



Flame Retardant Specification Manual

Industrial flame retardant treatment
of wood and wood-based panel products

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Industrial Flame retardant treatment of wood and wood-based panel products

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About the Wood Protection Association (WPA)

The WPA is a not for profit technical and advisory organisation interested in the development and promotion of wood protection technology to support the use of wood as a cost effective, sustainable and low environmental impact construction material.

The WPA acts as a technical advisor to British and European Standards setters on wood preservation, modified wood and the fire protection of wood. On the Regulations governing wood protection, the WPA is recognised as the authority on wood protection by agencies like the Health & Safety Executive, Environment Agency, Scottish Environmental Protection Agency, the Department for Environment, Food & Rural Affairs and the Highways Agency.

WPA/FRSM 3rd Edition: Record of Amendments

PAGE NO.	AMENDMENT NO.	AMENDMENT DATE	AMENDMENT SUMMARY



Wood Protection Association

Clicking on [highlighted text](#) will take you to the appropriate place in the document or to a linked web site page if it begins with the prefix [www](#).



ARCHITECTS HELPLINE

If you need help with a flame retardant specification then e-mail the WPA info@wood-protection.org

MORE SPECIFICATION GUIDANCE

The full range of WPA specification guides include:

- Wood Preservation Manual
- Flame Retardants Manual
- Modified Wood Manual
- Wood Selection Guide

Front cover:

Flame retardant project photographs (left to right) Borreraig Island house, Scotland; Banyan Wharfe, London; Art installation at the V&A Museum

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About this manual

Fire safety is a critical factor in building design. This Manual provides clear guidance about the flame retardant treatment of solid wood and wood-based products. It deals exclusively with quality assured products applied to new timber by an industrial process. All of the processes and wood species described are commercially available and technically suitable.

This Manual classifies flame retardant products into three types: those for dry interiors (Type INT1 – formerly DI); humidity resistant (Type: INT2 – formerly HR) and leach resistant (Type EXT – formerly LR). Treatment specification is simplified by the Commodity Code system established by the WPA. Five Commodity Specifications (FR1 – FR5) cover the different applications and service conditions of wood and wood-based panel components. Specification details and clauses are given for each code. These codes are recognized throughout the industry and referred to by other major specification bodies such as NHBC and NBS.

A list of flame retardant formulations and suppliers can be found in [Section 3](#). 'Approved' status formulations have had their fire performance and further properties assessed by an independent WPA panel and the suitability for use in the designated end use category confirmed. The approved characteristics are published in this manual. Manufacturers of 'Listed' formulations have declared the end use category for which their product is claimed to be suitable.

European classes of reaction to fire performance are now the norm, replacing traditional BS 476 classes. As a consequence, it is essential that specifiers understand the necessity for relevant fire performance certification and assurance of Building Regulations compliance when faced with a choice between flame retardant formulations and treated material.

The [Flame Retardant Specification Checklist](#) featured at the start of this Manual serves as a simple guide to help avoid the consequences of using unsuitable or unproven products in safety-critical situations



Borreraig House, Glendale, Scotland

Oak faced plywood lined walls

FR Specification: WPA Type INT2
(Humidity resistant)

Photo courtesy: Dualchas Architects &
Arch Timber Protection

Quick click to specifications

Please choose the service conditions for treated wood or wood-based panels:

FR1 [Wood and wood-based panels for non load-bearing interior use \(BS EN 1995 Service Class 1\)](#)

FR2 [Wood and wood-based panels for load-bearing interior use \(BS EN 1995 Service Class 1\)](#)

FR3 [Wood and wood-based panels for interior use \(BS EN 1995 Service Class 2\)](#)

FR4 [Wood and wood-based panels for weather-protected exterior use \(BS EN 1995 Service Class 2\)](#)

FR5 [Wood and wood-based panels and cedar shakes and shingles exposed to the weather \(BS EN 1995 Service Class 3\)](#)

WPA Specification Manual
flame retardant classifications:
Dry interior: Type **INT1**
Humidity resistant: Type **INT2**
Leach resistant: Type **EXT**

For [timber treaters](#) click here.

For [treated materials](#) click here.

1. Objectives, practice and specification of flame retardants

1.1 Objective and practice

The objectives of pretreating timber with flame retardants under controlled conditions are to improve the performance of wood and wood-based materials in fire situations to meet the high levels of performance required by Building Regulations and other regulatory requirements.

In addition to treatments designed to enhance performance in fire in completed structures, treatments are available to reduce the risk of fire in timber frame buildings during the construction phase. These are known as FR Build products and are subject to a series of tests developed by the Structural Timber Association. The technical aspects of this manual do not cover these products. The treatment of wood and wood-based materials with FR Build products is subject to mandatory certification under a WPA Benchmark quality scheme and certificated products are listed on the WPA website at www.wood-protection.org/fire-protection/quality-scheme and further information is available from the Structural Timber Association (www.structuraltimber.co.uk)

In the UK in 2013-14 fire services attended 61,500 building fires (39,600 in dwellings) and fires accounted for 322 deaths and 9748 injuries. (Communities and Local government Fire Statistics). Injuries in dwelling fires totaled 10,900 (Communities and Local Government Fire Statistics). The Geneva Association confirms in its annual World Fire Statistics Information Bulletin (April 2014) the estimate of fire costs for the UK at 0.13% of GDP. Overviews of the different costs of fire, including property damage, death, pain and suffering and precaution costs, estimated total costs at £8.3 billion for the UK (2008). It should not be assumed that, because wood is uprated by flame retardant treatment, there is a reduced requirement for good design and workmanship. The flame retardant pre-treatments recommended for the various commodities or end use situations are complementary to good design, workmanship and site practice – not a substitute for them.

The specifications contained in this manual relate to flame retarding processes and timber species which are both commercially available and technically suitable. The pre-treatment condition of the timber and suitable flame retardants in respect of various end use commodities are given.

All the flame retardant treatments listed in this Manual are capable of upgrading a wide variety of materials to a Euroclass C. In some cases, it is possible to achieve a Euroclass B. Wood and wood-based materials treated to Class 1 Surface Spread of Flame to BS 476 Part 7 and/or Class 'O' rating in accordance with Building Regulations are not now widely available. Other national, industry and transport standards are also capable of being met by some or all of the treatments.

In all cases the processor or manufacturer should be consulted.

1.2 Specification check list

Fire safety is a critical factor in building design. With the increasing use of wood as a low carbon sustainable construction material it is vital that any flame retardant treatment required in a building provides long-term, predictable protection backed by independent verification. The [Checklist](#) on page 5 has been produced by the WPA as a useful guide when assessing the suitability of one flame retardant formulation or treated material against another:



Art installation, V&A Museum
Created using Medite FR panels

Photo courtesy: Smartply/Medite

FLAME RETARDANT CHECKLIST

Six simple checks to make sure
FR specification is right first time.

[Click here.](#)

FLAME RETARDANT SPECIFICATION CHECKLIST

Step 1 Specification fundamentals

Before specifying a flame retardant, verify the specification fundamentals:

1.1 What fire performance is required ?

- Euroclass B or C

Note: Classifications according to BS476 Part 6 or 7 (Typically Class O and Class 1) appear in Building Regulations as alternatives to Euroclass classifications but treated wood and wood-based panels with BS 476 classifications are not now widely available.

1.2 What is the service environment?

- internal dry;
- internal humid or,
- external.

Step 2 Verify performance credentials of the product options

What fire performance properties are claimed by the manufacturers of the treatment options being considered?

All performance claims should be independently verified.

Check and establish that the claims made by the manufacturer reflect the performance required in Step 1.1 and the end use service environment in Step 1.2. Full guidance about the different standards and service environments is given in this Manual

Fire performance of WPA Benchmark approved materials (as listed in Certificates of Approval on pages 13-15) is independently verified.

Step 3 Is performance to Euroclass B or C required?

If performance in accordance with a European Standard is required (typically Euroclass B or C), the following key documents should be obtained to support the choice of treatment:

3.1 Classification Report(s) from a Notified Body in accordance with BS EN 13501.

These will state, based on data from tests to BS EN 13823 and EN ISO 11925, the fire performance of the FR treated timber (e.g. Class B, s1, d0, where 'B' is the class achieved, 's' is the smoke rating and 'd' is the burning droplets rating). This report will also specify a field of application to which the classification applies by defining the species of wood or wood-based material e.g. spruce and the allowed variation in thickness e.g. 12 to 25mm etc.

The thresholds to achieve Euroclass B are higher than for Euroclass C and, therefore, if material achieves a Euroclass B classification then it also conforms to Euroclass C provided there is no change in the field of application as detailed in the Classification report

The WPA strongly recommends that the description of the product given in the classification report is compared with the specification of the components to be used in the project and the design of the structure to ensure the classification in the report can be taken to apply to the material to be used in the project.

(Accompanying Extended Application Reports, see 3.2 below, may allow additional data to support the classification reports applicable to those circumstances).

continued...

Fitness for purpose check

Always check that the description of the material given in the Classification Report quoted by the manufacturer can be taken to apply to the material to be used in the project. Different species and cross sectional sizes do affect fire performance ratings and require an Extended Application Report – see Example: Fire Classification Scope.

Example: Fire Classification Scope

Example: If a Classification Report refers to Euroclass B, s1, d0 being achieved on 25mm thick spruce boards tested without an air gap on plasterboard, then the product cannot be assumed to confer the same reaction-to-fire performance for:

- Timbers less than 25mm
- Alternative species
- With an air gap
- Backing materials deemed to be of higher risk (in accordance with BS EN 13238)

Always select a flame retardant with a verifiable performance. If no Extended Application Report is available then choose another treatment that is appropriate to the application

FLAME RETARDANT SPECIFICATION CHECKLIST

Step 3 Is performance to Euroclass B or C required? (continued)

3.2 Extended Application Report

Provides the test evidence and its assessment which defines the product family or range of material and thicknesses, backing materials and air gap, to which a classification report can apply.

For approval purposes (see Section 3) the WPA only accepts classifications and any relevant supporting Extended Application Reports that conform to the principles agreed by The Group of Notified Bodies – Fire Sector Group (SHO2).

Extended Application Reports can minimise the need for fire testing. However, experience of testing materials of different densities indicates that density should not be used as the sole basis for Extended Application Reports especially across species – for example a fire classification for a species of low density cannot be used alone to predict the classification for a different species solely on the basis of its density without fire testing. The practice of Notified Bodies in providing Classification Reports for wood and wood-based materials on the basis of Extended Application Reports is evolving and WPA has proposed a new basis for this to be used at EU level but the association wishes to make it clear that existing Classification Reports from recognised Notified Bodies should be accepted for specification compliance.

Step 4 Is performance to BS 476 Part 7 and/or Part 6 required?

If fire protection in accordance with BS 476 Part 7 and/or Part 6 is required (typically Class 1 or Class 'O') the key documents to examine are the independent test reports that verify the performance to the required standard of treated material similar to that which it is to be specified.

