant treated lumber is outside the scope of this report, and is subject to the approval of the code official.

The steel components of the hold-downs described in this report have the following minimum base-metal thicknesses:

NOMINAL THICKNESS	MINIMUM BASE-METAL THICKNESS (in.)
$\frac{1}{2}$ inch	0.4845
$\frac{3}{8}$ inch	0.3600
No. 3 gage	0.2285
No. 7 gage (ASTM A653)	0.1715
No. 7 gage (ASTM A1011)	0.1705
No. 10 gage	0.1275
No. 12 gage	0.0975
No. 14 gage	0.0685

For SI: 1 inch = 25.4 mm.

3.2.2 Wood: Wood members with which the hold-downs are used 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). The required thickness (depth) of the wood members in the direction of the fastener penetration is specified in [Table 1B](#) for HDU hold-down assemblies, [Tables 2B](#) and [2D](#) for HDQ8/HHDQ hold-down assemblies, [Table 3](#) for DTT2 hold-down assemblies, and [Table 4B](#) for HDC10 hold-down assemblies. Unless noted otherwise, the minimum width of the wood members listed in [Tables 1B](#), [2B](#), [2D](#), [3](#), and [Table 4B](#) is $3\frac{1}{2}$ inches (88.9 mm). Additionally, the wood members used with the HDC hold-downs must have a minimum F_c^* of 1550 psi (10.7 MPa), where F_c^* is the NDS-specified reference compression design value parallel-to-grain, multiplied by all applicable adjustment factors except C_P .

3.2.3 SDS Wood Screws: Fasteners used with the hold-down assemblies described in [Tables 1B](#), [2B](#), [2D](#), [3](#), and [4B](#) must be Simpson Strong-Tie SDS wood screws recognized in [ESR-2236](#). Model numbers shown in this report do not include the SDS model number after the hold-down model number (e.g., HDU4-SDS2.5), but the information shown applies. SDS screws used in contact with preservative-treated or fire-retardant-treated lumber must, as a minimum, comply with [ESR-2236](#). The lumber treater or Simpson Strong-Tie Company should be contacted for recommendations on minimum corrosion resistance and connection capacities of fasteners used with the specific proprietary preservative-treated or fire-retardant-treated lumber.

3.2.4 Threaded Rods: As a minimum, threaded steel rods must comply with [ASTM A307 A36](#) or [F1554](#).

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 Hold-down Assembly: The allowable loads shown in [Tables 1B](#), [2B](#), [2D](#), and [4B](#) of this report 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 SDS wood screws used to attach the hold-down device to the wood member; and, in some cases as noted, (5) bearing plates or washers. The allowable loads for these assemblies are based on allowable stress design (ASD) and include the load duration factor, C_D , corresponding with the applicable loads in accordance with the National Design Specification (NDS) for Wood Construction. The assembly must have an allowable strength equal to or exceeding the required strength of the assembly under the

action of the ASD (Allowable Stress Design) load combinations referenced in the applicable code.

Where design load combinations include earthquake loads or effects, story drifts of the structure must be determined in accordance with Section 12.8.6 of ASCE 7 by using strength-level seismic forces without reduction for ASD. The deflection of a shear wall restrained from overturning by hold-downs installed in accordance with this report is calculated using Equation 23-2 shown in Section 2305.3 of the IBC, or Equation 4.3-1 shown in Section 4.3.2 of AWC SDPWS-2015 (Special Design Provisions for Wind and Seismic) or ANSI AF&PA SDPWS-2008, as applicable. The total deflection values, Δ_{all} and Δ_s , at ASD-level and strength-level forces, respectively, for hold-down assemblies shown in Tables 1B, 2B, and 4B of this report, include all sources of hold-down assembly elongation, such as fastener slip, hold-down device extension and rotation, and anchor rod elongation where the unbraced length of the rod is a maximum of 6 inches (152 mm) for assemblies using HDU, HDQ, and HHDQ hold-downs; and a maximum of 4.5 inches (114 mm) for assemblies using DTT2 hold-downs. The contribution of the hold-down anchor rod elongation to the total elongation (deflection) of the hold-down assembly needs to be considered when the actual diameter, length, or ASTM steel specification of the anchor rod differs from that described in this report.

Please note: When seismic governs, the symbol Δ_s as used in this report for hold-down assemblies refers to the symbol d_a in Section 2305.3 of the IBC and to the symbol Δ_a in Section 4.3.2 of AWC SDPWS-2015 or ANSI/AF&PA SDPWS-2008, as applicable.

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

When hold-downs are fastened to wood having a moisture content greater than 19 percent (16 percent for engineered lumber), or where wet service is expected, the allowable loads shown in Tables 1B, 2B, 2D, and 3 of this report must be adjusted by the wet service factor, C_M , specified in the NDS.

When hold-downs are fastened to wood that will experience sustained exposure to temperatures exceeding 100°F (37.8°C), the allowable loads shown in Tables 1B, 2B, 2D, and 4B in this report must be adjusted by the temperature factor, C_t , specified in the NDS.

