

FIRE-RATED ASSEMBLIES AND SPRINKLER SYSTEMS

Featuring Fire Assembly Details and
Sprinkler Installation Guidelines

- For Use with Trus Joist® Products Only
- Floor/Ceiling, Roof/Ceiling, and Wall Assemblies
- Char Rates and Flame Spread Comparisons
- Fire Facts Q&A
- CPVC and Steel Sprinkler Pipe Details



Now includes TJI® Joists with
Flak Jacket® Protection



This guide contains information to help you specify and install Trus Joist® products in fire-safe assemblies in floors, roofs, and walls, and provides technical information and details for installing sprinkler systems. The information provided is intended for use with Trus Joist® products only. For applications beyond the scope of this publication, contact your Weyerhaeuser representative.

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Fire-Safe Construction

Fire-safe construction and life safety are major concerns for everyone in the building materials and construction industry. The 2011 U.S. Fire Administration statistics⁽¹⁾ on residential and commercial fires in the U.S. alone include 2,530 fire fatalities and an estimated \$9 billion in property damage. These numbers underscore the seriousness of the issue and the need for fire-safe construction.

For over 40 years, prefabricated wood I-joists and other Weyerhaeuser building products have established a record of safe and reliable performance in millions of structures. Many of these structures, such as one- or two-family residential dwellings, do not require specific fire-resistance ratings per building codes but may require unrated membrane protection. The information provided in this guide is intended to help you make an informed decision on fire-safe design and specify Trus Joist® products with fire safety in mind.

Additional information on fire-resistance testing and fire-safe construction can also be found online; see the websites referenced on page 15.



TJI® joists are also available with **Flak Jacket™ protection**, a proprietary, patent-pending coating that enhances the fire resistance of TJI® joists.

Common one-hour floor-ceiling assemblies require two-layer gypsum ceilings. **TJI® joists with Flak Jacket™ protection** provide a single-layer solution for one-hour floor ceiling assemblies. They also meet the requirements of 2012 IRC R501.3, so they can be used in unfinished basements without membrane protection. See page 7 for assemblies or contact your Weyerhaeuser representative for more information.

Note: Some TJI® joist sizes and series may not be available in your region. Contact your Weyerhaeuser representative for more information.

FIRE-RESISTANCE CATEGORIES

There are two categories of construction: fire-resistance-rated and unrated.

Fire-resistance-rated construction requirements govern the following:

- Materials and assemblies used for structural fire resistance
- Fire-resistance-rated construction practices
- Requirements for the separation of adjacent spaces that safeguard against the spread of fire and smoke within a building and between buildings.

Unrated construction does not require a fire-resistance rating because it relies on other forms of protection, such as:

- Smaller areas of habitable space
- Multiple paths of exit, such as doors and windows
- Spacing between houses

Fire-Resistance-Rated Construction

Multi-family and commercial buildings usually require fire-resistance-rated construction and sprinklers because of the structure's square footage and height. Because single-family dwellings usually have less habitable space and a lower height, they can be built using unrated construction. However, in both cases, building codes require that the building provide occupants with sufficient means to exit the structure during a fire. The building's construction must resist the spread of a fire while also maintaining sufficient structural integrity.

In fire-resistance-rated construction, building codes specify that floor/ceiling, roof/ceiling, and wall assemblies be rated using a standard fire-resistance test. ASTM E119 or CAN/ULC-S101 standard tests were used to rate the assemblies listed in this guide. In order to maintain an assembly's fire rating, penetrations such as those for lights and vents must follow specified installation methods and meet code requirements.

(1) Per USFA's website at usfa.fema.gov/statistics/estimates/

Unrated Construction

In unrated construction, the structural elements of single-family dwellings can be made of any material permitted by the building code. Fire protection requirements for single-family dwellings usually require a physical separation (typically Type X gypsum board) between building sections such as the garage and habitable space.

Traditionally, exposed floor or ceiling framing has been allowed in unrated construction. But according to the 2012 International Residential Code (IRC), an exposed floor or ceiling framing system may require protection. Section R501.3 of the 2012 IRC states that a ½" gypsum wall board or ⅝" wood structural panel membrane (or equivalent) must be added to the underside of any exposed floor or ceiling system that does not meet the exceptions listed in R501.3.

Weyerhaeuser supports the membrane protection requirements in the 2012 code; however, for specific fire protection requirements in any building, the designer and builder must consult with local building officials or an authority who has jurisdiction in their area.

In unrated construction, floors, roofs, and walls can be assembled in three ways:

1. **Unrated, unprotected assemblies:** Structural members that meet the exceptions listed in R501.3 of the 2012 IRC are left exposed (no gypsum board attached) to the occupied space. Neither the structural members nor the assembly have a required fire-resistance rating, except for flame spread.
2. **Unrated, membrane-protected assemblies:** A non-fire-rated membrane, such as standard gypsum wallboard (as required by Section R501.3 of the 2012 IRC), encloses the structural members. Neither the structural members nor the assembly have a fire-resistance rating, except for flame spread. Penetrations in the membrane, such as those for lighting, are not regulated. The added membrane is considered passive protection.
3. **Unrated assemblies with sprinklers:** Fires are actively suppressed through code-approved sprinkler systems. Sprinklers can be added to either unprotected or membrane-protected systems.

FIRE SUPPRESSION AND PROTECTION

The *NFPA 550 Guide to the Fire Safety Concepts Tree* states that fires can be managed by suppressing the fire (with sprinklers) or controlling the fire by construction (with membrane protection). Fire safety goals such as life safety, property protection, and continuity of building operations help determine the strategy to manage fire.

Active Fire Suppression

Automatic fire sprinkler systems are commonly required by building codes in schools, office buildings, factories, and other commercial buildings. Buildings designed with sprinkler systems are allowed larger areas and a greater height than buildings designed without sprinkler systems.

Fire service agencies such as the U.S. Fire Administration promote the use of residential sprinkler systems, citing benefits such as lower overall cost of construction for the home builder, plus a safer environment and lower insurance rates for the homeowner. Using automatic fire sprinkler systems provides the following benefits:

- Early and unsupervised suppression
- Reduced fire and smoke development
- Potentially enhanced life safety for the occupant(s)

Passive Fire Protection

Independent tests show that, when compared to protected systems, unprotected framing systems (whether combustible or non-combustible) suffer increased structural degradation when exposed to fire. All floor framing materials—sawn lumber, wood I-joists, trusses, and light-gauge steel—succumb quickly to fire if not protected. Applying a protective membrane, such as gypsum ceiling board, to all types of floor framing within the structure will provide uniform protection to the structural framing members. Passive fire protection can do the following:

- Delay fire growth involving structural elements
- Reduce the potential for significant property damage to structural elements

Concealed Space Protection

In addition to protecting occupied space, building codes for rated construction require construction techniques and materials that restrict the movement of air or flames to other areas of the building through concealed spaces. Typical framing methods leave voids between structural members and between membranes within a wall. During a fire, hot gases and flames can advance through these voids and carry the fire into ceiling spaces. Fire-blocking and draft-stopping in strategic locations help retard the advancement of a concealed-space fire while occupants safely exit the structure.

Examples of concealed-space protection include the following:

- Blocking between floor joists
- Blocking between the bottom and top plates of walls
- Framing around stairwell openings
- Sealing around penetrations for wiring or ventilation

The rated walls in this guide were designed to retard fire from penetrating walls and advancing into an adjacent floor system or a floor/ceiling space above. These wall designs address fire-blocking requirements for concealed spaces in multi-story and townhouse structures, which require a continuous fire separation between dwelling units and/or between buildings.

Some of the wall designs have unrated floor/ceiling assemblies as permitted by model building codes. Others have rated floor/ceiling assemblies that act as horizontal fire separations.

The center-wall designs shown provide the listed vertical fire resistance on both sides of the wall and are considered a single assembly.

The end-wall designs shown provide the listed vertical fire resistance on the occupancy side of exterior walls and do not contain specific details for cladding on the exterior side of the vertical studs. End-wall designs can also be used for stairwells, provided that the gypsum on the stairwell side is the same as on the occupancy side.

This guide does not address code requirements for firewalls that provide a complete separation and structural independence between buildings. For those applications, see NFPA 221: *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls* or an official commentary to the building code.

Smoke Detectors

Smoke detectors are universally recognized as the most cost-effective life-saving devices. Although smoke detectors do not provide protection to the structure or to the contents in a home, they do alert occupants to potential fire hazards and allow them time to escape. Similarly, carbon monoxide detectors can also alert occupants to faulty heating appliances or air contamination in the early stages of a fire.

CHAR RATES AND FLAME SPREAD

Char Rates

Char rates are used to compare the rate of combustion between wood products. Although no ASTM or CAN/ULC test standards for char rate currently exist, most wood product testing laboratories burn the test specimen for a measured time period using a single radiant energy source, then extinguish the burn and measure the remaining section. The depth of char divided by the measured time period is the char rate. A lower char rate indicates a slower rate of burn.

Research conducted at the Forest Products Laboratory demonstrates that these char-rate calculation procedures are applicable to TimberStrand® laminated strand lumber (LSL), Parallam® parallel strand lumber (PSL), and Microllam® laminated veneer lumber (LVL). In a report dated February 2000, researcher Robert H. White concluded, “One-dimensional charring tests of structural composite lumber products, including LVLs, PSLs, and LSLs, confirmed that charring of these products in the standard fire-endurance test may be considered comparable with solid wood. Such results support the use of the fire-resistance calculation procedures for solid wood to estimate the ratings of composite lumber products.” (*Charring Rate of Composite Timber Products*, Proceedings of the 4th International Wood and Fire Safety Conference, 2000.)

Char Rate Comparison

Product or Wood Species	Char Rates ⁽⁶⁾	
	Inches/Hour	mm/Min.
TimberStrand® LSL ⁽¹⁾	1.7	0.72
Parallam® PSL ⁽¹⁾	1.5	0.64
Microllam® LVL ⁽²⁾	1.4	0.59
TJI® Joist Performance Plus® Web ⁽³⁾	1.5	0.62
OSB ⁽⁴⁾	1.5	0.64
Douglas Fir ⁽⁵⁾	1.6	0.68
Southern Pine ⁽⁵⁾	2.2	0.93
Hemlock (Eastern) ⁽⁵⁾	1.6	0.68
Sitka Spruce ⁽⁵⁾	1.7	0.72
Ponderosa Pine ⁽⁵⁾	2.1	0.89

- (1) Southwest Research Institute, *Project No. 01-1046-001*.
 (2) TRADA International, *Project No. RRESF91013*.
 (3) Weyerhaeuser Research & Development Report No. 991-1763.
 (4) Forest Products Laboratory Report FPL-RP-610. *Fire Resistance of Engineered Wood Rim Board Products*, May 2003.
 (5) *Fire Protection Handbook*, 19th Edition, Volume II, Table 8.3.6, National Fire Protection Association.
 (6) Nominal char rates, B7.



Char rate and flame spread classes reveal that Weyerhaeuser engineered lumber, OSB, and sawn lumber have equivalent fire performance characteristics because Weyerhaeuser products are composed of approximately 95% wood fiber.

Flame Spread

A flame spread test is used to evaluate the surface flammability of a material or product. Test standards are defined by ASTM E84 in the United States and CAN/ULC-S102 in Canada. The Flame Spread Index is used by the model building codes to classify building content and surface finishes. A low rating means slow flame spread.

Flame Spread Comparison

Product or Wood Species	Flame Spread Index (Range)	Flame Spread Class
TimberStrand® LSL ⁽¹⁾	140 ⁽⁶⁾	III or C
Parallam® PSL ⁽²⁾	50 ⁽⁶⁾	II or B
Microllam® LVL ⁽³⁾	50 ⁽⁶⁾	II or B
OSB ⁽⁴⁾	131 ⁽⁷⁾ (74–172)	III or C
Douglas Fir ⁽⁵⁾	(70–100)	III or C
Southern Pine ⁽⁵⁾	(130–195)	III or C
Hemlock (Western) ⁽⁵⁾	(60–75)	II or B
Sitka Spruce ⁽⁵⁾	100 ⁽⁶⁾	III or C
Ponderosa Pine ⁽⁵⁾	(105–230)	III or C

- (1) PFS Corporation, *Report No. WR-94105*.
 (2) Warnock Hersey, Fire Laboratory Division, *Report No. 3521*.
 (3) Warnock Hersey, Fire Laboratory Division, *Report No. 3815*.
 (4) *Design for Code Acceptance 1*, American Wood Council.
 (5) *Wood Handbook USDA, FS Agriculture Handbook 72*, rev. 1999, p. 17–3.
 (6) Single test.
 (7) Average of 14 tests.

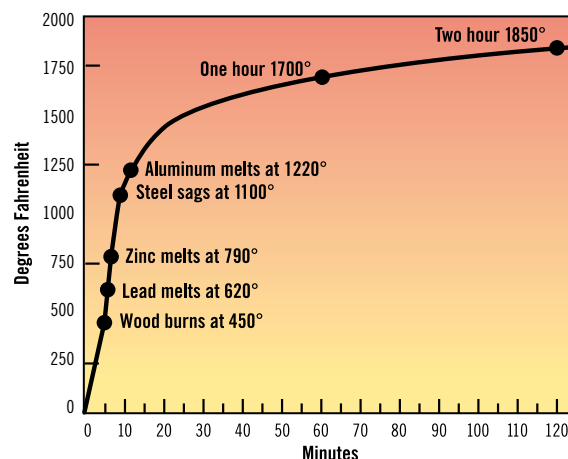
Standards for Determining Fire Resistance of Construction and Building Materials

In the United States and Canada, the model building codes rely on test standards to establish the relative fire resistance of different wall and floor or roof/ceiling assemblies. These standards include the test methods ASTM E119, ANSI/UL 263, CAN/ULC-S101, and NFPA 251. All of these tests are based on the standardized fire time-temperature curve shown below.

