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Attn: Tim Kaucher, P.E.  
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RESEARCH REPORT: RR 25720  
(CSI# 06090)

BASED UPON ICC-ES EVALUATION  
REPORT NO. ESR-2330

REEVALUATION DUE DATE:  
September 1, 2010

Issued Date: September 1, 2009

Code: 2008 LABC

**GENERAL APPROVAL** - Simpson Strong-Tie - Screw Style Hold Down Connectors - HDU, HDQ8, HHDQ, PHD and DTT2.

**DETAILS**

The above assemblies and/or products are approved when in compliance with the description, use, identification and findings of ICC-ES Report No. ESR-2330, dated May 1, 2009 of the ICC Evaluation Service. The report, in its entirety, is attached and made part of this general approval.

The parts of ICC-ES Report No.ESR-2330 which are excluded on the attached copy have been removed by the Los Angeles Building Department as not being included in this approval.

**The approval is subject to the following conditions:**

1. The values shown in this report shall not be used in the repair, retrofit and new construction of tilt-up and masonry wall anchorage (in tension) for the connection with the horizontal wood diaphragm.
2. A 25% reduction in all allowable loads specified in the research report shall be taken in hold-down devices as required by Section 2306.5 of the 2008 Los Angeles City Building Code.
3. The tabulated allowable loads shall not be increased for duration of loading.

RR 25720  
Page 1 of 2

Simpson Strong-Tie

Re: Simpson Strong-Tie - Screw Style Hold Down Connectors - HDU, HDQ8, HHDQ, PHD and DTT2.

4. Wood screw capacity shall be verified where the wood species is other than Douglas Fir Larch (specific gravity of 0.50).

## **DISCUSSION**

The report is in compliance with 2008 Los Angeles 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), dated on October 2005 (editorially revised April 2008).

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.

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.

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Attachment: ICC ES Report No. ESR-2330 (10 Pages)

# ICC-ES Evaluation Report

**ESR-2330**

Reissued May 1, 2009

This report is subject to re-examination in two years.

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**DIVISION: 06—WOOD AND PLASTICS**  
**Section: 06090—Wood and Plastic Fastenings**
**REPORT HOLDER:**
**SIMPSON STRONG-TIE COMPANY, INC.**  
 5956 WEST LAS POSITAS BOULEVARD  
 PLEASANTON, CALIFORNIA 94588  
 (800) 925-5099  
[www.strongtie.com](http://www.strongtie.com)
**EVALUATION SUBJECT:**
**SIMPSON STRONG-TIE SCREW HOLD-DOWN  
CONNECTORS**
**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

- 2006 *International Building Code*® (IBC)
- \* ■ ~~2006 *International Residential Code*® (IRC)~~
- ~~Other Codes (see Section 8.0)~~

**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 IBC Sections 2304.9.3, 2305.1, 2305.3.2, 2305.3.7, 2305.3.8.2.4, 2308.9.3.1, and 2308.9.3.2; 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.~~

**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 <sup>3</sup>/<sub>8</sub>-inch-thick-by-1-inch-deep (9.5 mm by 25.4 mm) steel bar stock, and the washers are formed from <sup>3</sup>/<sub>8</sub>-inch-thick (9.5 mm) steel plate. The HHDQ bodies are formed from No. 7 gage steel, and the load transfer plates are <sup>1</sup>/<sub>2</sub>-inch-thick (12.7 mm) steel plate. See Table 2A for HDQ8 and HHDQ hold-down dimensions and fastener requirements.

**3.1.3 PHD Hold-downs:** PHD 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 3. The PHD2 and PHD5 bodies are formed from No. 14 gage galvanized steel and the PHD6 bodies are formed from No. 12 gage galvanized steel. The base plates are formed from No. 3 gage steel. See Table 3A for PHD hold-down dimensions and required fasteners.

**3.1.4 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. The DTT2 is formed from No. 14 gage galvanized steel. One steel, plain (flat), standard plate (W) washer conforming to ASTM F 844 and ASME B18.22.1, Type A, with a <sup>9</sup>/<sub>16</sub>-inch (14.3 mm) inner diameter, a <sup>1</sup>/<sub>8</sub>-inch (35 mm) outer diameter, a minimum thickness of 0.109 inch (2.77 mm), and a minimum hardness of 60 HRB must be installed between the nut and the seat of the DTT2 hold-down. The standard plate washer dimension tolerances must be in accordance with ASTM B18.22.1. See Table 4 for product dimensions, required fasteners and allowable loads.

