

Fire-Retardant-Treated (FRT) Plywood

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INTRODUCTION

Codes assure fire safety by controlling such things as size and design of the structure and flame-spread and fire burn-through resistance of the components used in structural systems. While FRT plywood is classified by the codes as a combustible material, its low flame spread characteristics have led to building code provisions that safely allow FRT plywood to be used in certain applications in buildings otherwise required to be of noncombustible construction.

Fire-retardant-treated plywood or lumber is pressure-impregnated with chemicals to permanently inhibit combustion. This qualifies it for a lower flame-spread rating (at least as low as gypsum wallboard) and smoke developed index, and reduces its fire-hazard classification. When it is identified as such by a code-recognized testing agency label, it is rated on parity with noncombustible construction by many insurance rating bureaus.

The required treating standards and locations within the building codes where the standards are referenced, as well as where fire-retardant-treated FRT plywood can be safely used, are outlined in this document. Currently, there is no standard for FRT oriented strand board (OSB).

CONSTRUCTION TYPES

The stated purpose of the International Building Code (IBC) is to “safeguard public health and safety”. To keep buildings on parity with one another, the IBC has established five building types and numerous occupancy classifications based mainly on material usage and fire safety. It thus sets allowable heights and areas for the buildings based on these occupancy classes and building types.

Building Types I and II are called “noncombustible” (usually steel and concrete) and are typically the most expensive of the five types. They allow the largest areas. Fire-retardant-treated wood and Heavy Timber construction are allowed limited use in Type I and II as noted in the code. Often, Heavy Timber design is used where the beauty of exposed wood is used to enhance the appearance.

Depending on the design, **Building Types IIIA and IV** are usually less expensive to construct than Types I and II. The interior walls, floors and roofs can be conventional untreated wood. Noncombustible exterior walls are required for these building types. The IBC, however, allows fire-retardant-treated wood for exterior walls as an option if the designer chooses to use wood walls.



Building Type V (often called wood frame) is typically the least expensive of the five building types – particularly when load-bearing walls are used. Type V construction allows regular, untreated wood throughout the structure. While the basic allowable areas are smaller than for other building types of construction, the use of fire sprinklers, set-backs and hourly rated walls, floors and roofs (along with other factors) can permit area increases that are quite significant.

For instance, IBC Table 503 shows a basic area of 18,500 square feet for Occupancy Group E (education) of Type V-A construction. Permissible area increases detailed in IBC Sections 503 through 507, however, can result in one-story Type V educational buildings up to 87,875 square feet in area and two-story schools can be up to 138,750 square feet.

FIRE-RETARDANT TREATED PLYWOOD

Fire-retardant-treated wood is defined in Section 2303.2 of the 2006 IBC as “any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84, a listed flame-spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.” The ASTM E 84 test is also called “The Tunnel Test” because the test material is suspended from the lid of a test chamber that is approximately 25 feet long by one foot high and 1-1/2 feet wide. A standard gas flame, driven by a standard air flow, moves the flame front along the bottom surface of the mounted test material.

The progress of the flame front of the test material is compared with the progress of the flame front on red oak. The test material is given a rating of 100 if the distance is the same as on the red oak.

From the test results, materials are assigned a “Flame Spread Index” that is defined in IBC Section 802 as “a comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84.”

The flame spread classifications given in IBC Section 803 are:

Class A: Flame spread 0-25; smoke-developed 0-450.

Class B: Flame spread 26-75; smoke-developed 0-450.

Class C: Flame spread 76-200; smoke-developed 0-450.

The fire-retardant pressure treatment of FRT plywood is performed in accordance with Standard U1, Commodity Specification H, as published by American Wood Protection Association (AWPA).

FASTENERS FOR FIRE-RETARDANT-TREATED PLYWOOD

Section 2304.9.5 of the IBC and Section R319.3 of the IRC require hot-dip zinc-coated steel, stainless steel, silicon bronze or copper fasteners in accordance with ASTM A 153 or ASTM B 695, Class 55 minimum (except for bolts 1/2-inch diameter or larger).

BURN-THROUGH RESISTANCE AND DESIGN CAPACITIES OF FRT WOOD

While fire-retardant treatment of wood inhibits the ability of flames to spread across the surface of the wood product, fire retardants do not reduce the rate at which wood degrades through its thickness when subjected to an elevated heat source. Therefore fire-retardant treatments do not improve the fire endurance rating of a fire-rated assembly, such as a one-hour wall, to any significant extent; nor will FRT plywood take the place of gypsum wallboard in listed fire-rated assemblies.