This time-temperature curve provides a standardized exposure for evaluating structural components and systems. This standard has been used for many decades by agencies such as ASTM, UL, and ULC, and for building codes that address fire resistance. While a tested one-hour assembly may or may not contain a real-world fire for a full hour, it does provide a relative measure of fire resistance.

With this in mind, the floor/ceiling, roof/ceiling, and wall assemblies shown on the following pages have been evaluated using this standard, and therefore can be specified for the resistance ratings stated.

Time-Temperature Curve (Used by ASTM, UL, ULC, and NFPA)



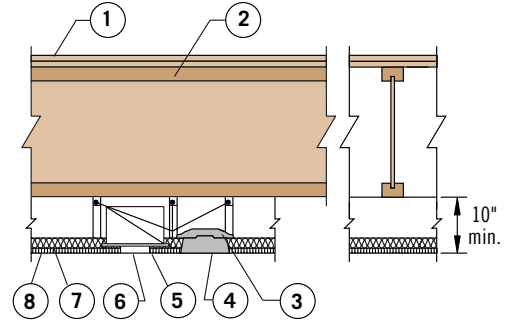
ONE-HOUR FLOOR/CEILING, ROOF/CEILING ASSEMBLIES

Lightweight concrete or approved gypsum concrete topping with appropriate sheathing can be substituted for the decking material shown in any of these assemblies.

Assembly A

Intertek
WNR FCA 60-11
ICC-ES ESR-1153

1. Double wood floor
2. TJI® joist with minimum 1½" flange depth (see TJI® Joist Specifications table on page 16 for flange sizes)
3. Fixture protection
4. 24" x 48" recessed light fixture
5. Cold-rolled channels
6. 12" air diffuser
7. Minimum 1"-thick (4 pcf minimum) mineral wool blankets
8. ⅝" acoustical panels, 24" x 24" or 24" x 48", supported by an approved exposed fire-rated suspension system



Assembly B

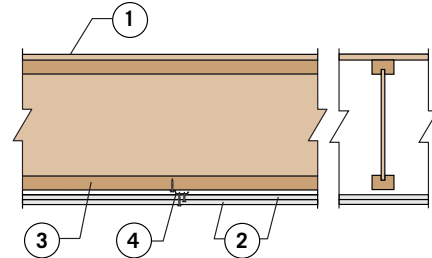
Intertek
WNR FCA 60-01
WNR FCA 60-03
PFS FA-1
ICC-ES ESR-1153

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed.
2. Two layers ⅝" Type X gypsum board complying with ASTM C36 or two layers of ½" Type C gypsum board.
3. TJI® joist
4. Resilient channels (optional)*

Optional: Minimum 3½"-thick glass fiber insulation or non-combustible insulation, rated R-30 or less.*

***Resilient channels are required when insulation is used.**

Note: For information on IIC and STC ratings for Assembly B, see *Sound Performance of Trus Joist® TJI® Joist Fire Rated Floor Assemblies*, TJ-4035.

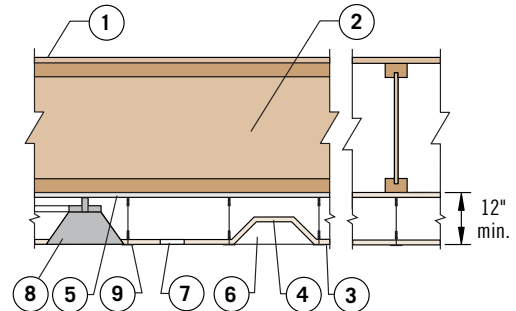


Assembly C

ICC-ES ESR-1153

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed.
2. TJI® joist
3. ⅝" ceiling panels, 24" x 24"
4. Fixture protection
5. ½" Type C gypsum board or ⅝" Type X gypsum board
6. 24" x 48" recessed light fixture
7. 6" x 12" opening for return air
8. 12" diameter diffuser opening
9. Steel suspension grid

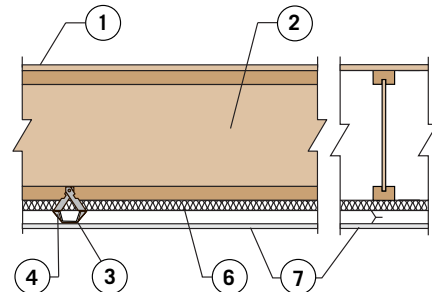
Note: Additional restrictions apply to Intertek's version of this listing. Refer to WNR FCA 60-08 for additional information.



Assembly D

Intertek
WNR FCA 60-05
ICC-ES ESR-1153

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJI® joist with minimum 1¾" flange thickness (see TJI® Joist Specifications table on page 16 for flange sizes)
3. No. 26 gauge galvanized steel furring channel installed perpendicular to joists spaced 24" on-center. Furring channels spaced 1½" from and on each side of wallboard end joints and 24" on-center away from end joints. Channel secured to joists with support clips (item 4) at each joist location. At channel splices, adjacent pieces overlapped 6" and tied with double strand of No. 18 SWG galvanized steel wire at each end of overlap.
4. Simpson Strong-Tie Co. Type CSC support clips to be used to support furring channels at the intersection with each joist. Support clips nailed to side of joist bottom flange with 1½" long No. 11 gauge nails.
5. Stabilizer strap (not shown). ¾" x 6" No. 24 gauge galvanized-steel strap used to prevent rotation of the support clips at wallboard end joints and along walls.
6. Minimum 1"-thick (6 pcf minimum) mineral wool blankets
7. ½" Type C gypsum board (⅝" Type X gypsum for FCA 60-05)



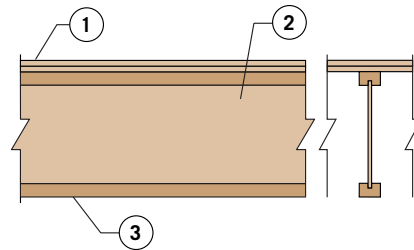
For additional construction information on these assemblies, see ICC-ES reports for the U.S. and Intertek listings for Canada.

ONE-HOUR FLOOR/CEILING, ROOF/CEILING ASSEMBLIES

Lightweight concrete or approved gypsum concrete topping with appropriate sheathing can be substituted for the decking material shown in any of these assemblies.

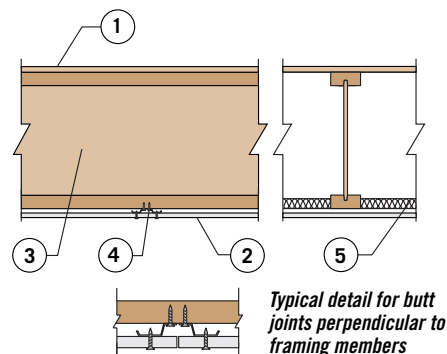
Assembly E ICC-ES ESR-1153

1. Double wood floor or single layer of 48/24 tongue-and-groove span-rated sheathing (Exposure 1)
2. TJI® joist
3. An approved ceiling system that will provide a 40-minute finish rating



Assembly F Intertek WNR FCA 60-07 ICC-ES ESR-1153

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed
2. 5/8" Type C gypsum board
3. 11 7/8" deep TJI® 560D joist minimum (minimum flange size for this assembly is 1 1/2" thick x 3 1/2" wide). Joists spaced at 24" on-center, maximum.
4. Resilient channel at 16" on-center
5. Minimum 1 1/2"-thick (2.5 pcf minimum) mineral wool batts



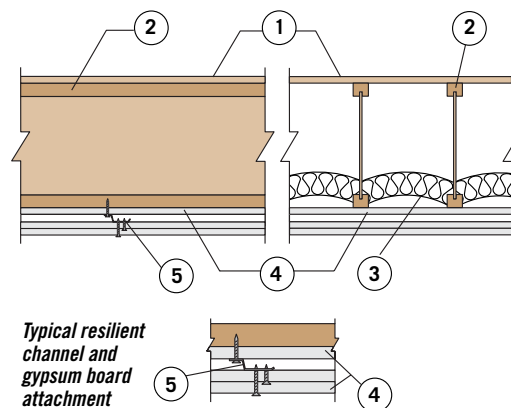
TWO-HOUR FLOOR/CEILING, ROOF/CEILING ASSEMBLY

Lightweight concrete or approved gypsum concrete topping with appropriate sheathing can be substituted for the decking material shown in any of these assemblies.

Assembly G Intertek WNR FCA 120-3 ICC-ES ESR-1153

Assembly G is typically used for garage/living unit separation

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJI® joist, 24" on-center maximum
3. Optional glass fiber insulation, unfaced batts, 3 1/2" thick in plenum, supported by stay wires 12" on-center and centered on joist bottom flanges
4. Three layers of 5/8" Type C gypsum board
5. Resilient channels at 16" on-center located between first and second layers of gypsum board



For additional construction information on these assemblies, see ICC-ES reports for the U.S. and Intertek listings for Canada.

TJI® JOISTS WITH FLAK JACKET® PROTECTION

Lightweight concrete or approved gypsum concrete topping with appropriate sheathing can be substituted for the decking material shown in any of these assemblies.

Assembly H

PFS FJ-1

ICC-ES ESR-1153

One-hour assembly for rated construction

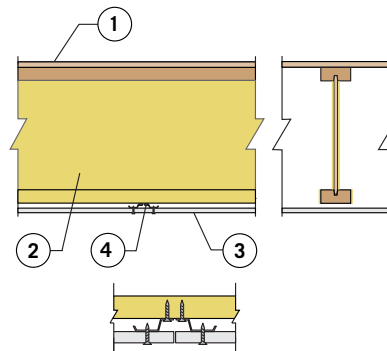


1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1); glued with a subfloor adhesive and nailed
2. TJI® 210, 230, 360, or 560 joist with Flak Jacket® protection and joist on-center spacing of 16" or less. For wider spacing (up to 24" on-center) use a minimum of 11 1/8" deep TJI® 230, 360, or 560 joists.
3. One layer of 5/8" Pabco® Type C gypsum board
4. Resilient channels at 16" on-center

Optional: Glass fiber insulation, 3 1/2" thick in TJI® joist cavity, between TJI® joists above the bottom flange.

Note: For design of this assembly, use 90% of the published TJI® joist bending moment capacity.

For information on IIC and STC ratings for Assembly H, see *Sound Performance of Trus Joist® TJI® Joist Fire Rated Floor Assemblies*, TJ-4035.



Floor Assembly Compliant with 2012 IRC R501.3

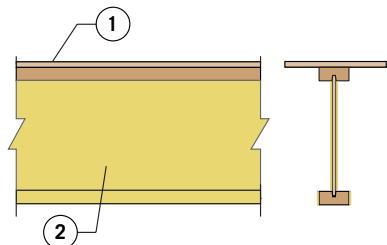
PFS FJ-2

ICC-ES ESR-1153



1. Appropriate span-rated sheathing (Exposure 1)
2. TJI® 210, 230, 360, or 560 series joist with Flak Jacket® protection

No gypsum board is required in this assembly when using TJI® joists with Flak Jacket® Protection



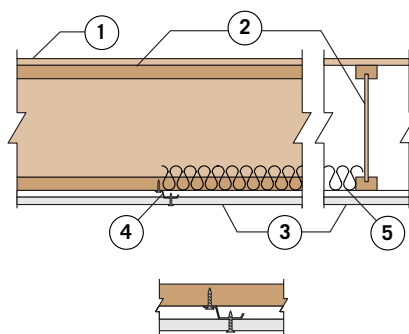
45-MINUTE FLOOR/CEILING ASSEMBLIES FOR CANADA

Intertek WNR FCA 45-01

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJI® joist
3. Single layer 5/8" Type X gypsum board
4. Optional resilient channels at 16" on-centre
5. If resilient channels are used, optional 3 1/2"-thick (minimum) glass fibre insulation or non-combustible insulation, rated R-30 or less, may be added.

Note: For concrete topping applications, a single layer of 40/20 span-rated sheathing (Exposure 1) over joists at 24" on-centre with 1 1/2" lightweight concrete or 1" of gypsum concrete is an allowed deck alternative. If the joists are spaced no more than 20" on-centre, 3/4" gypsum concrete topping is permitted.

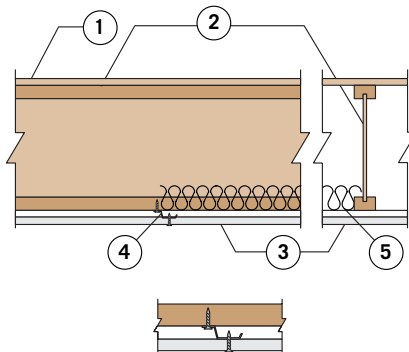
Currently, a 45-minute floor/ceiling system is only used in Canada. For additional construction information, see Intertek listings.



Intertek WNR FCA 45-06

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1). 40/20 tongue-and-groove, span-rated sheathing (Exposure 1) is permitted with proprietary gypsum as listed in WNR FCA 45-06.
2. TJI® joist
3. Proprietary 5/8" Type C gypsum board
4. Resilient channels at 16" on-centre, maximum
5. Optional (not required): Minimum 3 1/2"-thick glass fibre insulation or non-combustible insulation, rated R-30 or less

Currently, a 45-minute floor/ceiling system is only used in Canada. For additional construction information, see Intertek listings.