Class 'O' is an artificial class specified in UK Building Regulations requiring a particular performance in both BS 476 Parts 6 and 7. Supplementary reports are sometimes produced to draw together the test data from BS 476 Parts 6 and 7. Although supplementary reports are not normally necessary in regulatory terms, they do provide reassurance about the performance of the treated material.

Note: Treated wood and wood-based panels with BS 476 classifications are not now widely available.

Step 5 Quality Assurance

To be listed in this manual, WPA requires that the manufacture of flame retardant formulations and their application to timber should be under a third party quality assurance scheme, ideally according to ISO 9001.

The WPA Benchmark Scheme for flame retardant treatment of wood and wood-based materials by pressure impregnation has been developed for use as a quality schedule in BS EN 9001. This includes a schedule defining the standard of treatment to be consistently achieved. WPA members who work in accordance with WPA Quality Scheme are listed in [Table 1-1](#). Further details are available on request from WPA.

Step 6 If in any doubt, check with the WPA.

Detailed specification guidance can be found in this manual. Designers may also register for the Architects Help-line on the Association's web site www.wood-protection.org and request specific project or material guidance.

IMPORTANT NOTE

Only Fire Classification Reports from valid Notified Bodies should be relied on to justify specification of a flame resistant formulation or treated material

IMPORTANT NOTE: BRITISH STANDARDS AND EUROCLASSES

If the specification calls for Class 1 or Class 'O' (or indeed any other BS 476 class) it should be understood that a product having only a Euroclass rating as described in step 3 of this Checklist cannot be taken as being equivalent to Class 1 or Class 'O'; nor in the same way can a BS 476 class be taken as being equivalent to a Euroclass. The two methods of test and interpretation of the results are entirely different.

CAUTION: SITE APPLIED COATINGS AND LOW VISCOSITY LIQUIDS

Formulations for surface application depend on correct application rates and/or film thicknesses being achieved. When they are applied by brush or spray on site, fire performance can only be assured when application is under an independent certification and accreditation scheme for installers. It is very difficult to achieve the required application rate of low viscosity liquids when applied to vertical surfaces.

2. General Specification

2.1 General specification for the physical properties of flame retardant formulations

WPA flame retardant formulations fall into one of three broad categories. The three types of system may be distinguished by properties, which limit or recommend their use in specific circumstances. The variation in these properties is largely due to the nature of the chemicals used in the formulations and the complexity and degree of chemical reaction required in formulating them.

The three types are:

WPA Type INT1 (formerly DI – dry interior)

WPA Type INT2 (formerly HR – humidity resistant)

WPA Type EXT (formerly LR – leach resistant)

Note: the WPA FR Types align with a draft CEN standard *Durability of reaction to fire performance – Classes of fire-retardant treated wood products in interior and exterior end use applications*. [Number of this standard not yet confirmed].

The three WPA Type formulations only refer to products listed in Tables 1-1, 1-2 and 1-3 of this manual.

All impregnation formulations are waterbased.

Formulation types and suitability for BS EN 1995 Service Classes

TYPE	BS EN 1995 SERVICE CLASS	CONDITIONS
INT1	1	Moisture content in materials corresponding to 20°C and rh <65% for most of the year
INT2	2	Moisture content in materials corresponding to 20°C and rh <85% for most of the year
EXT	3	Conditions leading to higher moisture content in materials than SC 2

INT1 (dry interior)

Interior type. The common feature is that the treated wood or wood-based panel is sensitive to high humidity; prolonged exposure may result in salt efflorescence and/or migration. Their use is therefore restricted to interior environments conforming to BS EN 1995 Service Class 1: Timber in buildings with heating and protected from damp conditions (moisture content in materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 65 % for a few weeks per year) – e.g. internal walls, internal floors (other than ground floors) and warm roofs,

INT2 (humidity resistant)

Humidity resistant type. Treated wood or wood-based panel is far less sensitive to high or fluctuating humidity and can therefore be used in practically all interior situations including BS EN 1995 Service Class 2: Timber in covered buildings (moisture content in the material corresponding to a temperature of 20°C and a relative humidity of the surrounding air only exceeding 85 % for a few weeks per year) – e.g. ground floor structures where no free moisture is present, cold roofs, the inner leaf of cavity walls, swimming pools, storage and pallet systems, scaffold boards and fully protected external uses.

EXT (leach resistant)

Leach resistant type. The treated wood or wood-based panel can be used in all interior and above ground exterior situations including BS EN 1995 Service Class 3 – components exposed to the weather (climatic conditions leading to higher moisture contents than in Service Class 2) – e.g. cedar shingles and unprotected exterior cladding. Full exterior exposure will eventually lead to a reduction in effectiveness but at a much slower rate than with other types of treatment.



Banyan Wharfe Development, London

External cedar cladding

FR Specification: Type EXT (leach resistant)

WPA Commodity code-FR5

Photo courtesy: Arch Timber Protection

2.2 Fire performance requirements

The fire performance for all materials that are to be used in buildings, including wood and wood-based panels, are stated in Building Regulations that apply in different areas of the UK.

2.2.1 Construction Products Regulation (CPR), European fire test methods and European harmonised standards

The Construction Products Regulation requires all products to meet its seven basic requirements. This is demonstrated by declaring compliance with harmonised product standards when they become available and applying the CE mark as required in the relevant standard. This is done in conjunction with a Notified Body and involves testing in accordance with European fire test methods.

Results from the traditional BS 476 fire test methods (2.2.2) cannot be used to demonstrate compliance with a European product standard. Instead, the European standards make reference to European fire test methods, the relevant ones for flame retardant treated construction products being:

EN ISO 11925 – Ignitability test

EN 13823 – Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a Single Burning Item

The classification of a product (according to BS EN 13501-1) as a result of a reaction to fire test is included in a classification report. Results from the European fire tests are expressed in terms of Euroclasses (known as Euroclass A, B, C, D, E and F).

Building Regulations Approved Document B references Euroclasses for fire performance alongside the equivalent BS 476 classes. Note, however, that flame retardant treated wood and wood-based materials classified according to BS 476 is not now widely available.

The BS476 classes and the new Euroclasses are not interchangeable because they are derived from different test methods measuring different properties. They cannot, therefore, be used as substitutes for each other.

Whilst common fire test methods will be used throughout Europe, the same product will not necessarily be accepted for the same end use throughout Europe as the regulations for individual member states may be different.

Harmonised product standards are now published for the following materials and compliance, including CE marking, is mandatory when the CPR applies:

BSEN 13986 Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking

BS EN 14915 Solid wood panelling and cladding – Characteristics, evaluation of conformity and marking

EN 14374:2004 Timber structures. Structural laminated veneer lumber.

EN 14342: 2013 Wood Flooring. Characteristics, evaluation of conformity and marking

Compliance with Building Regulations can be shown by the use of European tests or National test methods such as BS 476 Part 7. However, once a product standard is designated as 'harmonised' by publication in the EU Official Journal it becomes mandatory and compliance can only be demonstrated by the use of European standard tests.

In complying with the requirements of these European Standards, manufacturers must demonstrate conformity of the product with the relevant technical specification which will include some degree of testing (both fire and mechanical testing) and certification by a third party; such Assessment and Verification of Constancy of Performance of a product to the relevant harmonised standard is a legal requirement of the CPR.

2.2.2 Traditional British Standards

As treated wood and wood-based panels with BS 476 classifications are not now widely available the following information is provided for completeness.



Bell Rock Hotel, Europa-Park
External timber cladding prior to coating
FR Specification: WPA Type INT2
(Humidity resistant)

Photo courtesy: BASF Wolman

As an alternative to materials with Euroclass performance ratings, Building Regulations include fire performance requirements in terms of a given performance when tested according to prescribed British Standard test methods.

The principal standard that has been used for many years assessing the reaction to fire performance of wood building materials is BS 476 'Fire Tests on Building Materials and Structures'.

The test method most widely used for assessing the effectiveness of flame retardant treatments is BS 476 Part 7, which is used to classify a material in terms of the 'Spread of Flame' across its surface under the test conditions. In general, untreated wood or wood-based panels fall into classes 3 or 4, i.e. a rapid surface flame spread. Treatment with flame retardant chemicals can upgrade such materials to class 1, i.e. a low surface flame spread. This level, the highest achievable with this test method, is the performance normally required for wall and ceiling linings.

In certain high-risk areas, such as escape routes, some building regulations require Class 'O' standard of performance. To comply materials must have a class 1 surface spread of flame and a low fire propagation index (less than 12) when tested to BS 476 Part 6. Certain wood-based materials can meet this standard of performance.

2.3 Specifying treatment – Processors and products listed in this manual

WPA Commodity Specifications

Five WPA Commodity Specifications exist (see [Section 6](#)) and it is recommended that these are consulted where appropriate. Each of these give guidance on hazard, wood species, condition and cutting after treatment and selection of flame retardant, and include a model specification phrase.

Flame retardant impregnation

If the material is capable of being impregnated with an aqueous solution of the flame retardant consider vacuum-pressure impregnation. Exterior grade plywoods can be impregnated safely.

The structural integrity of some wood-based panels is reduced by impregnation with an aqueous solution and therefore should not be post-impregnated. These include MDF, Particleboard, Flaxboard and OSB. A material with enhanced reaction to fire performance incorporated during manufacture or factory-applied surface coating should be used in these instances where commercially available.

Choice of flame retardant

Consider the end use application in terms of exposure to weathering and humidity and select the minimum appropriate type of flame retardant treatment. Note that in some situations a treatment type can be used in a higher water-exposure end-use through the use of suitable maintained coatings. For example, wood treated with a type INT2 formulation and with a suitable maintained coating may be used in a weather-exposed (BS EN 1995 Service Class 3) situation.

Processors and products listed in this Manual

A number of flame retardant formulations and processors are listed in this manual. Full details can be found in [Section 3](#) including information about the criteria for a formulations to be listed by the WPA along with the WPA approval assurance scheme that results in products being granted WPA Approved Product status.

Ancillary properties of the treated timber

Contact the manufacturer for further, specific information on the properties of the timber.

See [page 10](#) for model specification phrases where WPA Commodity Specifications are not appropriate.



Robin House Hospice, Leeds

Interior and exterior timber cladding
FR Specification: WPA Type INT2 (humidity resistant for internal) and WPA Type: EXT (leach resistant for external uncoated cladding)

Photo courtesy: Arch Timber Protection and Hoskins Architects

For [WPA commodity codes and specification phrases](#) click here.



WPA Benchmark FR Build is a quality scheme for the application of flame retardant products that are approved by the Structural Timber Association (STA) under its FR Build requirements to mitigate the impact of fire of timber frame structures during construction. All products approved by STA must be applied with a process quality assessed under the WPA Benchmark FR Build Scheme.

