# Alternate Fasteners for Connection Details in AWC DCA6 with Simpson Strong-Tie Strong-Drive® Screws

The American Wood Council (AWC) publication, *Prescriptive Residential Wood Deck Construction Guide* (DCA6-2018), which is based on the 2015 International Residential Code, provides prescriptive deck construction details and requirements for decks built for one- and two-family dwellings.

The details given here are for fastener connections for beam-to-post, diagonal bracing, and sistered-stair stringer connections that have been designed and analyzed for use as alternates to those included in DCA6 subject to approval by the local building department. Wet service was included in the analysis. For more information, refer to technical bulletin T-C-DCA6DECK21.

### Beam-to-Post Connection

DCA6 Figure 8A details the attachment of a beam to a notched post, with two ½"-diameter through bolts with washers as the connection to resist uplift and lateral displacement.

Simpson Strong-Tie tested beam-to-notched post assemblies fastened with Strong-Drive Timber screws (SDWS22500DB), Timber-Hex HDG screws (SDWH27400G), and Timber stainless-steel screws (SDWS27500SS) and compared the lateral capacities to the prescriptive bolted connection. The table lists the respective quantities for each Strong-Drive screw type that are equivalent to the two ½"-diameter through bolts that are shown in DCA6 Figure 8A. Figures 1 through 4 show the screw fastening patterns at spliced and nonspliced connections.

## Strong-Drive Screws Equivalent to DCA6 Figure 8A Prescribed Through Bolts

| Length (in.) | Model No. | Quantity Required | |
|---|---|---|---|
| | | Spliced | Non-Spliced |
| 5 | SDWS22500DB | 6 / Figure 1 | 3 / Figure 2 |
| 4 | SDWH27400G | 6 / Figure 1 | 3 / Figure 2 |
| 5 | SDWS27500SS | 8 / Figure 3 | 4 / Figure 4 |

1. Material: Hem-Fir minimum.
2. Post Size: If the post size is larger than 6x6 (nominal), substitute longer screw lengths to achieve the same penetration into the post and beam.
3. SDWH27400G: Only applies to a 3x beam.

