

## Hangers

Joist hangers are commonly used in wood frame construction to provide a critical connection from one structural member to another. The need for compatible connectors and proper installation required iLevel<sup>®</sup> to develop a close working relationship with the hanger manufacturers and to provide training on the proper selection and use of I-joist and structural composite lumber (SCL) hangers.

The criteria to be met by all potential hanger suppliers prior to their products becoming approved are summarized below. Additionally, iLevel continues to work closely with approved suppliers in the development of new connectors and the enhancement and refinement of existing connectors.

### Approved Hanger Supplier Criteria for Use with iLevel<sup>®</sup> Trus Joist<sup>®</sup> Products

The criteria focus on the following:

1. Code acceptance
2. Appropriate engineering and product application
3. Technical support provided by the hanger supplier
4. Appropriate quality assurance and independent third-party inspection
5. Ability of the supplier to provide a proper level of service
6. The supplier's willingness to work with iLevel on the enhancement of existing connectors or the development of new ones as needed

### Approved Joist Hanger Suppliers

Three joist hanger manufacturers are currently approved to provide joist hangers and other connectors for use with iLevel<sup>®</sup> Trus Joist<sup>®</sup> products:

- **Simpson Strong-Tie<sup>®</sup> Company, Inc.**  
5956 W. Las Positas Boulevard  
Pleasanton, CA 94588  
(800) 925-5099  
[www.strongtie.com](http://www.strongtie.com)  
Simpson Strong-Tie<sup>®</sup> connectors are approved for use in the U.S., Canada, Japan, Australia and Europe.
- **United Steel Products (USP) Structural Connectors<sup>®</sup>**  
14305 South Cross Drive – Suite 200  
Burnsville, MN  
(800) 328-5934  
[www.uspconnectors.com](http://www.uspconnectors.com)  
USP Structural Connectors<sup>®</sup> connectors are approved for use in the U.S. and Canada.
- **Cullen Building Products, Ltd.**  
170 Savannah Oaks Drive  
Brantford, ON, Canada  
(866) 867-8867  
[www.cullen-bp.com](http://www.cullen-bp.com)

In some cases, not all connectors manufactured by an approved supplier are approved for use with iLevel products. To determine if a particular connector is approved, please consult any of the following sources:

- iLevel literature for Trus Joist Products
- Literature produced by the approved supplier specifically listing the use of its products with Trus Joist<sup>®</sup> products
- iLevel Structural Frame Software, such as TJ-Beam<sup>®</sup> or TJ-Xpert<sup>®</sup>
- Contact your local iLevel representative.

### Minimum Metal Thickness

It is highly recommended that hangers be comprised of no lighter than 18 gauge steel. Lighter gauge hangers lack sufficient strength and rigidity to provide adequate support, including lateral stability. Hangers that are 18 ga are limited to 1,475 lbs and hangers made with 16 ga are limited to 1,575 lbs (2,415 lbs and 2,655 lbs Canadian Limit State Design - LSD).

**Minimum Nail Penetration**

Sufficient nail penetration maximizes the capacity of the connector. For the U.S., the following penetrations must be achieved:

Nail	Face Mount Hangers	Top Flange Hangers
<b>10d Short (0.148" x 1 1/2")</b>	1 1/2" min	1 1/2" min
<b>10d Common (0.148" x 3")</b>	1 3/4" min	3" min
<b>16d Common (0.162" x 3 1/2")</b>	2" min	3 1/2" min

The required penetration for face mount hangers is 12 times the nail diameter. Refer to hanger manufacturer's literature for the appropriate adjustments for reduced penetration. Contact the manufacturer for appropriate top flange hanger reductions since top flange hanger capacities are often based on testing rather than calculation. Note, for top flange hangers, the support member must be wide enough to accommodate top flange tabs.

**Wood Nailers**

For hanger applications within the U.S., TimberStrand® LSL plate material can be considered as equivalent to Douglas fir. Published uplift values may not be applicable to wood nailers; check with the hanger manufacturer for additional information.

**Lateral Stability**

Unless supplemental restraint is provided, the depth of the hanger should be at least 60% of the supported joist depth. Additionally, Trus Joist® products require web stiffeners if the side flanges of the hanger do not extend at least 3/8" over the sides of TJI® joist top flanges. Some connectors have been designed specifically for use with TJI® joists to provide full lateral support without the use of web stiffeners. Figure 1 illustrates lateral joist support requirements for hangers.