Model specification phrases where WPA Commodity Specifications are not appropriate:

BS EN 1995 Service Class 1 environments: *[insert material/species]* to be treated to *[insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7]*, using a WPA Type INT1 dry interior formulation listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

Exhibition or hoarding materials (BS EN 1995 Service Class 1): *[insert material/species]* to be treated to *[insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7]*, using a WPA Type INT1 dry interior formulation listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

BS EN 1995 Service Class 2 environments: *[insert material/species]* to be treated to *[insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7]*, using a WPA Type INT2 humidity resistant formulation listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

BS EN 1995 Service Class 3 environments: *[insert material/species]* to be treated to *[insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7]*, using a WPA Type EXT leach resistant formulation listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

* Where specifiers wish to specify use of a particular named flame retardant (Table 1-2), and/or to require that treatment be carried out in accordance with the WPA Benchmark Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Scheme' should be added to the specification.

3. Flame retardant processors and products

WPA Benchmark FR

Benchmark FR is the WPA quality scheme for wood and wood-based materials such as panel products whose reaction to fire classification has been enhanced by a flame retardant treatment process in factory-controlled conditions or by the incorporation of flame retardant chemicals as part of the manufacturing process. Products certificated under this scheme must incorporate a flame retardant produced under an ISO9001 quality management system. Details of the WPA Benchmark FR scheme are available at <http://www.wood-protection.org/quality-assurance/>

Processors who carry out flame retardant impregnation treatment under a third party quality assurance scheme (e.g. BS EN ISO 9001) are listed in Table 1-1. Processors who produce Benchmark certified products operate under a third party quality assurance scheme (e.g. BS EN ISO 9001) incorporating the WPA Quality guidance Note QGN1: Flame Retardant Treatment of Timber. These are identified in [Table 1-1](#). The current list of Benchmark certified products is available at www.wood-protection.org/fire-protection/quality-scheme

Flame retardant formulations supplied by members of the Wood Protection Association are listed in [Table 1-2](#) in accordance with the manufacturer's declaration of type (INT1, INT2 or EXT) for which evidence is provided to WPA in accordance with the requirements of [Annex 1](#). Other formulation or treated wood characteristics are not independently assessed unless a formulation has been assessed under the association's approval scheme.



Private house, Dulwich, London

Western Red Cedar external cladding

FR Specification: WPA Type INT2 and finished with a high performance protective coating

Photo courtesy: Arch Timber Protection

QUICK CLICK TO:

[Quality assured wood treaters](#)

[Impregnation products](#)

[Wood-based panels](#)

[Specification checklist](#)



The WPA approval scheme for flame retardant formulations includes independent assessment of fire test certificates and classification reports. Other characteristics that affect performance in service such as strength of treated wood and smoke emission are also assessed. Approval scheme criteria are in a separate document. Approved formulations are shown in bold type in the tables. The approved characteristics are shown in certificates, which follow [Table 1-2](#).

[Table 1-3](#) lists flame retardant wood-based panels (including panels incorporating flame retardant components during manufacture and products impregnated or coated with flame retardant formulations after manufacture) supplied by WPA members.

For the particular combination of structure design, wood species/thickness or panel type/thickness to be used in a structure, flame retardant performance requirement and intended service environment, specifiers/users should either, for WPA approved formulations, check the approved characteristics (see Certificate of Approval) or, for WPA listed products, seek confirmation from the treater or supplier that appropriate classification reports exist. The specification checklist ([Section 1.2](#)) provides a detailed guide to the information that a specifier should seek before selecting a particular formulations.

In all cases where a fire retardant is used the field of application within the supporting EN 13501-1 reaction to fire classification document must be adhered to. The EN 13501-1 classification document allows a manufacturer to state a Euroclass performance and it should be from a third party accredited fire test laboratory. The field of application will detail both the product parameters which are covered such as loading of fire retardant, thicknesses, species or joint types, while also specifying suitable end use applications such as air gaps, mounting and fixing, orientation and covered materials. A change in any of the criteria mentioned can have a considerable impact on the fire performance of a product. If the product or end use application used is outside the scope of the field of application, it is not covered by the classification document.

TABLE 1-1 Flame retardant impregnation processors (treaters)

MANUFACTURER / PROCESSOR		
Arch Timber Protection Wheldon Road Castleford West Yorkshire WF10 2JT	Tel: 01977 714000 E: timberprotectionadvice.ukca@lonza.com W: www.archtp.com	BSI Registered firm BS EN ISO 9001 Certificate No: FM01636 WPA Benchmark FR Certificate No: FR/201101 This processor is operates a service treatment of wood and wood based panel products under WPA Benchmark FR quality scheme.
WJ Components Ltd Rix Road Stoneferry Hull HU7 0BT	Tel: 01482 338950 Fax: 01482 338951 E: info@wjcomponents.co.uk W: www.wjcomponents.co.uk	BSI Registered firm BS EN ISO 9001 UKAS Certificate No: 8097 WPA Benchmark FR Certificate No: FR/201102 This processor is operates a service treatment of wood and wood based panel products under WPA Benchmark FR quality scheme.
Marley Eternit Ltd The Old Shipyard Gainsborough Lincolnshire DN21 1NG	Tel: 01427 613868 E: info@marleyeternit.co.uk W: www.marleyeternit.co.uk	BSI Registered firm BS EN ISO 9001 Certificate No: GB02/56747 WPA Benchmark FR Certificate No: FR/2013001 This processor of wood produces scaffold boards and construction products under the WPA Benchmark FR quality scheme.

TABLE 1-2 Flame retardant formulations manufactured and supplied by WPA members¹

(Contact suppliers for information on processors using particular products)

MANUFACTURER / PROCESSOR	FORMULATION NAME	FORMULATION TYPE (see Section 2)	FUNCTION (Notes 1 and 2)	QUALITY ASSURANCE	MAXIMUM RETENTION ²
Arch Timber Protection Wheldon Road Castleford West Yorkshire WF10 2JT Tel: 01977 714000 Email: timberprotectionadvice.ukca@lonza.com Website: www.archfiretreatments.co.uk	Dricon®	INT2	FR ³ /EBD ⁴	BBA ⁵ Cert.No. 87/1841 (Dricon only)	INT2 up to 153 kg/m ³ .
	NON-COM® Exterior	EXT	FR ³ /EBD ⁴	BSI Registered firm	EXT up to 125 kg/m ³ . INT2 up to 142 kg/m ³
	ATP Generic	INT1	FR ³	BS EN 9001 Certificate FM01636	N/A
Koppers Performance Chemicals Fieldhouse Lane Marlow Bucks SL7 1LS Tel: 01628 486644 Fax: 01628 476757 Email: kpc@koppers.eu Website: www.kopperspc.eu	Koppers FirePRO	INT2	FR ³ /EBD ⁴	BSI registered firm BS EN 9001 Certificate FM 01724	INT2 up to 160 kg/m ³
	Exterior Fire-X	EXT	FR ³ /EBD ⁴		EXT up to 59 kg/m ³ , INT2 up to 73 kg/m ³
BASF Wolman GmbH UK Office BASF PLC Earl Road Cheadle Hulme Cheshire SK8 6QG Tel: 0161 488 5329 Email: jessica.ahlback@basf.com Website: www.basf.com/wolman	Wolmanit Firestop®	INT2	FR ³	ISO 9001 Certificate NL009954-1 (Bureau Veritas Inspection & Certification The Netherlands B.V.)	INT2 up to 97 kg/m ³
Zero Ignition 2 Rendezvous Rd. Worthing Barbados BB15006 Email: ian.king@zeroignition.com Website: www.zeroignition.com	Zero Ignition Solution.	See Note 6.		BSI registered firm BS EN 9001 Certificate: FS27822	N/A

Notes

1. Products for which a maximum retention is indicated have their 'type' (INT1, INT2 or EXT) verified in accordance with Annex 1 of this manual by independent assessment of test data.
2. Maximum retention is the highest retention of flame retardant product in treated wood shown in tests in accordance with Annex 1 to meet the criteria for the relevant product type (INT2 or EXT). Type EXT products must meet the criteria for INT2 and EXT classifications. Type INT1 products are hygroscopic by default so a maximum retention is not applicable (N/A)
3. Flame Retardant
4. Enhanced Biological Durability
5. British Board of Agrement
6. This product is for addition to panel products as part of the manufacturing process. The panel manufacturer will provide details of the FR characteristics and the situation(s) and environment(s) in which the panel may be used.
7. Products listed in **Bold** have been subject to independent assessment under the WPA product approval scheme for FR products. Details of the FR characteristics are given in the WPA Certificates of Approval which appear in this Manual.

TABLE 1-3 Flame retardant treated wood and wood-based panels supplied by WPA members

SUPPLIER/MANUFACTURER	DESCRIPTION OF PRODUCT(S)
<p>MEDITE SMARTPLY Persimmon House Anchor Boulevard Crossways Business Park Dartford Kent, DA2 6QH Tel: 01322 424900 Fax: 01322 424920 Email: info@smartply.com Website: www.smartply.com</p>	<p>MEDITE SMARTPLY markets the SMARTPLY® brand of Medium Density Fibreboard. SMARTPLY® FR (Flame Retardant) Euro Class B & C is an MDF panel developed specifically for use in situations where a Euro Class B or a Euro Class C flame retardant board is required under building regulations.</p> <p>Third party certification to these requirements and also CE conformity are available upon application. All SMARTPLY products possess third party audited FSC Chain of Custody.</p> <p>BS1 Registered firm BS EN ISO 9001 Certificate No: IE-19.3756</p> <p>WPA Benchmark FR Certificate No: FR/201302</p> <p>This manufacturer produces SMARTPLY FR OSB3 under the WPA Benchmark FR Quality Scheme.</p> <p>For specific requirements, contact SMARTPLY technical sales staff.</p>
<p>Meyer Timber Ltd Meyer House Hadleigh Park Grindley Lane Stoke on Trent ST11 9LW Tel: 0845 873 5000 Fax: 0845 873 5005 Email: sales.stoke@meyertimber.com Website: www.meyertimber.com Approved ISO 9001:2008 BMS</p>	<p>Importer and National Distributor of wood-based panels, including:</p> <p>Flame Retardant Panels, CPD compliant, with full system 1 attestation to BS EN 13986. Declarations of Conformity available for Euroclass B & C FR Processed Plywood, MDF and Chipboard.</p> <p>Stock-holding depots located Nationwide all FSC & PEFC chain of custody certified, with guaranteed Next-Day delivery for all Ex Stock orders placed by 5:00pm to almost anywhere in mainland UK.</p> <p><i>Products also include:</i></p> <ul style="list-style-type: none"> • Structural Plywood & Chipboard • Raw and veneered MDF • Fire Resistant Door Blanks • Fire Resistant Architectural Bespoke Doors • Cutting, bonding and edging of panels to order.
<p>Timbmet Kemp House Chawley Park Cumnor Hill Oxford OX2 9PH Tel: 01865 862223 Fax: 01865 860348 Email: oxfsales@timbmet.com Website: www.timbmet.com</p>	<p>Distributor of hardwoods, panel products and other added-value timber products. The company operates sites throughout the UK, and is committed to sustainability through the provision of responsible timber solutions with full Chain of Custody certification.</p> <p>Range includes hardwoods, clear softwoods, panel products, machined timbers, engineered solutions, flooring and doors.</p> <p>Timbmet Ltd supplies an extensive range of panel products including fire resistant and fire retardant materials.</p> <p>Flame Retardant Boards</p> <ul style="list-style-type: none"> • Chipboard FR Euroclass B • Plywood Euroclass B & C • Melamine Faced Chipboard FR Euroclass B • MDF Euroclass B & C <p>Fire Resistant Door Blanks</p> <ul style="list-style-type: none"> • Lightweight block core • Egger Eurospan FD30 • Halspan Prima & Optima • Blankfort Plus FD30 & FD60 <p>Fire Resistant Doors</p> <ul style="list-style-type: none"> • Viscount Plus FD30 & FD60 – a range of fully finished internal veneered fire doors with 10 year guarantee

WPA Flame Retardant Approval Scheme Certificate of Approval

APPROVED PRODUCT: **DRICON®**

Arch Timber Protection, Wheldon Road, Castleford, West Yorkshire, WF10 2JT

Tel: 01977 714000 Email: timberprotectionadvice.ukca@lonza.com

This approval covers the following characteristics of DRICON and DRICON-treated wood and wood-based board materials for which evidence was presented to the panel:

Formulation Type: WPA Type INT2 (see [Section 3](#) for suitable uses)

Application Method: Vacuum pressure impregnation with kiln drying of treated wood and wood-based board materials.