The design of wood members fastened to the hold-down devices must consider combined stresses due to axial tension or compression, and flexural bending induced by eccentricities in the connection about either or both axes, relative to the centroid of the wood member. Stresses must be evaluated at the critical net section for total combined stress in accordance with the NDS.

The design of hold-downs used in series must account for the cumulative deformation of all hold-downs within that series.

4.1.2 Hold-down Devices Used as Anchorage of Structural Walls: Allowable tensile strengths and strength-level displacements are specified in Table 1C for HDU hold-down devices. Allowable tensile and compressive strengths and corresponding displacements are specified in Table 2C for HDQ8/HHDQ hold-down devices. These values are for the steel anchorage device independent of the SDS screws and anchor rod, and are used when designing structural wall anchorage in accordance with Section 12.11.2.2.2 of ASCE 7. Allowable

compression loads of a structural wall anchorage system consisting of HDQ8/HHDQ hold-down devices, wood members, SDS wood screws, and threaded anchor rod, are shown in Table 2D. Axial compression of the anchor rod must be calculated when the actual diameter, length, or ASTM steel specification of the anchor rod differs from that described in the footnotes to Table 2D. The effective length and slenderness ratio of anchor rods subject to axial compression loads must be determined using accepted engineering principles.

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

Where design load combinations include earthquake loads or effects, the design strength of anchorage to concrete must be determined in accordance with Sections 1901.3 and 1905 of the 2015 IBC, Section 1909 of the 2012 IBC or Section 1912 of the 2009 or 2006 IBC, 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 this evaluation report and the manufacturer's published installation instructions. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.

4.3 Special Inspection:

4.3.1 IBC: For compliance with the 2015, 2012 or 2009 IBC, a statement of special inspection must be prepared by the registered design professional in responsible charge, and submitted to the code official for approval, where required by Section 1704.3 of the 2015 and 2012 IBC or Section 1705 of the 2009 IBC. For compliance with the 2006 IBC, a quality assurance plan must be submitted to the code official for approval, where required by Sections 1705 or 1706 of the 2006 IBC. Special inspections for seismic resistance must be conducted as required, and in accordance with the appropriate sections of Chapter 17 of the IBC. Special inspections for anchor bolts in concrete or masonry must be conducted in accordance with Section 1705.3 or 1705.4 of the 2015 and 2012 IBC; and Section 1704.4 or 1704.5 of the 2009 and 2006 IBC.

4.3.2 IRC: 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 Section 4.3.1, as applicable for installations under the IRC.

5.0 CONDITIONS OF USE

The Simpson Strong-Tie hold-down connectors 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** The connectors must be manufactured, identified and installed in accordance with this report and the manufacturer's published installation instructions. A copy of the instructions must be available at the jobsite at all times during installation.
- 5.2** Calculations showing compliance with this report must be submitted to the code official. The calculations must be prepared by a registered design professional

where required by the statutes of the jurisdiction in which the project is to be constructed.

- 5.3 Adjustment factors noted in Section 4.1 and the applicable codes must be considered, where applicable.
- 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 steel hold-down connectors with preservative- or fire-retardant-treated lumber must be in accordance with Section 3.2.1 of this report. Use of fasteners with preservative- or fire-retardant-treated lumber must be in accordance with Section 3.2.3 of this report.
- 5.6 Anchorage to concrete or masonry structural members must be designed in accordance with Section 4.1.3 of this report.
- 5.7 No further duration of load increase for wind or earthquake loading is allowed.
- 5.8 Welded hold-downs (models HHDQ11 and HHDQ14) are manufactured under a quality control program

with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Hold-downs (Tie-downs) Attached to Wood Members (AC155), dated October 2005 (editorially revised May 2015).

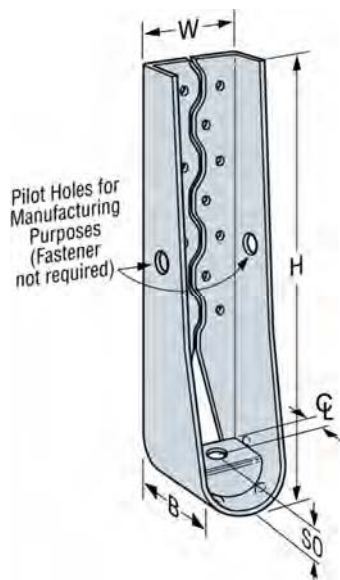
7.0 IDENTIFICATION

The hold-down devices described in this report are identified with a die-stamped label or an adhesive label indicating the name of the manufacturer (Simpson Strong-Tie), the model number, and the number of the index evaluation report ([ESR-2523](#)) which contains a summary of all the product model numbers in the ICC-ES evaluation reports listed in that report for this manufacturer. The SDS wood screws are identified as described in evaluation report [ESR-2236](#).