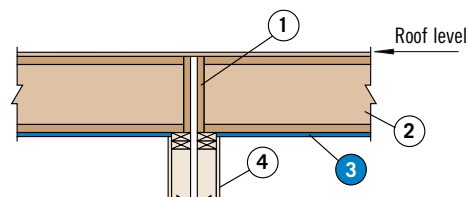


ONE-HOUR CENTER-WALL ASSEMBLIES

Roof Level Application Only: TJI® roof joists with rim board carrying a small portion of roof load.

Design 1R (Roof level only)

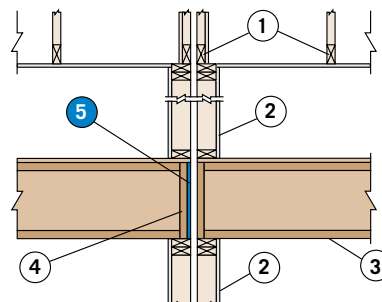
1. 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20".
2. Unrated roof/ceiling
3. Unrated or rated gypsum board ceiling, taped and filled
4. One-hour-rated wall construction



Two-Story Application: Double bearing wall, with rim board carrying a small portion of roof load applied by bottom chord of truss running parallel to the wall. TJI® joists are either perpendicular or parallel to the wall. Blocking as required for stability.

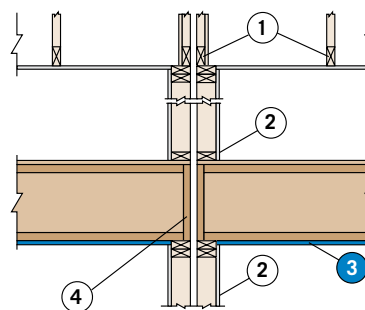
Design 1A

1. Bottom chord of roof truss, parallel to wall
2. One-hour-rated wall construction
3. Unrated floor/ceiling (no ceiling membrane)
4. 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"
5. Continuous ½" Type X gypsum wallboard, applied to inner side of rim board on one side and fastened with 1½" Type W screws at 12" on-center



Design 2A

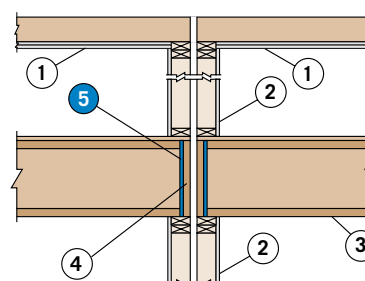
1. Bottom chord of roof truss, parallel to wall
2. One-hour-rated wall construction
3. Unrated or rated gypsum board ceiling, taped and filled
4. 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"



Multi-Story Application: Double bearing wall, with full design load on rim board applied individually to each side of the wall assembly. Blocking as required for stability, both sides of wall.

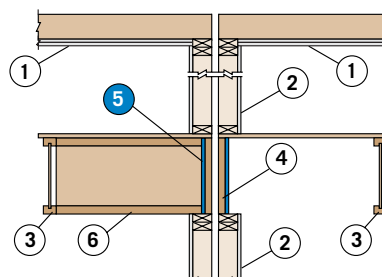
Design 3A

1. One-hour-rated roof/ceiling assembly
2. One-hour-rated wall construction
3. Unrated floor/ceiling (no ceiling membrane)
4. 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"
5. Continuous ½" Type X or Type C gypsum wallboard, applied on occupancy side of both rim boards and fastened with 1½" Type W screws at 12" on-center



Design 3B

1. One-hour-rated roof/ceiling assembly
2. One-hour-rated wall construction
3. Unrated floor/ceiling (no ceiling membrane)
4. 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"
5. Continuous ½" Type X or Type C gypsum wallboard, applied to each rim board on occupancy side and fastened with 1½" Type W screws at 12" on-center
6. Blocking



Designs above as evaluated by Intertek Testing Services. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and CCMC 12627-R and 13261-R in Canada.

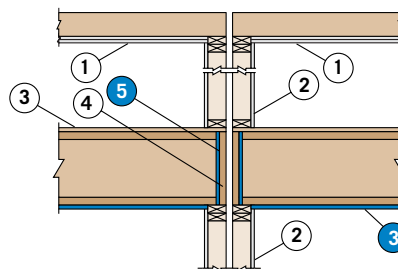
Critical gypsum board placement shown in blue

ONE-HOUR CENTER-WALL ASSEMBLIES

Multi-Story Application: Double bearing wall, with full design load on rim board applied individually to each side of the wall assembly. TJI® joists are either perpendicular or parallel to wall. Blocking as required for stability.

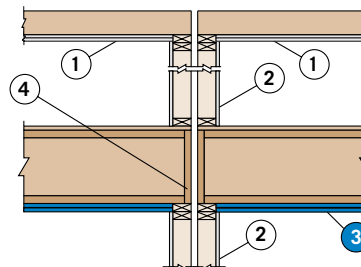
Design 4A

1. One-hour-rated floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. 45-minute-rated floor/ceiling
4. 1½" TJI® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"
5. Continuous ½" conventional gypsum wallboard, applied to each rim board on occupancy side and fastened with 1¼" Type W screws at 12" on-center.
Alternative (not shown): 1½"-thick mineral wool batt insulation, friction-fit, in place of gypsum wallboard.



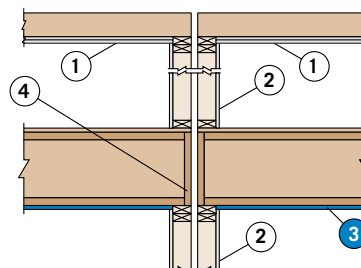
Design 5A

1. One-hour-rated floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. One-hour-rated floor/ceiling assembly
4. 1½" TJI® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"



PFS WS-1

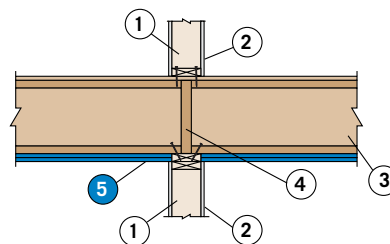
1. Code required floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. Maximum 16" deep TJI® joist with minimum ½" gypsum ceiling
4. 1¾" 1.55E TimberStrand® LSL with maximum vertical load of 2000 plf ASD (unfactored). When joists are deeper than 9½" and run parallel to the wall, install blocking at 4' on-center.



Multi-Story Application: Single bearing wall with full design load on rim board. TJI® joists are either perpendicular or parallel to the wall. Blocking as required for stability.

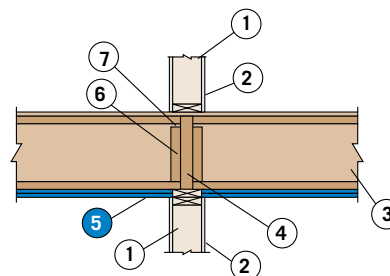
Design 6A

1. 2x6 minimum studs
Alternative (not shown): 2x4 staggered studs attached to 2x6 plates in bearing wall.
2. One-hour-rated wall construction
3. Non-continuous TJI® joists at 24" on-center maximum, abutting to continuous rim board along the wall
4. 1½" TJI® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less;
1¼" TimberStrand® LSL rim board for depths of 18" and 20"
5. 45-minute- or one-hour-rated floor/ceiling



Design 7A

1. 2x4 or 2x6 minimum studs
2. One-hour-rated wall construction
3. Continuous TJI® joists at 24" on-center maximum across the wall
4. Rim board for blocking: Cut to fit snug between joist flanges, toenail to keep in position. Use 1½" TJI® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less; 1¼" TimberStrand® LSL rim board for depths of 18" and 20".
5. 45-minute- or one-hour-rated floor/ceiling
6. Web stiffeners attached to each side of TJI® joist web at rim board location. See Weyerhaeuser literature for placement and nailing requirements.
7. Gap: ¼" maximum between joist flange and web stiffener.



Designs above as evaluated by Intertek Testing Services. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and CCMC 12627-R and 13261-R in Canada.

Critical gypsum board placement shown in blue

ONE-HOUR END-WALL ASSEMBLIES

Multi-Story Application: Single bearing wall with full design load on rim board. TJI® joists are either perpendicular or parallel to wall with continuous rim. Bracing or blocking as required for stability. *This design can also be used for interior walls if 5/8" Type X gypsum is installed on the opposite side (not shown).*

Designs 1A and 1B

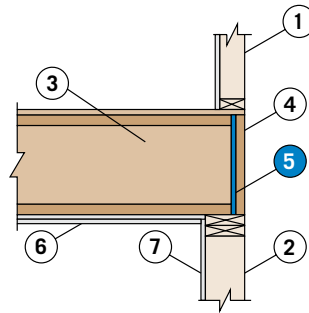
One hour, from occupant side

1. 2x4 minimum studs
2. 2x6 minimum studs
3. TJI® joists
4. Continuous 1½" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less; continuous 1¼" TimberStrand® LSL rim board (minimum) for depths of 18" and 20"
5. Continuous 5/8" Type X gypsum board applied to rim board on occupancy side and fastened with 1½" Type W screws at 12" on-center (gypsum board may be eliminated if a one-hour-rated floor/ceiling assembly exists)
6. One-hour-rated floor/ceiling system (if required)
7. Continuous 5/8" Type X gypsum board

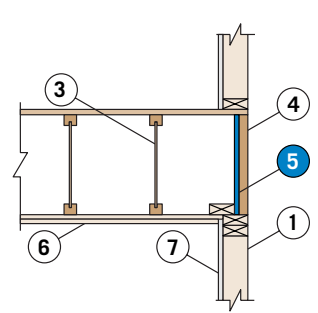
Not shown: Specific details for gypsum board and exterior wall cladding.

As evaluated by Intertek Testing Services. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and CCMC 12627-R and 13261-R in Canada.

1A: Joists Perpendicular to Wall



1B: Joists Parallel to Wall



Design 2A

One hour, from occupant side

1. TJI® joists
 2. Continuous 5/8" Type X gypsum board (fastened with 1½" Type W screws at TJI® joist rim)
 3. 2x6 minimum studs
 4. 2x4 minimum studs
 5. One-hour-rated floor/ceiling system (if required)
- For Continuous Rim:**
6. Continuous TJI® rim joist (single joist allowed if it meets vertical load requirement)
 7. Continuous 5/8" Type X gypsum board in web area of rim joist, fastened with 1½" Type W screws

For TJI® Blocking:

8. 5/8" Type X gypsum board, fastened with 1½" Type W screws, between joists (notch to fit into web area of adjacent joists)
9. TJI® blocking between joists
10. 5/8" Type X gypsum board in web area of TJI® blocking, fastened with 1½" Type W screws (extend to fit into web area of adjacent joists)

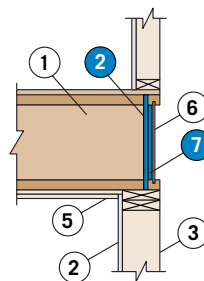
Not shown: Specific details for gypsum board and exterior wall cladding.

As evaluated by Intertek Testing Services.

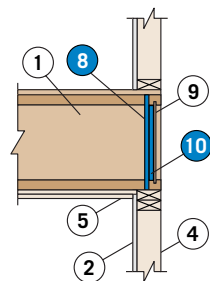
Exterior Wall (No fire protection on exterior side of joist rim)

Joists Perpendicular to Wall

Continuous Rim



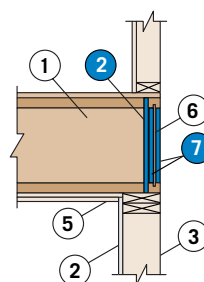
TJI® Blocking



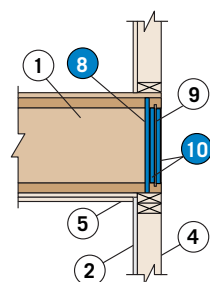
Interior Wall (Fire protection on exterior side of joist rim)

Joists Perpendicular to Wall

Continuous Rim



TJI® Blocking



Critical gypsum board placement shown in blue

TWO-HOUR END-WALL ASSEMBLIES

Multi-Story Application: Single bearing wall with full design load on rim board. TJI® joists are either perpendicular or parallel to wall with continuous rim. Blocking as required for stability. *This design can also be used for interior walls if 5/8" Type X gypsum is installed on the opposite side (not shown).*

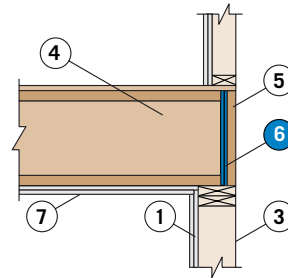
Designs 3A and 3B

Two hour, from occupant side

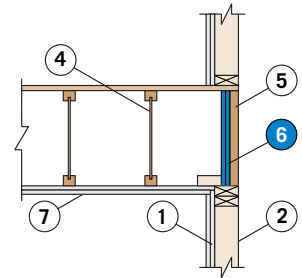
1. Two layers 5/8" Type X gypsum board
2. 2x4 minimum studs
3. 2x6 minimum studs
4. TJI® joists
5. 1 1/8" TJ® Rim Board or 1 1/4" TimberStrand® LSL for depths of 16" or less; 1 1/4" TimberStrand® LSL rim board for depths of 18" and 20"
6. Two layers 1/2" Type X gypsum board fastened with 1 3/4" Type W screws. (One layer 5/8" Type X gypsum board, fastened with 1 1/2" Type W screws, when floor/ceiling assembly is one-hour rated.)
7. One-hour-rated floor/ceiling assembly (if required)

Not shown: Specific details for gypsum board and exterior wall cladding.