DRICON is approved for the treatment of the following materials to achieve Euroclass C*

MATERIAL	THICKNESS(ES)
American White Oak	18mm and thicker
Ash	18mm and thicker
Birch Plywood	4mm and thicker
Douglas Fir	18mm and thicker
European Oak	18mm and thicker
Far Eastern Plywood	3.6mm and thicker
Hardboard	3.0-3.2mm and thicker
Larch	18mm and thicker
Opepe	21mm and thicker
Pine	12mm and thicker
Spruce	12mm and thicker
Spruce Plywood	12mm and thicker
Thermally modified spruce	18mm and thicker
Western Red Cedar	17mm and thicker

*Contact the manufacturer for further details if the material or thickness is not included in the table

DRICON is approved for the treatment of the following materials to achieve Euroclass B*

MATERIAL	THICKNESS(ES)
American White Oak	18mm and thicker
Ash	18mm and thicker
Birch Plywood	12mm and thicker
Douglas Fir	18mm and thicker
European Oak	18mm and thicker
Far Eastern Plywood	9mm and thicker
Larch	18mm and thicker
Opepe	21mm and thicker
Pine	12mm and thicker
Spruce	12mm and thicker
Spruce Plywood	12mm and thicker
Thermally modified spruce	18mm and thicker
Western Red Cedar	17mm and thicker

*Contact the manufacturer for further details if the material or thickness is not included in the table

DRICON is approved for the treatment of the following materials to achieve BS476 Part 7 Class 1 Surface Spread of Flame*

MATERIAL	THICKNESS(ES)
Birch Plywood	12mm
Birch Combi Plywood	12mm
Far Eastern Plywood	12mm and 18mm

*Contact the manufacturer for further details if the material or thickness is not included in the table



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FIRE RETARDANT TREATED TIMBER
AND PANEL PRODUCTS

WPA Flame Retardant Approval Scheme Certificate of Approval

DRICON-treated wood and wood-based board materials have the following characteristics:

Hygroscopicity	Type INT2 humidity classification confirmed in accordance with Pr EN15912.
Leach resistance under a maintained coating	Type EXT leach resistance under a coating classification confirmed in accordance with Pr EN15912.
Durability in service	WPA Type INT2-treated wood maintained fire performance after 21 years in test (TRADA long-term programme started 1986).
Metal fixings and fastenings	Corrosion of metals in contact with DRICON-treated wood products is no greater than with untreated wood products.
Strength of treated timber	No significant change from untreated for structural calculations.
Smoke emission	Acceptable in restricted means of escape areas (French Railway Carriages F1).
Smoke toxicity	No additional toxicity compared with untreated (Boeing BSS 72339).
Other approvals (full details available from the WPA or the approval holder).	Agrément Certificate 87/1841 (British Board of Agrément) Underwriters Laboratories Inc (USA)



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**FIRE RETARDANT TREATED TIMBER
AND PANEL PRODUCTS**

WPA Flame Retardant Approval Scheme Certificate of Approval

APPROVED PRODUCT: **Koppers FirePRO**

Koppers Performance Chemicals UK, Fieldhouse Lane, Marlow SL7 1LS
Tel: 01628 486644 Fax: 01628 476757 Email: kpc@koppers.eu

This approval covers the following characteristics of Koppers FirePRO and Koppers FirePRO-treated wood and wood-based board materials for which evidence was presented to the independent product approval panel:

Formulation Type:	WPA Type INT2 (see Section 3 for suitable uses)
Application Method:	Vacuum pressure impregnation with air or kiln drying of treated wood and wood-based board panels

Koppers FirePRO is approved for the treatment of the following materials to achieve Euroclass C*

MATERIAL	THICKNESS(ES)
Softwood plywood**	9mm and thicker
Far Eastern plywood	12mm and thicker
Birch plywood	12mm
Spruce	38mm

* Contact the manufacturer for further details if the materials or thickness is not included in the table
** Specifiers and users wishing to use plywood manufactured from softwood must check with Koppers that the test data supporting this entry is relevant to the species used for that plywood.

Koppers FirePRO is approved for the treatment of the following materials to achieve Euroclass B*

MATERIAL	THICKNESS(ES)
Western red cedar†	17mm and thicker
Softwood plywood**	12mm and thicker
Far eastern plywood	5.5mm and thicker
Birch plywood	25mm

* Contact the manufacturer for further details if the materials or thickness is not included in the table
† Specifiers and users of other softwoods should contact Koppers for advice on treatment.
** Specifiers and users wishing to use plywood manufactured from softwood must check with Koppers that the test data supporting this entry is relevant to the species used for that plywood

Koppers FirePRO-treated materials have the following characteristics:

Hygroscopicity	Type INT2 humidity classification confirmed in accordance with ASTM D3201.94.
Durability in service	WPA Type INT2-treated wood maintained fire performance after 21 years in test (TRADA long-term programme started 1986). The chemicals in Koppers FirePRO indicate at least this level of durability in INT2 service conditions.
Metal fixings and fastenings	Metals suitable for use with untreated wood and wood-based materials may be used with FirePRO-treated material when used in the same in-service conditions.
Strength of treated timber	No significant change from untreated for structural calculations.
Smoke emission	Acceptable on UK railways.
Smoke toxicity	Acceptable on UK railways.
Preservative performance	Retentions required to achieve both Euroclass B and C exceed the minimum required to conform with BS 8417:2011, Table 5 Use Classes 1, 2 and 3c 60 year service life. Koppers FirePro is authorised for use as a wood preservative in the UK (HSE CoE 428AP).



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WPA Flame Retardant Quality Scheme Certificate of Approval

APPROVED PRODUCT: Koppers Exterior Fire-X

Koppers Performance Chemicals, Fieldhouse Lane, Marlow SL7 1LS

Tel: 01628 486644 Fax: 01628 476757 Email: kpc@koppers.eu

This approval covers the following characteristics of Koppers Exterior Fire-X and Koppers Exterior Fire-X-treated wood and wood-based board materials for which evidence was presented to the independent product approval panel:

Product Type:	WPA Type EXT (see Section 3 for suitable uses)
Application Method:	Vacuum pressure impregnation with kiln drying of treated wood and wood-based board materials

Koppers Exterior Fire-X is approved for the treatment of the following materials to achieve Euroclass B*

MATERIAL	THICKNESS(ES)
Softwood**	18mm and thicker
Douglas fir	18mm and thicker
Spruce	18mm and thicker
Larch	18mm and thicker
TM Frake	18mm and thicker
Sweet chestnut	22mm and thicker
Oak	22mm and thicker

* Contact the manufacturer for further details if the materials or thickness is not included in the table

** Specifiers and users must check with Koppers that the test data supporting this entry is relevant to the species used.

Koppers Exterior Fire-X is approved for the treatment of the following materials to achieve Euroclass BROOF (t4)

MATERIAL	THICKNESS(ES)
Western red cedar shingles	10mm and thicker

Exterior Fire-X-treated wood and wood-based board materials have the following approved characteristics:

Hygroscopicity	Type INT2 classification confirmed in accordance with WPA criteria. Maximum loading for INT2 classification: 73 kg/m ³ .
Durability	Meets the performance requirements of the WPA Flame Retardant Specification Manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products for classification as EXT after accelerated weathering. Maximum loading for EXT classification: 59 kg/m ³ .
Strength of treated wood	Design value adjustments are recommended for timber treated with Koppers Fire-X in some situations. Contact Koppers Performance Chemicals for advice on design value adjustments.
Smoke emission	Not relevant in the UK for exterior use. Classified typically as smoke classification S1 or S2 according to EN13501.



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WPA Flame Retardant Approval Scheme Certificate of Approval

APPROVED PRODUCT: **NON-Com Exterior** Date of certificate: **13 August 2012**

Arch Timber Protection, Wheldon Road, Castleford, West Yorkshire, WF10 2JT

Tel: 01977 714000 Fax: 01977 714001 Email: timberprotectionadvice.ukca@lonza.com

This approval covers the following characteristics of NON-COM Exterior treated wood and wood-based board materials for which evidence was presented to the independent product approval panel:

Formulation Type: WPA Type EXT (see [Section 3](#) for suitable uses)

Application Method: Vacuum pressure impregnation with kiln drying of treated wood and wood-based board materials.

NON-COM Exterior is approved for the treatment of the following materials used with or without an air gap to achieve Euroclass C

MATERIAL*	THICKNESS(ES)
Larch	18 (18/9) ¹ mm and thicker
Spruce	12mm and thicker
Western Red Cedar	12mm and thicker
Thermally modified timber	19mm and thicker
Cumaru	20mm and thicker
Iroko	18mm and thicker
European oak	18mm and thicker
Ipe	19mm and thicker
Douglas Fir	18mm and thicker

NON-COM Exterior is approved for the treatment of the following materials used with or without an air gap to achieve Euroclass B

MATERIAL*	THICKNESS(ES)
Larch	18 (18/9) ¹ mm and thicker
Spruce	12mm and thicker
Western Red Cedar	12mm and thicker
Thermally modified timber	19mm and thicker
Cumaru	20mm and thicker
Iroko	18mm and thicker
European oak	18mm and thicker
Ipe	19mm and thicker
Douglas Fir	18mm and thicker

NON-COM Exterior-treated wood and wood-based board materials have the following characteristics:

Hygroscopicity	Type INT2 humidity classification confirmed in accordance with WPA criteria.
Durability	Meets the requirements of TS 15912 for EXT grade flame retardant treatment after accelerated weathering.
Metal fixings and fastenings	Corrosion of metals in contact with NON-COM Exterior treated wood products is no greater than with untreated wood products when used in the same service conditions.
Strength of treated timber	No significant change from untreated for structural calculations.
Smoke emission	Not relevant in the UK for exterior use. Classified typically as smoke classification S1 or S2 according to EN13501.
Smoke toxicity	Not relevant for exterior use.
Other approvals	(full details available from the WPA or the approval holder) Accepted as a treatment for exterior timber cladding in situations adjacent to boundaries or above 18m.
Preservative performance	NON-COM Exterior confers enhanced biological durability by chemical modification. It is anticipated NON-Com Exterior treated timber will achieve a 30 year desired service life in use class 3 as defined in EN 335-1. Chemical modification processes are understood to be outside of the scope of the Control of Pesticides and Biocidal Products Regulations.



