The railing connection is a crucial deck connection, and it is often inadequately constructed. To provide the required load resistance at the handrail, the post must not only be fastened to the rim joist, but also be tied back into the joist framing. Bolts or lag screws through the post and rim joist alone do not typically meet the performance requirements of the building code. This technical bulletin provides details for code-compliant 36” and 42” guardrail post connections.

The details on p. 2 show various methods for connecting the guardrail post using either the Simpson Strong-Tie® DTT2 deck tension tie or HD3BHDG holdown. These details allow for a connection to the deck framing at the joists or blocking. All details meet the IRC code-required load at a maximum guardrail height of 36” above the deck surface in an outward direction.

Details on p. 3 show how to use the HTT4HDG tension tie to meet the IBC code requirements for a one- or two-family dwelling at a maximum guardrail height of 42” above the deck surface to resist the 200 lb. load in an outward direction.

When using ZMAX® or hot-dip galvanized connectors, use hot-dip galvanized fasteners that meet the specifications of ASTM A153. Simpson Strong-Tie stainless-steel connectors are manufactured from Type 316 stainless steel and therefore require Type 316 stainless-steel fasteners.

Material/Finish:  
DTT2Z — 14 ga. carbon steel with ZMAX galvanized coating  
DTT2SS — 14 ga. Type 316 stainless steel  
HD3BHDG, HTT4HDG — hot-dip galvanized

Fasteners:  
DTT2Z — (8) Strong-Drive® HEAVY-DUTY CONNECTOR screws (SDS), double-barrier coating (included)  
DTT2SS — (8) SDS screws, Type 316 stainless steel (included)  
HD3BHDG — (2) ⅜” bolts  
HTT4HDG — (18) #10 x 1 ½” Strong-Drive SD CONNECTOR screws (SD) or (18) 0.148” x 1 ½” nails

Installation:  
• Use all specified fasteners. Refer to the General Notes in the current Wood Construction Connectors catalog for additional important information.  
• For the DTT2, the supplied cut washer must be installed between the nut and the seat.  
• SDS screws install best with a low-speed, high-torque drill with a ¾” hex driver.  
• Bolt holes shall be a minimum of ⅛” to a maximum of ¼” larger than the bolt diameter (per NDS section 11.1.2).  
• A washer is not required between the base plate of the HD3BHDG holdown and the anchor nut.
All 36" high guardrail details assume the following:

- Maximum 36" guardrail height
- Minimum nominal 4x4 guardrail post
- Minimum nominal 2x8 rim joist, joists and blocking
- DF or SP framing lumber

Detail A: Fasten blocking to joist with (24) 0.148" x 3" nails

Detail B: Fasten each blocking together with (12) 0.148" x 3" nails
All 42" high guardrail details assume the following:

- Maximum 42" guardrail height and minimum nominal 4x4 guardrail post
- HTT4HDG with #10 x 1½" SD screws and minimum 2x8 HF or SPF framing lumber
- HTT4HDG with 0.148" x 1½" nails or #10 x 1½" SD screws and minimum 2x8 DF or SP framing lumber
- DTT2 with ¼" x 1½" SDS screws and minimum 2x10 DF, HF, SP or SPF framing lumber
- DTT2 uses ½"-diameter machine bolts or threaded rods with nuts and BP1/2 bearing plates

Alternate attachment of 42" guardrail post both inside and outside rim/joist:

DTT2Z or DTT2SS with ¼" x 1½" SDS and ½"-diameter bolt or threaded rod with nuts and BP1/2HDG bearing plates for min. 2x10 framing lumber
Guards: What the Codes Require
The 2018 International Residential Code (IRC) and 2018 International Building Code (IBC) each have specific requirements for the design, construction and use of guards. Some of these requirements are shown below.

