

**MFRT™ Class-A Fire Protected Lumber**

**TER No. 1703-18**

**Issue Date: September 25, 2017**

**Updated: February 23, 2018**

**Subject to Renewal: October 1, 2018**

**M-Fire Suppression, Inc.**

19300 Hamilton Ave., Suite 270  
Gardena, CA 90248  
949-375-8336  
[mfiresuppression.com](http://mfiresuppression.com)  
[Steve@mfiresuppression.com](mailto:Steve@mfiresuppression.com)

**Additional Listees:**

**MHA Building Systems LLC**

1331 E. Kettleman Lane  
Lodi, CA 95240

**DIVISION: 06 00 00 – WOOD, PLASTICS, AND COMPOSITES**

Section: 06 05 83 – Shop–Applied Wood Coatings

Section: 06 11 00 – Wood Framing

Section: 06 17 00 – Shop-Fabricated Structural Wood

**1. Product Lines Evaluated:**

1.1. Lumber treated with AAF21 to create MFRT™ Class-A Fire protected lumber.

1.1.1. AAF21 is intended as a treatment for solid sawn lumber in limited interior, dry use conditions (see [Section 3.1.7](#)). It is a fire retardant coating and is used as an alternative to Fire Retardant Treated Wood (FRTW)

1.2. For the most recent version of this Technical Evaluation Report (TER), visit [drjengineering.org](http://drjengineering.org). For more detailed state professional engineering and code compliance legal requirements and references, visit [drjengineering.org/statelaw](http://drjengineering.org/statelaw). DrJ is fully compliant with all state professional engineering and code compliance laws.

1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).

***DrJ is a Professional Engineering Approved Source***

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with *IBC* Section 1703.

## Technical Evaluation Report (TER)

- 1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see [drjcertification.org](#).
- 1.5. Requiring an evaluation report from a specific private company (i.e. ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
- 1.6. DrJ's code compliance work:
  - 1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
  - 1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ take professional responsibility for its specified scope of work.

## 2. Applicable Codes and Standards:<sup>1</sup>

- 2.1. *2009, 2012 and 2015 International Building Code (IBC)*
- 2.2. *2009, 2012 and 2015 International Residential Code (IRC)*
- 2.3. *2009, 2012 and 2015 International Fire Code (IFC)*
- 2.4. *ANSI/AWC National Design Specification (NDS) for Wood Construction*
- 2.5. *ASTM D143 – Standard Test Methods for Small Clear Specimens of Timber*
- 2.6. *ASTM D3201 – Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products*
- 2.7. *ASTM D5116 – Standard Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products*
- 2.8. *ASTM D5197 – Standard Test Method for Determination of Formaldehyde and Other Carbonyl Components in Air*
- 2.9. *ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials*
- 2.10. *AWPA E12-15 – Standard Method of Determining Corrosion of Metal in Contact with Treated Wood*
- 2.11. *AWPA M4 – Standard for the Care of Preservative-Treated Wood Products*
- 2.12. *AWPA U1 – Use Category System: User Specification for Treated Wood*
- 2.13. *UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials*
- 2.14. *UL 2818 – 2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings*

## 3. Performance Evaluation:

- 3.1. AAF21 has been evaluated to determine its suitability to treat lumber used in above ground applications where it is required by code to provide the following:
  - 3.1.1. Use where treated materials are used as an interior finish in new or existing construction to achieve the reduced flame spread and smoke developed indices required by the code.
  - 3.1.2. Alternative to fire retardant treated wood as required by [IBC Section 2303.2](#)<sup>2</sup> and [IRC Section R317.3](#) and [Section R317.4](#).

---

<sup>1</sup> Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2015 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2012 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any, see [Section 8](#).

<sup>2</sup> [2012 IBC Section 2303.1.8](#)

## Technical Evaluation Report (TER)

- 3.1.3. Strength adjustment of lumber treated with AAF21 in accordance with *ASTM D143* and [IBC Section 2303.2.5](#).
- 3.1.4. Flame spread index and smoke developed index properties where required by [IBC Section 2303.2.2](#) and [IBC Section 1403.5](#) and [IRC Section R302.9](#) and [Section R802.1.5](#)<sup>3</sup>.
- 3.1.5. Moisture content in accordance with [IBC Sections 2303.2.7](#) and [2303.2.8](#).
- 3.1.6. Corrosion resistance of fasteners in contact with treated wood in accordance with [IBC Section 2304.10.5](#) and [IRC Section R317.3](#).
- 3.1.7. The following uses are outside the scope of this evaluation:
  - 3.1.7.1. Use as a treatment for wood structural panels (i.e., OSB and Plywood).
  - 3.1.7.2. Use in unconditioned attics and roofing applications.
  - 3.1.7.3. Use as a treatment for lumber grades other than those listed in [Section 4.2](#).
  - 3.1.7.4. Renewal or maintenance requirements for the treated products.
  - 3.1.7.5. Performance of this product with an over coating such as paints, stains or other coatings.
- 3.2. Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