(3A) Joists Perpendicular to Wall



(3B) Joists Parallel to Wall



As evaluated by Intertek Testing Services. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and CCMC 12627-R and 13261-R in Canada.

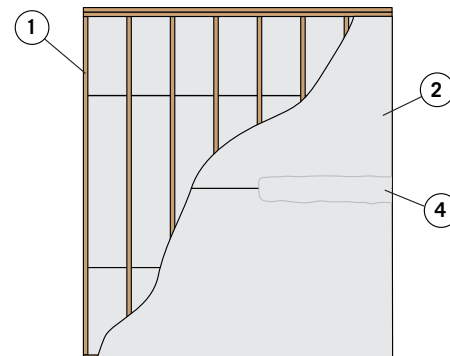
ONE-HOUR WALL ASSEMBLY WITH TIMBERSTRAND® LSL STUDS

2x6 Wall Application: 2x6 wall comprised of Trus Joist TimberStrand® LSL studs and gypsum wallboard applied horizontally. 2x6 or larger TimberStrand® LSL is permitted as a substitute in fire-rated assemblies when used in the same or larger dimensions as sawn lumber.

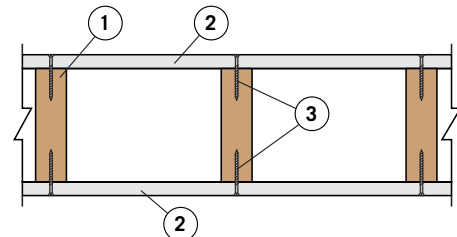
TimberStrand LSL Wall Assembly

1. 2x6 TimberStrand® LSL studs, spaced 16" on-center, with double top plates and single bottom plate
 2. 5/8" Type X gypsum wallboard, 4' wide, applied horizontally. Horizontal joints are unblocked. Horizontal application of wallboard represents the direction of least fire resistance as opposed to vertical application.
 3. 2 1/4" #6 Type S drywall screws, spaced along stud at 7" on-center and covered with joint compound
 4. Wallboard joints covered with paper tape and joint compound
- The design axial compressive stress within the TimberStrand® LSL studs must not exceed **the least** of the following:
 - 435 psi
 - $F_c \times 0.30$, where F_c is the compression design value parallel-to-grain for the TimberStrand® LSL, adjusted by all applicable adjustment factors (in accordance with the NDS®), including the column stability factor C_p
 - $F_c \times 0.30$, where F_c is calculated in accordance with the NDS®, assuming a slenderness ratio L_e/d of 21

Note: Additional requirements may apply when this assembly is used in Canada. Contact your Weyerhaeuser representative for assistance.



Top View (plates not shown)



This assembly has been tested to ASTM E119/NFPA 251 and CAN/ULC-S101 Standards.

Critical gypsum board placement shown in blue

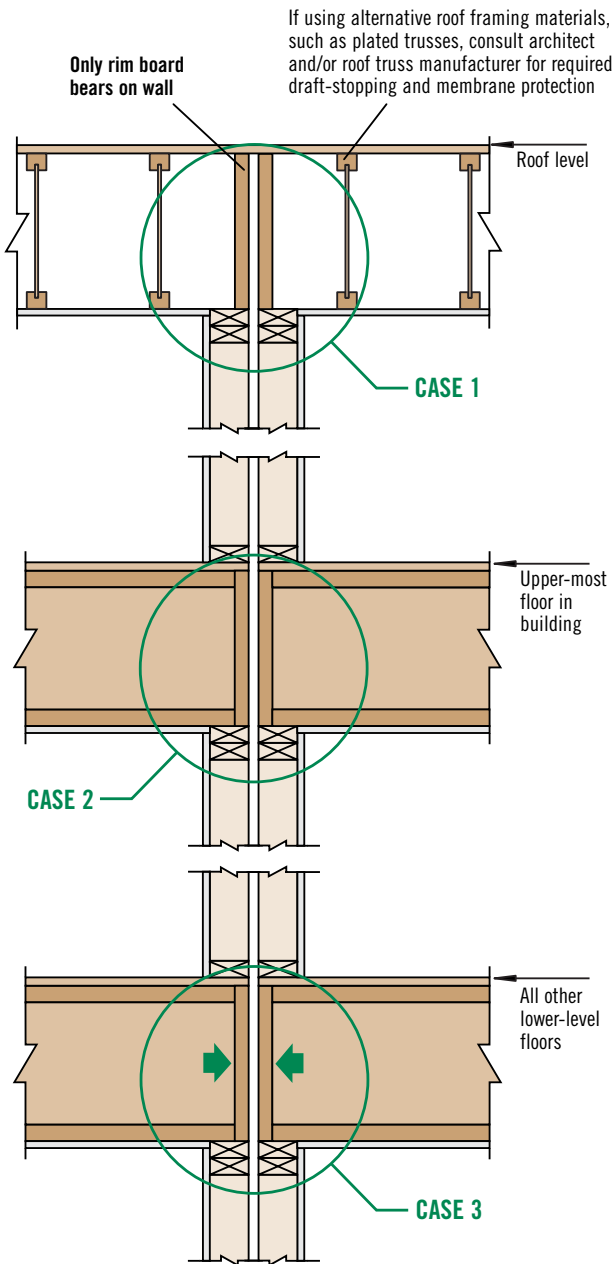


How to Use The Assemblies and Table on Pages 12 and 13

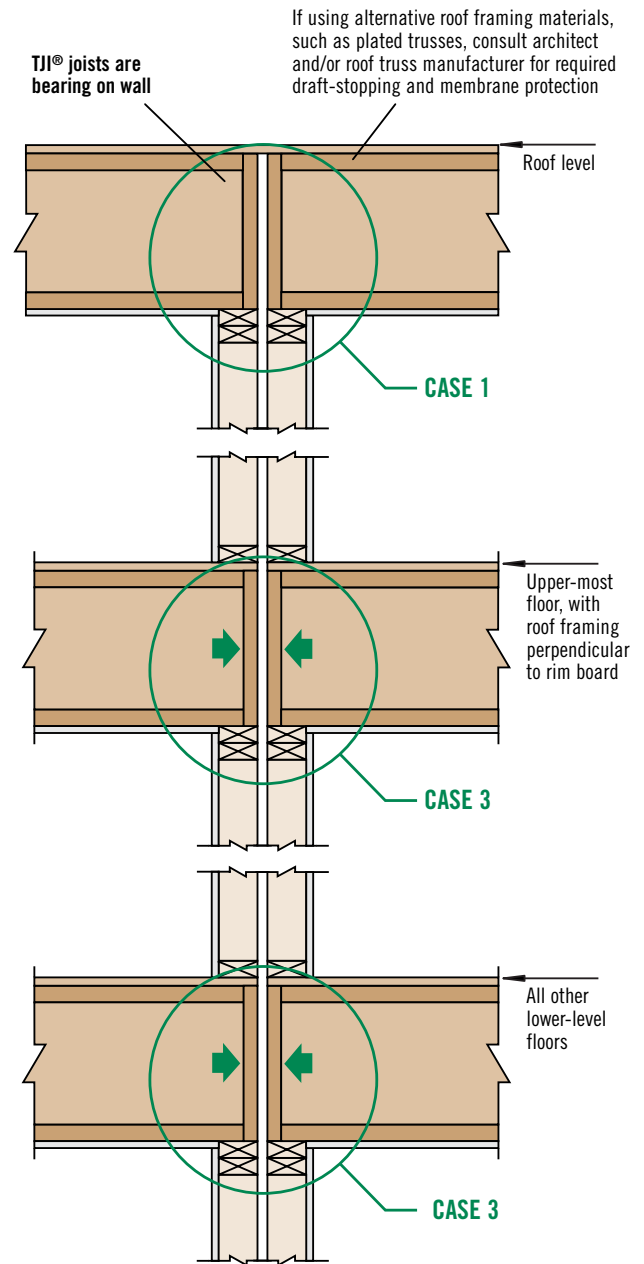
1. Review the **Case Definitions** and typical wall assemblies on pages 12 and 13 to determine the appropriate case for your application.
2. In the table on page 13, locate the correct **Case** and **Type of Use**.
3. Scan across the row to find the corresponding wall assembly detail and rim protection requirement.
4. Refer to the specific wall assembly detail (on pages 8–11) for installation guidelines and membrane protection requirements.

 Indicates membrane protection may be required in these areas. Refer to table on page 13 and the corresponding wall design detail.

TJI® Roof Joists Parallel to Wall

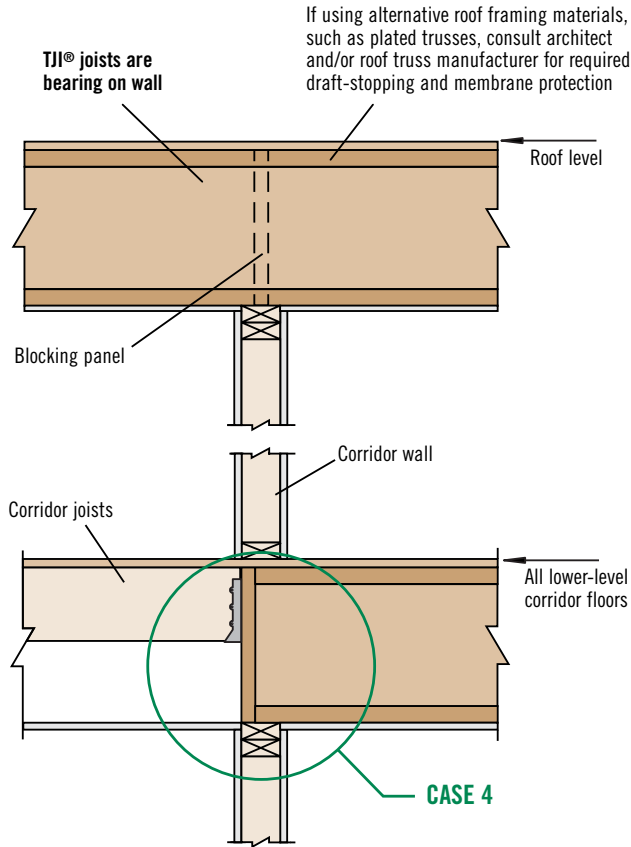


TJI® Roof Joists Perpendicular to Wall

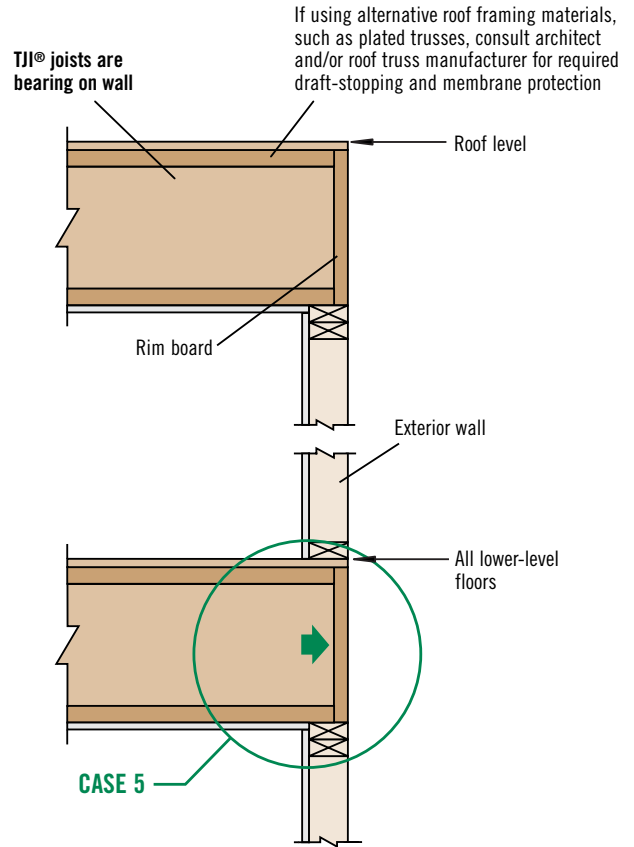




TJI® Joists at Corridor Walls



TJI® Joists at Exterior Walls



Case Definitions

- CASE 1:** Roof level only. Rim board supports no loads from upper levels apart from small area of roof loading.
- CASE 2:** Upper-most floor in building. Rim board supports very light loads from upper levels; roof framing parallel to rim board.
- CASE 3:** Typical lower-level floor. Rim board supports roof and/or floor loads from upper levels
- CASE 4:** Corridor wall (separating corridor from residential suite). Rim board supports roof and/or floor loads from upper levels.
- CASE 5:** Exterior wall. Rim board supports roof and/or floor loads from upper levels.