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FIRE RETARDANT
TREATED TIMBER

NOTES:

¹Values correspond to t_1/t_2 where t_1 is the total thickness of cladding and t_2 is the minimum exposed thickness of cladding, as defined in BS EN 14915: 2006.

* Specifiers and users should contact the manufacturer for further details if the particular materials or thickness they wish to use is not included in these tables.

4. Methods of applying flame retardants

4.1 Vacuum Pressure Treatments

4.1.1 Condition of wood and wood-based panels for treatment

- (a) Surface characteristics: the surface of the material shall be free from mud, dirt, dust, paint, polish and other surface finish; and in the case of timber, bark.
- (b) Freedom from active decay or insect attack: material shall be free from all signs of active attack by wood destroying fungi and insects. Material showing signs of attack by sap stain fungi or pinhole borer shall be acceptable subject to agreement between the treater and customer.
- (c) Moisture content; the average moisture content shall not exceed
 - 28% for large cross sectional timber
 - 22% for timber boarding
 - 15% for board material

when determined in accordance with the method given in 8.3.

Material should only be treated above this moisture content at the customer's request and where test work has shown that a satisfactory level of treatment can be obtained to achieve the required performance level.

NOTE:

1. *If material is frozen, the penetration of the flame retardant will be limited. Care should be taken not to treat material in this condition.*
2. *Final moisture content after treatment and redrying should be as close to the in-service moisture content as possible so as to avoid undue swelling or shrinkage of the material.*
3. Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.

4.1.2 Details of treatment

As far as practicable, materials for which different treatment schedules are appropriate (due to species, dimensions or end use) should not be treated in the same charge, unless the most intense schedule required can be applied without detriment to those materials requiring lesser schedules.

The materials shall be stacked in the treatment vessel to ensure that the flame retardant solution shall have free access to all faces of the material and to facilitate natural drainage.

Flame retardant formulations are generally applied at ambient temperatures. Where variations exist these shall be detailed in the treatment plant's Operating Manual.

The precise schedules used for flame retardant impregnation treatments vary from processor to processor and should be contained in each treatment plant's Operating Manual. All will be tailored to produce material processed to meet the fire test performance specified.

Where preservation is claimed in addition to fire retardancy it should be noted that penetration requirements can be different and the severity of the schedule should be geared to the higher of the two requirements.

4.1.3 Health and Safety

Persons applying flame retardants shall observe the safety precautions laid down by the manufacturer with regard to personal safety measures (e.g. protective clothing) and general safety precautions (e.g. fire risk, disposal of flame retardant, disposal of treated wood waste, handling of treated material, safety of treatment vessels etc.). [See Section 7.](#)

Where flame retardant treatments claim preservative properties then compliance with UK Control of Pesticide Regulations or the Biocidal Products Regulation (EU No 528/2012), as appropriate is required and approval for use by the HSE must be obtained prior to making claims.



Primary School, Swansea

Cedar shingle external facade.

FR Specification: WPA Type EXT (Leach Resistant), WPA Commodity code: F5.

Photo courtesy: John Brash & Co.

4.2 Manufactured wood-based panels

Wood-based panels products of MDF, particleboard, flaxboard and OSB (if available) normally incorporate FR chemicals as an integral part of manufacture where fire protection is required.

4.3 Surface-applied products

Products for surface application depend on correct application rates and/or film thicknesses being achieved.

For low viscosity liquids this can only be reliably achieved by application under controlled factory conditions, typically with components treated in the horizontal position to facilitate the required application rate of the liquid.

When such products are applied by brush or spray on site, fire performance can only be assured when application is under an independent certification and accreditation scheme for installers.

5. Characteristics of treated materials

5.1 Standard of treatment

Flame retardant treatments are usually specified in terms of the performance of the treated product in a European or British Standard test,

In the case of European standards, the Notified Body will stipulate the processing parameters in terms of a factory production control system and undertake continuous surveillance. In the case of British standards, no processing, loading, penetration or solution strength requirements are prescribed and it is the responsibility of the flame retardant manufacturer/processor to ensure that the processing necessary for a particular material to achieve the required test performance is applied.

The most usual levels of performance required of impregnation flame retardant treated wood and wood-based panels are:

- Euroclass B
- Euroclass C
- Class 1 surface spread of flame to BS 476: Part 7
- Class 'O' defined in terms of BS 476: Parts 6 and 7

Other levels of performance, usually defined in terms of BS 476 Parts 3, 6 and/or 7, may be encountered occasionally.

5.2 Wood species

Most timber species listed in BS EN 350-2 as having sapwood in treatability classes 1, 2 and 3, can generally be treated to Euroclass C or Class 1.

The list of materials that can be upgraded to comply with Euroclass B and Class 'O' is limited, generally to those species listed in BS EN 350-2 as having sapwood in treatability classes 1 or 2 but can include some species in treatability class 3 and certain panel products.

It should be noted, however, that some species can be prone to cupping, warping, twisting and bowing, colour degradation etc. as a consequence of treatment and the supplier of the flame retardant treatment service should be consulted.

5.3 Fabrication after treatment

As far as possible, all cutting, machining, etc. should be undertaken before treatment. Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.



Hoylake Lifeboat Station

Internal roof timber cladding

FR Specification: WPA Type INT2

Photo courtesy: Arch Timber Protection

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

5.4 Post-treatment drying

All impregnation-type flame retardant treatments are water borne and most treated material is for interior application. It follows that it is often necessary to reduce the moisture content of the treated timber or board product after treatment, to approximately that which it will achieve in service. These levels are specified in BS 5268: Part 2, BS 1186: Part 1, various commodity specifications and in numerous guidance documents. Drying may be achieved by simple exposure to warm, dry interior conditions, low-temperature dehumidifier driers or conventional kilns. If it is desired to use moisture meters of the electrical resistance type to monitor the drying process precautions should be taken to ensure that the readings are reliable. Not only does the wood temperature affect the response of this type of meter but also readings may be inaccurate due to the presence of dissociated salts, particularly Type INT1 formulations. Where appropriate, specific guidance should be sought from the treatment manufacturer and/or meter manufacturer. General guidance for kiln operators on the special precautions to be taken when drying treated material is given in the BRE Timber Drying Manual. Particularly with plywood, it should be remembered that flame retardant processing will have relieved some of the stresses pressed into the boards and that restraint to hold the boards flat whilst they are being dried will often be necessary with thicker boards.

Failure to dry to appropriate levels before treated materials are put into interior service will result in shrinkage, possible distortion and additionally, may give rise to problems with gluing, finishing and corrosion of metals. It is also axiomatic that dried materials should be stored under appropriately dry conditions before installation.

5.5 Effect of flame retardant treatment on mechanical and physical properties

- (i) A weight increase of up to approximately 20% can result from the incorporation of the treatment chemicals.
- (ii) Dimensions of solid timber and plywood should remain essentially unchanged after treatment and redrying.
- (iii) MDF, particleboard, flaxboard and OSB are not suitable for impregnation processes, as the physical properties of the manufactured product are greatly reduced by such processing.
- (iv) The water-borne nature of the treatment will often result in raised grain or surface roughening, which may necessitate a sanding treatment after drying.
- (v) Treated products are generally more abrasive to saw blades and cutters than their untreated counterparts.
- (vi) The effect on hygroscopicity and equilibrium moisture content of the treatment varies considerably with the type. Type INT1 formulations may render the treated material hygroscopic at relative humidities above about 75% and at higher humidities may result in equilibrium moisture content above the fibre saturation point. Other types have little effect and the response of the treated material is broadly comparable with that of the untreated material.
- (vii) When using resistance type moisture meters caution should be exercised as the chemicals used for treatment may affect the electrical conductivity of the wood and give erroneous readings. Consult the flame retardant product manufacturer for advice.
- (viii) Type INT1 formulations can reduce the strength of treated timber significantly; the effect is greatest on impact strength, least on modulus of elasticity in bending. Effects are generally small for material air dried at 25 deg. C. or less after treatment and get progressively greater with higher drying temperatures.
- (ix) Treatment may affect wood colour. Type EXT treatment will often give a darker appearance, due to high temperature of the curing phase and additionally, may induce resin exudation. Check with the formulation manufacturer if post-treatment colour is important.



Kielder Observatory, Northumberland

Douglas Fir – exterior support
Whitewood – frame carcassing
Siberian Larch – cladding
Plywood – interior boarding

All components treated with a flame retardant: WPA Type EXT or INT2 as appropriate.

Photo courtesy: Charles Barclay Architects

- (x) Where a wood preserving effect is claimed, the product must be approved under the Control of Pesticides Regulations 1986 or authorised under the Biocidal Product Regulation.

5.6 Effect of flame retardant treatment on compatibility

- (i) Compatibility of flame retardant treated materials (FRTM) with adhesives, sealants/mastics, surface coatings and metal fittings and fixings should be checked with the FRTM supplier. If an approved flame retardant treatment is being used some information is provided in individual approval certificates in [Section 3.](#)
- (ii) If a separate wood preservative treatment is to be given in addition to the flame retardant treatment, the compatibility of the systems must be checked with the manufacturers. Assuming that this is feasible then the preservative treatment should be done first and appropriate interval for fixation/drying/solvent loss allowed before treatment with the flame retardant. In some cases, in particular in respect of product standards, such treatments may invalidate the fire classification.

5.7 Service life

Type EXT treatments are suitable for uses conforming to BS EN 1995 Service Class 3 (fully exterior) situations, although there will be some reduction in performance on prolonged weathering. Experience in service with the Type EXT product listed in this manual indicates a service life in excess of 20 years.

Type INT2 treatments are suitable for uses conforming to BS EN 1995 Service Class 2 situations (where high humidity or intermittent condensation may be a problem), but are not appropriate for fully-exposed uses unless protected by a suitable maintained coating*. Tests conducted by the Wood Protection Association with Type INT2 products indicate a service life in excess of 60 years.

Type INT1 treatments should be restricted to interior uses conforming to BS EN 1995 Service Class 1. In such circumstances a service life in excess of 60 years can be expected.

5.8 Care of treated timber

All treated material should be identified as to type (i.e. INT1, INT2 or EXT), rated performance and process batch. Such identification should remain with the material at least until installation, in order that compliance with building control requirements can be demonstrated.

