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
- Fire Facts Q&A
- CPVC and Steel Sprinkler Pipe Details
**Fire-Safe Construction**

Fire-safe construction and life safety are major concerns for everyone in the building materials and construction industry. The 2015 U.S. Fire Administration statistics\(^1\) on residential and commercial fires in the U.S. alone include 3,280 fire fatalities and an estimated $14.3 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.

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

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**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 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/data/statistics/
Unrated Construction

In unrated construction, the structural elements of one-and-two-family dwellings can be made of any material permitted by the building code. Fire protection requirements for dwellings usually require a physical separation (typically Type X gypsum board) between building sections such as the garage and habitable space, and a fire-resistance rated assembly between attached dwelling units. However, construction within a dwelling unit is typically unrated. Traditionally, exposed floor or ceiling framing (such as in an unfinished basement) has been allowed in unrated construction. But according to the 2012 and 2015 International Residential Code (IRC), an unfinished floor or ceiling framing system may require protection. The IRC states that a 1/2" gypsum wall board or 1/4" wood structural panel membrane (or equivalent) must be added to the underside of any floor or ceiling system that does not meet the exceptions listed in R501.3 of the 2012 IRC or R302.13 of the 2015 IRC.

FIRE RESISTANCE CATEGORIES (CONTINUED)

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 damage to structural elements

Concealed Space Protection

In addition to protecting occupied space, building codes require construction techniques and materials that restrict the movement of air or flames to other areas of the building through concealed spaces. Fire-blocking and draft-stopping in strategic locations 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 wall studs
- Plates at top and bottom of walls
- Framing around stairwell openings
- Sealing around penetrations for wiring or ventilation

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.

Fire-Resistance-Rated Assemblies

This guide includes fire-resistance-rated assemblies using Trus Joist® engineered wood products for both horizontal and vertical separations within a structure and between adjacent structures. These assemblies address requirements for multi-story and townhouse structures, which require a continuous fire separation between dwelling units and/or between buildings. Assemblies shown include:

- Fire-resistance-rated assemblies using TJI® joists for roof/ceiling and floor/ceiling applications;
- A tested wall assembly that uses TimberStrand® LSL framing;
- Details that address the intersection of horizontal and vertical assemblies using Trus Joist® rim board products, including TimberStrand® LSL and TJI® Rim Board.

The required fire resistance at the intersection of horizontal and vertical assemblies is typically achieved by a combination of ceiling membrane protection, direct-applied protection, and the inherent resistance of the rim board or blocking — assuming that the fire originates in the occupied space. The center-wall designs shown provide the indicated fire-resistance-rating for fires originating on either side of the wall. The end-wall designs shown provide the indicated fire-resistance-rating for fires originating on the occupancy side of exterior walls and do not contain specific details for cladding on the exterior side of the studs. Some end-wall assemblies, such as those installed close to a property line or at the location of an interior stairwell, also require a fire-resistance rating from the exterior side. In those cases, protection applied to the exterior side must protect the rim board equally as well as the combination of ceiling membrane and direct-applied gypsum does 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.
**Char Rates**

Research conducted at the Forest Products Laboratory demonstrates that TimberStrand® laminated strand lumber (LSL), Parallam® parallel strand lumber (PSL), and Microllam® laminated veneer lumber (LVL) char similarly to sawn lumber. 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.)

In addition, Technical Report 10 (TR10) from American Wood Council (AWC) summarizes the results of fire-resistance tests of exposed structural composite lumber (SCL) beams, columns, tension members, and rim boards, which demonstrate that a nominal char rate of 1 1/2” per hour is appropriate for the design of exposed SCL members for fire-resistance calculations. PSL, LVL, and LSL are recognized in the National Design Specification (NDS) for Wood Construction for fire-resistance calculations using this nominal char rate.