### 4. Product Description and Materials:

- 4.1. AAF21 (FT) is a non-halogenated factory applied wood protection coating that uses ammonium phosphate, diammonium phosphate, ammonium bromide and other proprietary fire-retardant additives to coat wood members by means of a dipping process.
- 4.2. The lumber covered in this TER include:
  - 4.2.1.1. Douglas Fir (DF) and Spruce Pine Fir (SPF).
- 4.3. AAF21 (FT) protected lumber is acceptable for use in the following *AWPA*<sup>4</sup> Use Categories:
  - 4.3.1. UC1 – Interior construction – millwork and finishings.
  - 4.3.2. UC2 – Interior construction – interior beams, timbers, flooring, framing, millwork, and sill plates.
- 4.4. Minimum coverage rate is 500 square feet per gallon.

### 5. Applications:

#### 5.1. General

- 5.1.1. AAF21 (FT) is a protective coating for solid sawn DF and SPF lumber used in floor and wall framing.
  - 5.1.1.1. Applications include but are not limited to fire inhibition treatment for beams, columns, headers, joists, and wall studs.
- 5.1.2. AAF21 (FT) protected wood lumber is suitable for above ground applications not subject to contact with liquid water.

#### 5.2. Design

- 5.2.1. Allowable design stresses for AAF21 (FT) protected lumber for dry conditions of use are the same as the wood product before treatment in accordance with *ASTM D143*.
- 5.2.2. Since AAF21 (FT) is a topically applied coating treatment, not a pressure treatment; the wood is not incised, so the *ANSI/AWC NDS* Incising Factor (Section 4.3.8) is not applicable.

---

<sup>3</sup> [2012 IRC Section R802.1.3](#)

<sup>4</sup> These are *AWPA* designated wood preservation systems and retentions (pressure impregnation processes only) which have been determined to be effective in protecting wood products under specified exposure conditions. The use of AAF21 protective wood coatings, while purposely not included in the *AWPA*'s specification, satisfies and complies with the intent of the Building Code, and is an equivalent treated material in quality, strength, effectiveness, durability and safety. Therefore, M-Fire Suppression, Inc. protective wood coatings treated articles are deemed to be Non-*AWPA* Standardized; however, the intent of the building code has been satisfied and is adequately supported by third-party verified data and accredited testing protocols. See [IBC Section 104.11](#) for methods of obtaining "Alternative Materials Approval" via Building Official Authority.

## Technical Evaluation Report (TER)

- 5.2.3. Maximum duration of load design stress increase shall not exceed 1.6. Duration of load design stress increase equal to or less than 1.6 shall be in accordance with Section 2.3.4 of *ANSI/AWC NDS*.
- 5.2.4. The design provisions for wood construction noted in [IBC Section 2301.2](#) and [IRC Section R301.1.3](#) apply to AAF21 (FT) protected lumber unless otherwise noted in this TER.
- 5.2.5. Field cuts, notches, or bored holes do not need to be site treated.
- 5.2.6. Connections
- 5.2.6.1. Lateral loads for nails, screws, bolts, and withdrawal loads for nails and screws, installed in AAF21 (FT) protected lumber shall be in accordance with *ANSI/AWC NDS* using the species specific gravity.

### 5.3. Fire Resistance Properties

- 5.3.1. Lumber protected by AAF21 (FT) meet the requirements where surface burning and smoke developed index values are required to be tested by [IBC Section 2303.2](#) and [IRC Section R302.9](#) and [Section R802.1.5](#)<sup>5</sup> in accordance with *ASTM E84* extended 20 minutes, as follows:

Flame Spread & Smoke Developed Indexes of MFRT™ Class A Fire Protected Lumber		
	Flame Spread	Smoke Developed
Spruce Pine Fir	≤25	≤450
Douglas Fir	≤25	≤450

1. Tested in accordance with *ASTM E84* and *UL 723*.  
2. Additionally, the flame front did not progress more than 10.5 feet beyond the centerline of the burners at any time during the test.

Table 1: Flame Spread & Smoke Developed Indexes of MFRT™ Class A Fire Protected Lumber

### 5.4. Moisture Resistance Properties

- 5.4.1. The moisture content of AAF21 (FT) treated lumber is under 28 percent when tested in accordance with *ASTM D3201* procedures at 92 percent relative humidity (at 80°F) and meets the requirements of [IBC Section 2303.2.7](#) and [IRC Section R802.1.5.9](#). Testing has not been provided for elevated temperature and humidity in accordance with [IBC Section 2303.2.5.2](#) or [IRC Section R802.1.5.7](#) so use in roofs/attics of structures is not approved.