**3.2 Materials:**

**3.2.1 Steel:** The bodies of the HDU, PHD, and HDQ8 hold-downs are fabricated 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 tensile strength,  $F_u$ , of 45,000 psi (310 MPa). The load transfer base plates of the HDU and PHD series hold-downs are fabricated from ASTM A 1011, 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 bodies of the HHDQ hold-downs are fabricated from ASTM A 1011, 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 A 36 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 A 653, SS designation, Grade 33 steel.

The galvanized bodies of the HDU, HDQ8, PHD, and DTT2 hold-downs have a minimum G90 zinc coating in accordance with ASTM A 653. 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<sup>2</sup>), total for both sides in accordance with ASTM A 123. 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. PHD base plates, 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 steel components of the hold-downs described in this report have the following minimum base-metal thicknesses:

NOMINAL THICKNESS	MINIMUM BASE-METAL THICKNESS (in.)
1/2 inch	0.4845
3/8 inch	0.3600
No. 3 gage	0.2285
No. 7 gage (ASTM A 653)	0.1715
No. 7 gage (ASTM A 1011)	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 3B for PHD hold-down assemblies, and Table 4 for DTT2 hold-down assemblies. Unless noted otherwise, the

minimum width of the wood members listed in Tables 1B, 2B, 2D, 3B, and 4 is 3 1/2 inches (88.9 mm).

**3.2.3 SDS Wood Screws:** Fasteners used with the hold-down assemblies described in Tables 1B, 2B, 2D, 3B, and 4 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 A 307 or A.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 Hold-down Assembly:** The allowable loads shown in Tables 1B, 2B, 2D, 3B, and 4 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 7-05 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 2305.3.2 of the IBC, or Equation 4.3-1 shown in Section 4.3.2 of ANSI/AF&PA SDPWS-2005 (Special Design Provisions for Wind and Seismic). The total deflection values,  $\Delta_{all}$  and  $\Delta_s$ , at ASD-level and strength-level forces, respectively, for hold-down assemblies shown in Tables 1B, 2B, 3B, and 4 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, HHDQ, and PHD hold-downs, or 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  $\Delta_s$  as used in this report for hold-down assemblies refers to the symbol  $d_a$  in Section 2305.3.2 of the IBC and to the symbol  $\Delta_a$  in Section 4.3.2 of ANSI/AF&PA SDPWS-2005.

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, 3B and 4 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, 3B, and 4 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 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.

**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 7-05. 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 Section 1912 of the 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:** Periodic special inspection must be provided in accordance with Section 1707.3 with the exception of those structures that qualify under Section 1704.1.

**4.3.2 IRC:** ~~Special inspections are not required.~~

## 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 a Professional Service Industries, Inc. (AA-660), or by Intertek Testing Services NA, Inc. (AA-688).

## 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 April 2008).

## 7.0 IDENTIFICATION

The hold-down devices 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 ([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. Additionally, the HHDQ11 and HHDQ14 hold-down devices manufactured in the United States are identified with the acronym of the inspection agency (PSI), and the HHDQ11 and HHDQ14 hold-down devices manufactured in Canada are identified with the name of their inspection agency (Intertek). The SDS wood screws are identified as described in evaluation report [ESR-2236](#).

## 8.0 OTHER CODES

### 8.1 Evaluation Scope

In addition to the codes referenced in Section 1.0, the products in this report were evaluated for compliance with the requirements of the following codes:

- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)

\* Deleted by City of Los Angeles

\* The products described in this report comply with, or are suitable alternatives to what is specified in, the codes listed above, subject to the provisions of Sections 8.2 through 8.7.

**8.2 Uses:**  
Simpson Strong-Tie 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 IBC Sections 2304.9.3, 2305.1, 2305.3.2, 2305.3.6, 2305.3.7.2.4, and 2308.9.3.1; 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.

**8.3 Description:**  
See Section 3.0 of this report.

**8.4 Design and Installation:**  
See Section 4.0 of this report, except for the following modifications:

\* Revise the first sentence in the second paragraph of Section 4.1.1: Where design load combinations include earthquake loads or effects, story drifts of the structure must be determined in accordance with Section 9.5.5.7.1 of ASCE 7-02 by using strength-level seismic forces without reduction for ASD.

- Revise the third sentence in Section 4.1.2: 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 9.5.2.6.3.2 of ASCE 7-02 and Sections 1620.3 through 1620.5 of the IBC.