**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**

<table>
<thead>
<tr>
<th>Product or Wood Species</th>
<th>Flame Spread Index</th>
<th>Flame Spread Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>TimberStrand® LSL(1)</td>
<td>140</td>
<td>C</td>
</tr>
<tr>
<td>Parallam® PSL(2)</td>
<td>50</td>
<td>B</td>
</tr>
<tr>
<td>Microllam® LVL(3)</td>
<td>50</td>
<td>B</td>
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<tr>
<td>OSB(4)</td>
<td>75-175</td>
<td>C</td>
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<tr>
<td>Aspen(4)</td>
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<td>Douglas Fir(4)</td>
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<td>Southern Pine(4)</td>
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<tr>
<td>Hemlock (Western)(4)</td>
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<td>B</td>
</tr>
<tr>
<td>Ponderosa Pine(4)</td>
<td>55</td>
<td>B</td>
</tr>
</tbody>
</table>

(1) PFS Corporation, Report No. WR-94105; aspen TimberStrand® LSL.
(2) Warnock Hersey, Fire Laboratory Division, Report No. 3521; Douglas fir Parallam® PSL.
(3) Warnock Hersey, Fire Laboratory Division, Report No. 3815; Douglas fir Microllam® LVL.
(4) Design for Code Acceptance 1, American Wood Council.

**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

Assembly A

1. Double wood floor
2. TJI® joist with minimum 1 1/4" 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. 1/4" acoustical panels, 24" x 24" or 24" x 48", supported by an approved exposed fire-rated suspension system

Assembly B

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed.
2. Two layers 5/8" Type X gypsum board complying with ASTM C1396 or two layers of 1/2" Type C gypsum board.
3. TJI® joist
4. Resilient channels (optional)*
Optional: Minimum 3/4"-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

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed.
2. TJI® joist
3. 1/4" ceiling panels, 24" x 24"
4. Fixture protection
5. 1/4" Type C gypsum board or 1/4" 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

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJI® joist with minimum 1 3/8" 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 1 1/4" 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 1 1/2" long No. 11 gauge nails.
5. Stabilizer strap (not shown). 1/4" 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. 1/4" Type C gypsum board (1/4" 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. TJ® 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. ¼" Type C gypsum board
3. 1⅛" deep TJ® 560D joist minimum (minimum flange size for this assembly is 1¼" thick x 3½" wide). Joists spaced at 24" on-center, maximum.
4. Resilient channel at 16" on-center
5. Minimum 1½"-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

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJ® joist, 24" on-center maximum
3. Optional glass fiber insulation, unfaced batts, 3½" thick in plenum, supported by stay wires 12" on-center and centered on joist bottom flanges
4. Three layers of ¼" 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.
Lightweight concrete or approved gypsum concrete topping with appropriate sheathing can be substituted for the decking material shown in any of these assemblies.

**Intertek WNR FCA 45-01**

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1)
2. TJ® joist
3. Single layer ¼" Type X gypsum board
4. Optional resilient channels at 16" on-centre
5. If resilient channels are used, optional 3½"-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 1½" lightweight concrete or 1" of gypsum concrete is an allowed deck alternative. If the joists are spaced no more than 20" on-centre, ¼" gypsum concrete topping is permitted.

**Intertek WNR FCA 45-06**

1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1).
2. 40/20 tongue-and-groove, span-rated sheathing (Exposure 1) is permitted with proprietary gypsum as listed in WNR FCA 45-06.
3. TJ® joist
4. Proprietary ¼" Type C gypsum board
5. Resilient channels at 16" on-centre, maximum
6. Optional (not required): Minimum 3½"-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:** TJ® roof joists with rim board carrying a small portion of roof load.

**Design 1R (Roof level only)**

**Intertek WNR RB 60-01**

1. 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”.
2. Unrated roof/ceiling
3. Unrated or rated gypsum board ceiling (if required)
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. TJ® joists are either perpendicular or parallel to the wall. Blocking as required for stability.

**Design 2A**

**Intertek WNR RB 60-02**

1. Bottom chord of roof truss, parallel to wall
2. One-hour-rated wall construction
3. Unrated or rated gypsum board ceiling (if required)
4. 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”

**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**

**Intertek WNR RB 60-03**

1. One-hour-rated roof/ceiling assembly
2. One-hour-rated wall construction
3. Unrated or rated gypsum board ceiling
4. 1 1/4" 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”
5. Continuous or discontinuous ¼" Type X gypsum wallboard, applied on occupancy side of both rim boards and fastened with two rows of 1 ½" Type W screws at 12” on-center. When discontinuous gypsum protection is used with TJ® joists, gypsum must be notched at the four corners to ensure a tight fit to the web and to completely cover the rim board. Alternatively, a web stiffener (with ½” gap) must be used to fill the space between the gypsum and the web.