Harmonised product standards provide CE marking details to demonstrate compliance with the Construction Products Regulation.

The normal precautions with regard to handling, transport and site storage of dried timber and wood-based sheet materials should be followed, together with additional safeguards to prevent moisture absorption by Type INT1 treated materials. These last will absorb moisture readily from humid storage or site conditions, negating the effect of post-treatment drying. Storage must be undertaken in dry conditions and installation delayed until the structure is weatherproofed and the relative humidity maintained below 75%.

5.9 Safety

Treated materials present no additional hazard if handled in accordance with normal good practice for timber and wood-based materials. Normal personal hygiene should be observed after handling treated products. Precautions should be taken to avoid the inhalation of dust during factory or on-site cutting and fixing. Residues from such operations should be disposed of in a manner similar to that specified for residues of preservative-treated timber. ([See Section 7.1.3](#))



Welsh Assembly, Cardiff

Cedar clad interior

FR Specification: WPA Type INT2

Photo courtesy: Arch Timber Protection

*NOTE: COATINGS

Protective coatings (which must not affect the reaction to fire classification of the materials) applied over treatments of types INT1 and INT2 may extend their application into situations with a greater moisture hazard but should not be relied upon for long-term protection, unless anticipatory maintenance can be guaranteed for the anticipated service life of the building.

6. Commodity specifications

Many wood and wood-based materials can have their performance in fire situations improved by the controlled impregnation of flame retardant chemicals applied by vacuum/pressure methods as described in [Section 5](#) of this Manual.

Due to variations found in wood-based materials, particularly panel products, caution should be exercised in the selection of appropriate materials for processing. Thus attention should be given to parameters and properties such as adhesives, dimensional stability, wood species, brand names for fibreboards and particleboards, country of origin and veneer configuration for plywoods, etc.

The selection of plywood for treatment should take due account of the quality of the adhesive bond, the quality of the veneers in the core and the biological durability of the particular timber species used.

Bonding Quality is defined by BS EN 314-2 and gives rise to three bond classes, in harmony with the use classes defined in BS EN 335-1, namely:

- Bond class I:** For use in dry interior areas
- Bond class II:** For use in humid areas or in occasional exposure to wetting
- Bond class III:** For use in unprotected exterior conditions or areas exposed to frequent wetting.

The quality of the core veneers (i.e. the incidence of open defects) can influence, when tested to BS EN 314, the test results for bond classes, for example, causing a bond chemically capable of achieving a bond class III to be downgraded to bond class II.

BS EN 636, Plywood Specifications, takes into consideration the bond class achieved to BS EN 314-2 and the biological durability of the wood giving a specification class also in harmony with the BS EN 335-1 use classes, namely:

- Class I:** For use in dry interior areas
- Class II:** For use in humid areas or in occasional exposure to wetting
- Class III:** For use in unprotected exterior conditions or areas exposed to frequent wetting.

Consideration should then be taken of the nature of the FR treatment process during which significant stress could be applied to the bond, and in respect to which, a higher bond quality might be required to survive the treatment process than might otherwise have been required to satisfy the normal conditions of service.

In the commodity specifications that follow, reference will be made to these standards in specifying minimum requirements of plywood selected for treatment.

For the particular combination of structure design, wood species/thickness or panel type/thickness to be used in a structure, flame retardant performance requirement and intended service environment, specifiers/users should either for approved formulations check the approved characteristics (see Certificate of Approval) or, for listed formulations, seek confirmation from the treater or supplier that appropriate classification reports exist. The checklist ([Section 1.2](#)) provides a detailed guide to the information that a specifier should seek before selecting a particular formulation.



Culloden Battlefield Visitor Centre

Internal and external Scottish Larch and Oak cladding

FR Specification: WPA Type EXT and INT2

Photo courtesy: National Trust for Scotland

For FR processed wood-based panels (BS EN13986), solid wood panelling and cladding (BS EN14915), structural laminated veneer lumber (BS EN 14374) and wood flooring (BS EN 14342) to be used in permanent construction, the Construction Products Regulation (EU No 305/2011) imposes the highest level of Assessment and Verification of Constancy of Performance. For such products to be CE marked in accordance with these standards, they must be treated to Euroclasses B or C, as classified in accordance with BS EN 13501-1. Specifiers should insist upon a Declaration of Performance, which will specify the unique reference number allocated to the product, the notified body that carried out the tests and the limitations regarding use. The Declaration may also show the CE mark, which the product would be entitled to carry. CPR compliant FR products CANNOT by definition be supplied without the intervention of a Notified Body.

For other end uses or where CE marking is not a requirement, fire test certificates may be all that is required, either reaction to fire Euroclass B and C (to BS EN 13501-1) or classes 0 and 1 (to BS 476-6&7).

Using a Wood Protection Association member company will generally provide assurance that the necessary test evidence and certification exist.

6.1 FR1 – Flame retardant treatment of wood and wood-based panels for non load-bearing interior use (BS EN 1995 Service Class 1)

6.1.1 Scope

This specification gives recommendations for the types of materials and flame retardants that can be used for example in lining materials, shopfitting, exhibitions, transport, etc. where humidity is not a consideration.

The specifier can specify in accordance with European fire test methods or BS 476 provided these comply with Building Regulations Approved Document B where applicable.

For panel products for constructional end uses, the specifier must specify in accordance with BS EN13986 if CE marking is a requirement.

For solid wood panelling and cladding products for constructional end uses, the specifier must specify in accordance with BS EN14915 if CE marking is a requirement.

6.1.2 Hazards

Materials used in such situations generally require a Euroclass C or Class 1 surface spread of flame to BS 476: Part 7. In high risk areas they may need to comply with Euroclass B or Class 'O' as defined in Building Regulations.

Treatment types INT1, INT2 and EXT ([Sections 2, 3](#)) can be used.

6.1.3 Before and after treatment

The material before treatment should be in a suitable condition as recommended in [Section 4](#).

The quality of joinery timber should be in accordance with BS EN 942.

Care should be taken to exclude material infected with incipient decay, particularly in the case of western hemlock.

Plywood for FR1 must meet the following minimum requirements:

- BS EN 314-2, Bond class III
- BS EN 636, Class II

For other panel products, the manufacturer should be consulted due to the potential of swelling and the loss of physical characteristics.

Where European product standards exist, the untreated plywood or board products must meet the requirements of the standard if the material is to be CE marked.

Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.



Saville Building Visitor Centre, Windsor

Birch plywood flowing roof structure

FR Specification: WPA Type INT2
(humidity resistant)

Photo courtesy: Arch Timber Protection
and Glen Howell Architects

WPA COMMODITY SPECIFICATION

FR1

Flame retardant treatment of wood and wood-based panels for non load-bearing interior use:

- wall linings,
- shopfitting,
- exhibitions,
- transport.

Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

Impregnation with water-containing flame retardants increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood (see section 5.3). Drying is usually accelerated by kiln drying.

6.1.4 Flame retardant treatments and methods of application

Types INT1, INT2 and EXT (Sections 2, 3)

Application can be by double vacuum, full cell or empty cell to suit the permeability of the materials.

6.1.5 Model specification phrase

WPA FR1 commodity specification: [insert material/species] to be treated to [insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7] using a WPA Type [insert INT1; or INT2; or EXT] formulation* listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

** Where specifiers wish to specify use of a particular named flame retardant product, and/or to require that treatment be carried out in accordance with the WPA Benchmark Quality Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Quality Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Quality Scheme' should be added to the specification.*

6.2 FR2 – Flame retardant treatment of wood and wood-based panels for load-bearing interior use (BS EN 1995 Service Class 1)

6.2.1 Scope

This specification gives recommendations for the type of materials and flame retardants that can be used for roofing members, support columns, flooring where humidity is not a consideration.

The specifier can specify in accordance with European fire test methods or BS 476 provided this complies with Building Regulations Approved Document B where applicable.

For panel products for constructional end uses, the specifier must specify in accordance with BS EN13986 if CE marking is a requirement.

For solid wood panelling and cladding products for constructional end uses, the specifier must specify in accordance with BS EN 14915 if CE marking is a requirement.

6.2.2 Hazards

Materials used in such situations generally require a Euroclass C or Class 1 surface spread of flame to BS 476: Part 7. In high risk areas they may need to comply with Euroclass B or Class 'O' as defined in Building Regulations.

Treatment types INT1, INT2 and EXT (Section 2) can be used. This is a load-bearing specification so specifiers should check with product suppliers for information on wood strength after flame retardant treatment. (see also BRE Report No. IP24/79).

Other than plywoods, caution should be exercised with any other type of panel product used for flooring as swelling and loss of integrity are almost certain to occur when using water borne treatments.

6.2.3 Before and after treatment

The material before treatment should be in a suitable condition as recommended in Section 4.



Linden Homes development

Larch external cladding pressure impregnated with leach resistant FR and compatible wood stain vacuum applied

Photo courtesy: Arch Timber Protection

WPA COMMODITY SPECIFICATION

FR2

Flame retardant treatment of wood and wood-based panels for load-bearing interior use:

- roofing membranes,
- support structures,
- support columns,
- flooring, where humidity is not a consideration.

The quality of joinery timber should be in accordance with BS EN 942.

Care should be taken to exclude material infected with incipient decay, particularly in the case of western hemlock.

Plywood for FR1 must meet the following minimum requirements:

BS EN 314-2, Bond class III

BS EN 636, Class II

Where European product standards exist, the untreated plywood or board products must meet the requirements of the standard if the material is to be CE marked.

Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.

Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

Impregnation with water-containing flame retardants increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood ([see section 5.3](#)). Drying is usually accelerated by kiln drying.

6.2.4 Flame retardant treatments and methods of application

Types INT1, INT2 and EXT ([Sections 2, 3](#)).

Application can be by double vacuum, full cell or empty cell to suit the permeability of the materials.

6.2.5 Model specification phrase

WPA FR2 commodity specification: [insert material/species] to be treated to [insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7] using a WPA Type [insert INT1; or INT2; or EXT] formulation* listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

** Where specifiers wish to specify use of a particular named flame retardant product, and/or to require that treatment be carried out in accordance with the WPA Benchmark Quality Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Quality Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Quality Scheme' should be added to the specification.*

6.3 FR3 – Flame retardant treatment of wood and wood-based panels for interior use (BS EN 1995 Service Class 2)

6.3.1 Scope

This specification gives recommendations for the type of materials and flame retardants that can be used for all interior purposes where humidities above 75% are likely to be encountered, e.g. swimming pools, leisure centres, agricultural buildings.

The specifier can specify in accordance with European fire test methods or BS 476 provided this complies with Building Regulations Approved Document B where applicable.

For panel products for constructional end uses, the specifier must specify in accordance with BS EN 13986 if CE marking is a requirement.

For solid wood panelling and cladding products for constructional end uses, the specifier must specify in accordance with BS EN 14915 if CE marking is a requirement.

WPA COMMODITY SPECIFICATION

FR3

Flame retardant treatment of wood and wood-based panels for interior use:

- swimming pools,
- leisure centres,
- agricultural buildings.