**8.5 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 8.1 of this report, subject to the conditions of use described in Section 5.1 through 5.8.

**8.6 Evidence Submitted:**  
See Section 6.0 of this report.

**8.7 Identification:**  
See as Section 7.0 of this report.

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 <sup>11</sup> / <sub>16</sub>	3	3 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>8</sub>	5/8	6
HDU4	10 <sup>15</sup> / <sub>16</sub>	3	3 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>8</sub>	5/8	10
HDU5	13 <sup>3</sup> / <sub>16</sub>	3	3 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>8</sub>	5/8	14
HDU8	16 <sup>5</sup> / <sub>8</sub>	3	3 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>2</sub>	7/8	20
HDU11	22 <sup>1</sup> / <sub>4</sub>	3	3 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>2</sub>	1	30
HDU14	25 <sup>21</sup> / <sub>32</sub>	3	3 <sup>1</sup> / <sub>2</sub>	1 <sup>9</sup> / <sub>16</sub>	1 <sup>9</sup> / <sub>16</sub>	1	36

SI: 1 inch = 25.4 mm.

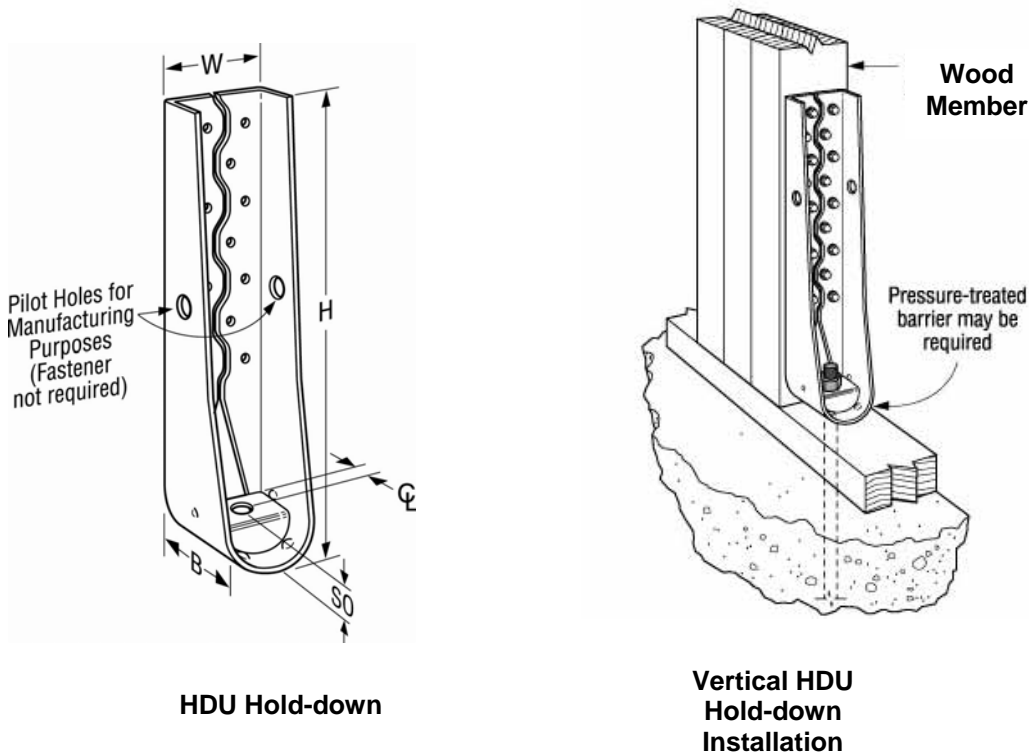


FIGURE 1—HDU SERIES HOLD-DOWNS

\* Deleted by City of Los Angeles

**TABLE 1B—ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDU SERIES HOLD-DOWN ASSEMBLIES<sup>1,2,3,4</sup>**

HOLD-DOWN MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE TENSION LOADS <sup>5</sup> , $P_{all}$ (lbs) $C_D = 1.33$ or $C_D = 1.6$						DISPLACEMENT $\Delta$ AT MAXIMUM LOAD <sup>8,9</sup> (in.)	
		Wood Member Thickness <sup>6</sup> (in.)						$\Delta_{all}$	$\Delta_s$
		3	3.5	4.5	5.5	7.25	5.5 <sup>(7)</sup>		
HDU2	1/4x1.5	1,810	1,810	1,810	1,810	1,810	1,810	0.069	0.090
	1/4x2.5	3,075	3,075	3,075	3,075	3,075	3,075	0.088	0.118
HDU4	1/4x1.5	3,105	3,105	3,105	3,105	3,105	3,105	0.083	0.108
	1/4x2.5	4,565	4,565	4,565	4,565	4,565	4,565	0.114	0.154
HDU5	1/4x1.5	3,960	3,960	3,960	3,960	3,960	3,960	0.109	0.142
	1/4x2.5	5,645	5,670	5,670	5,670	5,670	5,670	0.115	0.158
HDU8	1/4x1.5	5,980	5,980	5,980	5,980	5,980	5,980	0.087	0.115
	1/4x2.5	5,980	6,970	7,870	7,870	7,870	7,870	0.113	0.161
HDU11	1/4x2.5	—	—	—	9,535	11,175 <sup>(10)</sup>	11,175	0.137	0.182
HDU14	1/4x2.5	—	—	—	—	14,390 <sup>(10)</sup>	14,445	0.172	0.239

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

<sup>1</sup>Tabulated 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.

<sup>2</sup>The 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.