Rim Board Installation Options for One-Hour-Rated Wall Assemblies⁽¹⁾

Case #	Type of Use	Floor/Ceiling or Roof/Ceiling Assembly Rating	Centre Wall Design Detail ⁽²⁾	End Wall Design Detail ⁽²⁾	Gypsum for Rim Board Protection
1	Townhouse	Non-rated Gypsum	1R	N.A.	not required
	3 Storey, Wood	45 minute	1R	N.A.	not required
	4+ Storey, Wood	60 minute	1R	N.A.	not required
2	Townhouse	Non-rated Gypsum	2A	N.A.	not required
	3 Storey, Wood	45 minute	2A	N.A.	not required
	4+ Storey, Wood	60 minute	2A	N.A.	not required
3	Townhouse	Non-rated Gypsum	3A or 3B	N.A.	½" Type C or X
	3 Storey, Wood	45 minute	4A	N.A.	½" Non-rated ⁽³⁾
	4+ Storey, Wood	60 minute	5A	N.A.	not required
4	Townhouse	Non-rated Gypsum	N.A.	N.A.	N.A.
	3 Storey, Wood	45 minute	6A	N.A.	not required
	4+ Storey, Wood	60 minute	6A	N.A.	not required
5	Townhouse	Non-rated Gypsum	N.A.	1A or 1B	⅝" Type X
	3 Storey, Wood	45 minute	N.A.	1A or 1B	⅝" Type X
	4+ Storey, Wood	60 minute	N.A.	1A or 1B	not required

(1) Table applies to Group C (residential) occupancies where combustible construction is permitted. Refer to the National Building Code of Canada for additional information and restrictions. Verify local requirements for floor/ceiling, roof/ceiling, and wall membrane protection.

(2) See pages 8–9 for corresponding centre-wall details, and pages 10–11 for end-wall details.

(3) As an alternative, 1½" mineral wool batt insulation (friction fit) may be used in lieu of ½" gypsum wallboard.

Variations in fuel load, ventilation, and ignition source make every fire different.

FIRE RATINGS

If a fire-rated assembly has a one-hour rating, does that mean it will last one hour during a real fire?

Not necessarily. Every fire is different, so it would be virtually impossible to design a test that fits all possible scenarios. The fire-resistance rating is strictly for comparing alternative materials and assemblies against one another. The one-hour rating represents a 60-minute resistance using the standard time-temperature curve.

How realistic is the comparison between the time-temperature curve developed for standard fire-resistance tests and the conditions in a real fire?

Variations in fuel load, ventilation, and ignition source make every fire different. These disparities make it difficult to produce a time-temperature curve that reflects general fire conditions modeled for fires of similar duration and intensity.

Tests of simulated room fires conducted by the National Bureau of Standards⁽¹⁾ and the Forest Products Laboratory have produced time-temperature curves that differ noticeably from the standard curve shown on page 4. Although the standard time-temperature curve may not match any one real-world fire, it provides a widely accepted standard for evaluating the relative performance of different assemblies.

For more information on the time-temperature curve, see *Fire Development and Wall Endurance in Sandwich and Wood-Frame Structures*, by the USDA, FS, Forest Products Laboratory⁽²⁾, or *Fire Development in Residential Basement Rooms*, by the National Bureau of Standards⁽³⁾.

What is the difference between an “assembly rating” and a “finish rating”?

An assembly rating is the fire-endurance rating for an entire assembly (e.g., a one-hour assembly). A finish rating indicates how effective the ceiling or membrane is at protecting the wood structure. It represents the time it takes for the face of the framing closest to the fire to experience one of the following: a 325°F temperature rise at a single location, or an average temperature rise of 250°F over several locations. For a gypsum ceiling, it is the time required for the unexposed surface of the gypsum to reach either of these conditions. A typical finish rating for ½"-thick, fire-rated gypsum wallboard is about 20 minutes.

How does insulation affect the performance of fire-rated assemblies?

Generally, if an assembly meets fire-rating requirements without insulation, it will meet the requirements with insulation—provided that an air gap is maintained between the insulation and the gypsum board.

Testing by the National Research Council of Canada (NRCC) has shown that, when properly attached with resilient channels, two layers of ½" Type X gypsum board will provide a minimum one-hour rating regardless of whether or not insulation is used.

Can TJI® joist assemblies in floor and roof applications maintain their fire-endurance rating when holes are cut through the web for plumbing, wiring, or duct work?

Yes. Holes of allowed sizes, drilled or cut through the joist webs to accommodate utilities, are considered when fire ratings are granted.

What are the requirements for rim board in wall separations?

Wall and roof assemblies are tested for fire endurance using ASTM E119 and CAN/ULC S101 test protocols and do not consider the role that rim board plays in wall separations. However, rim board in a rated assembly may have to meet certain requirements set by the authority having jurisdiction. In some cases, gypsum board may be attached to rim board to meet the rating requirements. The wall assemblies in this guide have been independently evaluated by Intertek Testing Services.

Does this guide include all fire-resistant assemblies evaluated for use with Weyerhaeuser products?

No. Only the most common applications are included in this guide. Additional assemblies and more information on fire testing may be found at:

American Forest and Paper Association: awc.org
(see *DCA No. 3, Fire Rated Wood Floor and Wall Assemblies*)

Gypsum Association: gypsum.org
(see *Fire Resistance Design Manual, 20th Edition GA-600-12*)

Intertek SpecDirect: spec-direct.com
(use free access, search for Weyerhaeuser NR Company)

Underwriters Laboratories, Inc.: ul.com/fire

WEYERHAEUSER PRODUCTS

Can Parallam® PSL be substituted for sawn lumber or glue-laminated beams in heavy timber construction or fire-rated assemblies?

Yes. All model code agencies in the U.S. and Canada recognize Parallam® PSL as a suitable alternative in heavy timber construction if it meets or exceeds the minimum dimensional requirements shown in Table 602.4 of the 2012 IBC. Tests conducted at Underwriters Laboratories Inc., Intertek Testing Services/Warnock Hersey, and Southwest Research Institute indicate that the fire resistance of Parallam® PSL is equivalent to that of sawn lumber or glue-laminated timber.

Can TimberStrand® LSL be used as a substitute for sawn lumber in fire-rated assemblies?

Yes. In both Canada and the U.S., when used in the same or larger dimensions as sawn lumber, TimberStrand® LSL is permitted as a substitute in any fire-rated floor assembly and in wall assemblies that use 2x6 or larger sawn lumber.

TimberStrand® LSL of the same or larger dimension may be used as a substitute for sawn lumber in fire-rated floor assemblies.

Can 1½" TJI® Rim Board and 1¼" TimberStrand® LSL be used as fire blocking?

Yes. In the U.S. and Canada, engineered lumber rim board with a minimum net thickness of 1" may be used in lieu of 2x_ nominal lumber for fire blocking.

Have Weyerhaeuser's fire-rated assemblies changed now that some joist series use a thinner flange?

No. The fire-resistance rated assemblies recognized in ICC-ES ESR-1153 have not changed. However, per ICC-ES ESR-1153, three assemblies (A, D, and F) require minimum flange sizes that would exclude the use of joists with thinner flanges. Note that WRN FCA 60-08 also requires a minimum flange size for Assembly C.

FLAMMABILITY

Do TJI® joists, TimberStrand® LSL, and sawn lumber joists have similar flame spread ratings?

Yes. TJI® joists, TimberStrand® LSL, sawn lumber joists, and other wood-based products (such as OSB and plywood) all have a Class C flame spread rating.

Flame spread ratings are approximate ratings of surface flammability, which affects fire propagation rate and available escape time. Model building codes require a low flame-spread rate in critical safety zones such as exit locations. Low index numbers signify slower flame spread; high numbers indicate quicker flame spread. The Flame Spread Index (FSI) ranges from 0–25 for Class A (Level I), 26–75 for Class B (Level II), and 76–200 for Class C (Level III) materials.

Flame spread ratings apply primarily to building contents and wall finishes. Because sawn lumber joists, TJI® joists, and TimberStrand® LSL are used as structural supports and are typically covered with other materials, this rating is typically not an issue.

What about flame spread ratings for Microllam® LVL and Parallam® PSL?

The flame spread comparison table on page 4 shows that flame spread ratings for Microllam® LVL and Parallam® PSL are equal to or lower than those of equivalent sawn lumber species.

Can Weyerhaeuser engineered lumber products be treated with a fire retardant?

Weyerhaeuser does not recommend pressure treating their engineered lumber products with a fire retardant. Reductions to the structural properties and impacts on dimensional stability may occur and those reductions have not yet been evaluated. The application of any pressure, fire-retardant treatment voids Weyerhaeuser's product warranty. Topical, non-pressure treatments suitable for wood products can be applied; however, Weyerhaeuser does not evaluate their compatibility or durability, or make any claims as to their effectiveness. Consult with the manufacturer of the fire-retardant treatment for data on the compatibility, durability and effectiveness of topical treatments.

SAFETY IN A REAL FIRE

Do the adhesives used in Weyerhaeuser engineered lumber products increase smoke toxicity compared to ordinary wood?

No. The leading cause of death in fires is smoke inhalation. Testing shows that there is no significant difference between the smoke toxicity of ordinary wood and that of engineered lumber products of the same species.

Do adhesives contribute to early structural collapse compared to the performance of ordinary wood?

No. Adhesives do not trigger an early structural collapse. The wood material—not the adhesive—controls fire resistance. See page 4 for flame spread and char rate data. Additional information can also be found at the American Wood Council's site: woodaware.com.

Do adhesives promote the spread of fire?

No. For strand products, such as OSB, TimberStrand® LSL, and Parallam® PSL, standardized flame spread tests show that the progression of flame along the product surface does not change within the current classification (Class C) due to the presence of the adhesive. The adhesive is a small percentage of the overall product and the impact on fire spread is negligible. The adhesive used to assemble other products (such as TJI® joist flanges or Microllam® LVL) is located inside the product, away from the surface, and does not impact flame spread.

Also see the first two questions in the **Flammability** section.

Where can I find additional information on fire-resistant testing and fire-safe construction?

See the following websites for more information:

American Wood Council: awc.org

Canadian Wood Council: cwc.ca

International Code Council: iccsafe.org

International Code Council Evaluation Service: icc-es.org

National Fire Protection Association: nfpa.org

(1) National Bureau of Standards is now known as the National Institute of Standards and Technology.

(2) USDA, Forest Service, Forest Products Laboratory, Research Paper FPL 364, March 1980.

(3) National Bureau of Standards, NBSIR, 80-2120, for Division of Energy, Building Technology and Standards, U.S. Department of Housing and Urban Development.

SPRINKLER SYSTEMS

This section provides information for supporting sprinkler systems with Trus Joist® TJI® joists. The technical information and details provided are intended for use with Trus Joist® products only. For options beyond the scope of this guide, contact your Weyerhaeuser representative.

General Assumptions and Guidelines

- The details in this guide are intended for use with Trus Joist® products only.
- The connections shown in the details will support the sprinkler pipes indicated or the loads shown, provided that the required loads have been included in the original design of the Trus Joist® TJI® joist system.
- The hangers and installation methods shown in this guide are in accordance with the following design specifications:
 - NFPA 13 requires that hangers be designed to support 5 times the weight of the water-filled pipe plus 250 lbs at each point of piping support. Standard ferrous hardware referred to in NFPA 13/13R (such as U-hooks, eye rods, and steel trapezes) or accepted proprietary hardware are the responsibility of others.
 - NFPA 13 requires that sprinkler piping be substantially supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lbs applied at the point of hanging. Fasteners (such as lag screws and machine bolts) and structural wood hanger blocks are designed to support the weight of the water-filled pipe plus a temporary 250 lb load using values from the 2005 NDS®.
- Lead holes and size limitations for fasteners are to be in accordance with the fastener information below and the applicable requirements of the NFPA 13/13R.
- All wood hanger blocks are to be minimum No. 2 grade or equivalent.

- For allowable holes in the webs of TJI® joists, see tables on page 17. Tables assume uniformly loaded joists; for other loading conditions and hole sizes, contact your Weyerhaeuser representative.
- The seismic bracing shown on sprinkler details S50–S53 (on pages 22 and 23) require that the system designer specify the frequency of the bracing.
- Pipe sizes shown in steel pipe details assume pipes are supported at 15' on-center. Pipe sizes shown on CPVC details assume pipes are supported at the spacing shown in CPVC table below. Refer to NFPA for actual spacing limitations.

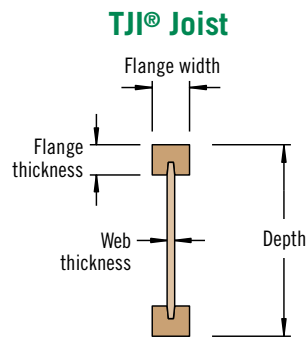
Assumed Loads for Water-Filled Steel Pipes at 15' on-center

Pipe Diameter	2"	2½"	3"	3½"	4"	5"	6"
Load (lbs)	77	118	162	202	246	352	475

Assumed Loads for CPVC Water-Filled Pipes

Pipe Diameter	1"	2"	3"
Load (lbs)	5	18	50
Support on-center spacing	6'	8'	10'

TJI® JOIST DESCRIPTIONS



The Trus Joist® TJI® joist product line is manufactured in lengths up to 64' and in numerous depths.

Depths: 9½", 11⅞", 14", 16, 18", 20", 22", and 24"

Flange Material: Microlam® LVL or MSR lumber in sizes shown in table at right.

Web Material: ⅜" or ⅞" Performance Plus® web material

Code Evaluation: See ICC-ES ESR-1153

TJI® Joist Specifications

TJI® Joist Series	Flange Width	Flange Thickness	Web Thickness	Depths
110	1¾"	1¼"–1¾"	⅜"	9½", 11⅞", 14"
210	2¼"	1¼"–1¾"	⅜"	9½", 11⅞", 14", 16"
230	2⅝"	1¼"–1¾"	⅜"	9½", 11⅞", 14", 16"
360	2⅝"	1¾"	⅜"	9½", 11⅞", 14", 16", 18", 20"
560	3½"	1¾"	⅞"	9½", 11⅞", 14", 16", 18", 20"
560D	3½"	1½"	⅞"	11⅞", 14", 16", 18", 20", 22", 24"
s31, s33	2½"	1½"	⅜"	9½", 11⅞", 14", 16"
s47	3½"	1½"	⅞"	9½", 11⅞", 14", 16", 18", 20"

- For load capacities, bearing details, and other information, contact your Weyerhaeuser representative.