**Design 3B**

**Intertek WNR RB 60-03**

1. One-hour-rated roof/ceiling assembly
2. One-hour-rated wall construction
3. Unrated or rated gypsum board ceiling
4. 1 1/4" 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”
5. Continuous or discontinuous ¼" Type X gypsum wallboard, applied to each rim board on occupancy side and fastened with two rows of 1 ½" Type W screws at 12” on-center. When discontinuous gypsum protection is used with TJ® joists, gypsum must be notched at the four corners to ensure a tight fit to the web and to completely cover the rim board. Alternatively, a web stiffener (with ½” gap) must be used to fill the space between the gypsum and the web.
6. Blocking

Designs above as evaluated by Intertek Testing Services. Refer to Intertek SPEC ID: 39709 for additional wall assembly options. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and Intertek CCRR-0222C in Canada.

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

Design 4A
Intertek WNR RB 60-03
1. One-hour-rated floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. Minimum ⅝" Type X gypsum ceiling
4. 1⅛" 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 or discontinuous ½" conventional gypsum wallboard, applied to each rim board on occupancy side and fastened with two rows of ⅝" Type W screws at 12" on-center. When discontinuous gypsum protection is used with TJ® joists, gypsum must be notched at the four corners to ensure a tight fit to the web and to completely cover the rim board. Alternatively, a web stiffener (with ¼" gap) must be used to fill the space between the gypsum and the web.

Alternative (not shown): 1½"-thick mineral wool batt insulation, friction-fit, in place of gypsum wallboard.

PFS WS-1
1. Code required floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. Maximum 16" deep TJ® joist with minimum ½" gypsum ceiling
4. 1¼" 1.55E TimberStrand® LSL with maximum vertical load of 2000 psf ASD (unfactored). When joists are deeper than 9½" and run parallel to the wall, install blocking at 4' on-center.

Design 5A
Intertek WNR RB 60-03
1. One-hour-rated floor/ceiling or roof/ceiling assembly
2. One-hour-rated wall construction
3. One-hour-rated floor/ceiling assembly
4. 1⅛" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less; 1¼" TimberStrand® LSL rim board for depths of 18" and 20"

Design 6A
Intertek WNR RB 60-04
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 TJ® joists at 24" on-center maximum, abutting to continuous rim board along the wall
4. 1⅛" 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. Minimum ⅝" Type X gypsum ceiling

Design 7A
Intertek WNR RB 60-05
1. 2x4 or 2x6 minimum studs
2. One-hour-rated wall construction
3. Continuous TJ® 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 1⅛" 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. One-hour-rated floor/ceiling
6. Web stiffeners attached to each side of TJ® 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. Refer to Intertek SPEC ID: 39709 for additional wall assembly options. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and Intertek CCR-022C in Canada.
**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.

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**Designs 1A and 1B**  
**One hour, from occupant side(1)**

1. Intertek WNR RB 60-06
2. One-hour-rated wall construction
3. TJI® joists
4. Continuous 1¾" TJI® 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. One-hour-rated floor/ceiling system

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

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

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**Designs 2A**  
**One hour, from occupant side(1)**

1. Intertek WNR RB 60-07
2. TJI® joists
3. Continuous ¾" Type X gypsum board (fastened with 1½" Type W screws into each flange at 12" on-center)
4. One-hour-rated wall construction (2x6 minimum)
5. One-hour-rated wall construction
6. One-hour-rated floor/ceiling system (if required)

**For Continuous Rim:**
7. Continuous TJI® rim joist (single joist allowed if it meets vertical load requirement)
8. Continuous ¾" Type X gypsum board in web area of rim joist, fastened with two rows of 1½" Type W screws at 12" on-center

**For TJI® Blocking:**
9. ¾" Type X gypsum board, fastened with 1½" Type W screws into each flange at 12" on-center, between joists (notch to fit into web area of adjacent joists)
10. TJI® blocking between joists
11. ¾" Type X gypsum board in web area of TJI® blocking, fastened with two rows of 1½" Type W screws at 12" on-center (extend to fit into web area of adjacent joists)

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

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Designs above as evaluated by Intertek Testing Services. Refer to Intertek SPEC ID: 39709 for additional wall assembly options. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and Intertek CCRR-0222C in Canada.