**PREVENT ROTATION**

Hangers provide some joist rotation resistance; however, additional lateral restraint may be required for deep joists.

**No Web Stiffener Installed**  
Hanger side flange supports joist top flange.

**Web Stiffener Required**  
Hanger side flange should be at least 60% of joist depth or potential joist rotation must be addressed.

**Rotation Resistance**  
If non-skewed hanger side flange is less than 60% of joist depth, attach staggered A34 framing anchors above the hanger.

**No Web Stiffener Results in Rotation**  
Hanger side flange is below the joist top flange. No web stiffener results in rotation, unless restrained by other means.

Figure 1

**Filler and Backer Blocks with TJI® Joist Hangers**

Backer blocks are required on both sides of TJI® joist headers. For double TJI® joist headers, place a filler block between the TJI® joists and the backer blocks on the outside of each joist as required for nail penetration. Install backer blocks tight to top flange for top flange hangers and tight to bottom flange for face mount hangers.

**Exception:**

- With top flange hangers, backer blocks are not required for downward loads of 250 lbs or less (factored resistance of 395 lbs for Canadian Limit States Design).
- Multiple member TJI® joist headers need to be adequately connected to achieve desired performance. This requires proper selection of a nailing or bolting pattern and attention to web stiffener and blocking needs. Considering that most framers carry only 10d and 16d nails, nailing together multiple joists wider than 2½" can be a problem and requires special fabrication considerations (see Figure 2).
- Face mount hangers supported by 3½"-wide TJI® joists (e.g., TJI® 560 joists) need 10d (3") common or 16d (3½") common header nails. Shorter nails will not penetrate the header web.
- Top flange hangers may have lower capacities when supported by TJI® joist headers. Use 10d x 1½" header nails to prevent splitting.

## WOOD I-JOISTS

**SLOPED JOISTS**  
For sloped joists up to ¼:12 there is no reduction. For slopes greater than ¼:12 see individual product pages or refer to technical bulletin T-SLOPEJST (see page 187 for details).

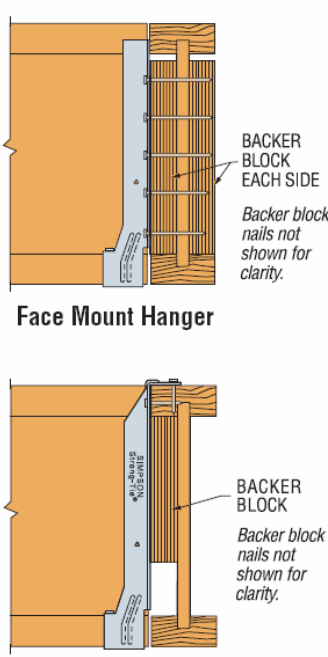
**MULTIPLE JOISTS**  
Multiple joists should be adequately connected together to act as one unit.

**FASTENERS**  
Use the correct nails. Wood may split if the nails are too large. Hanger nails into flanges should not exceed 10d common (0.148 dia.), no longer than 1½". Nails into web stiffeners should not exceed 16d commons (0.162 dia.).

**ECCENTRICALLY-LOADED I-JOISTS**  
Supporting a top flange hanger may require bottom flange restraining straps, blocking or directly-applied ceiling systems to prevent rotation at the hanger location.

**SKEWED JOISTS**  
Joists may be skewed up to 2½ degrees in a non-skewed hanger without any load reduction. Refer to individual hanger descriptions for information allowing any further skew applications.

### I-JOIST AS A HEADER INSTALLATIONS



Backer block nails not shown for clarity.

When face mount hangers are attached to I-joist headers, backer blocks must be installed to provide a nailing surface for the hanger nails. The backer blocks should be installed on both sides of the web and attached together with a minimum of 10-10d nails. The hanger nails should extend through the web. Contact the I-Joist manufacture for additional design considerations.

When top flange hangers are attached to I-joist headers, a backer block must be installed to prevent the top flange from rotating under load. The backer blocks should be installed with a minimum of 10-10d nails clinched. Check with the joist manufacture for additional design considerations.

Figure 2

### Torsional Resistance

Multiple member applications not equally loaded from above or loaded from one side or both require engineering design of the connections between individual members to ensure adequate performance. Generally, multi-ply rectangular members should be limited to a maximum of three plies, and multiple TJI® joist members should be limited to a maximum of two joists with flange widths less than 3½".