In addition, the treatment process itself may require a modification of the design capacities of the treated plywood. IBC Sections 2303.2.2.1 and 2303.2.2.2 require that “the effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.”

It should be noted that the “manufacturer” in this case is the treater of the plywood, not the manufacturer of untreated plywood. The treatment processes used are mostly proprietary and the manufacturers of the untreated plywood have no knowledge or control over the treatment process or whether the panels shipped from their mills will ultimately be treated.

TREATING PROCESS AND TEST STANDARDS

FRT plywood involves treating plywood with chemicals in accordance with the AWPA Standard U1. The FRT treating process is a secondary step accomplished after manufacturing of the plywood and therefore involves proprietary treating and redrying processes, evaluation, quality assurance and product labeling that are conducted by treating companies. Treating companies and their certification agencies evaluate FRT plywood for properties that influence their flame spread characteristics, structural performance and other properties that influence the performance of the products in construction uses.

Model codes recognize only FRT plywood that is labeled by independent certification agencies that provide inspection and testing services. This certification is separate from the APA trademark that is applied to the untreated plywood prior to leaving the plywood manufacturing plant.

The FRT treating and redrying process may affect properties such as structural capabilities, hygroscopicity (moisture content at a stable humidity) and corrosiveness of the finished products to fasteners and hanger hardware. Test methods and standards published by ASTM and AWPA are used to evaluate these mechanical and corrosiveness properties of FRT plywood. Information on the effect of treatment on the structural capacities of plywood is available from FRT plywood treaters.

The International Code Council Evaluation Service, Inc. (ICC-ES) publishes Acceptance Criteria AC66, *Acceptance Criteria for Fire-Retardant-Treated Wood*, as a basis for defining the necessary technical evaluation to assess the properties and performance of FRT wood products. Manufacturers that have had their products evaluated in accordance with AC66 can be found from the evaluation reports published at the ICC-ES web site (www.icc-es.org).

Since the FRT treating and redrying processes may affect the structural performance of plywood, **APA Span Ratings and load capacities that apply to untreated plywood may not apply following fire-retardant treating.** Obtain structural performance characteristics of FRT plywood from the company providing the treatment and redrying process.

TABLE 1

CODE REFERENCES WHERE FRT MAY BE USED IN LIEU OF NONCOMBUSTIBLE MATERIALS¹

Location	Construction Type	IBC, IRC or M ² Section	Location
Kiosks	I, II, III & IV	402.10.1.1.1	Malls
Children's Playground Structures	U	402.11.1.1	May be used when structures exceed 10 feet in height AND 150 square feet in area.
Canopies	IV	406.5.2	Over fuel pumps
Platforms-permanent	I, II & IV	410.4	Where platforms are not more than 30 inches above the main floor AND not more than 1/3 the area of the room AND not more than 3,000 square feet in area.
Wall framing	III	602.3	FRT permitted within exterior wall assemblies with a 2-hour rating or less.
Exterior wall assemblies	IV	610.4	FRT framing permitted within exterior wall assemblies with a 2-hour rating or less.
Partition-nonbearing	I & II	603.1.1.1.1	Where the required fire-resistance rating is 2 hours or less.
Exterior wall assemblies	I & II	603.1.1.1.2	Nonbearing - where no fire rating is required. Including girders, trusses framing and decking.
Roof constructions	I & II	603.1.1.3	EXCEPTION: In Type I Construction exceeding two stories in height, FRT is not permitted in roof construction when the vertical distance from the upper floor to the roof is less than 20 feet.
Partitions	I & II	603.1.8	Dividing portions of stores, offices or similar places, occupied by only one tenant, do not establish a corridor and have an occupant load of 30 or less.
Unprotected roof members	I, II, III & V	Table 601, footnote c	May be FRT when every part of roof construction is at least 20 feet above any floor immediately below it (EXCEPT in F-1, H, M and S-1 Occupancies).
Projections	I, II, III & IV	704.2.3	FRT projections permitted where openings are not permitted or protection of openings is required.
Parapets – exterior wall	III, IV & V	704.11.5.5.1, R317.2.2.2	Not required where exterior wall terminates at the underside of the roof sheathing or deck in Type III, IV and V construction provided that deck or sheathing is FRT for a distance of 4 feet. R-2 and R-3 with Class C roof covering.
Parapets - roof	III, IV & V	705.6.4.3, R317.2.2	Not required where wall terminates at the underside of combustible roof sheathing or deck in provided that deck or sheathing is FRT for a distance of 4 feet on both sides.
Walls and ceilings	III & V	803.4.2	May be FRT in lieu of fire-resistance rated or non-combustible construction.
Veneers – exterior (sidings)	I, II, III & IV	1405.4.1	FRT veneers (sidings) may be used on buildings up to 4 stories in height.
Trim - exterior	I, II, III & IV	1406.2.2	May exceed 10% of wall area even when separation distance is 5 feet or less.
Porches, decks, balconies and stairways - exterior	I & II	1406.3.1	Balconies, porches, decks and exterior stairways in buildings 3 stories or less may be FRT provided they are not used as required exits.
Bay Windows	I, II, III & IV	1406.4	FRT construction permitted in buildings of 3 stories or less.
Pedestrian Walkway	I & II	3104.3.2	Roof may be FRT per Table 601, Note c.
Solar collector mounts ²	All	M3201.2.2	FRT may be used.

