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ESR-2320

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This report is subject to renewal 11/2017.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 05 23—WOOD, PLASTIC AND COMPOSITE FASTENINGS

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY INC.

**5956 WEST LAS POSITAS BOULEVARD
PLEASANTON, CALIFORNIA 94588**

EVALUATION SUBJECT:

SIMPSON STRONG-TIE® COUPLING TAKE-UP DEVICE (CTUD), TAKE-UP DEVICE (TUD AND ATUD), RATCHETING TAKE-UP DEVICE (RTUD), AND TAKE-UP WASHER (TUW)



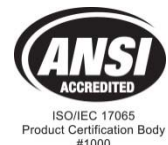
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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic and Composite Fastenings

REPORT HOLDER:

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EVALUATION SUBJECT:

SIMPSON STRONG-TIE® COUPLING TAKE-UP DEVICE (CTUD), TAKE-UP DEVICE (TUD AND ATUD), RATCHETING TAKE-UP DEVICE (RTUD), AND TAKE-UP WASHER (TUW)

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)

Property evaluated:

Structural

2.0 USES

The Simpson Strong-Tie® Coupling Take-Up Devices and Take-Up Devices described in this report are used in conjunction with continuous tie-down systems. They serve as part of a restraint system in wood-frame construction, to remove slack from the system by compensating for wood shrinkage and building settlement, in accordance with IBC Sections [2303.7](#) and [2304.3.3](#).

3.0 DESCRIPTION

3.1 General:

3.1.1 Coupling Take-Up Device (CTUD): The CTUD is an in-line, internally threaded coupling device that connects threaded rods together between floor levels, and removes slack in the continuous tie-down system when wood shrinkage or building settlement occurs. The device can be installed at any height in the wall, and has a rated compensation capacity of 1 inch (25 mm), to accommodate shrinkage and settlement from the story level in which it is installed. Each end of the CTUD is manufactured to create

a positive stop for the threaded rod. The CTUD has witness holes to allow for inspection of proper thread engagement. The CTUD65, CTUD75, CTUD76, CTUD87, CTUD97, and CTUD98 are reducing CTUD models, allowing transition between different rod diameters. See [Table 1](#) for recognized models and dimensions.

3.1.2 Take-Up Device (TUD and ATUD): The TUD and ATUD are in-line devices utilized at floor and roof levels to remove slack in the continuous tie-down system when wood shrinkage or building settlement occurs. The TUD and ATUD bear on a steel bearing plate installed on the top surface of the wood sole plate or top plates, and have rated compensation capacities as given in [Table 2](#), to accommodate wood shrinkage and building settlement. Since the rod is continuous through the TUD and ATUD, the TUD, or ATUD above it must compensate for slack in the continuous tie-down system resulting from the cumulative shrinkage and settlement in the wood framing below it. See [Table 2](#) for recognized models, rated shrinkage compensation capacities, and dimensions of the TUD and ATUD.

3.1.3 Ratcheting Take-Up Device (RTUD): The RTUD is a ratcheting device utilized at floor and roof levels to remove slack in the continuous tie-down system when wood shrinkage occurs. The RTUD sits on a steel bearing plate installed on the top surface of the wood sole plate or top plates, and is fastened to the wood framing. As shrinkage occurs, the RTUD moves downward along the threaded rod axis. When an upward force is applied, the RTUD locks into position and engages the rod to transfer the forces into the threaded rod. The RTUD has an unlimited shrinkage compensation capacity, provided there are no obstructions to the travel of the RTUD along the length of the threaded rod. See [Table 3](#) for recognized models and dimensions of the RTUD.

3.1.4 Take-Up Washer (TUW): The TUW is a ratcheting plate washer used in combination with the SDWF screw (recognized in [ESR-3046](#)) to resist wind uplift at floor levels. The TUW is fastened to the top surface of the wood sole plate using four SD9212 screws (recognized in [ESR-3046](#)), and one SDWF is installed into the center of the TUW, through the floor cavity, and into the top plates of the wall immediately below. As the SDWF is installed, the screw head pulls the TUW side tabs downward, which engage the screw. This action allows the TUW to move downward along the screw as shrinkage occurs. When an upward force is applied, the TUW locks onto the screw and engages it to transfer the forces. The TUW has a compensation capacity of 7/8 inch (22 mm). See [Table 4](#) for recognized models and dimensions of the TUW.