(1) Some end-wall assemblies, such as those installed close to a property line or at the location of an interior stairwell, require a fire-resistance rating from the exterior side. In those cases, protection applied to the exterior side must protect the rim board equally as well as the combination of ceiling membrane and direct-applied gypsum does on the occupancy side. Contact your Weyerhaeuser representative for assistance.
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.

Designs 3A and 3B
Two hour, from occupant side(1)

Intertek WNR RB 120-01
1. Two layers ⅝" Type X gypsum board
2. Two-hour-rated wall construction
3. Two-hour-rated wall construction (2x6 minimum)
4. TJI® joists
5. Continuous 1⅛" TJ® Rim Board or 1¼" TimberStrand® LSL for depths of 16" or less; continuous 1¼" TimberStrand® LSL rim board for depths of 18" and 20"
6. Two layers of continuous or discontinuous ½" Type X gypsum board fastened with 1⅛" Type W screws for the first layer and 2" Type W screws for the second layer. When discontinuous gypsum protection is used with TJI® joists, gypsum must be notched at the four corners to ensure a tight fit to the web and to completely cover the rim board. Alternatively, a web stiffener (with ⅛" gap) must be used to fill the space between the gypsum and the web.
7. One-hour-rated floor/ceiling assembly

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

Designs above as evaluated by Intertek Testing Services. Refer to Intertek SPEC ID: 39709 for additional wall assembly options. For specific information on rim board applications, see ICC-ES ESR-1387 in the U.S. and Intertek CCRR-0222C in Canada.

(1) Some end-wall assemblies, such as those installed close to a property line or at the location of an interior stairwell, require a fire-resistance rating from the exterior side. In those cases, protection applied to the exterior side must protect the rim board equally as well as the combination of ceiling membrane and direct-applied gypsum does on the occupancy side. Contact your Weyerhaeuser representative for assistance.

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.

TimberStrand LSL Wall Assembly

1. 2x6 or larger TimberStrand® LSL studs, spaced 16" on-center, with double top plates and single bottom plate
2. ¾" 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. 2¼" #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.

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

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only rim board bears on wall</td>
<td>Roof level</td>
<td>Upper-most floor in building</td>
</tr>
<tr>
<td>TJI® joists parallel to wall</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If using alternative roof framing materials, such as plated trusses, consult architect and/or roof truss manufacturer for required draft-stopping and membrane protection.

**TJI® Roof Joists Perpendicular to Wall**

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TJI® joists bearing on wall</td>
<td>Roof level</td>
</tr>
<tr>
<td>Upper-most floor with roof framing perpendicular to rim board</td>
<td></td>
</tr>
</tbody>
</table>

If using alternative roof framing materials, such as plated trusses, consult architect and/or roof truss manufacturer for required draft-stopping and membrane protection.
**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)**