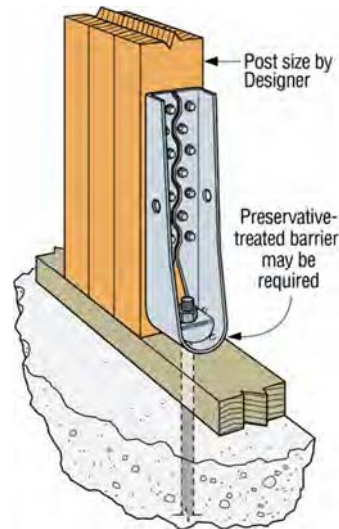
TABLE 1A—DIMENSIONS AND FASTENER REQUIREMENTS FOR HDU SERIES HOLD-DOWN CONNECTORS

HOLD-DOWN MODEL NO.	DIMENSIONS (in)					ANCHOR BOLT DIA. (in)	SDS SCREW QUANTITY
	H	W	B	CL	SO		
HDU2	8 ¹¹ / ₁₆	3	3 ¹ / ₄	1 ¹ / ₄	1 ³ / ₈	5 ⁵ / ₈	6
HDU4	10 ¹⁵ / ₁₆	3	3 ¹ / ₄	1 ¹ / ₄	1 ³ / ₈	5 ⁵ / ₈	10
HDU5	13 ³ / ₁₆	3	3 ¹ / ₄	1 ¹ / ₄	1 ³ / ₈	5 ⁵ / ₈	14
HDU8	16 ⁵ / ₈	3	3 ¹ / ₂	1 ¹ / ₄	1 ¹ / ₂	7 ⁷ / ₈	20
HDU11	22 ¹ / ₄	3	3 ¹ / ₂	1 ¹ / ₄	1 ¹ / ₂	1	30
HDU14	25 ²¹ / ₃₂	3	3 ¹ / ₂	1 ⁹ / ₁₆	1 ⁹ / ₁₆	1	36

For SI: 1 inch = 25.4 mm.



**HDU Hold-down
U.S. Patent
6,112,495;
5,979,130**



**Vertical HDU
Hold-down
Installation**

FIGURE 1—HDU SERIES HOLD-DOWNS

TABLE 1B—ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDU SERIES HOLD-DOWN ASSEMBLIES^{1,2,3,4}

HOLD-DOWN MODEL NO.	SDS SCREW SIZE (in.)	ALLOWABLE TENSION LOADS ⁵ , P_{all} (lbs) $C_D = 1.33$ or $C_D = 1.6$						DISPLACEMENT Δ AT MAXIMUM LOAD ^{8,9} (in.)	
		Wood Member Thickness ⁶ (in.)						Δ_{all}	Δ_s
		3	3.5	4.5	5.5	7.25	5.5 ⁽⁷⁾		
HDU2	1/4 x 1.5	1,810	1,810	1,810	1,810	1,810	1,810	0.069	0.090
	1/4 x 2.5	3,075	3,075	3,075	3,075	3,075	3,075	0.088	0.118
HDU4	1/4 x 1.5	3,105	3,105	3,105	3,105	3,105	3,105	0.083	0.108
	1/4 x 2.5	4,565	4,565	4,565	4,565	4,565	4,565	0.114	0.154
HDU5	1/4 x 1.5	3,960	3,960	3,960	3,960	3,960	3,960	0.109	0.142
	1/4 x 2.5	5,645	5,670	5,670	5,670	5,670	5,670	0.115	0.158
HDU8	1/4 x 1.5	5,980	5,980	5,980	5,980	5,980	5,980	0.087	0.115
	1/4 x 2.5	6,765	6,970	7,870	7,870	7,870	7,870	0.113	0.161
HDU11	1/4 x 2.5	—	—	—	9,535	11,175 ⁽¹⁰⁾	11,175	0.137	0.182
HDU14	1/4 x 2.5	—	—	—	—	14,390 ⁽¹⁰⁾	14,445	0.172	0.239

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

¹Tabulated allowable loads are for a hold-down assembly consisting of the hold-down device attached to a wood structural member with the size of SDS wood screws noted in the table. The quantity of SDS wood screws must comply with [Table 1A](#).

²The allowable loads for the hold-down assemblies are based on allowable stress design (ASD) and include the load duration factor, C_D , corresponding with wind/earthquake loading in accordance with the NDS. No further increase is allowed.

³When using the basic load combinations in accordance with IBC Section [1605.3.1](#), the tabulated allowable loads for the hold-down assembly must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section [1605.3.2](#) that include wind or earthquake loads that tabulated allowable loads for the hold-down assembly must not be increased by 33 1/3 percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

⁴Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report.

⁵The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ_s deformations.

⁶The minimum thickness of the wood members (i.e., the dimension parallel to the long axis of the SDS wood screws) must be as indicated in the table above. The minimum width of the wood members must be 3 1/2 inches, except as noted.

⁷The minimum width of the wood members must be 5 1/2 inches (6x6 nominal).

⁸Tabulated 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 anchor rod elongation, at ASD-level and strength-level forces, respectively.

⁹Elongation of the hold-down anchor rod must be calculated when the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report, or the actual unbraced length is greater than 6 inches. In lieu of calculating the elongation of the hold-down anchor rod for hold-downs raised 6 inches to 18 inches above the concrete, an additional 0.010 inch may be added to the tabulated hold-down displacement at allowable load, Δ_{all} , and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load, Δ_s , to account for anchor rod elongation.

¹⁰Requires a heavy hex anchor nut to achieve tabulated tension loads.