3.2 Materials:

3.2.1 CTUD and TUD: The CTUD and TUD bodies are fabricated from [ASTM A311-04](#) (Reapproved 2015) Class B, Grade 1144, steel, with a minimum tensile strength of 126,000 psi (869 MPa), and a minimum yield strength of 105,000 psi (724 MPa). The bodies are coated with a corrosion-resistant finish specified in the approved quality documentation. The springs are fabricated from [ASTM A313-13](#), Type 631, stainless steel torsional wire or [ASTM A228-14](#) steel wire.

3.2.2 ATUD: The ATUD body is fabricated from [ASTM B221-14](#) 6061-T6511 aluminum. The spring is fabricated from ASTM A228-14 steel wire.

3.2.3 RTUD: The RTUD is a proprietary steel device manufactured to meet the specifications noted in the manufacturing standard associated with this report. The RTUD3 and RTUD4 housing and inserts are fabricated from cast steel. The RTUD4B, RTUD5 and RTUD6 housing and inserts are fabricated from hot forged steel. Additional device components consist of steel washers, an internal tension ring and a PU foam rubber washer. Each steel component has a zinc/nickel electroplated finish with the exception of the internal tension ring.

3.2.4 TUW: The TUW plates are manufactured from No. 10 gage galvanized steel complying with [ASTM A653](#), SS designation, Grade 33. The minimum base-metal thickness is 0.1275 inch (3.24 mm).

3.2.5 Threaded Rod: Threaded rod used with the CTUD, TUD, ATUD, and RTUD must comply with the applicable code. Rods used with the CTUD must meet the diameter and thread specifications given in [Table 1](#), and ends of rods must be cut square. Maximum diameters for threaded rod used with the TUD and ATUD are given in [Table 2](#). Threaded rod used with the RTUD must meet the diameter requirements, thread specification and strength requirements as specified in [Table 3](#).

4.0 DESIGN AND INSTALLATION

4.1 Design:

Allowable design loads, deflections at allowable load, rated shrinkage compensation capacities and dimensions for CTUD models are given in [Table 1](#). Allowable design loads, deflections at allowable load, rated shrinkage compensation and dimensions for TUD and ATUD models are given in [Table 2](#). Allowable design loads, deflections at allowable load, and dimensions for the RTUD are given in [Table 3](#). Allowable design loads, deflections at allowable load, and dimensions for the TUW are given in [Table 4](#). Drawings and design details for the continuous tie-down system, including threaded rods, bearing plates, anchors, and wood framing members, must comply with the code and be submitted to the code official for approval. The continuous tie-down system must also be designed such that the slack in the system due to wood shrinkage and building settlement is less than the rated compensation capacity for each CTUD, TUD, and ATUD within the system.

4.2 Installation:

The CTUD, TUD, ATUD, RTUD, and TUW must be installed in accordance with the details in this report, the manufacturer's published installation instructions, and the drawings and design details approved by the code official. Threaded rod used with the CTUD, TUD, ATUD, or RTUD must comply with the requirements of Section 3.2.5. The continuous tie-down system must be installed plumb, such that the offset angle between the top of the floor and

the bottom of the top plates or bridge block above does not exceed 1.33 degrees from vertical for the CTUD, TUD, ATUD, and RTUD. For the TUW, the SDWF screw must be installed such that its angle with respect to the plane of the TUW plate does not exceed 2.0 degrees from vertical. The activation pin on the CTUD must remain in place until both threaded rods are installed, and the nut at the sole plate above is secured in accordance with the manufacturer's installation instructions. The activation pin on the TUD, and ATUD must remain in place until the plate washer and nut above it are secure. The TUW must be installed on the sole plate with four SD9212 screws, and the SDWF screw must be installed through the center of the TUW so that the tabs close to engage the SDWF screw threads. The go/no-go gage, supplied with the TUW, must be used in accordance with the manufacturer's installation instructions to ensure proper installation. [Figure 1](#) shows an installation detail for the CTUD; [Figure 2](#) shows an installation detail for the TUD and ATUD; [Figure 3](#) shows an installation detail for the RTUD; and [Figure 4](#) shows an installation detail for the TUW.