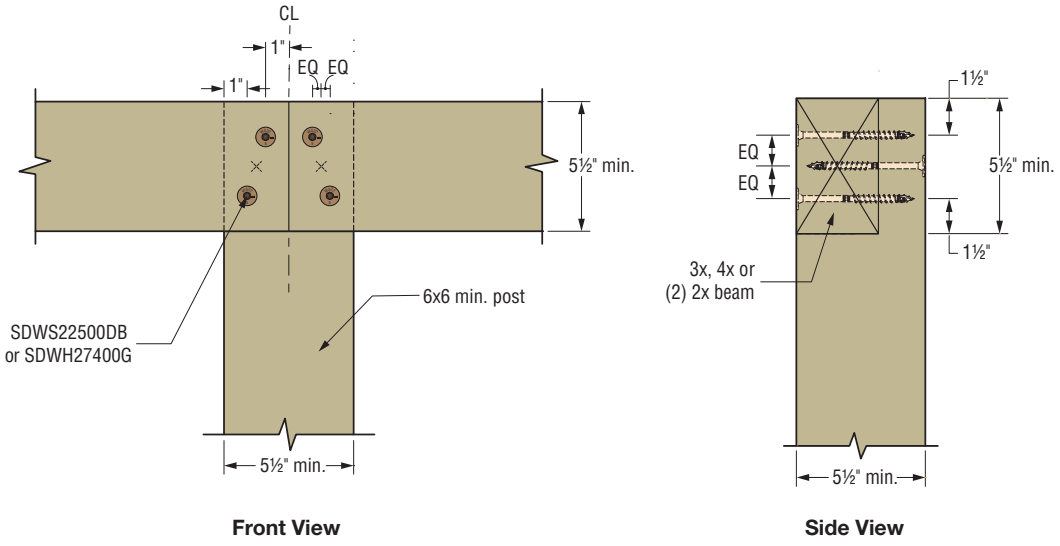



**Figure 1: Beam-to-Notched-Post Fastened with SDWS22500DB or SDWH27400G Screws (Spliced)**

# Alternate Fasteners for Connection Details in AWC DCA6 with Simpson Strong-Tie Strong-Drive® Screws (cont.)

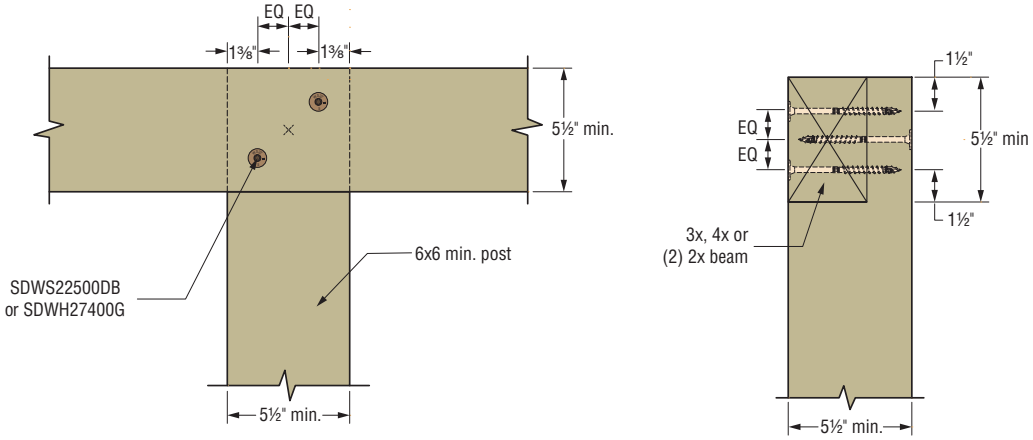



**Figure 2: Beam-to-Notched-Post Fastened with SDWS22500DB or SDWH27400G Screws (Non-Spliced)**

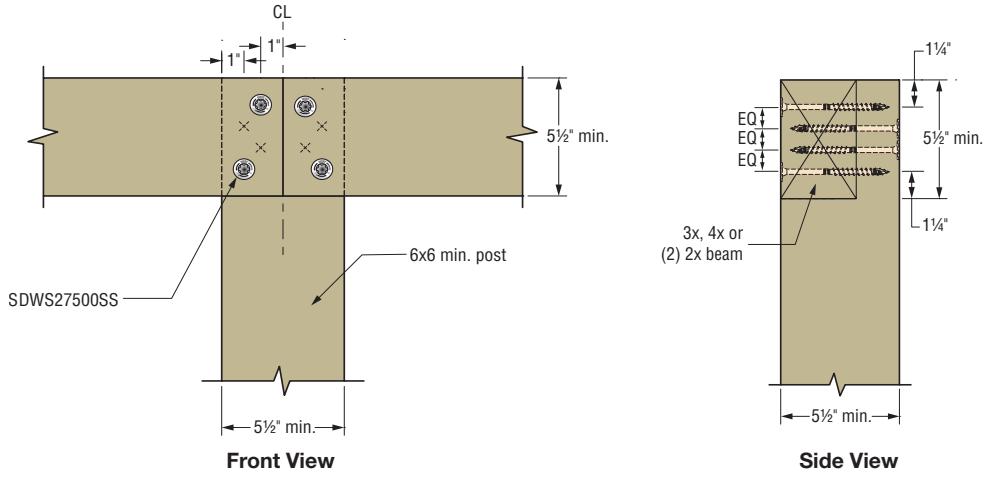



**Figure 3: Beam-to-Notched-Post Fastened with SDWS27500SS Screws (Spliced)**

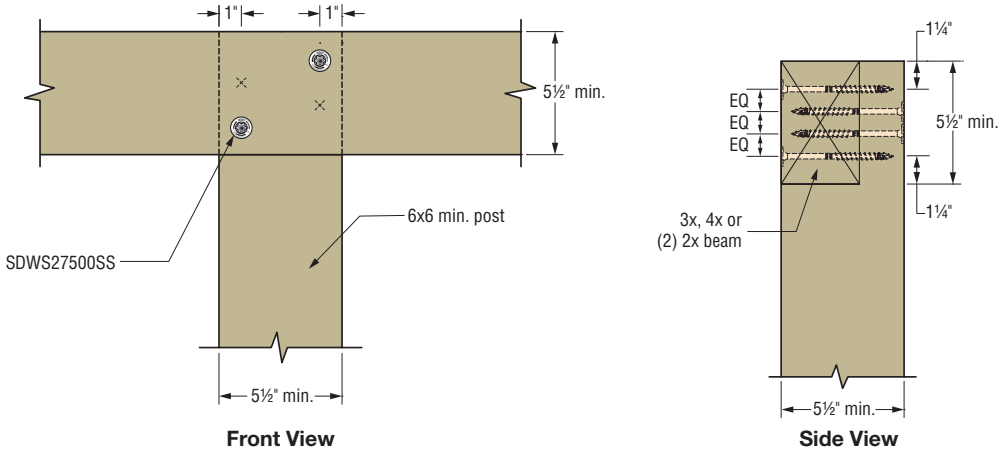



**Figure 4: Beam-to-Notched-Post Fastened with SDWS27500SS Screws (Non-Spliced)**

# Alternate Fasteners for Connection Details in AWC DCA6 with Simpson Strong-Tie Strong-Drive® Screws (cont.)

## Diagonal Brace Connection

DCA6 Figure 10 shows the detail of fastening diagonal bracing to the deck post and beam with a ½"-diameter lag screw and washer at each end of the brace.

Simpson Strong-Tie evaluated diagonal bracing with Strong-Drive Timber screws (SDWS22400DB), Timber-Hex HDG screws (SDWH27400G), and Timber stainless-steel screws (SDWS27400SS). The connection capacity of the Timber screws was compared to the connection capacity of prescriptive lag screws with washers. Based on the test data and engineering