



## Fire Tests for Pressure Fire Retardant Treated Wood

### INTERIOR FRTW (Lumber and Plywood)

#### **ASTM E-84 (aka: Steiner Tunnel, ULI 723, NFPA 225, UBC 8-1):**

Commonly referred to as the 24 ft. tunnel, ASTM E-84 measures the surface characteristics of FRTW and other building products. This large scale test requires enough material to cover 48 ft<sup>2</sup>. Results are compared to standards of untreated Red Oak, and cement fiber board and a correlation or "index" calculated for flame spread and smoke evolution. FR-S, Class A, and Class I protective ratings require a flame spread index of 25 or less and no evidence of progressive combustion after 30 minutes. Class B or II ratings require an index of 26-75 and Class C or III an index of 76-200.

#### **ASTM E-162 Radiant Panel Tests:**

This smaller test is also designed to measure flame spread but only requires a sample size of about .5 ft<sup>2</sup>. This test relies on a radiant heat source rather than direct flame to initiate ignition of the sample. Results are again compared to standards to form a flame spread index.

#### **NFPA-258 Smoke Density Test:**

These tests are basically conducted in a modified ASTM E-162 apparatus and test materials under a specific radiant heat flux's to measure the optical density of the smoke evolved and calculate a smoke density value.

#### **ASTM D-3201 Hygroscopicity:**

Designed to determine the hygroscopic potential of materials at specific temperatures and relative humidity levels encountered in service. These tests are run at 90% RH, but many manufacturers run the tests at higher humidities and temperatures to increase the absolute moisture content in the air and test the products in "worst case" scenarios.

#### **Mil 19140E Corrosion Tests:**

The standard for testing corrosion potential of FRTW is the Military Specification Mil-L-19140E. Testing is conducted by "sandwiching" metal plates between blocks of FRTW and exposing them at 120° F and 90% RH. This test is usually modified to incorporate additional metals that are more commonly used in service such as galvanized steel. Results are reported in mil per year loss of metals.

#### **ASTM D-5664 and D-5516 Strength Testing:**

Strength testing of FRTW is one of the most comprehensive tests performed. Today these tests require exposure to high humidity and temperatures such as those encountered in service. The advent of these tests have resulted in exposure of FRT Plywood at 170° F (ASTM D-5564), and lumber at 150° F (ASTM E-5516), prior to conducting typical bending, compression, tension, and shear tests.

### EXTERIOR FRTW (Lumber and Plywood)

Fire tests for exterior fire retardant treated wood are the same as the above interior tests except, because the intended usage is outdoors, there are no heat-strength tests and the material is re-tested after accelerated weathering tests that replicate years of outdoor weathering (commonly ASTM D-2898 or like standards).

#### **ASTM D-2898 Accelerated Weathering**

Method A subjects the specimens to 12 one-week conditioning cycles of 96 hours of water exposure and 72 hours of drying at 140° F (equivalent of over 800" of rain during the 12 week period). Method B subjects the specimens to 24-hr exposure cycles of 4-hr wetting, 4-hr drying, and 8-hr rest. Repeats the cycle for 1000-hr. The drying time is around 150° F with continuous ultraviolet sunlamp exposure throughout the drying time.

#### **MIL-L-1914E:**

Fire and related tests for Military Specification MIL-L-1904E Type I (interior) are basically the same as the above interior tests including ASTM E-84 except additional corrosion and toxicity tests are required. MIL-L-1904E Type II (exterior) requires re-testing after the ASTM D-2898 accelerated weathering test. Type II, Category 2 (Navy shipbuilding and repair) is required to be identified by a blue to blue-green dye.

### EXTERIOR FRTW (Shake/Shingle Siding)

Pressure Fire Retardant Treated exterior shake and shingle siding fire tests commonly include the ASTM E-84 test and rating system described above. Most will also have been treated/rated pursuant to the roofing tests including various weathering described below.