TABLE 1C—ALLOWABLE TENSION LOADS AND DISPLACEMENTS OF HDU SERIES HOLD-DOWN CONNECTORS^{2,3}

HOLD-DOWN MODEL NO.	ALLOWABLE TENSION LOAD, P_{all} (lbs)	DISPLACEMENT Δ AT MAX LOAD ⁴ (in)	
		Δ_{all}	Δ_s
HDU2	3,505	0.081	0.110
HDU4	4,990	0.089	0.117
HDU5	5,670	0.078	0.107
HDU8	9,950	0.131	0.164
HDU11	11,905	0.121	0.157
HDU14	15,905 ⁽⁵⁾	0.124	0.172

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

¹This table lists the allowable tensile strength of the steel hold-down connectors exclusive of fasteners and anchor rods when tested on a steel jig.

²Allowable tension loads are applicable for designs complying with Section [12.11.2.2.2](#) of ASCE 7.

³When using the basic load combinations in accordance with IBC Section [1605.3.1](#), the tabulated allowable loads for the hold-down must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section [1605.3.2](#) that include wind or earthquake loads that tabulated allowable loads for the hold-down must not be increased by 33 1/3 percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

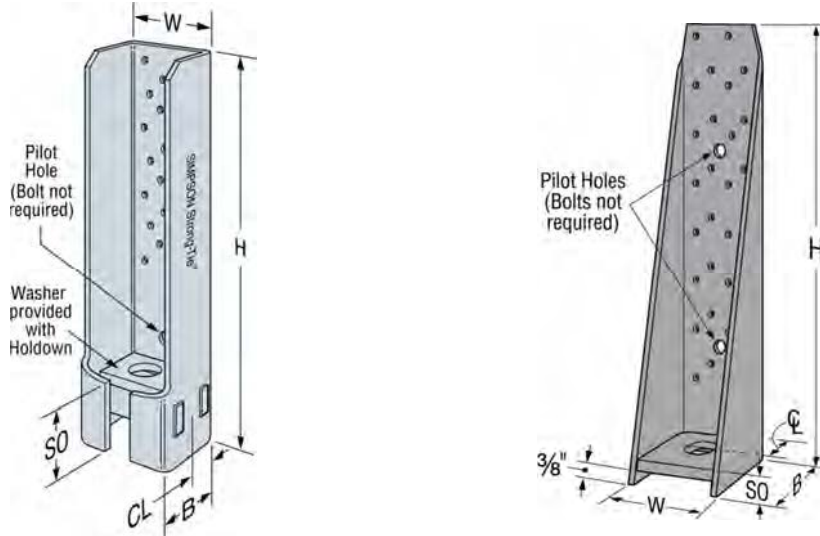
⁴ Δ_{all} is the displacement at the tabulated ASD load and Δ_s is displacement at the strength-level load. Tabulated displacement values in [Table 1C](#) consist only of deformation of the hold-down (tie-down) device when tested on a steel jig. Other variables contributing to total displacement, d_a , such as fastener slip, wood shrinkage, and anchor bolt/rod elongation, must be checked by the registered design professional. The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level loads associated with the tabulated strength-level deformations, Δ_s .

⁵Requires a heavy hex anchor nut to achieve tabulated tension loads.

TABLE 2A—DIMENSIONS AND FASTENER REQUIREMENTS FOR HDQ8/HHDQ HOLD-DOWN CONNECTORS

HOLD-DOWN MODEL NO.	DIMENSIONS (in)					ANCHOR BOLT DIA. (in)	SDS SCREW QUANTITY
	H	W	B	CL	SO		
HDQ8	14	2 ⁷ / ₈	2 ¹ / ₂	1 ¹ / ₄	2 ³ / ₈	⁷ / ₈	20
HHDQ11	15 ¹ / ₈	3	3 ¹ / ₂	1 ¹ / ₂	⁷ / ₈	1	24
HHDQ14	18 ³ / ₄	3	3 ¹ / ₂	1 ¹ / ₂	⁷ / ₈	1	30

For SI: 1 inch = 25.4 mm.



HDQ8 Hold-down
 U.S. Patents
 6,006,487 and
 6,327,831

HHDQ Hold-down

FIGURE 2A—HDQ8/HHDQ SERIES HOLD-DOWNS

TABLE 2B—ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDQ8/HHDQ SERIES HOLD-DOWN ASSEMBLIES^{1,2,3,4}

HOLD-DOWN MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE TENSION LOADS ⁵ , P _{all} (lbs) C _D = 1.33 or C _D = 1.6						DISPLACEMENT ^{8,9} Δ AT MAX LOAD (in)	
		Wood Member Thickness ⁶ (in.)						Δ _{all}	Δ _s
		3	3.5	4.5	5.5	7.25	5.5 ⁽⁷⁾		
HDQ8	¼ x 1.5	5,715	5,715	5,715	5,715	5,715	5,715	0.073	0.093
	¼ x 2.5	5,715	5,715	7,280	7,280	7,280	7,280	0.091	0.121
	¼ x 3	5,715	7,630	9,230	9,230	9,230	9,230	0.095	0.130
HHDQ11	¼ x 2.5	—	—	—	11,810	11,810	11,810 ⁽¹⁰⁾	0.131	0.168
HHDQ14	¼ x 2.5	—	—	—	—	13,015	13,710 ⁽¹⁰⁾	0.107	0.144

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

¹Tabulated allowable loads are for a hold-down assembly consisting of the hold-down device attached to a wood structural member with the size of SDS wood screws noted in the table above. The quantity of SDS wood screws must comply with [Table 2A](#).