analysis, a direct 1:1 substitution with one SDWS22400DB or one SDWH27400G, or one SDWS27400SS can be used in lieu of prescriptive ½" lag screws with washers. See Figure 5 for details.

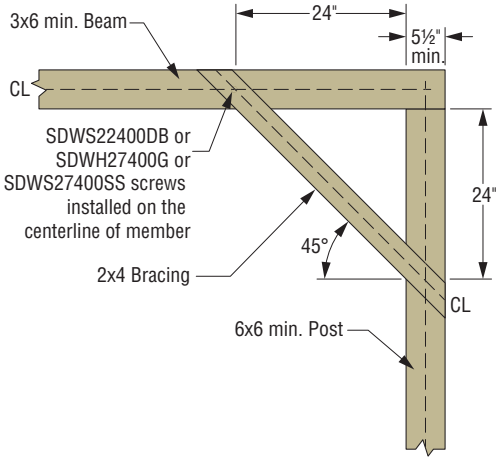



**Figure 5: Diagonal Bracing Connection with SDWS22400DB, SDWH27400G or SDWS27400SS Screws**

## Sistered Stair Stringers

DCA6 Figure 28 details the typical stair stringer requirements. The typical stair system consists of three 2x12 cut/notched stringers, which support the minimum width of 36" and a stair span length maximum of 6'-0". However, when the span is greater than 6'-0" and less than 13'-3", the stair system does not meet the deflection requirements of L/288 (¼" deflection). To stiffen the notched stair stringer, one solution is to sister a solid (uncut/un-notched) 2x12 to the outside of the cut/notched 2x12 stringers at the ends of the stair treads. The load path is from the tread to the cut stringers and then to the solid stringers by means of screw fastening.

Simpson Strong-Tie evaluated the sistered-stringer connection, and the recommendation for sistering cut stringers to solid stringers is to use one row of SDWS22300DB or SDWS27300SS installed at 18" on-center spacing and staggered as shown in Figure 6.