6.3.2 Hazards

Materials used in such situations generally require a Euroclass C or class 1 surface spread of flame to BS 476: Part 7. In high risk areas they may need to comply with Euroclass B or class 0 as defined in Building Regulations.

As relative humidity increases, Type INT1 treatments ([Section 2](#)) absorb excess moisture from the atmosphere. This can result in the materials reaching higher moisture content levels than untreated wood with migration of salts occurring. Excess moisture can also lead to corrosion of metal fastenings, strength losses, adverse effects on finishes and decay.

Only treatment types INT2 and EXT ([Sections 2, 3](#)) are recommended for these situations.

6.3.3 Before and after treatment

The material before treatment should be in a suitable condition as recommended in [Section 4](#).

The quality of joinery timber should be in accordance with BS EN 942.

Care should be taken to exclude material infected with incipient decay, particularly in the case of western hemlock.

Plywood for FR1 must meet the following minimum requirements:

- BS EN 314-2, Bond class III
- BS EN 636, Class II

Where European product standards exist, the untreated plywood or board products must meet the requirements of the standard if the material is to be CE marked.

Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.

Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

Impregnation with water-containing flame retardants increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood ([see section 5.3](#)).

6.3.4 Flame retardant treatments and methods of application

Types INT2 and EXT ([Sections 2, 3](#)).

Application can be by double vacuum, full cell or empty cell to suit the permeability of the materials.

6.3.5 Model specification phrase

WPA FR3 commodity specification: [insert material/species] to be treated to [insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7] using a WPA Type [insert INT2; or EXT] formulation* listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

** Where specifiers wish to specify use of a particular named flame retardant product, and/or to require that treatment be carried out in accordance with the WPA Benchmark Quality Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Quality Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Quality Scheme' should be added to the specification.*

FR4

Flame retardant treatment of wood and wood-based panels for weather-protected exterior use:

- covered walkways,
- protected overhangs,
- exterior cladding with weather resistant coating.

6.4 FR4 – Flame retardant treatment of wood and wood-based panels for weather-protected exterior use (BS EN 1995 Service Class 2)

6.4.1 Scope

This specification gives recommendations for the types of materials and flame retardants that can be used in weather protected exterior situations, e.g. covered walkways, protected overhangs and exterior timbers with a weather resistant maintained coating (see 5.6 for conditions for use of coatings).

The specifier can specify in accordance with BS 476 or European fire test methods provided this complies with Building Regulations Approved Document B where applicable.

For panel products for constructional end uses, the specifier must specify in accordance with BS EN 13986 if CE marking is a requirement.

For solid wood panelling and cladding products for constructional end uses, the specifier must specify in accordance with BS EN 14915 if CE marking is a requirement.

6.4.2 Hazards

Materials used in such situations generally require a Euroclass C or class 1 surface spread of flame to BS 476: Part 7. In high risk areas they may need to comply with Euroclass B or class 'O' as defined in Building Regulations.

Provided protection from direct rainfall is afforded, either by means of an overhang, or as a ceiling on a walkway, or by a weather resistant maintained coating (5.6), then the hazard situation is as for interior situations at high humidities ([section 6.3](#)).

As relative humidity increases Type INT1 treatments ([Section 2](#)) absorb excess moisture from the atmosphere. This can result in the materials reaching higher moisture content levels than untreated wood with migration of salts occurring. Excess moisture can also lead to corrosion of metal fastenings, strength losses, adverse effects on finishes and decay.

Only treatment types INT2 and EXT ([Sections 2, 3](#)) are recommended for these situations.

6.4.3 Before and after treatment

The material before treatment should be in a suitable condition as recommended in [Section 4](#).

The quality of joinery timber should be in accordance with BS EN 942.

Care should be taken to exclude material infected with incipient decay, particularly in the case of western hemlock.

Plywood for FR1 must meet the following minimum requirements:

- BS EN 314-2, Bond class III
- BS EN 636, Class II

Where European product standards exist, the untreated plywood or board products must meet the requirements of the standard if the material is to be CE marked.

Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.

Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

Impregnation with water-containing flame retardants increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood ([see section 5.3](#)). Drying is usually accelerated by kiln drying.

6.4.4 Flame retardant treatments and methods application

Types INT2 and EXT ([Sections 2, 3](#))

Application can be by double vacuum, full cell or empty cell to suit the permeability of the materials.

6.4.5 Model specification phrase

WPA FR4 commodity specification: [insert material/species] to be treated to [insert required fire performance class from this list: Euroclass B; or Euroclass C; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7] using a WPA Type [insert INT2; or EXT] formulation* listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

** Where specifiers wish to specify use of a particular named flame retardant product, and/or to require that treatment be carried out in accordance with the WPA Benchmark Quality Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Quality Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Quality Scheme' should be added to the specification.*

6.5 FR5 – Flame retardant treatment of wood and wood-based panels and cedar shakes and shingles exposed to the weather (BS EN 1995 Service Class 3)

6.5.1 Scope

This specification gives recommendations for the types of materials and flame retardants that can be used in weather exposed situations, e.g. cedar shakes and shingles, unprotected playground equipment and other exposed timbers.

The specifier can specify in accordance with European or BS 476 fire test methods provided this complies with Building Regulations Approved Document B where applicable.

For panel products for constructional end uses, the specifier must specify in accordance with BS EN 13986 if CE marking is a requirement.

For solid wood panelling and cladding products for constructional end uses, the specifier must specify in accordance with BS EN14915 if CE marking is a requirement.

6.5.2 Hazards

Materials used in such situations generally require a Euroclass C or class 1 surface spread of flame to BS 476: Part 7. In high-risk areas they may need to comply with Euroclass B or class 0 as defined in Building Regulations.

For cedar shakes and shingles an AA rating to BS 476: Part 3 is required.

For unprotected timbers exposed to direct rainfall the risk is one of chemicals being resolubilised and washed out of the materials.

Only Type EXT and INT2 (with a suitable maintained coating) ([Sections 2, 3](#)) offer long-term resistance to leaching in these situations.

6.5.3 Before and after treatment

The material before treatment should be in a suitable condition as recommended in [Section 4](#).

The quality of joinery timber should be in accordance with BS EN 942.

Care should be taken to exclude material infected with incipient decay, particularly in the case of western hemlock.

Plywood for selection must meet the following minimum requirements:

BS EN 314-2, Bond class III

BS EN 636, Class III

However, BS EN636, Specification class II might be acceptable in instances where a type INT2 process also contains preservative properties in addition to the flame retardant ones.

Where European product standards exist, the untreated plywood or board products must meet the requirements of the standard if the material is to be CE marked.

WPA COMMODITY SPECIFICATION

FR5

Flame retardant treatment of wood and wood-based panels and cedar shakes and shingles exposed to the weather:

- shingles and shakes,
- unprotected playground equipment,
- unprotected cladding.

Fabrication after treatment: as far as possible all major machining, particularly sawing and ripping, shall be carried out prior to treatment.

Where post-treatment machining, cross cutting, boring of holes, etc. is unavoidable, the freshly exposed surfaces must be treated as specified by the manufacturer of the treatment involved. This stipulation is particularly important with those treatments, which confer protection from fungal attack, since in these cases, it is essential to maintain a protective envelope of treated timber if protection is to be afforded under adverse conditions.

Where extensive machining occurs after treatment, e.g. ripping of solid timber sections, then the material shall be returned to the treatment plant for reprocessing.

Impregnation with water-containing flame retardants increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood (see section 5.3). Drying is usually accelerated by kiln drying.

6.5.4 Flame retardant treatments and methods of application

Type EXT treatment or type INT2 (with a suitable maintained coating) may be used in a weather-exposed situation (Sections 2, 3) where long-term durability is required.

Application is by vacuum/pressure full cell processes.

6.5.5 Model specification phrase

WPA FR5 commodity specification: [insert material/species] to be treated to [insert required fire performance class from this list: Euroclass C; or Euroclass B; or Class 1 Surface Spread of Flame to BS 476 Part 7; or Class 'O' BS 476 Parts 6 & 7; or an AA rating to BS 476: Part 3], using a WPA Type EXT or Type INT2 (with a suitable maintained coating) formulation* listed in the WPA manual Industrial Flame Retardant Treatment of Solid Timber and Panel Products*.

** Where specifiers wish to specify use of a particular named flame retardant product, and/or to require that treatment be carried out in accordance with the WPA Benchmark Quality Scheme appropriate details can be inserted where an asterisk appears in the above sentences. For treatment in accordance with the WPA Benchmark Quality Scheme, the phrase 'in accordance with the requirements of the WPA Benchmark FR Quality Scheme' should be added to the specification.*

7. Health and safety

7.1 Flame retardant treated material

7.1.1 General

Treated material is supplied in a dry condition. No special precautions other than those associated with handling untreated timber are necessary.

7.1.2 Machining and sanding treated material

If it is necessary to machine or sand treated material, an efficient dust extraction system should be used. However, machining of treated material should be kept to a minimum.

7.1.3 Wood waste

Great care must be taken to ensure that any wood waste resulting from the fabrication of material after treatment is disposed of safely in accordance with regulations. Treated waste must not be supplied for use as animal bedding or litter.

8. Analytical methods

8.1 Sampling of flame retardant formulations

Flame retardant formulations are either delivered in bulk as liquid concentrates or prepared on a top-up basis as required by dissolving powders in water. In all instances the flame retardant solution is held in an assortment of vertical/horizontal, closed/open top above/below ground, tanks.

Solutions are inspected and sampled on a regular basis, normally every time a treatment charge is to be carried out. This is to enable solution concentration and other properties that may have a significant bearing on the effectiveness of the process to be determined.

Sampling may be carried out by jug, dip cup, sample drain cocks, sample tubes or any other convenient means. Whichever means is used it is essential that the tank contents have been thoroughly agitated or circulated so that the sample taken is homogenous and representative of the bulk contents.

8.2 Sampling of flame retardant treated timber and sheet material

Where sampling of treated wood and wood-based panels is carried out it is dependent upon the particular aspect of the treatment, which is under examination. In all cases it is essential to ensure that the sample taken is representative of the remainder of the material in the charge. This applies to species, thickness, profile, number of veneers and type, heartwood and sapwood, etc.

8.2.1 For fire testing

Sufficient length or lengths of timber cross-section or of sheet materials should be cut to enable the particular fire test in question to be carried out. Test specimen sizes are given in the various test standards.

Where a relevant product standard exists, a notified body should witness the treatment and/or sampling.

8.2.2 Chemical analysis

Reference should be made to BS EN 351-2

8.3 Moisture content determination

Moisture content of flame retardant treated wood can be conducted by either the oven dry method or moisture meter method as outlined below.

When using resistance type moisture meters caution should be exercised as the chemicals used for treatment may affect the electrical conductivity of the wood and give erroneous readings. Consult the flame retardant product manufacturer for advice.