²The allowable loads for the hold-down assemblies are based on allowable stress design (ASD) and include the load duration factor, C_D, corresponding with wind/earthquake loading in accordance with the NDS. No further increase is allowed.

³When using the basic load combinations in accordance with IBC Section [1605.3.1](#), the tabulated allowable loads for the hold-down assembly must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section [1605.3.2](#) that include wind or earthquake loads, tabulated allowable loads for the hold-down assembly must not be increased by 33¹/₃ percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

⁴Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report.

⁵The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ_s deformations.

⁶The minimum thickness of the wood members (i.e., the dimension parallel to the long axis of the SDS wood screws) must be as indicated in the table above. The minimum width of the wood members must be 3¹/₂ inches, except as noted.

⁷The minimum width of the wood members must be 5¹/₂ inches (6x6 nominal).

⁸Tabulated 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 anchor rod elongation, at ASD-level and strength-level forces, respectively.

⁹Elongation of the hold-down anchor rod must be calculated when the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report, or the actual unbraced length is greater than 6 inches. In lieu of calculating the elongation of the hold-down anchor rod for hold-downs raised 6 inches to 18 inches above the concrete, an additional 0.010 inch may be added to the tabulated hold-down displacement at allowable load, Δ_{all}, and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load, Δ_s, to account for anchor rod elongation.

¹⁰Requires a heavy hex anchor nut to achieve tabulated tension loads.

TABLE 2C—ALLOWABLE TENSION AND COMPRESSION LOADS AND DISPLACEMENTS FOR HDQ AND HHDQ SERIES HOLD-DOWN CONNECTORS^{1,2,3}

MODEL NO.	ALLOWABLE LOAD ⁴ , P_{all} (lbs)		DISPLACEMENT ⁵ Δ AT MAXIMUM LOAD (in.)			
	Tension	Compression	Tension		Compression	
			Δ_{all}	Δ_s	Δ_{all}	Δ_s
HDQ8	12,200	7,725	0.080	0.101	0.052	0.067
HHDQ11	12,290	9,745	0.053	0.068	0.086	0.120
HHDQ14	14,605 ⁽⁶⁾	11,010 ⁽⁶⁾	0.036	0.052	0.070	0.097

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

¹This table lists the allowable tensile and compressive strengths of the steel hold-down connectors exclusive of fasteners and anchor rods when tested on a steel jig.

²Allowable tension and compression loads are applicable for designs complying with Section 12.11.2.2.2 of ASCE 7.

³When using the basic load combinations in accordance with IBC Section 1605.3.1, the tabulated allowable loads for the hold-down must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section 1605.3.2 that include wind or earthquake loads that tabulated allowable loads for the hold-down must not be increased by 33¹/₃ percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

⁴The designer must verify that the hold-down anchor bolt is adequate to resist compression forces based on the unbraced length of the anchor bolt.

⁵ Δ_{all} is the displacement at the tabulated ASD loads and Δ_s is displacement at strength-level loads. Tabulated displacement values in Table 2C consist only of deformation of the hold-down (tie-down) device when tested on a steel jig. Other variables contributing to total displacement, d_a , such as fastener slip, wood shrinkage, and anchor bolt/rod elongation, must be checked by the registered design professional. The tabulated allowable tension and compression (ASD) loads must be multiplied by 1.4 to obtain the strength-level loads associated with the tabulated strength-level deformations, Δ_s .

⁶A heavy hex anchor nut is required to achieve tabulated loads.

TABLE 2D—ALLOWABLE COMPRESSION LOADS AND DISPLACEMENTS FOR HDQ8/HHDQ SERIES HOLD-DOWN ASSEMBLIES^{1,2,3}

MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE COMPRESSION LOADS ⁴ , P_{all} (lbs) $C_D = 1.33$ or $C_D = 1.6$						DISPLACEMENT ^{5,6} Δ AT MAX LOAD (in)	
		Wood Member Thickness ⁷ (in.)						Δ_{all}	Δ_s
		3	3.5	4.5	5.5	7.25	5.5 ⁽⁸⁾		
HDQ8	1/4 x 1.5	5,570	5,570	5,570	5,570	5,570	5,570	0.038	0.045
	1/4 x 2.5	5,570	5,570	7,825	7,825	7,825	7,825	0.049	0.075
	1/4 x 3	5,570	5,570	8,995	8,995	8,995	8,995	0.053	0.076
HHDQ11	1/4 x 2.5	—	—	—	10,860	10,860	10,860 ⁽⁹⁾	0.109	0.143
HHDQ14	1/4 x 2.5	—	—	—	—	12,035	12,035 ⁽⁹⁾	0.081	0.110

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

¹Tabulated allowable compression loads are for a HDQ8 AND HHDQ Series hold-down assemblies consisting of the hold-down device attached to a wood structural member with the size of SDS wood screws noted in the table. The quantity of SDS wood screws must comply with Table 2A.