<sup>3</sup>When 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 increase by 33<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

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

<sup>5</sup>The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated  $\Delta_s$  deformations.

<sup>6</sup>The 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<sup>1</sup>/<sub>2</sub> inches, except as noted.

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

<sup>8</sup>Tabulated displacement values,  $\Delta_{all}$  and  $\Delta_s$ , 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.

<sup>9</sup>Elongation 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,  $\Delta_{all}$ , and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load,  $\Delta_s$ , to account for anchor rod elongation.

<sup>10</sup>Requires a heavy hex anchor nut to achieve tabulated tension loads.

**TABLE 1C—ALLOWABLE TENSION LOADS AND DISPLACEMENTS OF HDU SERIES HOLD-DOWN CONNECTORS<sup>2,3</sup>**

HOLD-DOWN MODEL NO.	ALLOWABLE TENSION LOAD, $P_{all}$ (lbs)	DISPLACEMENT $\Delta$ AT MAX LOAD <sup>4</sup> (in)	
		$\Delta_{all}$	$\Delta_s$
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 <sup>(5)</sup>	0.124	0.172

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

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

<sup>2</sup>Allowable tension loads are applicable for designs complying with Section 12.11.2.2.2 of ASCE 7-05 (2006 IBC); or Section 9.5.2.6.3.2 of ASCE 7-02 and Sections 1620.3 through 1620.5 of the 2003 IBC, as applicable.

<sup>3</sup>When 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 increase by 33<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

<sup>4</sup> $\Delta_{all}$  is the displacement at the tabulated ASD load and  $\Delta_s$  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,  $\Delta_s$ .

<sup>5</sup>Where noted, Heavy Hex anchor nut required to achieve tabulated tension loads.

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

HOLD-DOWN MODEL NO.	DIMENSIONS (in)					ANCHOR BOLT DIA. (in)	SDS SCREW QUANTITY
	H	W	B	CL	SO		
HDQ8	14	2 <sup>7</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>8</sub>	<sup>7</sup> / <sub>8</sub>	20
HHQ11	15 <sup>1</sup> / <sub>8</sub>	3	3 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	<sup>7</sup> / <sub>8</sub>	1	24
HHQ14	18 <sup>3</sup> / <sub>4</sub>	3	3 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	<sup>7</sup> / <sub>8</sub>	1	30

SI: 1 inch = 25.4 mm.