FASTENERS

General Guidelines for Lead Holes

Fastener Type	Approximate Lead Hole Size	Fastener Size
Nails	75% of nail diameter	0.162" diameter and larger
Wood Screws	70% of root diameter (⅛" for 18 gauge)	Larger than No. 8
Machine Bolts	Bolt diameter + ⅛" to ¼" max.	All
Lag Screws	⅛" (1) ⅜" (1) ½" (1) ¾" (1)	¼" diameter ⅜" diameter ½" diameter ¾" diameter

(1) Lead-hole size applies to the threaded part of the lag screw. For the unthreaded length of the screw, the lead hole is equal to the shank diameter.

General Notes

- Drive screws (those driven in with a hammer) are not allowed in TJI® joists.
- Lag screws shall be installed in prebored lead holes using a wrench or a drill/driver. Do not drive lag screws with a hammer.
- Follow the tables on this page for proper choice and installation of fasteners.
- For holes in TJI® joist webs, refer to **Allowable Holes** on page 17.

Cutting or drilling oversized holes in the webs or flanges of TJI® joists can weaken the structural integrity of the member to the point where it will need to be repaired or replaced, sometimes at great expense. Proper installation of the allowed fasteners is equally important to the structural integrity of the TJI® joists.

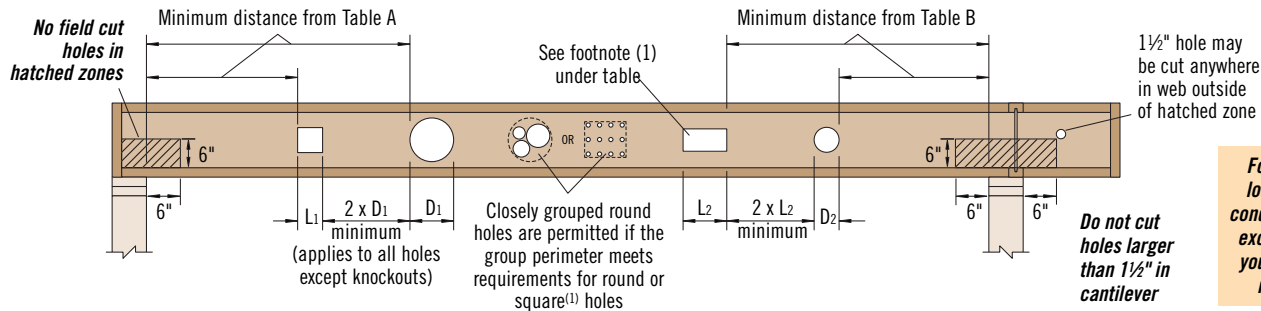
The table below shows the largest lead-hole and fastener sizes allowed in TJI® joist flanges. All holes and attachments made to the underside of a flange shall be located per details S21 and S22 on page 19.

Maximum Lead-Hole and Fastener Sizes for TJI® Joist Flanges

Flange Location	Maximum Lead Hole Size ⁽¹⁾	Maximum Fastener Size
Side	Not allowed	10d (0.148" x 3") nail
Top or Bottom	⅜"	¼" lag ⁽²⁾⁽³⁾

- Only one hole may be drilled in any cross section of any flange.
- Requires prebored lead hole—see **General Guidelines for Lead Holes** at left.
- ¾" lag allowed when joist flange width is greater than 1¾".

ALLOWABLE HOLES



For concentrated loads or for other conditions or possible exceptions, contact your Weyerhaeuser representative

Table A—End Support

Depth	TJI®	Minimum distance from edge of hole to inside face of nearest end support					
		● Round Hole Sizes Only ⁽¹⁾					
		2"	3"	4"	5"	6"	7"
9 1/2"	110	1'-0"	1'-6"	2'-0"	3'-0"	4'-0"	
	210	1'-0"	1'-6"	2'-6"	3'-0"	4'-6"	
	230	1'-6"	2'-0"	2'-6"	3'-6"	5'-0"	
	360	1'-6"	2'-0"	3'-0"	4'-0"	5'-0"	
	560	1'-6"	2'-6"	3'-6"	5'-0"	6'-0"	
	s31	1'-0"	2'-0"	2'-6"	3'-6"	5'-0"	
	s33	1'-6"	2'-6"	3'-0"	4'-0"	5'-6"	
	s47	1'-0"	1'-0"	2'-6"	4'-0"	5'-6"	
11 1/8"	110	1'-0"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"
	210	1'-0"	1'-6"	2'-0"	2'-0"	2'-6"	3'-6"
	230	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"
	360	1'-6"	2'-0"	3'-0"	3'-6"	4'-0"	5'-0"
	560	1'-6"	2'-6"	3'-0"	4'-0"	5'-0"	6'-0"
	s31	1'-0"	1'-6"	1'-6"	2'-0"	2'-6"	3'-6"
	s33	1'-0"	1'-6"	2'-6"	3'-0"	3'-6"	4'-6"
	s47	1'-0"	1'-0"	2'-0"	3'-0"	3'-6"	4'-6"
14"	110	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"
	210	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"	2'-6"
	230	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"	2'-6"
	360	1'-0"	1'-0"	1'-6"	2'-6"	3'-0"	4'-0"
	560	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"	5'-0"
	s31	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"	2'-6"
	s33	1'-0"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"	3'-6"
16"	210	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	230	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	360	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	2'-6"
	560	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"
	s31	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	1'-6"
	s33	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
18"	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
20"	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
22"	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
24"	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"

Table B—Intermediate or Cantilever Support

Depth	TJI®	Minimum distance from edge of hole to inside face of nearest intermediate or cantilever support					
		● Round Hole Sizes Only ⁽¹⁾					
		2"	3"	4"	5"	6"	7"
9 1/2"	110	2'-0"	2'-6"	3'-6"	4'-6"	6'-6"	
	210	2'-0"	2'-6"	3'-6"	5'-0"	7'-0"	
	230	2'-6"	3'-0"	4'-0"	5'-6"	7'-6"	
	360	3'-0"	4'-0"	5'-6"	6'-6"	8'-0"	
	560	3'-6"	5'-0"	6'-0"	7'-6"	9'-0"	
	s31	2'-0"	3'-0"	4'-0"	5'-0"	7'-6"	
	s33	2'-6"	3'-6"	5'-0"	6'-6"	8'-6"	
	s47	1'-6"	3'-0"	4'-6"	6'-0"	8'-0"	
11 1/8"	110	1'-0"	1'-0"	1'-6"	2'-6"	3'-6"	4'-6"
	210	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"	5'-0"
	230	1'-0"	2'-0"	2'-6"	3'-6"	4'-6"	5'-6"
	360	2'-0"	3'-0"	4'-0"	5'-6"	6'-6"	7'-6"
	560	1'-6"	3'-0"	4'-6"	5'-6"	7'-0"	8'-6"
	s31	1'-6"	2'-0"	2'-6"	3'-6"	4'-0"	5'-0"
	s33	2'-0"	3'-0"	3'-6"	4'-6"	5'-6"	7'-0"
	s47	1'-0"	1'-0"	2'-0"	3'-6"	5'-6"	7'-0"
14"	110	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"
	210	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"
	230	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"
	360	1'-0"	1'-0"	2'-0"	3'-6"	5'-0"	6'-0"
	560	1'-0"	1'-0"	1'-6"	3'-6"	5'-0"	6'-6"
	s31	1'-0"	1'-0"	1'-6"	2'-0"	3'-0"	3'-6"
	s33	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"	5'-0"
	s47	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"	5'-0"
16"	210	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	230	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	360	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	4'-0"
	560	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"
	s31	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"
	s33	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
18"	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
20"	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	560D	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
22"	560D	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"	3'-6"
24"	560D	1'-0"	1'-6"	2'-6"	3'-0"	4'-0"	5'-0"



DO NOT
cut or notch
flange.



DO NOT
cut holes in cantilever
reinforcement.

WARNING: Drilling, sawing, sanding or machining wood products generates wood dust. The paint and/or coatings on this product may contain titanium dioxide. Wood dust and titanium dioxide are substances known to the State of California to cause cancer. For more information on Proposition 65, visit wy.com/inform.

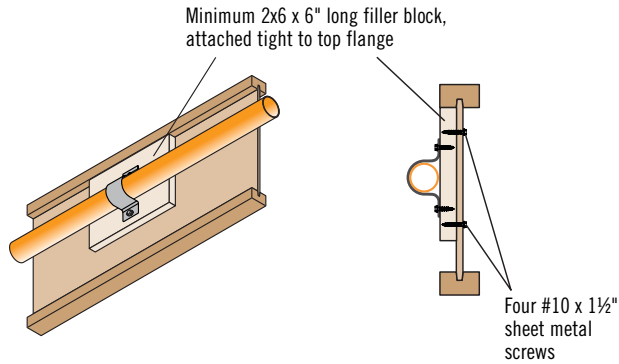
(1) Table applies to round holes only. For information on square or rectangular hole sizes, refer to the Weyerhaeuser specifier's guides listed below.

General Notes

- For simple span (5' minimum) uniformly loaded joists that meet the requirements of the Weyerhaeuser TJI® Joist specifier's guides listed at right, one maximum size round hole may be located at the center of the joist span **provided that no other holes occur in the joist**.
- Distances are based on the maximum uniform loads shown in Weyerhaeuser's TJI® Joist specifier's guides listed at right. For other loading conditions, use Forte® software or contact your Weyerhaeuser representative.
- Holes may be located vertically anywhere within the web. Leave 1/8" of web (minimum) at top and bottom of hole.
- Knockouts are located in web at approximately 12" on-center; they do not affect hole placement.
- For additional hole sizes, including those for square holes, see Weyerhaeuser's TJI® Joist specifier's guides (TJ-4000, TJ-4500, TJ-4005, and TJ-4510).

TJI® JOIST SPRINKLER DETAILS (CPVC PIPE)

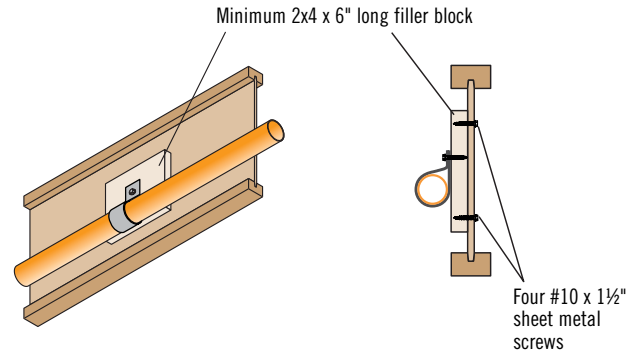
S1 Surface Mount Hanger with Double Fastener



Filler Block Material	Maximum Pipe Diameter
DF or SPF	2"

Install per NFPA 13 and manufacturer's instructions.

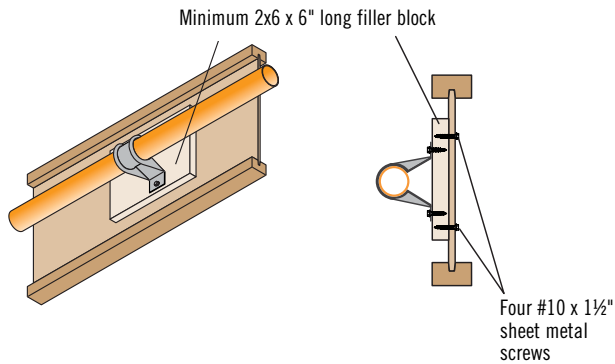
S2 Surface Mount Hanger with Single Fastener



Filler Block Material	Maximum Pipe Diameter
DF or SPF	2"

Install per NFPA 13 and manufacturer's instructions.

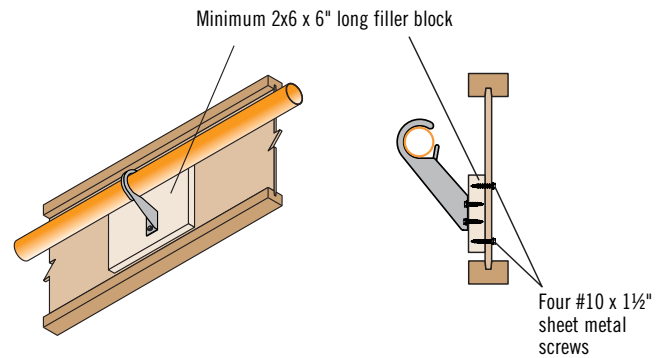
S3 Offset Hanger



Filler Block Material	Maximum Pipe Diameter
DF or SPF	1 1/4"

Install per NFPA 13 and manufacturer's instructions.

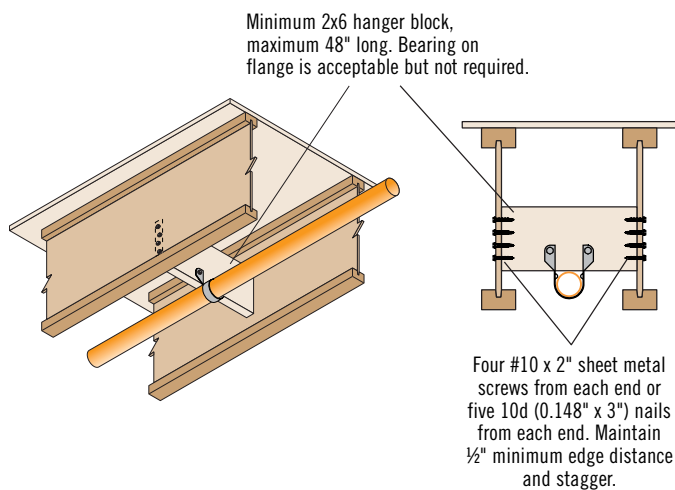
S4 Double Offset Hanger



Filler Block Material	Maximum Pipe Diameter
DF or SPF	1"

Install per NFPA 13 and manufacturer's instructions.