²Allowable compression loads are applicable for design of anchorage assemblies for structural walls in accordance with Section 12.11 of ASCE 7.

³When using the basic load combinations in accordance with IBC Section 1605.3.1, the tabulated allowable loads for the hold-down assembly must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section 1605.3.2 that include wind or earthquake loads that tabulated allowable loads for the hold-down assemblies must not be increased by 33¹/₃ percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

⁴The tabulated allowable compression load does not consider the end bearing capacity of the connected wood member.

⁵ Δ_{all} is the displacement at the tabulated ASD loads and Δ_s is displacement at strength-level loads. The tabulated allowable tension and compression (ASD) loads must be multiplied by 1.4 to obtain the strength-level loads associated with the tabulated strength-level deformations, Δ_s .

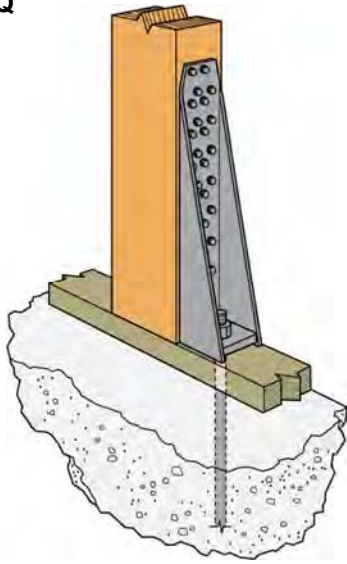
⁶The registered design professional must verify that the hold-down anchor bolt is adequate to resist design compression forces based on the unbraced length of the anchor bolt.

⁷The minimum thickness of the wood members (i.e., the dimension parallel to the long axis of the SDS wood screws) must be as indicated in the table above. The minimum width of the wood members must be 3¹/₂ inches, except as noted.

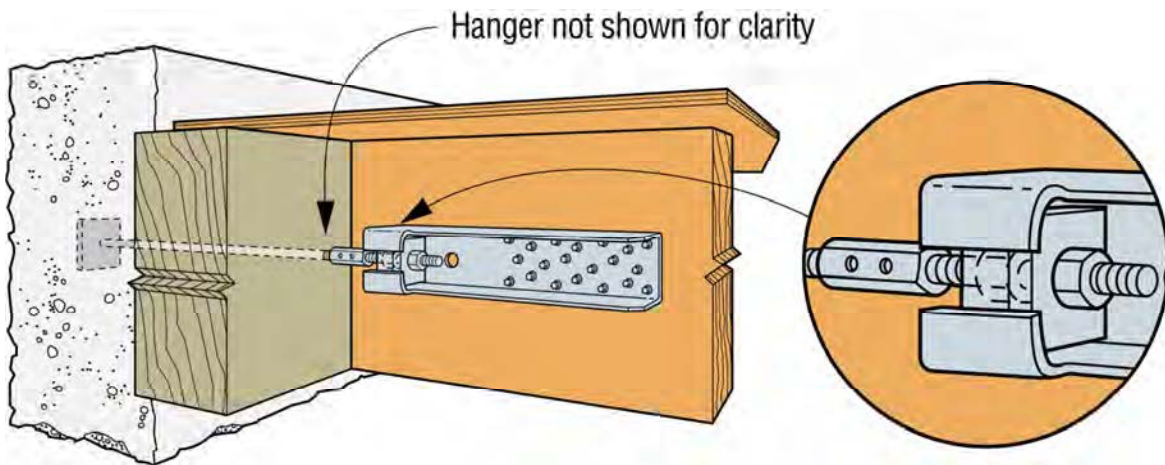
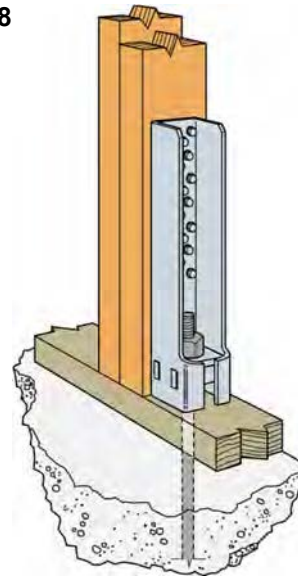
⁸The minimum width of the wood members must be 5¹/₂ inches (6x6 nominal).

⁹A heavy hex anchor nut is required to achieve tabulated loads.

**Vertical HHDQ
Hold-down
Installation**



**Vertical HDQ8
Hold-down
Installation**



**Horizontal HDQ8
Hold-down
Installation**

FIGURE 2B—TYPICAL INSTALLATIONS OF HDQ8/HHDQ SERIES HOLD-DOWNS

TABLE 3—DIMENSIONS, FASTENER REQUIREMENTS, ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR DTT2 SERIES HOLD-DOWN ASSEMBLIES^{1,2,3,4,5}

MODEL NO.	DIMENSIONS (inches)				REQUIRED FASTENERS			WOOD MEMBER THICKNESS ⁶ (inches)	ALLOWABLE TENSION LOADS ⁷ , P _{all} (lbs)		DISPLACEMENT Δ AT MAXIMUM LOAD ^{8,9}	
					Anchor Bolt Dia.	SDS Screws			C _D =1.0	C _D =1.6	Δ _{all}	Δ _s
	L	W	CL	B		Qty.	Size					
DTT2	6 ¹⁵ / ₁₆	3 ¹ / ₄	1 ³ / ₁₆	1 ⁵ / ₈	1/2	8	SDS 1/4 x 1 1/2	1.5	1,825	1,825	0.105	0.189
								3.0	2,000	2,145	0.128	0.241

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N.