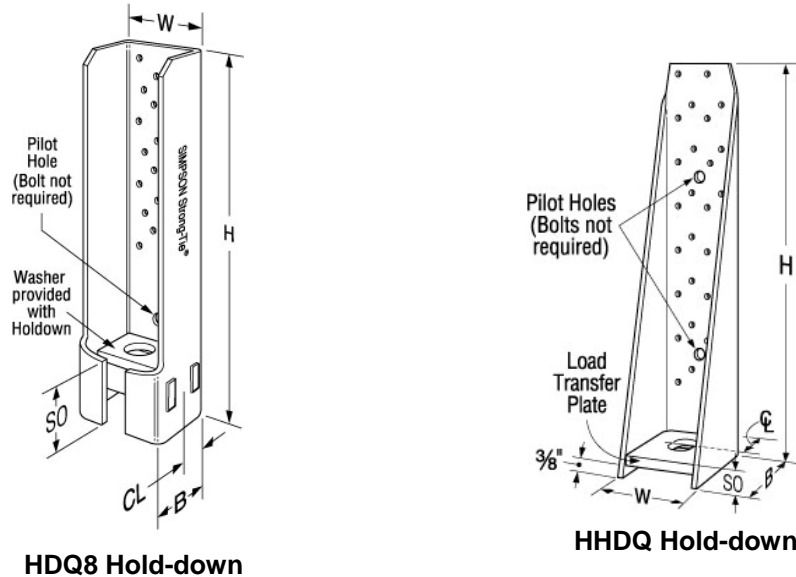


FIGURE 2A—HDQ8/HHQ SERIES HOLD-DOWNS

TABLE 2B—ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR HDQ8/HHQ SERIES HOLD-DOWN ASSEMBLIES<sup>1,2,3,4</sup>

HOLD-DOWN MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE TENSION LOADS <sup>5</sup> , P <sub>all</sub> (lbs) C <sub>D</sub> = 1.33 or C <sub>D</sub> = 1.6						DISPLACEMENT <sup>8,9</sup> Δ AT MAX LOAD (in)	
		Wood Member Thickness <sup>6</sup> (in.)						Δ <sub>all</sub>	Δ <sub>s</sub>
		3	3.5	4.5	5.5	7.25	5.5 <sup>(7)</sup>		
HDQ8	1/4x1.5	5,715	5,715	5,715	5,715	5,715	5,715	0.073	0.093
	1/4x2.5	5,715	5,715	7,280	7,280	7,280	7,280	0.091	0.121
	1/4x3	5,715	7,630	9,230	9,230	9,230	9,230	0.095	0.130
HHQ11	1/4x2.5	—	—	—	11,810	11,810	11,810 <sup>(10)</sup>	0.131	0.168
HHQ14	1/4x2.5	—	—	—	—	13,015	13,710 <sup>(10)</sup>	0.107	0.144

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

<sup>1</sup>Tabulated 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.

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

<sup>3</sup>When 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<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

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

<sup>5</sup>The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated Δ<sub>s</sub> deformations.

<sup>6</sup>The 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<sup>1</sup>/<sub>2</sub> inches, except as noted.

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

<sup>8</sup>Tabulated displacement values, Δ<sub>all</sub> and Δ<sub>s</sub>, 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.

<sup>9</sup>Elongation 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<sub>all</sub>, and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load, Δ<sub>s</sub>, to account for anchor rod elongation.

<sup>10</sup>Requires 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<sup>1,2,3</sup>**

MODEL NO.	ALLOWABLE LOAD <sup>4</sup> , $P_{all}$ (lbs)		DISPLACEMENT <sup>5</sup> $\Delta$ AT MAXIMUM LOAD (in.)			
			Tension		Compression	
	Tension	Compression	$\Delta_{all}$	$\Delta_s$	$\Delta_{all}$	$\Delta_s$
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 <sup>(6)</sup>	11,010 <sup>(6)</sup>	0.036	0.052	0.070	0.097

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

<sup>1</sup>This 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.

<sup>2</sup>Allowable tension and compression loads are applicable for designs complying with Section 12.11.2.2.2 of ASCE 7-05 (2006 IBC); or Section 9.5.2.6.3.2 of ASCE 7-02 and Sections 1620.3 through 1620.5 of the 2003 IBC, as applicable.

<sup>3</sup>When 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 increase by 33<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

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

<sup>5</sup> $\Delta_{all}$  is the displacement at the tabulated ASD loads and  $\Delta_s$  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,  $\Delta_s$ .

<sup>6</sup>A heavy hex anchor nut is required to achieve tabulated loads.

**TABLE 2D—ALLOWABLE COMPRESSION LOADS AND DISPLACEMENTS FOR HDQ8/HHDQ SERIES HOLD-DOWN ASSEMBLIES<sup>1,2,3</sup>**

MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE COMPRESSION LOADS <sup>4</sup> , $P_{all}$ (lbs) $C_D = 1.33$ or $C_D = 1.6$						DISPLACEMENT <sup>5,6</sup> $\Delta$ AT MAX LOAD (in)	
		Wood Member Thickness <sup>7</sup> (in.)							
		3	3.5	4.5	5.5	7.25	5.5 <sup>(8)</sup>	$\Delta_{all}$	$\Delta_s$
HDQ8	1/4x1.5	5,570	5,570	5,570	5,570	5,570	5,570	0.038	0.045
	1/4x2.5	5,570	5,570	7,825	7,825	7,825	7,825	0.049	0.075
	1/4x3	5,570	5,570	8,995	8,995	8,995	8,995	0.053	0.076
HHDQ11	1/4x2.5	—	—	—	10,860	10,860	10,860 <sup>(9)</sup>	0.109	0.143
HHDQ14	1/4x2.5	—	—	—	—	12,035	12,035 <sup>(9)</sup>	0.081	0.110

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

<sup>1</sup>Tabulated 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.