<table>
<thead>
<tr>
<th>Case</th>
<th>Type of Use</th>
<th>Floor/Ceiling or Roof/Ceiling Assembly Rating</th>
<th>Centre Wall Design Detail(2)</th>
<th>End Wall Design Detail(2)</th>
<th>Gypsum for Rim Board Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Townhouse</td>
<td>Non-rated Gypsum</td>
<td>1R</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>1</td>
<td>3 Storey, Wood</td>
<td>45 minute</td>
<td>1R</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>1</td>
<td>4+ Storey, Wood</td>
<td>60 minute</td>
<td>1R</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>2</td>
<td>Townhouse</td>
<td>Non-rated Gypsum</td>
<td>2A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>2</td>
<td>3 Storey, Wood</td>
<td>45 minute</td>
<td>2A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>2</td>
<td>4+ Storey, Wood</td>
<td>60 minute</td>
<td>2A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>3</td>
<td>Townhouse</td>
<td>Non-rated Gypsum</td>
<td>3A or 3B</td>
<td>N.A.</td>
<td>½&quot; Type C or X</td>
</tr>
<tr>
<td>3</td>
<td>3 Storey, Wood</td>
<td>45 minute</td>
<td>4A</td>
<td>N.A.</td>
<td>½&quot; Non-rated(3)</td>
</tr>
<tr>
<td>3</td>
<td>4+ Storey, Wood</td>
<td>60 minute</td>
<td>5A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>4</td>
<td>Townhouse</td>
<td>Non-rated Gypsum</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>4</td>
<td>3 Storey, Wood</td>
<td>45 minute</td>
<td>6A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>4</td>
<td>4+ Storey, Wood</td>
<td>60 minute</td>
<td>6A</td>
<td>N.A.</td>
<td>not required</td>
</tr>
<tr>
<td>5</td>
<td>Townhouse</td>
<td>Non-rated Gypsum</td>
<td>N.A.</td>
<td>1A or 1B</td>
<td>⅜&quot; Type X</td>
</tr>
<tr>
<td>5</td>
<td>3 Storey, Wood</td>
<td>45 minute</td>
<td>1A or 1B</td>
<td>⅜&quot; Type X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4+ Storey, Wood</td>
<td>60 minute</td>
<td>1A or 1B</td>
<td>⅜&quot; Type X</td>
<td></td>
</tr>
</tbody>
</table>

(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.
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(3) 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 TJ® joist assemblies in floor and roof applications maintain their fire-endurance rating when holes are cut through the web for plumbing, wiring, or ductwork?

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 Wood Council: awc.org
(see DCA No. 3, Fire Rated Wood Floor and Wall Assemblies)

Gypsum Association: gypsum.org

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

Underwriters Laboratories, Inc.: ul.com/fire

WEYERHAUSER PRODUCTS

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

Yes. In the U.S. and Canada, Parallam® PSL is a suitable alternative in heavy timber construction if it meets or exceeds the minimum dimensional requirements shown in Table 602.4 of the 2015 IBC (Table 2034.11 of 2018 IBC). Tests conducted at multiple accredited testing laboratories 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 in accordance with the TimberStrand® LSL wall assembly on page 11.
**FIRE FACTS Q&A**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can 1½” TJ® Rim Board and 1¼” TimberStrand® LSL be used as fire blocking?</td>
<td>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.</td>
</tr>
<tr>
<td>Have Weyerhaeuser’s fire-rated assemblies changed now that some joist series use a thinner flange?</td>
<td>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.</td>
</tr>
<tr>
<td>Are the flame spread ratings for Trus Joist engineered wood products similar to that of sawn lumber?</td>
<td>Yes. Trus Joist engineered wood products—including TJ® joists, TimberStrand® LSL, Parallam® PSL, Microllam® LVL, and TJ® Rim Board—demonstrate similar flame spread indices to sawn lumber of the same species.</td>
</tr>
<tr>
<td>What are flame spread indices and how are they used?</td>
<td>Flame spread indices are approximate ratings of surface flammability, which affects fire propagation rate and available escape time. Model building codes require a low flame-spread index 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, 26–75 for Class B, and 76–200 for Class C materials. Flame spread indices apply primarily to interior wall finishes. Because sawn lumber joists and Trus Joist® engineered wood products are used as structural supports and are typically covered with other materials, this rating is typically not an issue.</td>
</tr>
<tr>
<td>Can Weyerhaeuser engineered lumber products be treated with a fire retardant?</td>
<td>Weyerhaeuser does not recommend the application of fire retardants to engineered lumber products using pressure treatment or dipping. Reductions to the structural properties and impacts on dimensional stability may occur and those reductions have not been evaluated. The application of any fire-retardant treatment by pressure treatment or dipping voids Weyerhaeuser’s product warranty. Topical, non-pressure treatments suitable for wood products can be applied subject to limitations stated in Weyerhaeuser’s Technical Bulletin TB-310. 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.</td>
</tr>
</tbody>
</table>

---

**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 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 TJ® 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

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

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>2”</th>
<th>2½”</th>
<th>3”</th>
<th>3½”</th>
<th>4”</th>
<th>5”</th>
<th>6”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load (lbs)</td>
<td>77</td>
<td>118</td>
<td>162</td>
<td>202</td>
<td>246</td>
<td>352</td>
<td>475</td>
</tr>
</tbody>
</table>