¹One steel, plain (flat), standard plate (W) washer, as provided with the DTT2 hold-down, must be installed between the nut and the seat of the hold-down.

²Tabulated allowable loads are for a hold-down assembly consisting of the hold-down device attached to a wood structural member with the fasteners noted in [Table 3](#).

³The allowable loads for the hold-down assemblies are based on allowable stress design (ASD) and include the load duration factors, C_D, corresponding with a normal duration of load (C_D=1.0) and wind/earthquake loading (C_D=1.6) in accordance with the NDS. No further increase is allowed. Reduce where other load durations govern.

⁴When using the basic load combinations in accordance with IBC Section [1605.3.1](#), the tabulated allowable loads for the hold-down assembly must not be increased for wind or earthquake loading. When using the alternative basic load combinations in IBC Section [1605.3.2](#) that include wind or earthquake loads, the tabulated allowable loads for the hold-down assembly must not be increased by 33¹/₃ percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

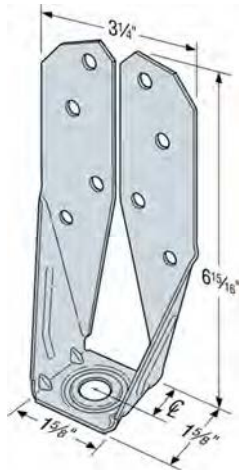
⁵Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report.

⁶The minimum thickness of the wood members (i.e., the dimension parallel to the long axis of the SDS wood screws) must be as indicated in the table above. The minimum width of the wood members must be 3¹/₂ inches.

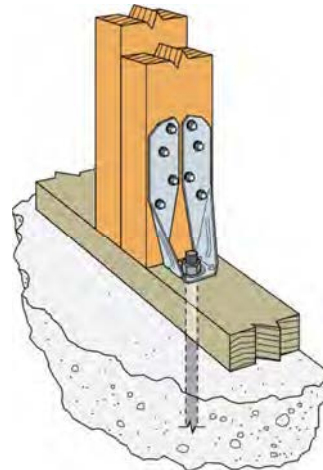
⁷The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ_s deformations.

⁸Tabulated 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 anchor rod elongation, at ASD-level and strength-level forces, respectively.

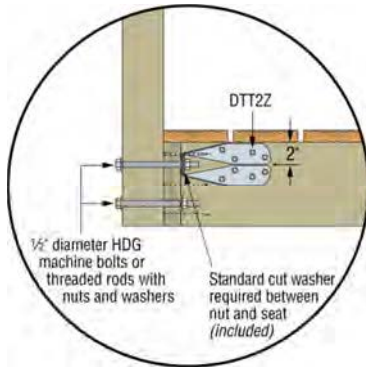
⁹Elongation of the hold-down anchor rod must be calculated when the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report, or the actual unbraced length is greater than 4.5 inches. In lieu of calculating the elongation of the hold-down anchor rod for hold-downs raised 4.5 inches to 18 inches above the concrete, an additional 0.010 inch may be added to the tabulated hold-down displacement at allowable load, Δ_{all}, and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load, Δ_s, to account for anchor rod elongation.



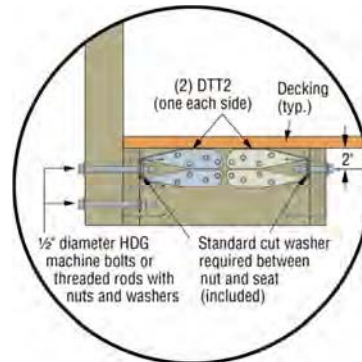
DTT2 Hold-Down



DTT2 Vertical Installation



DTT2 Horizontal Installation



DTT2 Horizontal Installation

FIGURE 3—DTT2 HOLD-DOWN

TABLE 4A—DIMENSIONS AND FASTENER REQUIREMENTS FOR HDC SERIES HOLD-DOWN CONNECTORS

MODEL NO.	DIMENSIONS (inches)				REQUIRED FASTENERS		
	H	W	B	CL	Anchor Bolt Dia. (in)	Qty.	SDS Screws Size
HDC10/22	14 ³ / ₈	3 ¹ / ₈	3	1 ⁹ / ₁₆	7/8	24	SDS 1/4 x 2.5
HDC10/4	14 ¹ / ₈	3 ⁹ / ₁₆	3	1 ¹³ / ₁₆	7/8	24	SDS 1/4 x 2.5

For SI: 1 lbf = 4.45N, 1 inch = 25.4 mm.