<sup>2</sup>Allowable compression loads are applicable for design of anchorage assemblies for structural walls in accordance with Section 12.11 of ASCE 7-05 (2006 IBC); or Section 9.5.2.6 of ASCE 7-02 and Sections 1620.3 through 1620.5 of the 2003 IBC, as applicable.

<sup>3</sup>When 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 increase by 33<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

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

<sup>5</sup> $\Delta_{all}$  is the displacement at the tabulated ASD loads and  $\Delta_s$  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,  $\Delta_s$ .

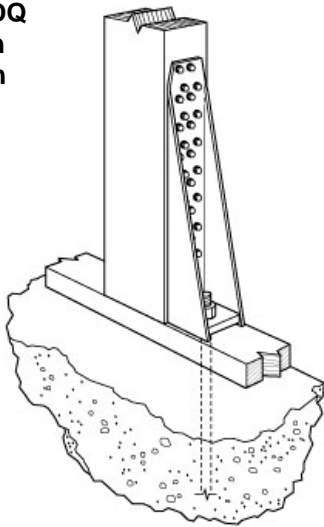
<sup>6</sup>The registered design professional must verify that the hold-down anchor bolt is adequate to resist design compression forces based on the unbraced length of the anchor bolt.

<sup>7</sup>The 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<sup>1</sup>/<sub>2</sub> inches, except as noted.

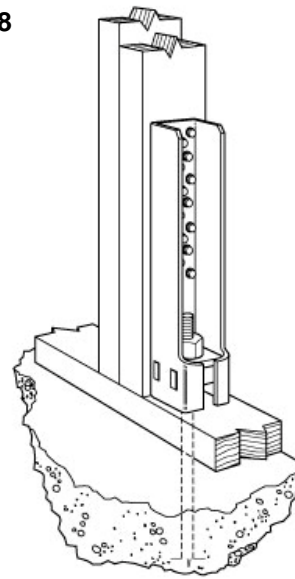
<sup>8</sup>The minimum width of the wood members must be 5<sup>1</sup>/<sub>2</sub> inches (6x6 nominal).

<sup>9</sup>A heavy hex anchor nut is required to achieve tabulated loads.

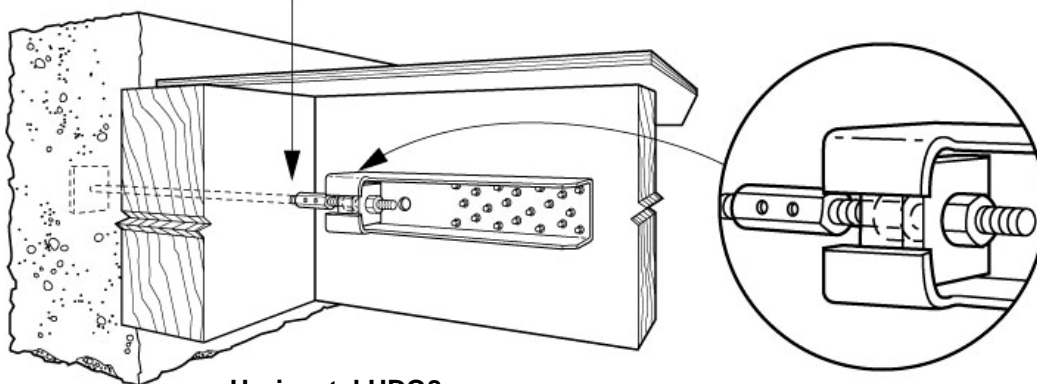
**Vertical HHDQ  
Hold-down  
Installation**