5.0 CONDITIONS OF USE

The Coupling Take-Up Device (CTUD), Take-Up Device (TUD and ATUD), Ratcheting Take-Up Device (RTUD), and Take-Up Washer (TUW) 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 devices must be installed in accordance with this report, the manufacturer's published installation instructions and the drawings and design details approved by the code official. In the event of a conflict between this report and the manufacturer's published installation instructions, the most restrictive governs.
- 5.2** The design values given in this report are for the CTUD, TUD, ATUD, RTUD, and TUW alone. No further increase in allowable load is permitted. Calculations, demonstrating that the design loads do not exceed the allowable loads and that the expected slack due to wood shrinkage and building settlement does not exceed the rated compensation capacity for each CTUD, TUD, ATUD, and/or TUW in the system, must be submitted to the code official for approval. The calculations must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3** When installation is complete, the CTUD, TUD, ATUD, RTUD, and TUW are limited to installations in dry, interior locations.
- 5.4** The CTUD, TUD, ATUD, RTUD, and TUW must not be used to support dead loads other than their own weight.
- 5.5** Use of the CTUD, TUD, ATUD, RTUD, and TUW in contact with fire-retardant-treated wood or preservative-treated wood is outside of the scope of this report.
- 5.6** When the devices are used in continuous rod systems that resist light-frame shear wall overturning forces, calculations must be submitted to the code official confirming that the total vertical displacement, which would include steel rod elongation and the shrinkage compensating device deflection, is less than or equal to 0.200 inch (5 mm) for each story, or between restraints, whichever is more restrictive, using allowable stress design (ASD). Shear wall drift

limit calculations must consider the 0.200 inch (5 mm) vertical displacement limit. This 0.200-inch (5 mm) vertical displacement limit may be exceeded when it can be demonstrated that the shear wall story drift limit and the deformation compatibility requirements of IBC Section 1604.4 are met when considering all sources of vertical displacement.

6.0 EVIDENCE SUBMITTED

- Data in accordance with ICC-ES Acceptance Criteria for Shrinkage Compensating Devices (AC316), dated June 2013 (editorially revised March 2015).

- Data in accordance with the ICC-ES Acceptance Criteria for Shrinkage Compensating Devices (AC316), dated June 2013. (2006 IBC and IRC)

7.0 IDENTIFICATION

The CTUD, TUD, ATUD, RTUD, and TUW bear a label with the model number, evaluation report holder name (Simpson Strong-Tie Company, Inc.), and the evaluation report number (ESR-2320). The reducing CTUDs are scored at the reducing end around the outside. The TUW is packaged with one SDWF screw, four SD9212 screws, and a go/no-go gage for use in installation.

TABLE 1—COUPLING TAKE-UP DEVICE (CTUD) SPECIFICATIONS¹

MODEL NUMBER	THREADED ROD DIAMETER ² (in - in)	DIMENSIONS		ALLOWABLE TENSION LOAD ^{3,4} (lbs)	SEATING INCREMENT, Δ _R ⁶ (inches)	DEFLECTION AT ALLOWABLE LOAD, Δ _A ⁶ (inches)
		W (in)	L (in)			
CTUD55	5/8 - 5/8	1 7/8	5	15,520	0.004	0.006
CTUD65 ⁽⁵⁾	3/4 - 5/8	2	5 1/2	31,795	0.003	0.060
CTUD66	3/4 - 3/4	2	5 1/2	31,795	0.003	0.060
CTUD75 ⁽⁵⁾	7/8 - 5/8	2	5 1/2	31,795	0.003	0.060
CTUD76 ⁽⁵⁾	7/8 - 3/4	2	5 1/2	31,795	0.003	0.060
CTUD77	7/8 - 7/8	2	5 1/2	31,795	0.003	0.060
CTUD87 ⁽⁵⁾	1 - 7/8	2 1/2	6 1/8	55,955	0.003	0.033
CTUD88	1 - 1	2 1/2	6 1/8	55,955	0.003	0.033
CTUD97 ⁽⁵⁾	1 1/8 - 7/8	2 1/2	6 1/8	55,955	0.003	0.033
CTUD98 ⁽⁵⁾	1 1/8 - 1	2 1/2	6 1/8	55,955	0.003	0.033
CTUD99	1 1/8 - 1 1/8	2 1/2	6 1/8	55,955	0.003	0.033

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

¹Coupling Take-Up Devices (CTUD) compensate for up to 1 inch (25 mm) of wood shrinkage or building settlement.

²Thread specification for threaded rod used with the CTUD must be UNC Class 2A, in accordance with [ANSI/ASME B1.1](#).

³Allowable tension loads are for the CTUD only. The attached components (including anchors, tension rods, bearing plates, wood framing members, etc.) must be designed to resist design loads in accordance with the applicable code.

⁴No further increase in allowable tension load is permitted.