¹ Based on the 2006 IBC and 2006 IRC. Always check code references and with local building officials prior to construction. Other modification language in the local codes may alter applicability.

² Based on the 2006 International Mechanical Code

TABLE 2

CODE LOCATIONS FOR APPLICABLE STANDARDS¹

IBC/IRC Section	Treating/Test Standard(s) Referenced
2303.2	ASTM E 84 (flame spread)
2303.2.1	ASTM D 2898 (weathering)
2303.2.2.1, R802.1.3.2.1	ASTM D 5516, ASTM D 6305 (panel tests)
2303.2.2.2, R802.1.3.2.2	ASTM D 5664, ASTM D 6841 (lumber tests)
2303.2.3, R802.1.3.1, R802.1.3.3	ASTM D 2898 (weathering)
2303.2.4, R802.1.3.4	ASTM D 3201 (hygroscopic properties)
2304.9.5, R319.3, R803.2.1.2	ASTM A 153, ASTM B 695 (fasteners)

¹ Based on the 2006 IBC and 2006 IRC. Always check code references and with local building officials prior to construction. Other modification language in the local codes may alter applicability.

CODE-APPROVED APPLICATIONS FOR FRT PLYWOOD

The following provisions permitting the use of FRT plywood in noncombustible structures and in lieu of noncombustible construction materials are provided in the IBC and the International Residential Code (IRC). Verify the correct application of FRT plywood with your local building code department.

IDENTIFICATION OF FIRE-RETARDANT-TREATED PLYWOOD

IBC Section 2303.2.1 requires that FRT plywood be labeled by the company that treats the plywood and that the label shall contain the following information:

1. The identification mark of an approved agency in accordance with IBC Section 1703.5.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with IBC Sections 2303.2.2 through 2303.2.5.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, the words of “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D 2898), must be included.

CONCLUSION

FRT plywood can be used in a variety of code-permitted applications. FRT plywood, however, is fire-retardant-treated subsequent to manufacture at the plywood mill. The plywood manufacturer has no knowledge of, nor responsibility for, the treated product or its subsequent performance. The required treater's marks are applied by the treater at the treating plant and are completely separate from the APA trademark.

All FRT plywood shall be properly labeled with the identifying mark of an approved testing agency, identification of the treating manufacturer, name of fire-retardant treatment, wood species, flame spread index and smoke developed index, drying method used after treatment and conformance with appropriate standards as required by Sections 2303.2.2 through 2303.2.5 of the IBC and R319.3 of the International Residential Code (IRC).

Consult with the individual manufacturers of FRT chemicals and treaters for FRT plywood design information or questions.

REFERENCES

American Society for Testing and Materials, *Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*, ASTM A 153/A153M-05, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Specification for Zinc Mechanically Deposited on Iron and Steel*, ASTM B 695-04, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing*, ASTM D 2898-08, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Test Method for Hygroscopic Properties of Fire-Retardant Treated Wood and Wood-Based Products*, ASTM D 3201-08a, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Test Method of Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures*, ASTM D 5516-03, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Test Methods of Evaluating the Effects of Fire-Retardant Treatment and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber*, ASTM D 5664-08, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing*, ASTM D 6305-08, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber*, ASTM D 6841-08, Annual Book of ASTM Standards, West Conshohocken, PA

American Society for Testing and Materials, *Test Methods for Surface Burning Characteristics of Building Materials*, ASTM E 84-08a, Annual Book of ASTM Standards, West Conshohocken, PA

International Code Council Evaluation Service, *Acceptance Criteria for Fire-Retardant-Treated Wood*, AC66, February 2007, ICC-ES, Whittier, CA

International Code Council, *International Building Code, 2006*, Country Club Hills, IL

International Code Council, *International Residential Code, 2006*, Country Club Hills, IL

International Code Council, *International Mechanical Code, 2006*, Country Club Hills, IL

Fire-Retardant-Treated (FRT) Plywood

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying engineered wood products, contact us:

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