**Vertical HDQ8  
Hold-down  
Installation**



Hanger not shown for clarity



**Horizontal HDQ8  
Hold-down  
Installation**

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

TABLE 3A—DIMENSIONS AND FASTENER REQUIREMENTS FOR PHD SERIES HOLD-DOWN CONNECTORS

MODEL NO.	DIMENSIONS (in)					ANCHOR BOLT DIA (in)	SDS SCREW QUANTITY
	H	W	B	CL	SO		
PHD2	9 <sup>5</sup> / <sub>16</sub>	2 <sup>7</sup> / <sub>8</sub>	2 <sup>13</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	<sup>5</sup> / <sub>8</sub>	10
PHD5	11 <sup>9</sup> / <sub>16</sub>	2 <sup>7</sup> / <sub>8</sub>	2 <sup>13</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	<sup>5</sup> / <sub>8</sub>	14
PHD6	13 <sup>13</sup> / <sub>16</sub>	2 <sup>15</sup> / <sub>16</sub>	2 <sup>13</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	<sup>7</sup> / <sub>8</sub>	18

SI: 1 inch = 25.4 mm.

TABLE 3B—ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR PHD SERIES HOLD-DOWN ASSEMBLIES<sup>1,2,3</sup>

MODEL NO.	SDS SCREW SIZE (in)	ALLOWABLE TENSION LOADS, $P_{all}$ (lbs) $C_D = 1.33$ or $C_D = 1.6$					DISPLACEMENT <sup>5</sup> $\Delta$ AT MAXIMUM LOAD (in)	
		Wood Member Thickness (in)					$\Delta_{all}$	$\Delta_s$
		3	3.5	4.5	5.5	7.25		
PHD2	1/4x1.5	2,785	2,785	2,785	2,785	2,785	0.085	0.110
	1/4x3.0	3,080	3,080	3,080	3,080	3,080	0.075	0.103
PHD5	1/4x1.5	3,395	3,395	3,395	3,395	3,395	0.081	0.107
	1/4x3.0	4,545	4,545	4,545	4,545	4,545	0.090	0.124
PHD6	1/4x1.5	4,535	4,535	4,535	4,535	4,535	0.069	0.092
	1/4x3.0	4,535	5,210	5,210	5,210	5,210	0.094	0.124

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

<sup>1</sup>Tabulated 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 3A.

<sup>2</sup>The allowable tension 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.

<sup>3</sup>When 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 increase by 33 1/3 percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

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

<sup>5</sup> $\Delta_{all}$  is the displacement at the tabulated ASD loads and  $\Delta_s$  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,  $\Delta_s$ .

<sup>6</sup>Elongation 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,  $\Delta_{all}$  all, and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load,  $\Delta_s$ , to account for anchor rod elongation.

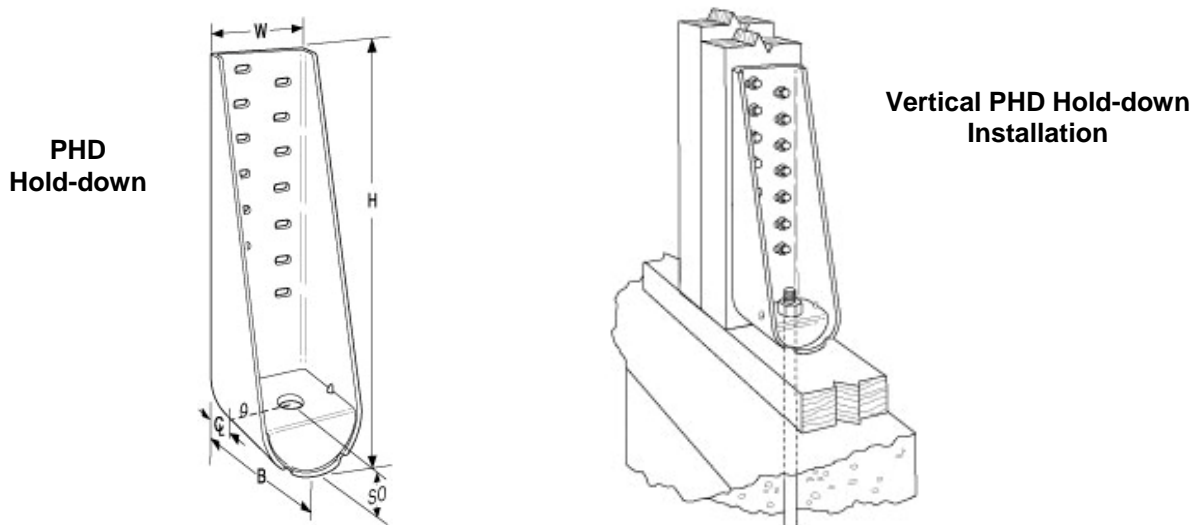


FIGURE 3—PHD SERIES HOLD-DOWNS

**TABLE 4—DIMENSIONS, FASTENER REQUIREMENTS, ALLOWABLE TENSION LOADS AND DISPLACEMENTS FOR DTT2 SERIES HOLD-DOWN ASSEMBLIES<sup>1,2,3,4,5</sup>**