### Assumed Loads for CPVC Water-Filled Pipes

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>1”</th>
<th>2”</th>
<th>3”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load (lbs)</td>
<td>5</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>Support on-center spacing</td>
<td>6”</td>
<td>8”</td>
<td>10”</td>
</tr>
</tbody>
</table>

**FASTENERS**

#### General Guidelines for Lead Holes

<table>
<thead>
<tr>
<th>Fastener Type</th>
<th>Approximate Lead Hole Size</th>
<th>Fastener Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nails</td>
<td>75% of nail diameter</td>
<td>0.162” diameter and larger</td>
</tr>
<tr>
<td>Wood Screws</td>
<td>70% of root diameter (1/4” for 18 gauge)</td>
<td>Larger than No. 8</td>
</tr>
<tr>
<td>Machine Bolts</td>
<td>Bolt diameter + 1/32” to 1/16” max.</td>
<td>All</td>
</tr>
<tr>
<td>Lag Screws</td>
<td>5/32” (TD) 5/32” (ND) 3/16” (TI) 1/8” (TD)</td>
<td>3/16” diameter 5/32” diameter 3/16” diameter 1/8” diameter</td>
</tr>
</tbody>
</table>

(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.

**TJI® JOIST DESCRIPTIONS**

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

** Depths:**
- 9¾", 11¾", 14", 16, 18, 20", 22", and 24".

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

**Web Material:** 3/4" or 5/8" Performance Plus® web material

Code Evaluation: See ICC-ES ESR-1153

**TJI® Joist Specifications**

<table>
<thead>
<tr>
<th>TJI® Joist Series</th>
<th>Flange Width</th>
<th>Flange Thickness</th>
<th>Web Thickness</th>
<th>Depths</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>1¾&quot;</td>
<td>1¾”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;</td>
</tr>
<tr>
<td>210</td>
<td>2½”</td>
<td>2½”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;</td>
</tr>
<tr>
<td>230</td>
<td>2¾”</td>
<td>2¾”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;</td>
</tr>
<tr>
<td>360</td>
<td>3¼”</td>
<td>3¼”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;, 18&quot;, 20&quot;</td>
</tr>
<tr>
<td>560</td>
<td>3½”</td>
<td>3½”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;, 18&quot;, 20&quot;</td>
</tr>
<tr>
<td>5680</td>
<td>3½”</td>
<td>3½”–1¾”</td>
<td>¾”</td>
<td>11¾&quot;, 14&quot;, 16&quot;, 18&quot;, 20&quot;, 22&quot;, 24&quot;</td>
</tr>
<tr>
<td>s31, s33</td>
<td>2½”</td>
<td>2½”–1¾”</td>
<td>¾”</td>
<td>9¾&quot;, 11¾&quot;, 14&quot;, 16&quot;, 18&quot;, 20&quot;</td>
</tr>
</tbody>
</table>

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

**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**

<table>
<thead>
<tr>
<th>Flange Location</th>
<th>Maximum Lead-Hole Size(1)</th>
<th>Maximum Fastener Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top or Bottom</td>
<td>Not allowed</td>
<td>10d (0.148&quot; x 3&quot;) nail</td>
</tr>
<tr>
<td></td>
<td>3/16”</td>
<td>1/4” lag(2)(3)</td>
</tr>
</tbody>
</table>

(1) Only one hole may be drilled in any cross section of any flange.
(2) Requires prebored lead hole—see General Guidelines for Lead Holes at left.
(3) 3/16” lag allowed when joist flange width is greater than 1¼".

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**ALLOWABLE HOLES**

![Diagram of allowable holes]

**Table A—End Support**

<table>
<thead>
<tr>
<th>Depth (TJI®)</th>
<th>Minimum distance from edge of hole to inside face of nearest end support</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 1/2&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-6&quot; 2'-6&quot; 3'-0&quot; 3'-6&quot; 5'-0&quot; 6'-0&quot; 7'-0&quot;</td>
</tr>
<tr>
<td>11 3/4&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>14&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
</tbody>
</table>

For square or rectangular holes, 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 specifer’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 1/4" of web (minimum) at top and bottom of hole.**

- **Knocks 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, and TJ-4510).**