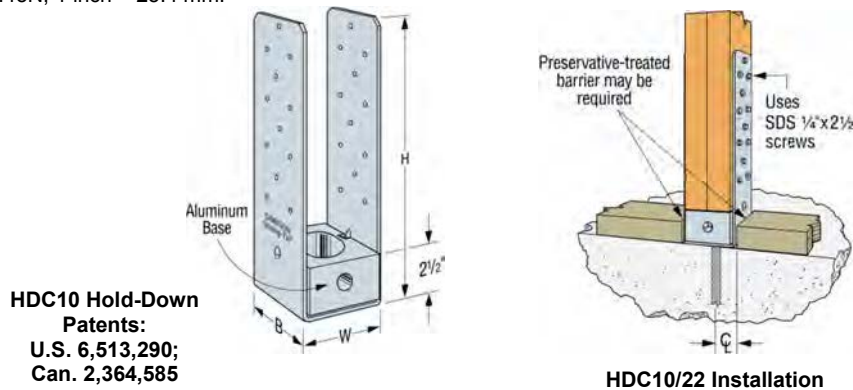


FIGURE 4—HDC10 HOLD-DOWN

TABLE 4B—ALLOWABLE TENSION/COMPRESSION LOADS AND DISPLACEMENTS FOR HDC SERIES HOLD-DOWN ASSEMBLIES^{1,2,3,4,12}

MODEL NO.	POST SIZE ^{7,9}	TENSION (Uplift) ⁵ C _D = 1.6			COMPRESSION (Download) ^{6,7}			
		Allowable Tension Load, P _{all} ⁽¹⁰⁾ (lbs)	Displacement, Δ, at maximum load (in) ⁽¹¹⁾		C _D = 1.0	C _D = 1.6 ⁽⁸⁾		
			Δ _{all}	Δ _s	Allowable Compression Load, P _{all} (lbs)	Allowable Compression Load, P _{all} ⁽¹⁰⁾ (lbs)	Displacement, Δ, at maximum load (in) ⁽¹¹⁾	
Δ _{all}	Δ _s	Δ _{all}	Δ _s	Δ _{all}	Δ _s	Δ _s		
HDC10/22	2-2x4	9,135	0.054	0.073	7,070	9,255	0.027	0.034
HDC10/4	4x4	9,135	0.054	0.073	9,600	10,550	0.029	0.036

For SI: 1 lbf = 4.45N, 1 inch = 25.4 mm.

¹One steel, plain (flat), SAE narrow (N) washer, as provided with the HDC10 hold-down, must be installed between the nut and the bottom of the U-shaped steel component of the hold-down.
²The allowable loads for the hold-down assemblies are based on allowable stress design (ASD) and include the load duration factor, C_D, as shown in the table in accordance with the NDS. No further increase is allowed, except as noted in footnote 8, below.
³When using the basic load combinations in accordance with IBC Section 1605.3.1, the tabulated allowable loads for the hold-down assembly must not be increased for wind or earthquake loading. When using the alternate basic load combinations, in IBC Section 1605.3.2 that include wind or earthquake loads, the tabulated allowable loads for the hold-down assembly must not be increased by 33¹/₃ percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.
⁴Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report.
⁵Allowable tension loads are for the hold-down assembly, consisting of the hold-down device attached to a wood structural member with the size and quantity of SDS wood screws noted in Table 4A.
⁶Allowable compression loads are based on the lesser of: a) the allowable compression load based on testing of the hold-down assembly, b) the calculated allowable concrete bearing strength, and c) the calculated bearing capacity of the wood members on the aluminum base.
⁷The wood member(s) must have a minimum F_c* of 1550 psi, where F_c* is the NDS-specified reference compression design value parallel-to-grain, multiplied by all applicable adjustment factors except C_p, and must be installed such that they bear directly upon the aluminum base. The bottom of the HDC10 hold-down must bear directly on concrete having a minimum compressive strength, f_c, of 2,500 psi.
⁸Allowable compression loads corresponding to a load duration factor of C_D=1.6 are governed by the concrete bearing strength, based on an assumed f_c of 2,500 psi and a gross bearing area of 9.38 in². The allowable compression loads, and the corresponding displacements may be linearly increased for higher concrete compressive strengths, up to maximum values as follows:

Model No.	P _{all} (lbs)	Δ _{all} (in)	Δ _s (in)
HDC10/22	11,315	0.031	0.038
HDC10/4	15,360	0.036	0.047

All other aspects of the foundation design, including but not limited to design for applicable shear and flexural stresses induced by the hold-down, must be considered by the designer.
⁹The cumulative thickness of the wood member(s) (i.e., the dimension parallel to the long axis of the SDS wood screws) must be 3 inches for the HDC10/22, and 3¹/₂ inches for the HDC10/4. The minimum width of the wood members must be 3¹/₂ inches.
¹⁰The tabulated allowable (ASD) loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ_s deformations.
¹¹Tabulated displacement values, Δ_{all} and Δ_s, for hold-down assemblies include all sources of hold-down assembly elongation, such as fastener slip, and hold-down device extension or compression, at ASD-level and strength-level forces, respectively.
¹²Due to the possibility of galvanic action, the HDC10 must be limited to covered end-use installations with dry conditions of use.