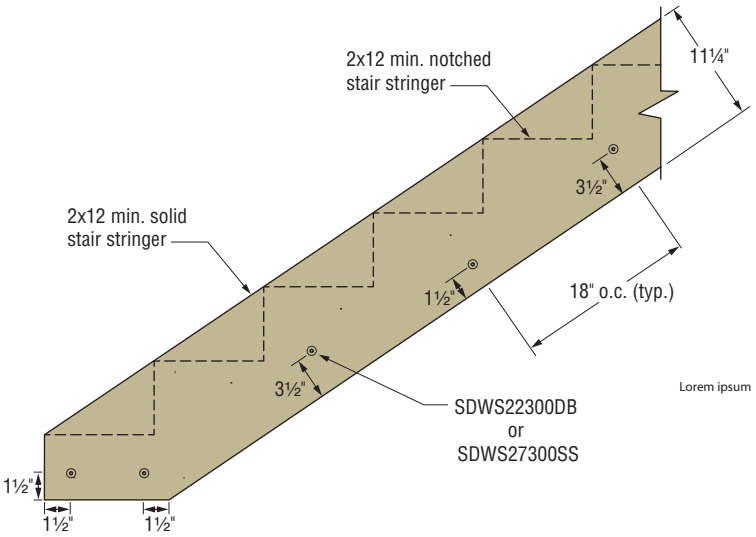


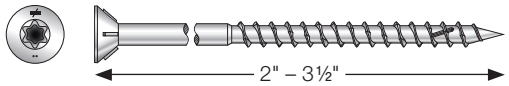

**Figure 6: Solid Stair Stringer-to-Cut Stringer Connection with SDWS22300DB or SDWS27300SS Screws**

# Deck-Drive™ DWP WOOD SS Screw

*High- to Severe-Exposure Wood Decking Applications*

The #10 Deck-Drive DWP Wood SS flat-head screws are deck fasteners that have been tested in accordance with ICC-ES Acceptance Criteria AC233 and are load rated for withdrawal resistance. These screws are a great solution for exterior connections where they will be exposed to high or severe corrosion.

**For more information,** see p. 72, C-F-2023 *Fastening Systems* catalog
See pp. 49–50 for allowable shear and withdrawal for #12 and #14 Strong-Drive® DWP WOOD SS screws.




## DWP WOOD SS Screw — Allowable Withdrawal and Pull-Through Loads

| Size x Length (in.) | Model No. | Thread Length (in.) | Head Dia. (in.) | Allowable Screw Tension (lb.) | Reference Withdrawal, W (lb./in.) | | Reference Pull-Through for 1½" Side Memeber, $W_H$ (lb.) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | DFL/SP | SPF/HF | DFL/SP | SPF/HF |
| #10 x 2 | T10200WP<br>S10200WP | 1.50 | 0.34 | 480 | 130 | 100 | 140 | 110 |
| #10 x 2½ | T10250WP<br>S10250WP | 2.00 | | | | | | |
| #10 x 3 | T10300WP<br>S10300WP | 2.16 | | | | | | |
| #10 x 3½ | T10350WP<br>S10350WP | 2.49 | | | | | | |

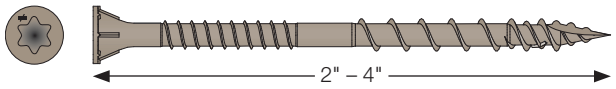
1. The tabulated allowable screw tension value is the tensile strength of the steel screw and may not be multiplied by any adjustment factors.
2. The tabulated reference withdrawal design value, W, is in pounds per inch of the thread penetration into the side grain of the main member.
3. The tabulated reference pull-through design value, $W_H$, is the allowable load for the fastener head pull-through for a minimum 1½" thick side member.
4. Tabulated reference withdrawal and pull-through design values, W and P, are shown at a load duration factor, $C_D$ = 1.0 and a wet service factor, $C_M$ = 1.0. Loads may be increased for load duration per the building code up to a $C_D$ = 1.6. Tabulated values must be multiplied by all applicable adjustment factors from the NDS as referenced in the IBC or IRC.
5. Embedded thread length is that portion held in the main member including the screw tip.

# *Deck-Drive*™ DSV **WOOD** Screw

*Multipurpose deck and other wood-to-wood applications*

Simpson Strong-Tie #10 Deck-Drive DSV wood screws are designed for preservative-treated decking applications and can also be used for general framing and construction with wood and engineered wood products. Quik Guard® coating on the DSV screws provides corrosion resistance for exterior and certain preservative-treated wood applications. The DSV screws have a 6-lobe drive with flat head and do not require predrilling for softer woods. The screws have been tested and evaluated in accordance with ICC-ES Acceptance Criteria AC233 (*Acceptance Criteria for Dowel-type Threaded Fasteners Used in Wood*), and are load rated for shear, pull-through and withdrawal resistance. The tables below provide load information for the DSV screws.