### 5.5. Fastener Corrosion

- 5.5.1. Fasteners used with AAF21 (FT) protected lumber shall be in accordance with [IBC Section 2304.10.5.4](#)<sup>6</sup> and [IRC Section R317.3](#).
- 5.5.1.1. Common steel, red brass and aluminum fasteners are approved for use in lumber protected by AAF21 (FT) in accordance with *AWPA E12-15*.

- 5.6. Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.

## 6. Installation:

- 6.1. Lumber treated with AAF21 (FT) shall be installed in accordance with the applicable code, the approved construction documents, this TER, the manufacturer's instructions and standard framing practice as applied to solid-sawn DF and SPF lumber as delineated by the QAI listing, as applicable.
- 6.1.1. In the event of a conflict between any of the above and this TER, the more restrictive shall govern.
- 6.2. AAF21 (FT) shall be applied at a coverage rate of 500 square feet per gallon. Heavier coating rates are permitted.
- 6.3. The applicator shall supply documentation to the building official showing that the minimum coverage rate has been obtained.

<sup>5</sup> [2012 IRC Section R802.1.3](#)

<sup>6</sup> [2012 IBC Section 2304.9.5](#)

## Technical Evaluation Report (TER)

- 6.4. The surface of the substrate shall be free of dirt, dust, oil, paint, stain or other materials that may prevent the coating from adhering to the substrate.
- 6.5. This product is not intended for use on surfaces that are subject to washing or where sustained humidity of 80 percent or more is expected.
- 6.6. Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

### 7. Test and Engineering Substantiating Data:

- 7.1. Test reports and data supporting the following properties:
  - 7.1.1. Flexure (MOR/MOE/) of LVL/EWP in accordance with *ASTM D143* by Wood Durability Lab (SDL) at the LSU Agricultural Center.
  - 7.1.2. Flame spread index and smoke developed index in accordance with *ASTM E84*, *UL 723*, *NFPA 255*, *UBC 8-1*, or *ASTM E2768* by QAI Laboratories.
  - 7.1.3. Hygroscopic properties in accordance with *ASTM D3201* by QAI Laboratories.
  - 7.1.4. Reaction with metals in accordance with *AWPA E12* by QAI Laboratories.
  - 7.1.5. Greenguard Certification Test – Fire Retardant Wood Treatments, Report #90886-02, in accordance with *ASTM D5116* and *ASTM D5197* by Underwriters Laboratory Environment.
- 7.2. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.3. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.4. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate, as it undertakes its engineering analysis.
- 7.5. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.6. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.7. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC*, *WFCM*, *IBC*, *SDPWS*, *NDS*, *ACI*, *AISI*, *PS-20*, *PS-2*, etc.). This includes review of code provisions and any related test data that aids comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g. lumber, steel, concrete, etc), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

### 8. Findings:

- 8.1. When used in accordance with the manufacturer's installation instructions and this TER, AAF21 (FT) protected lumber comply with, or are a suitable alternative to, the requirements of [IBC Chapter 23](#); [IRC Chapter 5](#), [6](#) and [8](#) as follows:
  - 8.1.1. AAF21 (FT) protection does not affect the allowable design stresses allowed for untreated lumber as applied to solid sawn DF and SPF lumber.
  - 8.1.2. DF and SPF lumber protected with AAF21 (FT) meet the requirements where surface burning characteristics are required to be tested by [IBC Section 2303.2](#) and [IRC Section R302.9](#) and [Section](#)

## Technical Evaluation Report (TER)

[R802.1.5](#)<sup>7</sup> in accordance with *ASTM E84* extended 20 minutes, *UL 723* extended 20 minutes, *NFPA 255* extended 20 minutes, *UBC 8-1* extended 20 minutes, and *ASTM E2768*.

- 8.1.3. AAF21 (FT) protected lumber meets the required moisture resistance properties in accordance with [IBC Section 2303.2.7](#) and [IRC Section R802.1.5.9](#).
- 8.1.4. The corrosion rate of steel, red brass and aluminum fasteners is not increased by the use of AAF21 (FT) treated lumber and use of other fasteners is in accordance with [IBC Section 2304.10.5](#)<sup>8</sup> and [IRC Section R317.3](#).

- 8.2. [IBC Section 104.11](#) and [IRC Section R104.11](#) (*IFC Section 104.9* is similar) state:

**104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.<sup>9</sup>

- 8.3. This product has been evaluated with the codes listed in [Section 2](#), and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this report, they are listed here:

- 8.3.1. No known variations

- 8.4. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. Dr.J's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers when signed and sealed.