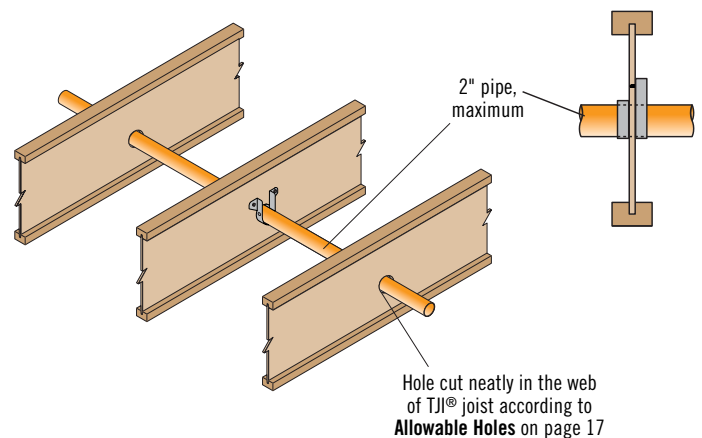
S5 Face Mount Hanger



Filler Block Material	Maximum Pipe Diameter
DF or SPF	2"

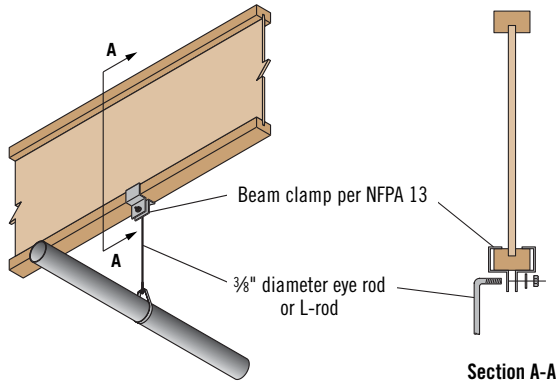
Install per NFPA 13 and manufacturer's instructions.

S6 Hanger at Web Hole



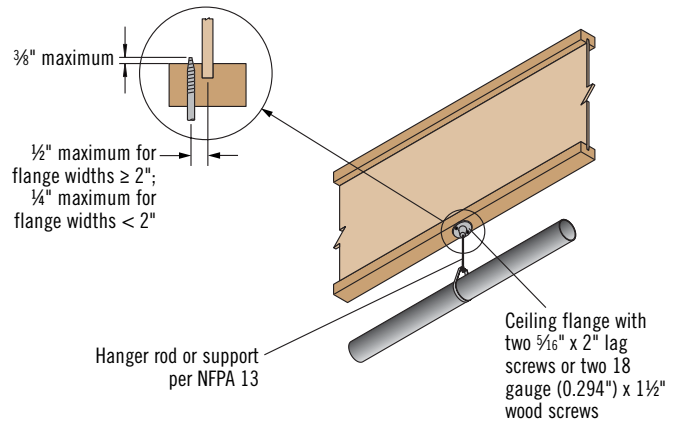
Maximum pipe diameter is 2". Install per NFPA 13 and manufacturer's instructions.

S20 Beam Clamp



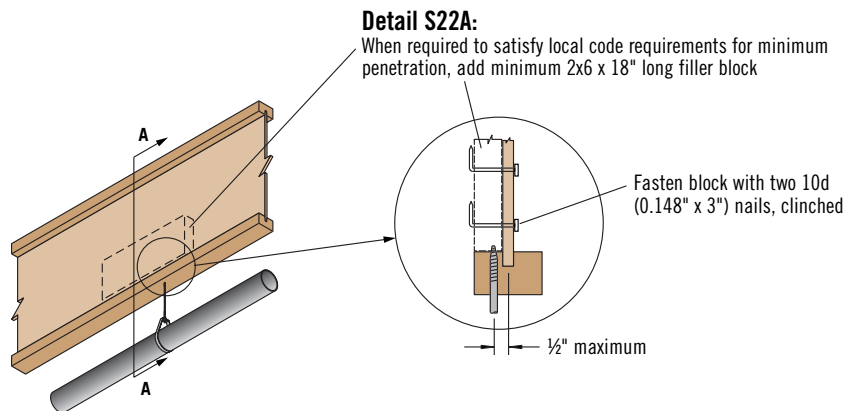
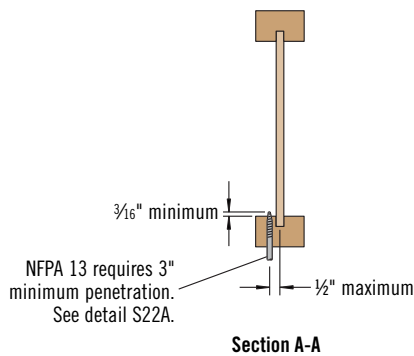
At maximum hanger spacing, maximum pipe diameter is 4". Check flange and clamp dimensions for compatibility.

S21 Ceiling Flange



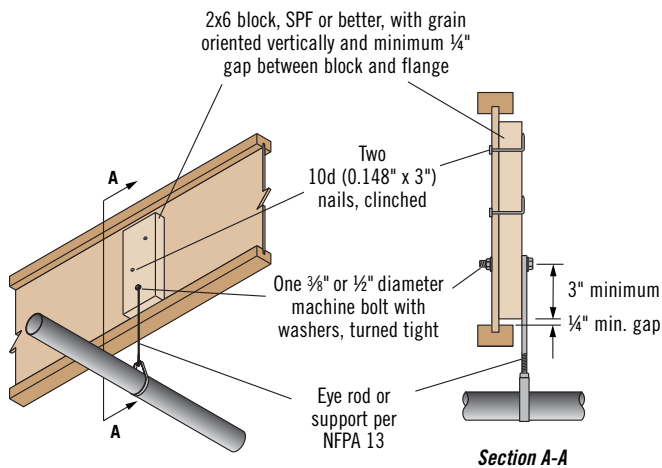
At maximum hanger spacing, maximum pipe diameter is 2". Penetration of screws into web is allowed.

S22 S22A Coach Screw into Joist Flange



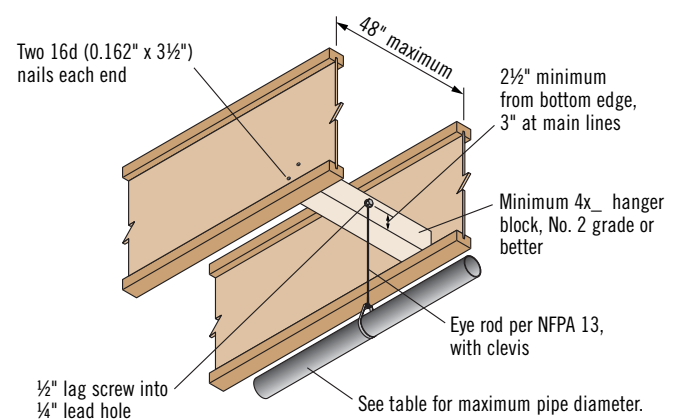
At maximum hanger spacing, maximum pipe diameter is 2" (4" at detail S22A). Penetration of screws into web is allowed.

S23 Rod Bolted to Filler Block



At maximum hanger spacing, maximum pipe diameter is 2" for 3/8" bolts, 4" for 1/2" bolts.

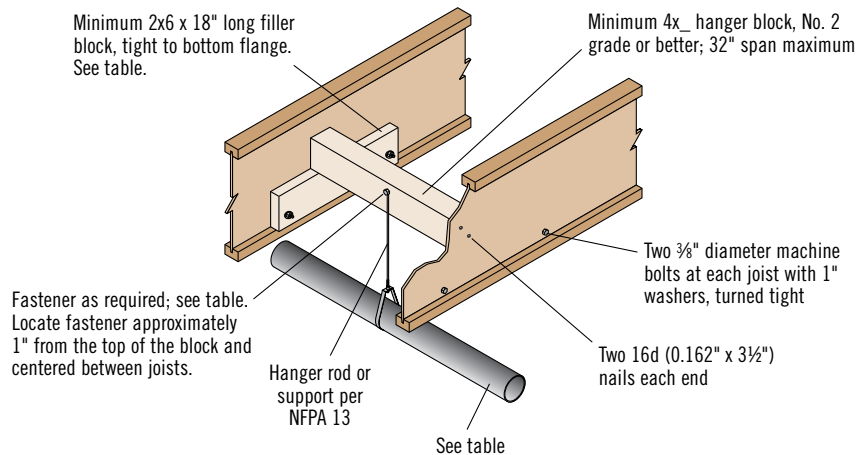
S24 Rod with Support Member



Block Material	Lag Screw Size	Maximum Pipe Diameter
DF or SP	1/2" x 3"	3 1/2"
SPF or HF	1/2" x 3"	2 1/2"

Center pipe support (parallel or perpendicular) between joists.

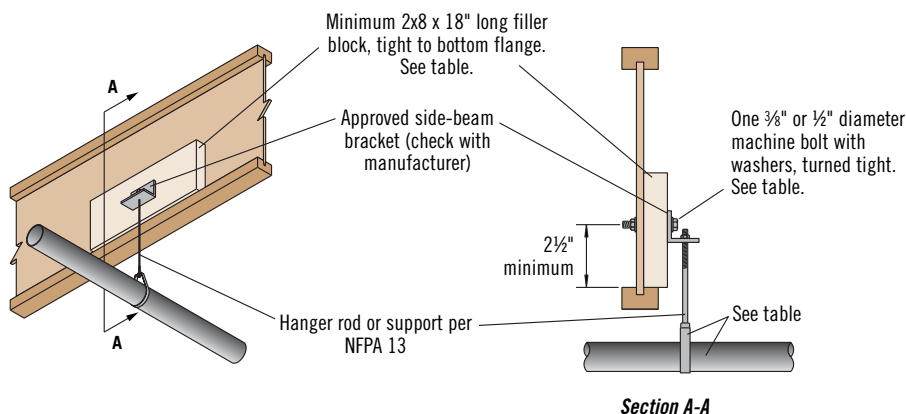
S25 Rod with Support Member and Filler Block



Filler Block Material	Fastener Type	Maximum Pipe Diameter
DF or SP	1/2" x 3" lag screw	3 1/2"
	3/8" machine bolt	2"
	1/2" machine bolt	6"
SPF or HF	1/2" x 3" lag screw	2 1/2"
	3/8" machine bolt	2"
	1/2" machine bolt	5"

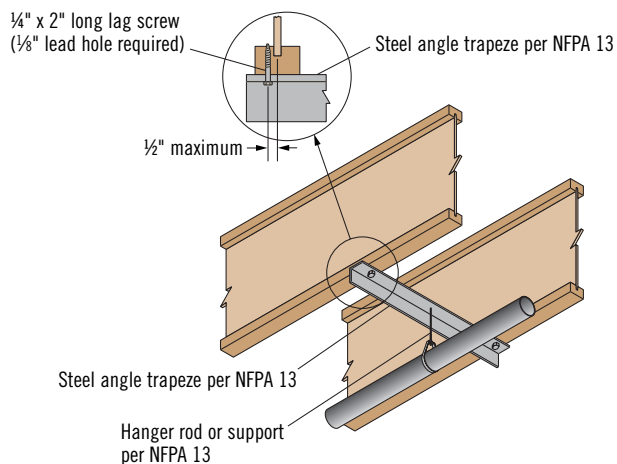
Center pipe support (parallel or perpendicular) between joists.

S26 Rod with Side-Beam Bracket



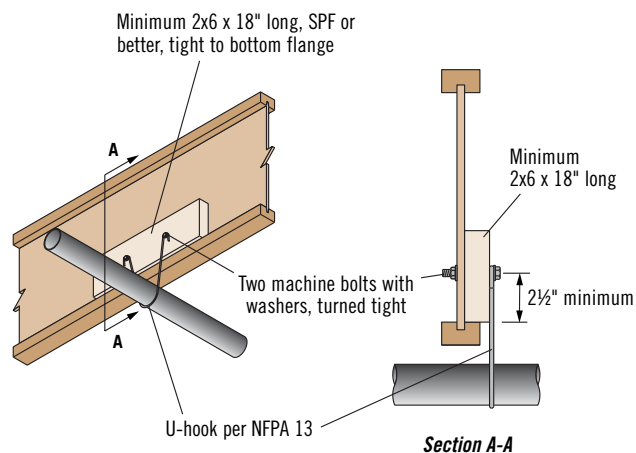
Block Material	Bolt Size	Hanger Thickness	Maximum Pipe Diameter
DF or SP	1/2"	3/8"	3 1/2"
	3/8"	3/16"	2"
SPF or HF	1/2"	3/8"	2 1/2"

S27 Rod with Steel Angle Trapeze



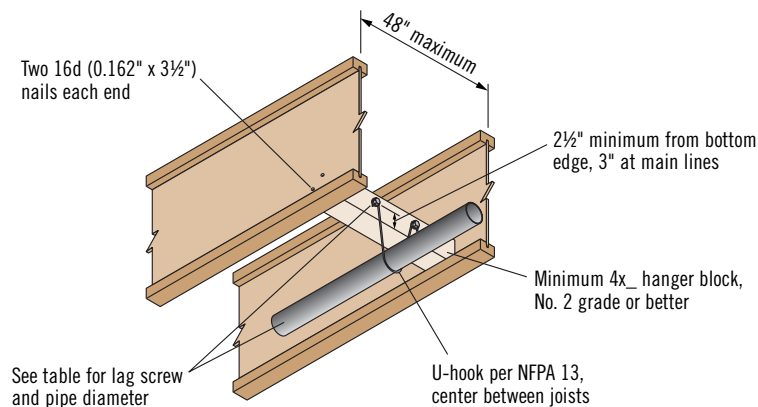
At maximum hanger spacing, maximum pipe diameter is 4". Center pipe support (parallel or perpendicular) between joists.