When is a guard required?
“Guards shall be located along open-sided walking surfaces, including stairs, ramps, and landings, that are located more than 30 inches measured vertically to the floor or grade below…”

IRC 2018, Section R312.1.1
“Guards shall be located along open-sided walking surfaces… that are located more than 30 inches measured vertically to the floor or grade below…”

IBC 2018, Section 1015.2
If a guard is not required because the deck or porch is 30 inches or less above the floor or grade, does the guard have to be code compliant?
All guards must be designed and constructed in accordance with the governing building code, including guards that are not required. The general public expects all guards to perform and fail resulting from guard failures can cause serious injury regardless of the fall height.

What is the guard height requirement?
In the IRC, “guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches high…”

IRC 2018, Section R312.2
In the IBC, “required guards shall be not less than 42 inches high…”

IBC 2018, Section 1015.3
How much force must a guard be capable of resisting?
For one- and two-family dwellings, both the IRC and IBC require guards be designed to resist a single concentrated load of 200 lb. applied in any direction at any point along the top.

IRC 2018, Table R301.5; IBC 2018, Section 1607.8
The International Code Council Evaluation Service Acceptance Criteria 273 for Handrails and Guards (AC273) requires posts attached to wood supporting structures that are part of handrails and guards in or on one- and two-family dwellings under the IBC and IRC are capable of resisting an ultimate horizontal concentrated load applied on the post at the top rail height of 600 lb. Allowable loads are determined from the lowest ultimate load of three tests (or average of six) with a safely factor of three.

What is the allowable deflection of a fully loaded guard post?
The building codes do not contain deflection limits for guards, however AC273 places reasonable limits on tested assemblies. The maximum permissible deflection in AC273 for 36”-high guards is 3”.

How does load or deflection at the top of a guard post relate to a connector at the base of a guard post?
As a result of the large leverage arm of a guard post, the tension force in the post-to-deck connector will be much larger than the force at the top of the post. Similarly, any deflection at the post-to-deck connector will result in amplified deflection at the top of the post. For a 36” post connected to a 2x8 deck joist, a 200 lb. force at the top will result in about 1,800 lb. force in a connector located 2” from the top of the joist. A 1/4” of deflection in this connector will result in over 2” of deflection at the top of the post.

Do the Simpson Strong-Tie details address load applied in all directions?
The details in this technical bulletin address an outward force on the guardrail. An additional connector can be installed on the lower bolt to resist an inward force.

Why have the code requirements changed?
The 200 lb. point load requirement in the code is not new. However there has been an increased focus on this requirement in recent years. Research and testing conducted at Virginia Tech on post-to-rim-joist connections indicated common bolted or lag screwed connections to a rim joist alone did not meet the load requirements in the code.

Why the Simpson Strong-Tie solution?
The connection details shown have been designed to meet the requirements in the building code. Simpson Strong-Tie also performed testing on several full-scale assemblies. Some of the testing performed on a 36” guardrail post is summarized in the table below.

<table>
<thead>
<tr>
<th>Connector</th>
<th>Post-Fastening Assembly</th>
<th>Average Test Ultimate</th>
<th>Average Deflection at 200 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT2</td>
<td>Outside rim joist, fastened to joist</td>
<td>635 lb.</td>
<td>21/2*</td>
</tr>
<tr>
<td></td>
<td>Outside rim joist, fastened to blocking</td>
<td>650 lb.</td>
<td>11/4*</td>
</tr>
<tr>
<td>HD3BHDG⁶</td>
<td>Outside rim joist, fastened to joist</td>
<td>790 lb.</td>
<td>11/4*</td>
</tr>
<tr>
<td></td>
<td>Outside rim joist, fastened to blocking</td>
<td>655 lb.</td>
<td>11/4*</td>
</tr>
</tbody>
</table>

1. Applied load and measured deflection shown are at top of 36” post. 
2. HD3B values based on testing with a lower-capacity holdown.


This technical bulletin is effective until June 30, 2022, and reflects information available as of March 1, 2020. This information is updated periodically and should not be relied upon after June 30, 2022.

Contact Simpson Strong-Tie for current information and limited warranty or see strongtie.com.

© 2020 Simpson Strong-Tie Company Inc. • P.O. Box 10789, Pleasanton, CA 94588 · T-C-GRDRLPST20 3/20 exp. 6/22