⁵The CTUD65, CTUD75, CTUD76, CTUD87, CTUD97, and CTUD98 models are reducing CTUD models, allowing transition between different rod diameters.

⁶The device average travel and seating increment, Δ_R, and deflection at allowable load, Δ_A, are additive, and describe the total movement of the device at allowable load, Δ_T. For design loads, P_D, less than the allowable load, P_A, the total movement of the device, Δ_T, is calculated as follows: Δ_T = Δ_R + Δ_A(P_D/P_A).

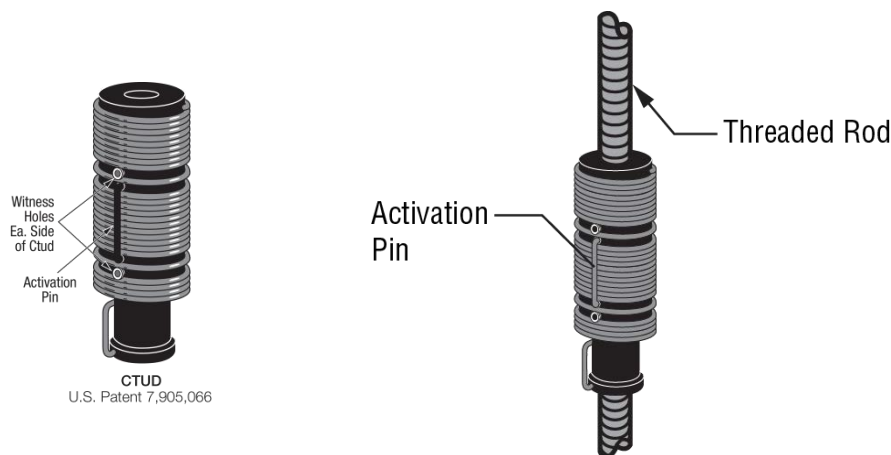


FIGURE 1—DIMENSIONS AND TYPICAL INSTALLATION OF THE CTUD

TABLE 2—TAKE-UP DEVICE (TUD / ATUD) SPECIFICATIONS

MODEL NUMBER	MAXIMUM THREADED ROD DIAMETER (in)	DIMENSIONS		RATED COMPENSATION CAPACITY (inches)	ALLOWABLE LOADS ^{1,2} (lbs.)	SEATING INCREMENT, Δ_R ³ (inches)	DEFLECTION AT ALLOWABLE LOAD, Δ_A ³ (inches)
		W (in)	L (in)				
TUD9	1 ¹ / ₈	2 ¹ / ₈	2 ¹ / ₄	1	34,655	0.001	0.014
TUD10	1 ¹ / ₄	2 ³ / ₈	2 ¹ / ₄	1	45,400	0.001	0.033
ATUD5	5 ⁵ / ₈	1 ³ / ₈	1 ⁷ / ₈	3 ³ / ₄	6,565	0.001	0.009
ATUD6-2	3 ³ / ₄	1 ³ / ₄	3 ¹ / ₈	2	11,430	0.004	0.022
ATUD9	1 ¹ / ₈	2 ¹ / ₈	2 ¹ / ₄	1	15,560	0.002	0.013
ATUD9-2	1 ¹ / ₈	2 ¹ / ₈	3 ⁷ / ₈	2	12,790	0.002	0.037
ATUD9-3	1 ¹ / ₈	2 ¹ / ₈	5	3	11,830	0.002	0.034
ATUD14	1 ³ / ₄	2 ⁷ / ₈	2 ¹ / ₄	3 ³ / ₄	24,395	0.005	0.015

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

¹Allowable loads are for the TUD and ATUD only. The attached components (including anchors, tension rods, bearing plates, wood framing members, etc.) must be designed to resist design loads in accordance with the applicable code.

²No further increase in allowable load is permitted.

³The device average travel and seating increment, Δ_R , and deflection at allowable load, Δ_A , are additive, and describe the total movement of the device at allowable load, Δ_T . For design loads, P_D , less than the allowable load, P_A , the total movement of the device, Δ_T , is calculated as follows: $\Delta_T = \Delta_R + \Delta_A(P_D/P_A)$.