**Table B—Intermediate or Cantilever Support**

<table>
<thead>
<tr>
<th>Depth (TJI®)</th>
<th>Minimum distance from edge of hole to inside face of nearest intermediate or cantilever support</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 1/2&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>11 3/4&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>14&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
</tbody>
</table>

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

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

For more information go to www.P65Warnings.ca.gov and www.P65Warnings.ca.gov/wood.
**TJI® JOIST SPRINKLER DETAILS (CPVC PIPE)**

**S1 Surface Mount Hanger with Double Fastener**

- Minimum 2x6 x 6" long filler block, attached tight to top flange
- Four #10 x 1½" sheet metal screws

**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**

- Minimum 2x4 x 6" long filler block
- Four #10 x 1½" sheet metal screws

**Filler Block Material**
- Maximum Pipe Diameter
- DF or SPF
- 2" Install per NFPA 13 and manufacturer’s instructions.

**S3 Offset Hanger**

- Minimum 2x6 x 6" long filler block
- Four #10 x 1½" sheet metal screws

**Filler Block Material**
- Maximum Pipe Diameter
- DF or SPF
- 1½" Install per NFPA 13 and manufacturer’s instructions.

**S4 Double Offset Hanger**

- Minimum 2x6 x 6" long filler block
- Four #10 x 1½" sheet metal screws

**Filler Block Material**
- Maximum Pipe Diameter
- DF or SPF
- 1" Install per NFPA 13 and manufacturer’s instructions.

**S5 Face Mount Hanger**

- Minimum 2x6 hanger block, maximum 48" long. Bearing on flange is acceptable but not required.
- Four #10 x 2" sheet metal screws from each end or five 10d (0.148" x 3") nails from each end. Maintain ½" minimum edge distance and stagger.

**Filler Block Material**
- Maximum Pipe Diameter
- DF or SPF
- 2" Install per NFPA 13 and manufacturer’s instructions.

**S6 Hanger at Web Hole**

- 2" pipe, maximum
- Hole cut neatly in the web of TJI® joist according to Allowable Holes on page 17

**Filler Block Material**
- Maximum Pipe Diameter
- DF or SPF
- 2" Maximum pipe diameter is 2". Install per NFPA 13 and manufacturer’s instructions.
**S20 Beam Clamp**

Beam clamp per NFPA 13

Section A-A

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

**S21 Ceiling Flange**

Ceiling flange with two ½" lag screws or two 18 gauge (0.294") x ⅛" wood screws

Section A-A

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

**S22 Coach Screw into Joist Flange**

NFPA 13 requires 3" minimum penetration. See detail S22A.

Section A-A

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**

2x6 block, SPF or better, with grain oriented vertically and minimum ¼" gap between block and flange

Section A-A

At maximum hanger spacing, maximum pipe diameter is 2" for ½" bolts, 4" for ¾" bolts.

**S24 Rod with Support Member**

Two 16d (0.162" x 3½") nails each end

Section A-A

See table for maximum pipe diameter.

**Material** | **Lag Screw Size** | **Maximum Pipe Diameter**
--- | --- | ---
DF or SP | ½" x 3" | 3½" |
SPF or HF | ½" x 3½" | 2½" |

Center pipe support (parallel or perpendicular) between joists.
**TJI® JOIST SPRINKLER DETAILS (STEEL PIPE)**

---

### S25 Rod with Support Member and Filler Block

Minimum 2x6 x 18" long filler block, tight to bottom flange. See table.

- Two ½" diameter machine bolts at each joist with 1" washers, turned tight
- Two 16d (0.162" x 3½") nails each end

Center pipe support (parallel or perpendicular) between joists.

---

### S26 Rod with Side-Beam Bracket

Minimum 2x8 x 18" long filler block, tight to bottom flange. See table.

- One ⅛" or ½" diameter machine bolt with washers, turned tight. See table.

---

### S27 Rod with Steel Angle Trapeze

½" x 2" long lag screw (⅛" lead hole required)

- Steel angle trapeze per NFPA 13
- Hanger rod or support per NFPA 13

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

---

### S28 U-Hook with Filler Block

Minimum 2x6 x 18" long, SPF or better, tight to bottom flange

- Two machine bolts with washers, turned tight

At maximum hanger spacing, maximum pipe diameter is 3½" for ⅛" bolts, 4" for ½" bolts.