**For more information,** see p. 76, C-F-2023 *Fastening Systems* catalog




## DSV WOOD Screw — Allowable Shear Loads

| Size x Length (in.) | Model No. | Thread Length (in.) | DFL/SP Reference Allowable Shear Load (lb.) | | | | SPF/HF Reference Allowable Shear Load (lb.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Side Member Thickness (in.) | | | | Side Member Thickness (in.) | | | |
| | | | 1.5 | 2.0 | 2.5 | 3.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| #10 x 2½ | DSV212 | 1.50 | 106 | — | — | — | 83 | — | — | — |
| #10 x 3 | DSV3 | 1.50 | 173 | 99 | — | — | 131 | 80 | — | — |
| #10 x 3½ | DSV312 | 2.00 | 173 | 173 | 99 | — | 131 | 131 | 80 | — |
| #10 x 4 | DSV4 | 2.50 | 173 | 173 | 173 | 99 | 131 | 131 | 131 | 80 |

1. Allowable loads are based on full penetration into the main member. Full penetration is the screw length minus the side member thickness.
2. Allowable loads are shown at the wood load duration factor of $C_D$ = 1.0. Loads may be increased for load duration per the building code up to a $C_D$ = 1.6. Tabulated values must be multiplied by all applicable adjustment factors per the NDS. For DSV in-service moisture content greater than 19%, use $C_M$ = 0.62.
3. Loads are based on installation into the side grain of the wood with the screw axis perpendicular to the face of the member.
4. Loads are based on tests of connections made with same species as main and side members. For connections with mixed species, use the loads for the species with the lower specific gravity.
5. Engineered wood must have a minimum modulus of elasticity grade of 0.80E and a minimum equivalent specific gravity of at least 0.50 to use the DFL/SP values, or 0.42 to use the SPF/HF values.

# Deck-Drive™ DSV WOOD Screw (cont.)

## DSV WOOD Screw — Allowable Withdrawal and Pull-Through Loads

| Size x Length (in.) | Model No. | Thread Length (in.) | Reference Allowable Withdrawal, W (lb./in.) | | Reference Allowable Withdrawal, $W_{max}$ (lb./in.) | | Reference Pull-Through, $W_H$ (lb.) | |
|---|---|---|---|---|---|---|---|---|
| | | | DFL/SP | SPF/HF | DFL/SP | SPF/HF | DFL/SP | SPF/HF |
| #10 x 2 | DSV2 | 1.25 | 121 | 94 | 150 | 115 | 174 | 154 |
| #10 x 2½ | DSV212 | 1.50 | | | 180 | 140 | | |
| #10 x 3 | DSV3 | 1.50 | | | 180 | 140 | | |
| #10 x 3½ | DSV312 | 2.00 | | | 240 | 190 | | |
| #10 x 4 | DSV4 | 2.50 | | | 300 | 235 | | |

1. The tabulated Reference Allowable Withdrawal design value, W, is in pounds per inch of the thread penetration into the side grain of the main member.
2. The tabulated Reference Maximum Withdrawal design value, $W_{max}$, is in pounds where the entire thread length is embedded into the side grain of the main member.
3. Reference withdrawal design values, W and $W_{max}$, are shown at $C_D$ = 1.0. Loads may be increased for load duration per the building code up to $C_D$ = 1.6. Tabulated values must be multiplied by all applicable adjustment factors from the NDS. For DSV in-service moisture content greater than 19%, use $C_M$ = 0.70.
4. Embedded thread length is that portion of the end threads in the main member, including the screw tip.
5. Reference Pull-Through, $W_H$, values are based on pull-through of a 1½"-thick side member, and $C_D$ = 1.0.
6. Engineered wood must have a minimum modulus of elasticity grade of 1.55E and a minimum equivalent specific of at least 0.50 to use the DFL/SP values, or 0.42 to use the SPF/HF values.