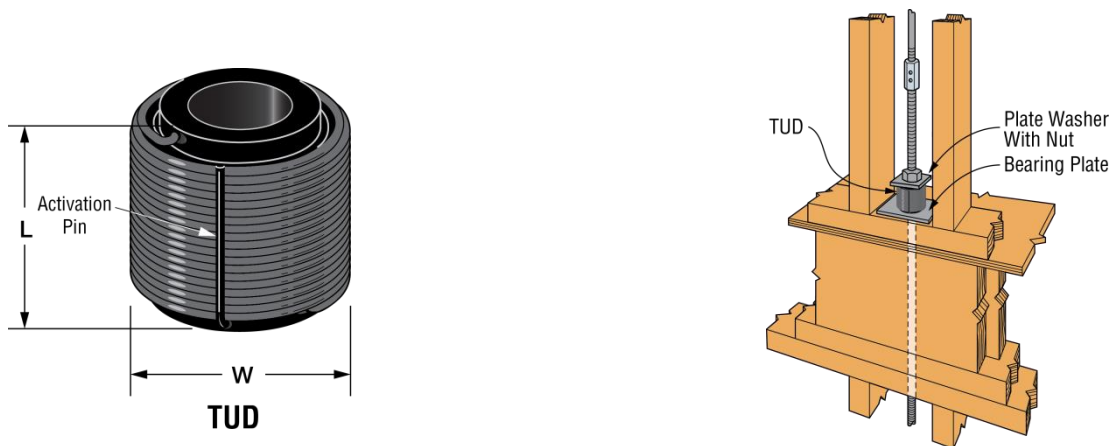


FIGURE 2—DIMENSIONS AND TYPICAL INSTALLATION OF THE TUD AND ATUD

TABLE 3—RATCHETING TAKE-UP DEVICE (RTUD) SPECIFICATIONS^{1,2}

MODEL NUMBER	THREADED ROD DIAMETER ³ (inch)	DIMENSIONS (inches)			ALLOWABLE LOAD ^{4,5} (lbs)	SEATING INCREMENT ⁶ , Δ_R (inch)	DEFLECTION AT ALLOWABLE LOAD ⁶ , Δ_A (inch)
		A	B	C			
RTUD3	3 ³ / ₈	1.886	1.344	0.941	3,335	0.053	0.015
RTUD4	1 ¹ / ₂	1.886	1.344	0.941	6,665	0.048	0.011
RTUD4B	1 ¹ / ₂	2.213	1.443	1.021	9,210	0.040	0.003
RTUD5	5 ⁵ / ₈	3.470	1.978	1.400	14,495	0.056	0.007
RTUD6	3 ³ / ₄	3.470	1.978	1.400	20,830	0.057	0.010

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 ksi = 6.89 MPa.

¹The RTUD compensates for an unlimited amount of wood shrinkage, provided there are no obstructions to the travel of the RTUD along the length of the threaded rod.

²RTUD must be attached to the sole plate or top plate with a minimum of two 8d x 2¹/₂ common nails.

³Thread specification for threaded rod used with the RTUD must be UNC Class 2A, in accordance with ANSI/ASME B1.1, and the specified minimum tensile strength, F_u , of the threaded rod must not exceed 80 ksi for the RTUD3, 90 ksi for the RTUD4, and 125 ksi for RTUD4B, RTUD5 and RTUD6.

⁴Allowable loads are for the RTUD only. The attached components (including anchors, tension rods, bearing plates, wood framing members, etc.) must be designed to resist design loads in accordance with the applicable code.

⁵No further increase in allowable load is permitted.

⁶The device average travel and seating increment, Δ_R , and deflection at allowable load, Δ_A , are additive, and describe the total movement of the device at allowable load, Δ_T . For design loads, P_D , less than the allowable load, P_A , the total movement of the device, Δ_T , is calculated as follows: $\Delta_T = \Delta_R + \Delta_A(P_D/P_A)$.