OVEN DRY METHOD

a) Apparatus:

A ventilated oven which can be thermostatically controlled at $103^{\circ} \pm 2^{\circ}\text{C}$.

b) Sample selection:

The sample to be cut should be a full cross-section taken not less than 230 mm from one end and 13 – 19 mm thick.

If it is not possible to cut the timber, borings totalling not less than 8 g may be taken not less than 230 mm from one end. The bore should be taken from the sapwood face to the centre of the section using a test borer consisting of a hollow auger and extractor. If the samples cannot be weighed immediately after extraction they should be individually sealed in a weighed airtight container.

c) Procedure:

The samples should be weighed as soon as possible after extraction or cutting and placed in an oven which has been adjusted to a temperature of $103^{\circ} \pm 2^{\circ}\text{C}$. The samples should be removed periodically, allowed to cool in a desiccator and then reweighed. The samples should be dried to a constant weight, such that the loss of weight for a drying interval of six hours does not exceed 0.1%.

d) Calculation:

The moisture content of the sample, as a percentage of the dry weight, is calculated using the following equation:

$$\text{Moisture content (\%)} = \frac{m1 - m2}{M2} \times 100$$

where: *m1* is the mass of the sample, in grams, when wet
m2 is the mass of the sample, in grams, after drying to a constant mass.

MOISTURE METER METHOD

When using resistance type moisture meters caution should be exercised as the chemicals used for treatment may affect the electrical conductivity of the wood and give erroneous readings. Consult the flame retardant product manufacturer for advice.

a) Apparatus :

An electrical resistance type moisture meter provided with insulated electrodes and calibrated for the species of wood to be measured. It should be capable of taking an individual measurement with an error of not greater than 2% for moisture contents of between 7% and 28% (m/m). It should be noted that such moisture meters are less accurate outside this range. Additionally, where treated timber is concerned the preservative can influence the accuracy of such meters and the advice of the preservative manufacturer should be sought.

b) Sample selection :

The timbers to be measured should be selected from random positions in the treatment charge. The number of heartwood and sapwood faces should be in the same ratio as the proportions of these types of wood in the charge as a whole.

If the number of components in the charge is n, moisture meter readings should be taken on no fewer than the square root of half n. The moisture content should be measured on each face not less than 230 mm from either end at a point midway across the width.

c) Procedure :

The electrodes should be driven into the wood to half its depth, or to a depth appropriate to the type of wood specified below. The line between the tips of the electrodes should be in direction of, or perpendicular to, the grain according to the instructions for the type of meter used.

TYPES OF WOOD	ELECTRODE DEPTH
i) Sapwood of all species.	25 mm or sapwood thickness if less than 25 mm.
ii) Heartwood of sweet chestnut, dahoma, danta, ekki, cuarea, iroko, kapur, kempas, makore, mansonia, oak, akan, opepe, utile.	5 mm
iii) Heartwood of species other than those listed in ii) Posts Other components	25 mm 12 mm

8.4 Analysis of flame retardant solutions

If it is necessary or required to undertake chemical analysis of flame retardant solutions the following comments should be helpful.

Flame retardant solutions based on compounds containing phosphorus, nitrogen, boron or sulphur can be analysed for such elements by most text book methods of chemical or instrumental analysis.

In case of doubt the manufacturer or processor should be consulted.

8.5 Analysis of flame retardant treated wood and wood-based panels

The elements listed in 8.4 can be checked for in flame retardant treated material. In general the material needs to be chemically digested to convert it to a solution or ground to sawdust and compressed into pellet form.

Analytical methods for polymer type products require particular care to ensure complete extraction and separation of the element under analysis, particularly from treated, cured timber.

Standard analytical methods can then be used.

In cases of doubt the manufacturer or processor should be consulted.

9. Factory production control and the WPA Quality Scheme

Factory production control (FPC) is a procedure adopted to demonstrate compliance with the requirements of product descriptions, customer specifications and standards. In the case of products whose compliance with the provisions of a harmonised standard under the EU Construction Products Regulation is obligatory, FPC is one part of the procedures required in the standard for Assessment and Verification of Constancy of Performance (AVCP).

Where the scope of a harmonised standard includes treatment to enhance reaction to fire classification the standard will require the involvement of a Notified Body in the AVCP process. The WPA Guide to CE Marking wood treated with a preservative or flame retardant lists harmonised standards that do include reaction to fire enhancement in their scope.

Consistent production of wood and wood-based materials to ensure their reaction to fire classification replicates that demonstrated in type testing is essential in the safety critical areas such material is used in. Benchmark FR is the WPA quality scheme for wood and wood-based materials whose reaction to fire classification has been enhanced by treatment with a flame retardant chemical in factory-controlled conditions. Products certificated under this scheme must incorporate a flame retardant produced under an ISO9001 quality management system.

Processors operate under a third party quality assurance scheme (e.g. BS EN ISO 9001) incorporating the WPA Quality Guidance Note QGN1: Flame Retardant Treatment of Timber. Benchmark certification is available for flame retardant treated wood and wood-based materials.

10. References

The Building Regulations for England and Wales. Approved Document B

BS 476 Fire tests on building materials and structures

BS 476-3 Fire tests on building materials and structures. Classification and method of test for external Fire exposure to roofs

BS 476-6 Method of test for fire propagation for products

BS 476-7 Method of test to determine the classification of the surface spread of flame of products

BS 6566-8 Specification for bond performance of veneer plywood.

BS EN 351-2 Guidance on sampling for the analysis of preservative-treated wood

BS EN ISO 9001 Quality management systems

BS EN ISO 11925-2 Reaction to fire tests for building products, Part 2- Ignitability when subjected to direct impingement of flame

BS EN 13501-1 Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests

BS EN ISO 13788 Hygrothermal performance of building components and building elements Internal surface temperature to avoid critical surface humidity and Interstitial condensation – Calculation methods

BS EN 13823 Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

BS EN 13986 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking

BS EN 14915 Solid wood panelling and cladding. Characteristics, evaluation of conformity and marking

BS EN 14374 Laminated veneer lumber (LVL) – Requirements

BS EN 14342 Wood flooring – Characteristics, evaluation of conformity and marking

BRE: Timber Drying Manual

Annex 1

Requirements for a flame retardant formulation listing in the WPA Flame Retardant Specification Manual

The manufacturers of products listed in this Manual have asserted that they hold data demonstrating the claimed fire performance in standard tests. A flame retardant formulation listing in this Manual refers specifically to the hygroscopic and leach resistant nature of the fire retardant treated product. WPA listing can only be given following independent evaluation of data by the WPA or a nominated body.

Tests shall be undertaken by an accredited laboratory (e.g. UKAS or equivalent).

Type INT1

No additional testing requirements.

In the absence of other information, all treatments falling outside the parameters qualifying for INT2 or EXT classification are deemed INT1.

Type INT2

Requirement: Wood treated with the flame retardant formulation must demonstrate a moisture content as a percentage of treated weight $\leq 28\%$ after testing as follows.

In all tests a minimum of 5 test samples must be used.

For impregnation products, 15 x 25 x 50 mm blocks of pine sapwood should be impregnated to give the highest loading (kg/m^3) of flame retardant formulation for which it is desired to claim INT2 suitability. Loading should be computed from (i) the treating solution strength, verified by analysis, (ii) the dimensions of the test samples before treatment to an accuracy of 1mm, and (iii) the weight to an accuracy of 0.1g of each test samples before and after treatment.

For surface applied formulations, the highest coverage of ready for use (after dilution if appropriate) flame retardant formulation for which it is desired to claim INT2 suitability should be applied to both sides of a 2mm thick pine sapwood veneer.

In the case of wood-based panels where the FR is added during the manufacture of the panel, the material should be representative of the product placed on the market.

Treated samples should, after treatment, be conditioned to approximately constant mass in a humidity cabinet at $50 \pm 5\%$ RH and $23 \pm 2^\circ\text{C}$

Conditioned samples should be exposed to $90 \pm 3\%$ and $27 \pm 2^\circ\text{C}$ for 10 days and then weighed to an accuracy of 0.1g (=W1). Each should then be dried in an oven at $103 \pm 2^\circ\text{C}$ for 24 hours and reweighed to an accuracy of 0.1g (=W2)

% moisture content should be calculated from:

$$\%MC = W1 - W2 / W2 * 100$$

An INT2 classification may be assigned only for treated zone retentions where the average %MC determined as above is at or below 28%. It is important to understand that the overall retention achieved during a commercial treatment charge is not the same as the treated zone retention. The overall retention of a commercially treated material is likely to be significantly lower than that of the treated zone retention, since the commercial product is likely to contain untreated areas (eg. untreated heartwood in the case of impregnation treatments). The treated zone retention is equal to the charge retention divided by the proportion of the timber penetrated.

Note: Methods in the draft CEN standard *Durability of reaction to fire performance — Classes of fire-retardant treated wood products in interior and exterior end use applications* [number of this standard not yet confirmed] may be used as alternative methods to those in this Annex.

For impregnation formulations the maximum treated zone retention (kg/m^3) will be stated as part of the formulation listing.

For superficial treatments, the dilution rate of the formulation as supplied (if applicable) and the maximum surface application rate (g/m^2) of diluted or ready to use formulation tested will be stated as part of the formulation listing.

The WPA listing will be accompanied by the information 'INT2 at treated zone loadings at or below $x \text{ kg/m}^3$ (or 'at or below $y \text{ g/m}^2$)'.

Wood and wood-based panels treated to higher retentions or surface application rates will be assumed to be Type INT1.

Type EXT

Requirements:

1. Wood treated with the flame retardant product must meet the requirements for a product classified as Type INT2.
2. Wood treated with the flame retardant formulation must, when tested as follows, demonstrate a total heat release (THR600s) increase of no more than 20% when compared with matched samples tested without weathering. Tests should be conducted with 21mm thick wood or wood-based panel samples (size according to NT Fire 053) treated to a retention or surface application rate representative of that used in practice. For superficial treatments, the declared surface application rate should be applied in accordance with the manufacturers instructions. In the case of panel products where the FR is added during the manufacture of the panel, the material should be representative of the product placed on the market.

Matched samples before and after weathering are tested using the cone calorimeter (ISO 5660). Permissible weathering regimes are those given in NT Fire 053 and the equivalent ASTM methods.

All formulations must meet the Type EXT and INT2 test criteria for a Type EXT classification.

For impregnation treatments and manufactured panels, the maximum treated zone retention (kg/m^3) from both tests will be stated as part of the product listing.

For superficial treatments, the dilution rate of the formulation as supplied (if applicable), the maximum surface application rate of diluted or ready to use formulation tested in both tests and the number of faces coated will be stated as part of the formulation listing. Where surface application rates and/or dilution rates are greater than those tested, the formulation will be assumed to be Type INT1.

The WPA listing will be accompanied by the information 'EXT at treated zone loadings at or below $x \text{ kg/m}^3$ (or 'at or below $y \text{ g/m}^2$)'.

Wood and wood-based panels treated to higher treated zone retentions or surface application rates will be assumed to be Type INT1.



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