## 9. Conditions of Use:

- 9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.
- 9.2. For field applied applications, the applicator shall provide documentation that the application rate does not exceeds 500 square feet per gallon.
- 9.3. Application is limited to DF and SPF Lumber substrates.
- 9.4. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.
- 9.5. Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.
- 9.6. Lumber treated with AAF21 (FT) shall be installed in accordance with the applicable code, the approved construction documents, this TER and the manufacturer's installation instructions. If there is a conflict between this report and the manufacturer's instructions, the more restrictive shall govern.
- 9.7. AAF21 (FT) is a water soluble product. This product shall not be used in locations subject to washing or wetting. Lumber bundles shall be protected from wetting during shipment, storage and installation.
- 9.8. Where required by the building official, proof of application shall be provided. Proof of application can be shown by subjecting treated and untreated samples to a small fire source such as a propane torch for approximately 20 seconds and comparing the results. The treated sample will exhibit a visible black char layer.
- 9.9. AAF21 (FT) complies with, or is a suitable alternative to the treatment required for DF and SPF lumber as permitted by the codes listed in [Section 2](#), subject to the following conditions:
  - 9.9.1. AAF21 (FT) protected lumber are suitable for above ground applications not subject to continuous contact with liquid water.

<sup>7</sup> [2012 IRC Section R802.1.3](#)

<sup>8</sup> [2012 IBC Section 2304.9.5](#)

<sup>9</sup> The last sentence is adopted language in the 2015 codes.

## Technical Evaluation Report (TER)

- 9.9.2. Fastener design values shall be determined using the specific gravity of the lumber species used in the coated product.
- 9.9.3. Cutting and notching of AAF21 (FT) coated lumber is permitted where allowed by the applicable building code, the manufacturer's recommendations, this TER or where the effects of such alterations are specifically considered in the design of the member by a Registered Design Professional.
  - 9.9.3.1. Field cuts, notches, or bored holes must be site treated in accordance with the manufacturer's instructions and AWPA M4 in accordance with [/RC Section R317.1.1](#) and [Section R318.1.2](#).
- 9.9.4. Duration of load increases shall be in accordance with the limitations of the applicable building code for sawn lumber, but not greater than 1.6.
- 9.9.5. AAF21 (FT) wood protection coating is provided by M-Fire Suppression in their Carson, CA facility or other facilities or affiliates with quality control inspections by an approved third-party quality control inspection agency.

### 9.10. Design

#### 9.10.1. Building Designer Responsibility

- 9.10.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [/RC Section R106](#) and [/BC Section 107](#).
- 9.10.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [/RC Section R301](#) and [/BC Section 1603](#).

#### 9.10.2. Construction Documents

- 9.10.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

### 9.11. Responsibilities

- 9.11.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.
- 9.11.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
- 9.11.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.11.4. This product is manufactured under a third-party quality control program in accordance with [/RC Section R104.4](#) and [R109.2](#) and [/BC Section 104.4](#) and [110.4](#).
- 9.11.5. The actual design, suitability and use of this TER, for any particular building, is the responsibility of the Owner or the Owner's authorized agent, and the TER shall be reviewed for code compliance by the Building Official.
- 9.11.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

## 10. Identification:

- 10.1. AAF21 (FT) wood protection coating described in this TER is identified by a label on the containers bearing the manufacturer's name, product name, date of manufacture, shelf life, and TER number.
- 10.2. Lumber factory treated with MFRT™ Class-A Fire Protected Lumber shall be labelled with the following information:
  - 10.2.1. Identification mark of an approved agency.
  - 10.2.2. Name of the fire retardant treatment (AAF21).

## Technical Evaluation Report (TER)

10.2.3. Name of the treating facility.

10.2.4. Species of wood treated.

10.2.5. Flame spread and smoke developed indices.

10.2.6. Example of acceptable product label, see [Figure 1](#) and [Figure 2](#).


M-Fire Suppression - MFRT Carson, CA. Treating facility Douglas Fir, ADAT Dr. J TER # 1703-18 LARR# 26112	QAI Laboratories Inc. listing # B1106 Flame Spread (under 25) Smoke Developed (under 450)  ASTM E84 30-minute extended test
---	---

Figure 1: Label for MFRT™ Class A Fire Protected Lumber – M-Fire – Carson, CA


MHA Building Systems LLC – licensed by M-Fire Suppression MFRT - Lodi, CA. Treating facility Douglas Fir, ADAT Dr. J TER # 1703-18, LARR# 26112	QAI Laboratories Inc. listing # B1106 Flame Spread (under 25)  Smoke Developed (under 450) ASTM E84 30-minute extended test
--	---

Figure 2: Label for MFRT™ Class A Fire Protected Lumber – MHA – Lodi, CA

10.3. Additional technical information can be found at [firebuster.net](http://firebuster.net).

### 11. Review Schedule:

11.1. This TER is subject to periodic review and revision. For the most recent version of this TER, visit [drjengineering.org](http://drjengineering.org).

11.2. For information on the current status of this TER, contact [DrJ Engineering](#).



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law, and P.E. Law](#)