## **EXTERIOR FRTW (Shake/Shingle Roofing) (ASTM E-108, UBC 15-2, UL 790, NFPA 256)**

### **ASTM E-108 & UBC 15-2 Spread of Flame Test:**

Designed to simulate a fire spreading across the field of the roof, up and over the eaves. Wind velocity –12 mph, gas flame temperature around 1400° F, test incline 5:12, test duration 10 minutes. Conditions of acceptance are no lateral spread of flame/For Class A, 2" maximum spread beyond impingement area; for Class B, 8" maximum spread beyond impingement area. Three test decks per material tested.

### **ASTM E-108 & UBC 15-2 Intermittent Flame Test:**

Designed to simulate the thermal shock and surface cooling of a roof covering with possible cracking and exposure, resulting from the ebb and flow of fire up and over the eaves.

Wind velocity 12 mph, gas flame temperature around 1400° F, test deck incline 5:12, test duration: Class B, 8 cycles-gas flame on 2 minutes. Class A, 15 cycles-gas flame on 2 minutes, off 2 minutes. Conditions of acceptance are, Class A and B, no penetration of the test deck, no exposure of roof deck by breaking, sliding, cracking, or warping of test material, no flying brands produced. Three test decks per material tested.

### **ASTM E-108 & UBC 15-2 Burning Brand Test:**

Designed to simulate burning material blown or fallen onto the roof. The Class B brands are made from strips of kiln dried Douglas Fir, forming a grid of 6" square and 2 1/4" thick. Class A brands are made from strips forming a grid 12" by 2 1/4" thick. The brands are ignited and placed on the most vulnerable locations on the test decks. Wind velocity and test deck incline are the same as in previous tests. Six test decks with one brand each for Class A. Three decks with two brands each for Class B. Conditions of acceptance are Class A and Class B, no penetration of the test deck, no exposure of the roof deck, no flying brands produced.

### **ASTM E-108 & UBC 15-2 Flying Brand Test:**

Designed to test the possibility of a shake or shingle roof producing flying brands capable of igniting combustible material. Wind velocity 12 mph increased to 18 mph after gas flame application for shake decks. Gas flame temperature around 1400° F, test duration 10 minutes for Class B, 20 minutes for Class A. Conditions for acceptance are no flying brands produced. Three test decks per material tested.

### **ASTM D-2898 Accelerated Weathering (Method A) & UBC 15-2 Rain Test:**

The rain test exposes the test decks to severe weathering conditions to explore the possibility of leaching the FR chemicals from the shakes and shingles. Six test decks of each material are placed in a test chamber at an incline of 4:12. The test decks are exposed to 12 one-week conditioning cycles. Each cycle consists of 96 hours of water exposure followed by 72 hours drying time at 1400° F (the equivalent of over 800 inches of rain during the 12 week period). Following the week rain-heat cycling, the decks are subjected to the Intermittent Flame, Burning Brand, and Flying Brand tests with the same acceptance conditions as the initial tests.

### **ASTM D-2898 Modified Accelerated Weathering (Method B) & ICBO AC 107 Amended Rain Test:**

ICBO has developed a more severe amended test. It increases exposures for six decks to three conditioning cycles per day totaling 252 eight-hour cycles (consisting of 4 hours of water exposure and 4 hours of drying) during the 12 week period and adds sunlamps for heat and ultraviolet (UV) exposure at drying temperatures of 145 to 155° F. About 1.6 million gallons of water are used during the 12 week test. After 12 weeks of cycling the decks are re-tested as noted above with the same acceptance conditions as the initial tests.

### **UBC 15-2, UL 790, NFPA 256 Natural Weathering Tests:**

This test exposes the test material/decks to actual weather conditions over a ten year period (ten year standard adopted by all major codes as sufficient indicator of durability of treatment process for essentially the useful life of the material). Fifteen test decks of each material are placed outside at an incline of 5:12 facing south. After each of one, two, three, five and ten years of exposure, three test decks of each tested material are conditioned to a moisture content of between 8 and 12% and re-tested under the Intermittent Flame, Burning Brand, and Flying Brand tests. The same acceptance criteria is used as in the initial fire tests.

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