The low torsional resistance of TJI® joists is also a design consideration for joist-to-joist connections. Eccentrically applied side loads, such as a top flange hanger hung from the side of a double joist, create the potential for joist rotation. Bottom flange restraining straps, blocking or directly applied ceiling systems may be needed on heavily loaded eccentric connections to resist rotation.

### Bearing Limitations

Hanger design values often exceed the bearing capacity of the supported TJI® joists. Always verify the bearing capacity of the TJI® joist to ensure that connector values are limited to the joist capacity. Allowable bearing values may be found by interpolating between the 1¾" and 3½" code-accepted bearing values with or without web stiffeners. Refer to the applicable code report.

As with TJI® joists, the hanger capacity may exceed the allowable compression perpendicular-to-grain for rectangular structural composite lumber. Nails through the sides of the hanger may be used to reduce the required bearing length. Nails help transfer loads directly from the supported member into the hanger, reducing the load transferred through direct bearing.

### Squeak Prevention

A properly installed floor system will reduce floor squeaks because of the dimensional and structural uniformity of TJI® joists and Trus Joist® beam products. However, incomplete or improper installation of hangers will not only affect the load-carrying capacity of the hanger but may also allow movement between the joist and the hanger, resulting in a squeak. The following precautions are recommended:

- Completely "set" nails with the head of each nail driven tightly to the hanger.
- Leave 1/16" clearance between the supported member and the header or back of the hanger.
- Seat the joist flush to the bottom of the hanger. A gap can allow movement when a load is applied. On Simpson Strong-Tie® ITT, IUT and VPA connectors, bend the bottom flange tabs over and nail through the tabs into the TJI® joist bottom flange.
- In some circumstances, squeaks can be reduced by placing a dab of subfloor adhesive in the seat of the hanger prior to joist installation, or if a hole is provided, install a wood screw (#8 x 1½" max.) through the bottom seat. To ensure uniform bearing, install screws before the glue sets. These methods should supplement, not replace, the joist nails unless verified otherwise.
- Place wood nailers flush or with a maximum allowable overhang of ¼" on foundation walls or steel I-beams. This will help prevent hanger distortion or squeaks due to rubbing.

See Figure 3 for additional information

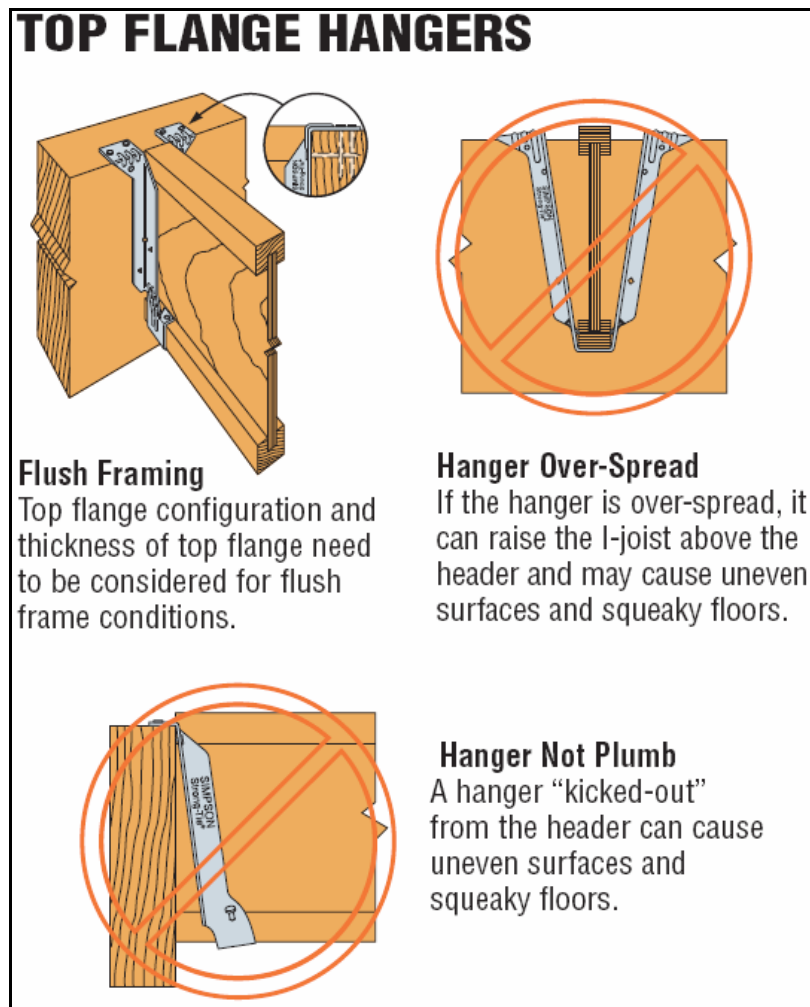


Figure 3

### Web Stiffeners

There are several reasons besides lateral stability for installing web stiffeners:

- **Joist Nails.** Many hangers require web stiffeners to provide sufficient penetration for joist nails. Reduced downward capacity or uplift capacity may occur if web stiffeners are not used.
- **Downward Bearing Capacity.** Some TJI<sup>®</sup> joists may have greater bearing capacity if web stiffeners are used.
- **Deformation of Wide Hangers.** For wide bottom seats, lighter gauge hangers are more susceptible to hanger seat deformation. Trus Joist<sup>®</sup> product literature and TJ-Beam<sup>®</sup> software may require web stiffeners if the load exceeds the capacity of the hanger without web stiffeners.

## Literature

Several pieces of technical joist hanger literature applicable to engineered wood products are available from the approved suppliers or from iLevel:

### Simpson Strong-Tie<sup>®</sup> Company, Inc.

- [Wood Construction Connectors.](#) Use of this catalog requires checking both the suitability of use with a TJI<sup>®</sup> joist and the TJI<sup>®</sup> joist end reaction capacity.
- [Connector Selection Guide for Use with Products Manufactured by iLevel.](#) This guide is specific to iLevel dealer-distributed products. The load capacities listed include consideration for both the joist-to-hanger and hanger-to-header connections.
- [Wood Construction Connectors for Canadian Limit States Design Loads.](#) This catalog lists loads and application information for the general line of Simpson Strong-Tie<sup>™</sup> Company, Inc. connectors on a Canadian Limit States Design basis. Use of this catalog requires checking both the suitability of use with a TJI<sup>®</sup> joist and the TJI<sup>®</sup> joist end reaction capacity.
- [Connector Selection Guide for Use with Commercial TJI<sup>®</sup> Joist Series and Structural Composite Lumber Products for Limit States Design or Connectors for use with Commercial TJI<sup>®</sup> Joist Series and Structural Composite Lumber Products.](#) Provides load and application information specific to connectors suitable for use with Commercial TJI<sup>®</sup> joists and beams.

### United Steel Products (USP) Structural Connectors<sup>®</sup>

- [USP Full Line Catalog.](#) Use of this catalog requires checking both the suitability of use with a TJI<sup>®</sup> joist and the TJI<sup>®</sup> joist end reaction capacity.

## iLevel<sup>®</sup> Literature for Trus Joist Products

Many pieces of literature for Trus Joist products contain load and application information with the specific, approved joist hanger suppliers. The load capacities, when listed, are the lesser of the joist-to-hanger and hanger-to-header capacities.

## Structural Frame Software

iLevel Structural Frame Software (TJ-Beam<sup>®</sup> and TJ-Xpert<sup>®</sup>) provides for complete joist hanger/connector selection for approved suppliers. The software accurately and efficiently checks both the joist-to-hanger and hanger-to-header connections.

## Special Connectors

Occasionally, needs arise for special connectors that are not stock items, are not listed in the literature, and are not readily available from the supplier. When this occurs, it is most often related to the custom Trus Joist product lines. Contact your local iLevel Representative for assistance. In many cases, the iLevel Technical Service Team, together with the hanger supplier, may be able to offer a practical solution as well as expedite production.

## Standards/Acceptance Criteria and Activity

ICC ES has developed a document entitled *Acceptance Criteria for Joist Hangers and Similar Devices* (AC 13). These criteria specify test methods and determination of the load capacity between a joist hanger and a specific header. ASTM D 1761, *Standard Test Methods For Mechanical Fasteners in Wood*, provides a methodology for joist hanger tests in Sections 41-52. Essentially the same test methods are prescribed in the ICBO Acceptance Criteria and ASTM D 1761.

## Standards Activity

There is currently an ASTM subcommittee working on the development of a draft joist hanger standard. In Canada, an approved clause is published in CSA O86.1-94, *Engineering Design in Wood (Limit States Design)*. This clause provides design and application requirements for joist hangers and prescribes the development of factored resistances for joist hangers to be used in Limit States Design.