---

**Filler Block Material** | **Fastener Type** | **Maximum Pipe Diameter**
---|---|---
DF or SP | ½" x 3" lag screw | 3½"
 | ⅜" machine bolt | 2"
SPF or HF | ⅜" x 3" lag screw | 2½"
 | ⅛" machine bolt | 2"
 | ½" machine bolt | 5"
**TJI® JOIST SPRINKLER DETAILS (STEEL PIPE)**

**S28 U-Hook with Support Member**

- Minimum 2x6 x 18” long, tight to bottom flange on both sides
- Two ½” diameter machine bolts with washers, turned tight
- Inverted U-hook per NFPA 13, center between joists

**S29 Pipe on Support Member**

- Minimum 2x6 x 18” long, SPF or better, tight to bottom flange
- Two ½” diameter machine bolts per joist with 1” washers, turned tight
- U-hook per NFPA 13, center between joists

**S30 Inverted U-Hook with Pipe Through TJI® Joist (4” Pipe Diameter, Maximum)**

- Hole cut neatly in the web of TJI® joist according to Allowable Holes on page 17
- Inverted U-hook per NFPA 13
- Minimum 2x6 x 18” long, tight to bottom flange
- Two ½” diameter machine bolts with washers, turned tight

**S31 Inverted U-Hook with Pipe Through TJI® Joist (6” Pipe Diameter, Maximum)**

- Hole cut neatly in the web of TJI® joist according to Allowable Holes on page 17
- Inverted U-hook per NFPA 13
- Minimum 2x6 x 18” long, tight to bottom flange on both sides
- Two ½” diameter machine bolts with washers, turned tight

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

- Minimum 2x6 x 18” long, tight to bottom flange on both sides
- Inverted U-hook per NFPA 13
- May be placed on either side of block
- Section A-A

**Block Material**

<table>
<thead>
<tr>
<th>Lag Screw Size</th>
<th>Maximum Pipe Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF or SP</td>
<td>¾” x 2½” 3½”</td>
</tr>
<tr>
<td></td>
<td>½” x 3” 4”</td>
</tr>
<tr>
<td>SPF or HF</td>
<td>¾” x 2½” 3½”</td>
</tr>
<tr>
<td></td>
<td>½” x 3” 4”</td>
</tr>
</tbody>
</table>

**Center pipe support (parallel or perpendicular) between joists.**

**TJI® Joist On-Center Spacing**

<table>
<thead>
<tr>
<th>Wood Hanger Block Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>32” or less</td>
</tr>
<tr>
<td>48”</td>
</tr>
</tbody>
</table>

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

---

Weyerhaeuser Fire-Rated Assemblies and Sprinkler Systems Guide  TJ-1500  October 2018  21
**Swivel Sway Brace on TJI® Joist Web**
(Loads Parallel or Perpendicular to TJI® Joists)

- **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)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Angle to Vertical (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30°</td>
</tr>
<tr>
<td>DF</td>
<td>430</td>
</tr>
<tr>
<td>SPF</td>
<td>365</td>
</tr>
</tbody>
</table>

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

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

- **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)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Blocking Condition</th>
<th>Angle to Vertical (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30°</td>
<td>45°</td>
</tr>
<tr>
<td>DF</td>
<td>465</td>
<td>660</td>
</tr>
<tr>
<td>SPF</td>
<td>410</td>
<td>580</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Angle to Vertical (θ)</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>370&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>600</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>SPF</td>
<td>340&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>590&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>

<sup>(1)</sup> If connection is centered within the length of the 4x block, loads may be increased to 400 lbs.
<sup>(2)</sup> 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.

---

**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)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Angle to Vertical (θ)</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>465</td>
<td>720</td>
<td>980</td>
<td></td>
</tr>
<tr>
<td>SPF</td>
<td>400</td>
<td>650</td>
<td>895</td>
<td></td>
</tr>
</tbody>
</table>

- 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.
You want to build solid and durable structures—we want to help. Weyerhaeuser provides high-quality building products and unparalleled technical and field assistance to support you and your project from start to finish.

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October 2018 • Reorder TJ-1500

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