MODEL NO.	DIMENSIONS (inches)				REQUIRED FASTENERS			WOOD MEMBER THICKNESS <sup>6</sup> (inches)	ALLOWABLE TENSION LOADS <sup>7</sup> , $P_{all}$ (lbs)		DISPLACEMENT $\Delta$ AT MAXIMUM LOAD <sup>8,9</sup>	
					Anchor Bolt Dia.	SDS Screws			$C_D=1.0$	$C_D=1.6$	$\Delta_{all}$	$\Delta_s$
	L	W	CL	B		Qty.	Size					
DTT2	6 <sup>15</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>16</sub>	1 <sup>5</sup> / <sub>8</sub>	1/2	8	SDS <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub>	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.

<sup>1</sup>One steel, plain (flat), standard plate (W) washer conforming to Section 3.1.4 of this report must be installed between the nut and the seat of the DTT2 hold-down.

<sup>2</sup>Tabulated 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 4.

<sup>3</sup>The 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.

<sup>4</sup>When 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 33<sup>1</sup>/<sub>3</sub> percent, nor can the alternative basic load combinations be reduced by a factor of 0.75.

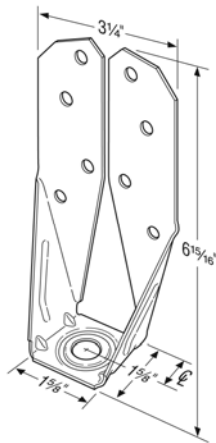
<sup>5</sup>Anchorage to concrete or masonry must be determined in accordance with Section 4.1.3 of this report.

<sup>6</sup>The 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<sup>1</sup>/<sub>2</sub> inches.

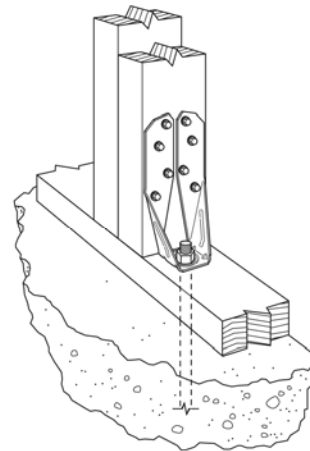
<sup>7</sup>The tabulated allowable (ASD) tension loads must be multiplied by 1.4 to obtain the strength-level resistance loads associated with the tabulated  $\Delta_s$  deformations.

<sup>8</sup>Tabulated displacement values,  $\Delta_{all}$  and  $\Delta_s$ , 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.

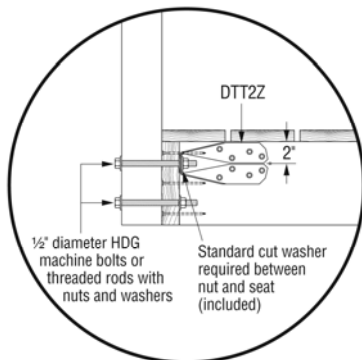
<sup>9</sup>Elongation of the hold-down anchor rod must be calculated when the ASTM steel specification of the anchor rod differs from that described in the Section 3.2.4 of this report, or the actual unbraced length is greater than 4.5 inches. In lieu of calculating the elongation of the hold-down anchor 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,  $\Delta_{all}$ , and an additional 0.014 inch may be added to the tabulated hold-down displacement at strength-level load,  $\Delta_s$ , to account for anchor rod elongation.



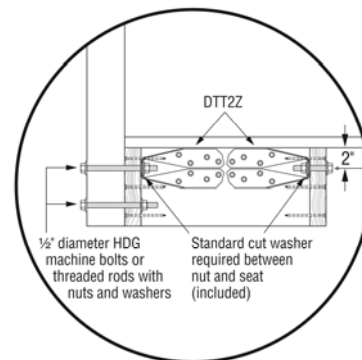
DTT2 Hold-Down



DTT2 Vertical Installation



DTT2 Horizontal Installation



DTT2 Horizontal Installation

FIGURE 4—DTT2 HOLD-DOWN