## Connection Geometry

| Condition | | | Minimum Distance or Spacing (in.) | Reduction Factor |
|---|---|---|---|---|
| Edge Distance | Perpendicular to grain loading | | ¾ | 0.91 |
| | Parallel to grain loading | | ½ | 1.00 |
| End Distance | Perpendicular to grain loading | | 4 | 0.91 |
| | Parallel to grain loading | | 4 | 1.00 |
| Spacing Between Fasteners in a Row | Perpendicular to grain loading | | 2 | 0.75 |
| | Parallel to grain loading | | 2 | 1.00 |
| Spacing Between Row | Perpendicular to grain loading | Non-staggered row | 1 | 0.75 |
| | | Staggered rows | 1 | 1.00 |
| | Parallel to grain loading | Non-staggered row | 1 | 0.88 |
| | | Staggered rows | 1 | 1.00 |

1. Edge distances, end distances, and spacing of the screws must be sufficient to prevent splitting of the wood, or as required by this table, or when applicable as recommended by the structural composite lumber manufacturer, whichever is the most restrictive.
2. Allowable shear loads shall be multiplied by the applicable tabulated reduction factors when used in the corresponding geometry.

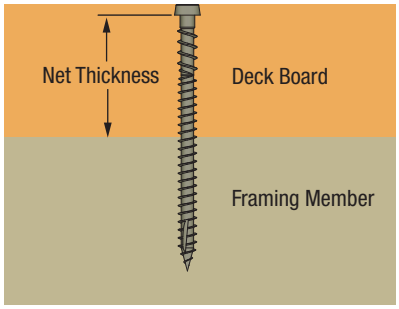
# Deck-Drive™ DCU COMPOSITE Screw

*Uplift Performance*

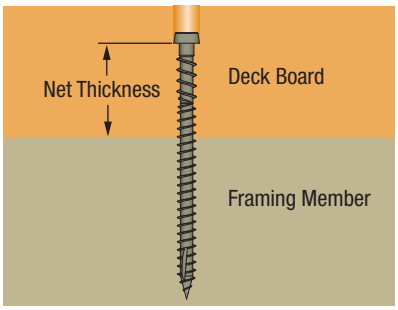
**For more information,** see pp. 90–91, C-F-2023 *Fastening Systems* catalog

The table below shows allowable uplift loads for Simpson Strong-Tie Deck-Drive DCU Composite screws (#10 dia. x 2¾" length, model no. DCU234) when they are used to attach non-wood deck boards to framing in face screw installations.

In an uplift scenario, there are two relevant modes of failure for screw connections in deck boards: screw pull-through of the deck board and screw withdrawal from the framing member. Pull-through testing was performed using 1" nominal thickness PVC and 1" and 2" nominal thickness Composite and High-Density Polyethylene (HDPE) decking products. The tests included conditions where the DCU composite screws were installed both flush to the surface and countersunk for the use of the Deck-Drive DCU screw plug solution, as shown in the figures below. Withdrawal testing was performed with the DCU screw embedded 1⅜" in southern pine lumber. The resulting allowable loads using a factor of safety of 5 are provided in the table below.




**Flush Installation of DCU Composite Screw**




**Countersunk Installation of DCU Composite Screw**

## DCU COMPOSITE Screw — Allowable Uplift for PVC, Composite, and HDPE Deck Boards Fastened to Southern Pine Framing

| Configuration | Deck Board (Nominal Thickness, Material) | Net Thickness (in.) | Allowable Uplift per Screw (lbf) |
|---|---|---|---|
| Flush Installation | 1" PVC | 1.000 | 101 |
| | 1" Composite | 1.000 | 148 |
| | 1" HDPE | 1.000 | 93 |
| | 2" Composite | 1.375 | 260 |
| | 2" HDPE | 1.375 | 191 |
| Countersunk Installation | 1" PVC | 0.725 | 77 |
| | 1"Composite | 0.725 | 128 |
| | 1" HDPE | 0.725 | 77 |
| | 2" Composite | 1.100 | 235 |
| | 2" HDPE | 1.100 | 150 |

1. Allowable uplift is limited by fastener pull-through value, which is the lessor of fastener pull-through and withdrawal. No other properties of the deck materials or deck construction are considered.
2. Withdrawal property is based on duration of load of $C_D$ = 1.6 and wet service factor of $C_M$ = 0.7.