S28 U-Hook with Filler Block



At maximum hanger spacing, maximum pipe diameter is 3 1/2" for 3/8" bolts, 4" for 1/2" bolts.

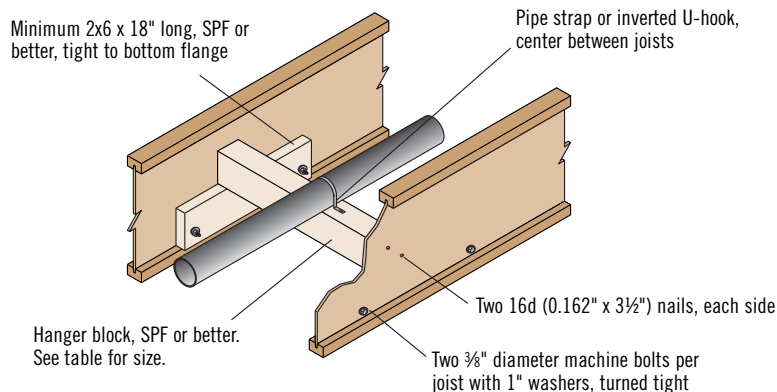
S29 U-Hook with Support Member



Block Material	Lag Screw Size	Maximum Pipe Diameter
DF or SP	$\frac{3}{8}$ " x $2\frac{1}{2}$ "	$3\frac{1}{2}$ "
	$\frac{1}{2}$ " x 3"	4"
SPF or HF	$\frac{3}{8}$ " x $2\frac{1}{2}$ "	$3\frac{1}{2}$ "
	$\frac{1}{2}$ " x 3"	4"

Center pipe support (parallel or perpendicular) between joists.

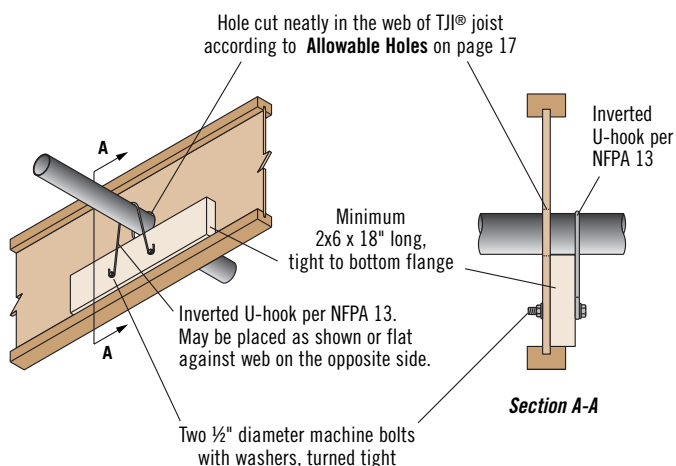
S30 Pipe on Support Member



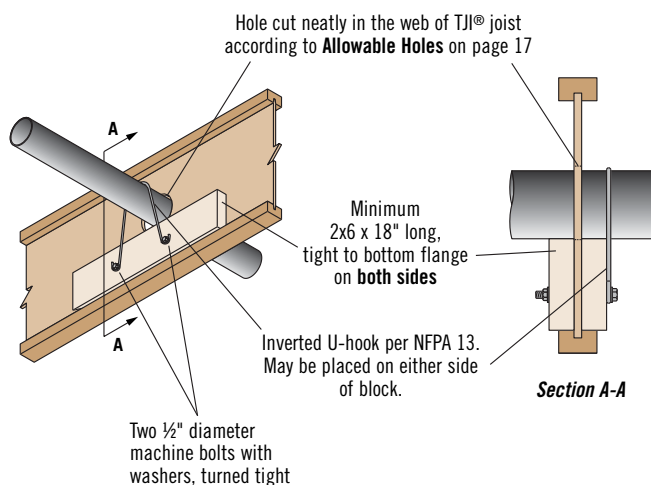
TJI® Joist On-Center Spacing	Wood Hanger Block Size
32" or less	4x4
48"	4x6

At maximum hanger spacing, maximum pipe diameter is 6".

S31 Inverted U-Hook with Pipe Through TJI® Joist (4" Pipe Diameter, Maximum)

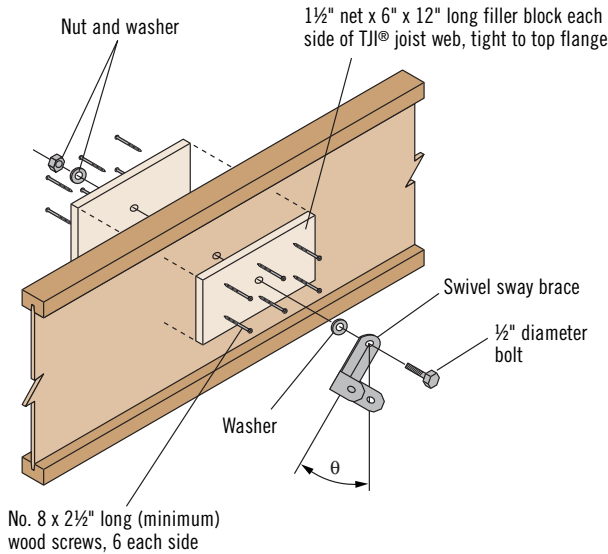


S32 Inverted U-Hook with Pipe Through TJI® Joist (6" Pipe Diameter, Maximum)



TJI® JOIST SPRINKLER DETAILS (SEISMIC)

S50 Swivel Sway Brace on TJI® Joist Web (Loads Parallel or Perpendicular to TJI® Joists)

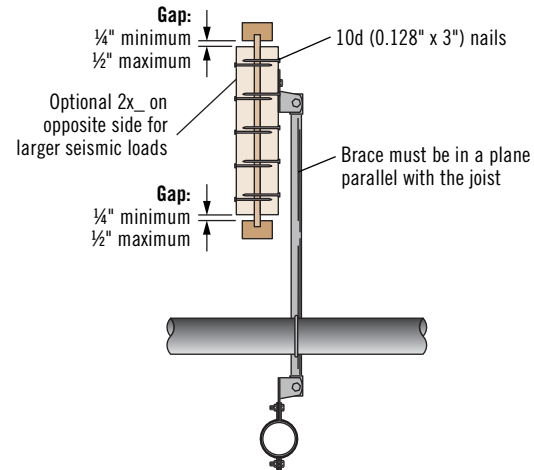
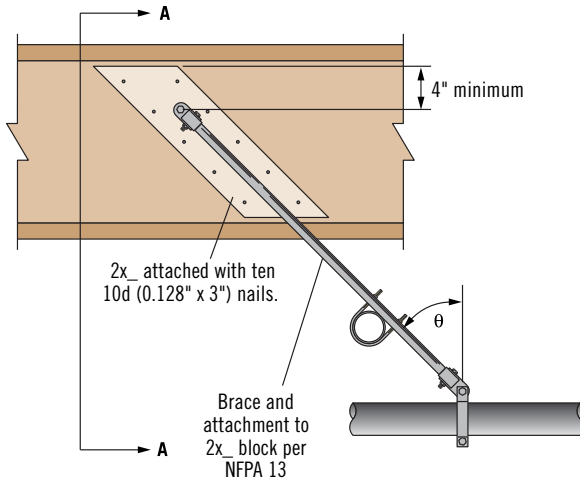


Allowable Horizontal Seismic Loads (lbs)

Species	Angle to Vertical (θ)		
	30°	45°	60°
DF	430	690	695
SPF	365	590	695

- Loads are based on the controlling connection to the joist.
- Loads include a 1.60 duration of load factor adjustment.

S51 Extended Swivel Sway Brace on TJI® Joist Web (Loads Parallel to TJI® Joists)



Section A-A

General Notes

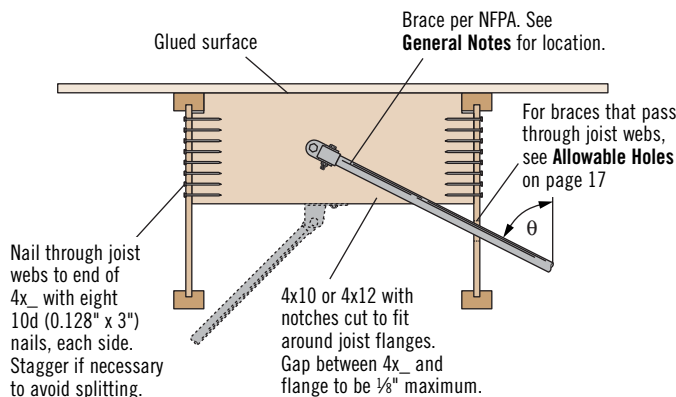
- Do not use this detail for loads perpendicular to the joist.
- Make connection in top half of block, centered at least 4" from the end of the block.
- The direction of the wood grain in the block is approximately parallel with the brace.

Allowable Horizontal Seismic Loads (lbs)

Species	Blocking Condition	Angle to Vertical (θ)		
		30°	45°	60°
DF	2x_ on one side	465	660	810
	2x_ on both sides	660	935	1,145
SPF	2x_ on one side	410	580	710
	2x_ on both sides	615	865	1,060

- Loads are based on the controlling connection to the joist.
- Loads include a 1.60 duration of load factor adjustment.

S52 Brace with Nailed Blocking (Loads Parallel or Perpendicular to TJI® Joists)



General Notes

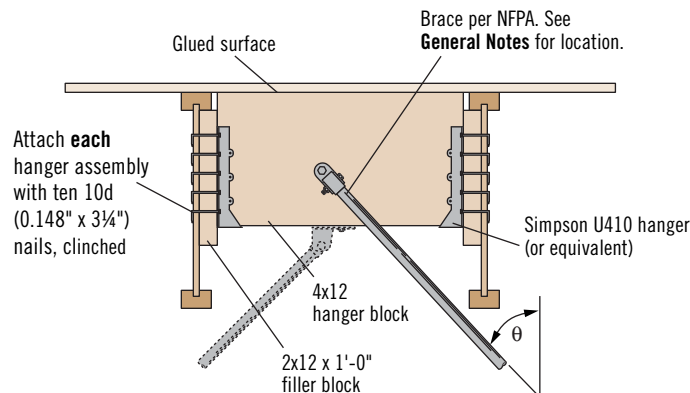
- Notch top corners of 4x blocking so it fits around joist flanges and tight to sheathing.
- Before installing, glue top edge of 4x blocking with a subfloor adhesive that meets the requirements of ASTM D 3498. Follow manufacturer's recommendations. Glued surfaces must be clean and dust free.
- For loads perpendicular to joists, the brace must be located a distance of at least 7 x the hole diameter used for brace attachment, measured from the end of the block. Maintain a 4-hole-diameter distance from all other edges.
- For loads parallel to joists (not shown), the brace must be attached to the upper half of the 4x blocking. The same end and edge distances as those noted above for loads perpendicular to joist must also be maintained.

Allowable Horizontal Seismic Loads (lbs)

Species	Angle to Vertical (θ)		
	30°	45°	60°
DF	370 ⁽¹⁾	600	600
SPF	340 ⁽¹⁾	590 ⁽²⁾	600

- (1) If connection is centered within the length of the 4x block, loads may be increased to 400 lbs.
- (2) If connection is centered within the length of the 4x block, loads may be increased to 600 lbs.
- Loads are based on the controlling connection to the joist.
 - The capacity of the brace fastener to the wood block may limit the capacity of the detail (see NFPA 13).
 - Loads include a 1.60 duration of load factor adjustment.

S53 Brace with Blocking in Hangers (Loads Parallel or Perpendicular to TJI® Joists)



General Notes

- Before installing, glue top edge of 4x blocking with a subfloor adhesive that meets the requirements of ASTM D 3498. Follow manufacturer's recommendations. Glued surfaces must be clean and dust free.
- Attach 4x hanger block by nailing through each hanger, filler block, and TJI® joist web with ten 10d (0.148\" x 3\") nails and clinch.
- For loads perpendicular to joists, the brace must be located a distance of at least 7 x the hole diameter used for brace attachment, measured from the end of the block. Maintain a 4-hole-diameter distance from all other edges.
- For loads parallel to joists (not shown), the brace must be attached to the upper half of the 4x blocking. The same end and edge distances as those noted above for loads perpendicular to joist must also be maintained.

Allowable Horizontal Seismic Loads (lbs)

Species	Angle to Vertical (θ)		
	30°	45°	60°
DF	465	720	980
SPF	400	650	895

- Loads are based on the controlling connection to the joist.
- The capacity of the brace fastener to the wood block may limit the capacity of the detail (see NFPA 13).
- Loads include a 1.60 duration of load factor adjustment.

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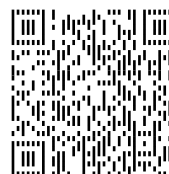
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