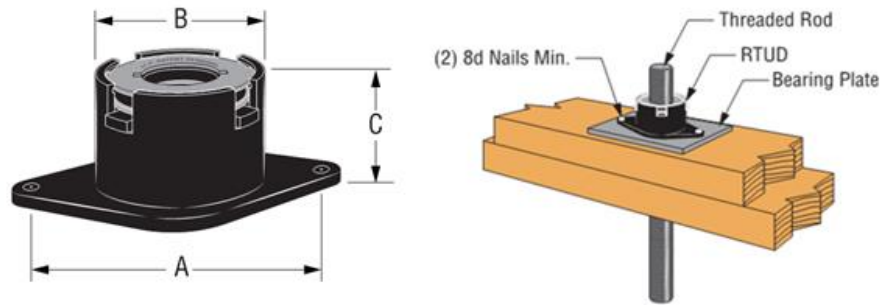


FIGURE 3—DIMENSIONS AND TYPICAL INSTALLATION OF THE RTUD

TABLE 4—TAKE-UP WASHER (TUW) SPECIFICATIONS¹

MODEL NUMBER	DIMENSIONS (inches)		FASTENER SCHEDULE		ALLOWABLE LOAD ^{4,5,6,7} (lbs)	SEATING INCREMENT ⁸ , Δ_R (inches)	DEFLECTION AT ALLOWABLE LOAD ^{8,9} , Δ_A (inches)
	A	B	Sole Plate ²	Top Plate ³			
TUW38	3.5	3.25	4 - SD9212	1 - SDWF	1,410	0.034	0.0050

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

¹The Take-Up Washer (TUW) compensates for up to $\frac{7}{8}$ inch (22 mm) of wood shrinkage.

²The TUW must be attached to the sole plate with four SD9212 screws.

³The SDWF screw must be installed through the hole in the center of the TUW, normal to the plane of the TUW, through the sole plate and floor cavity, and into the top plate of the floor below, until the head of the SDWF screw pulls the TUW side tabs downward, thereby engaging the shank of the screw.

⁴Tabulated allowable loads are for the TUW only, and apply only to tension loads that are in-line with the long axis of the SDWF screw. The allowable load of the TUW/SDWF assembly is limited by the lesser of: a) the tabulated allowable load given above, or b) the adjusted allowable withdrawal load for the SDWF screw, as given in [ESR-3046](#).

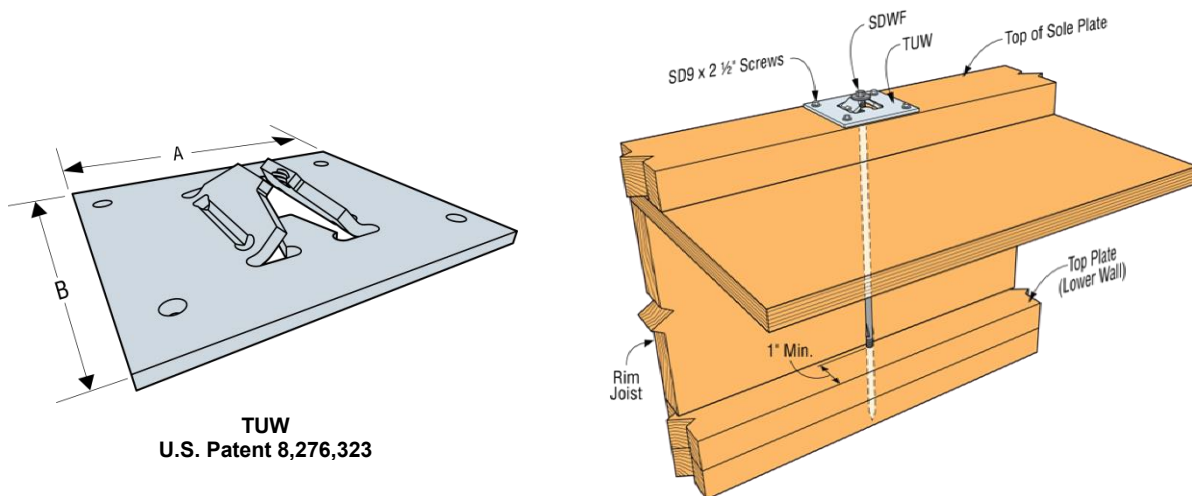
⁵The attached components (including screws and wood framing members, etc.) must be designed to resist design loads, and must account for serviceability limitations, in accordance with the applicable code.

⁶The TUW and SDWF have not been evaluated for lateral load transfer.

⁷No further increase in allowable tension load is permitted.

⁸The device average travel and seating increment, Δ_R , and deflection at allowable load, Δ_A , are additive, and describe the total movement of the device at allowable load, Δ_T . For design loads, P_D , less than the allowable load, P_A , the total movement of the device, Δ_T , is calculated as follows: $\Delta_T = \Delta_R + \Delta_A(P_D/P_A)$.

⁹The tabulated deflection at allowable load, Δ_A , accounts only for deformation of the TUW itself. It is not inclusive of additional deflections within the TUW/SDWF assembly, such as withdrawal and elongation of the SDWF screw.



TUW
U.S. Patent 8,276,323

FIGURE 4—DIMENSIONS AND TYPICAL INSTALLATION OF THE TUW