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Position Paper:

Reaction to fire testing and classification of untreated and fire retardant treated wood construction products to EN 13986, EN 14342 & EN 14915

Contents

1 General

In order to minimise the cost of testing most manufacturers will group their products when applying for a certificate of constancy of performance. The grouping can be different for each characteristic to be measured for the CE mark. In order to make a grouping of products for their fire characteristics it is necessary to work closely together with the relevant notified body (product certification body and/or testing laboratory) before any fire testing is performed. This co-operation is needed since it is necessary for the relevant notified body to consider the field of application of any reaction to fire performance parameters before it can be deemed valid for an entire group of products. In this process the notified body defines the direct and extended field of application of the fire performance parameters obtained.

This document is a tool to be used by notified bodies if asked by a manufacturer to assess the performance of grouped products. This document should also be used by a notified body as a tool to determine which product(s) in a group shall be tested for reaction to fire in order to obtain a field of application that covers the entire group or product range.

This document is split into three product groups:

- Untreated wood products
- Fire retardant impregnated wood products
- Fire retardant surface coated wood products

2 Wood construction product standards and guidance documents for reaction to fire performance

Wood products have a stable fire performance, and untreated wood products obtained a reaction to fire classification according to the so-called Classification Without Further Testing (CWT) procedure. Classifications for groups of wood products have been published in the Official Journal (Decision 2003/43 as amended by Decisions 2003/593 and 2007/348, and also Decisions 2005/610, 2006/213, 1292/2014 and 2293/2017).

2.1 European standards for wood products

There is a range of European standards for wood products. The main harmonised product standards to be used for CE-marking are:

- EN 13986 Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking
- EN 14342 Wood flooring – Characteristics, evaluation of conformity and marking
- EN 14915 Solid wood panelling and cladding – Characteristics, evaluation of conformity and marking.

EN 13986 includes factory made wood-based panels such as particleboard, plywood, hardboard, MDF and OSB. The other product standards mentioned above cover various products made of solid wood. At time of publishing EN 13986, EN 14342 and EN 14915 cover fire retardant treated wood products. Further standards will be included when available.

2.2 ETAG's/EAD's

There are also general European Technical Approval Guidelines (ETAG's) and European Assessment Documents (EAD's) which can be used for CE marking. One example is ETAG 028 'Fire retardant products'. It covers surface treatment of all products, including wood products, when incorporated in situ into the construction works at building sites. This position paper is not applicable to ETAGs and EADs, as the assessment of performance to EADs is the responsibility of the Technical Assessment Bodies.

2.3 Sampling

Fire retardant wood based construction products are at Assessment and Verification of Constancy of Performance (AVCP) system 1 and therefore the notified product certification body is responsible for the sampling. The GNB position paper NB-CPR/15/639 shall be followed. See section 7.2 for more information.

Test, extended application and classification reports written after July 1st 2013 must contain information on sampling.

3 Methods for reaction to fire testing and classification

The relevant test methods, extended application, classifications and guidance documents for the reaction to fire testing of wood construction products are:

- **EN 13238** - Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates
- **EN 13823** - Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item
- **EN ISO 11925-2** - Reaction to fire tests - Ignitability of products subjected to direct impingement of flame Part 2: Single-flame source test
- **EN ISO 9239-1** - Reaction to fire tests for floorings Part 1: Determination of the burning behaviour using a radiant heat source (ISO 9239-1:2010)
- **EN 15725** - Extended application reports on the fire performance of construction products and building elements
- **CEN/TS 15117** - Guidance on direct and extended application
- **CEN/TS 15447** - Mounting and fixing in reaction to fire tests under the Construction Products Directive
- **EN 13501-1** - Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

With EN 13823 being the decisive method for the classification of most wood products other than wood floorings, which are covered by EN ISO 9239-1.

The relevant classification system is according to EN 13501-1. For wood products except floorings the relevant main classes are B, C, D and E. The relevant additional classes for smoke development are s1, s2 and s3, and for burning droplets d0, d1 and d2.

For wood floorings the relevant main classes are B_{fl}, C_{fl}, D_{fl} and E_{fl}. The relevant additional classes for smoke development are s1 and s2.

The relevant standard for choosing a substrate for the fire testing is EN 13238. A substrate is the product immediately beneath the product to be tested and classified.

NOTE The cone calorimeter ISO 5660 can be a suitable small scale fire test method to be used for the development of fire retardant treatments, before the fire testing for classification. Suitable methods for the prediction of reaction to fire class according to EN 13501-1 include:

- Östman B, Tsantaridis L: Correlations between cone calorimeter and time to flashover in the room fire test. Fire and Materials, Vol. 18, 205-209, 1994.
- Messerschmidt B, Van Hees P & Wickström U: Prediction of SBI (Single Burning Item) test results by means of cone calorimeter test results. Proceedings Interflam '99. Interscience Communications, 1999.
- Hakkarainen T: Rate of heat release and ignitability indices in predicting SBI test results. Journal of Fire Sciences, 2001. Vol. 19, No. 4, pp. 284-305.

- Hansen A S: Prediction of heat release in the single burning item test. Fire and Materials, 2002. Vol. 26, No. 2, pp. 87-97.
- Tsantaridis L, Östman B, Hakkarainen T: Euroclass predictions for developing wood based products with improved fire performance. Proceedings Interflam 2010, 419-428, Interscience Communications, 2010

4 Product properties determining the reaction to fire behaviour of wood construction products

4.1 Untreated wood products

This section on untreated wood products is background information and is relevant also for fire retardant treated wood products.

Untreated wood products have a stable fire performance. Main product parameters influencing the reaction to fire characteristics of wood products are thickness, density and substrate (including air gap).

4.1.1 Thickness

Thickness is the main influencing factor for the reaction to fire performance of wood products. Untreated wood products thicker than about 18 mm with and without an air gap behind, and thinner wood products without an air gap behind, conforming to EN 13986 or EN 14915, achieve at least classes D-s2, d0 and Dfl-s1.

4.1.2 Density

Density has an influence on the fire performance of wood products. At least class D-s2,d0 is achieved for untreated wood products with density greater than about 400 kg/m³ conforming to EN 13986, EN 14915 or EN 14342. Untreated wood products with a density less than 300 kg/m³ conforming to EN 13986 are usually in class E.

4.1.3 Substrate and air gap

The substrate for the fire testing is the product behind the wood product. Mounting the test product with an air gap between it and the substrate usually gives a worse performance than mounting without an air gap. The worst case should be tested if seeking a general classification, otherwise the appropriate case for a given end use should be tested.

An air gap will influence the reaction to fire performance of wood products e.g. that are less than about 18 mm thick, and of wood products with open joints. A ventilated air gap is more severe than an unventilated air gap, since it allows for ventilation and combustion of the backside of the tested wood product.

The substrate behind the wood product may influence the reaction to fire behaviour, particularly if there is an air gap and the wood product is less than 18mm thick, since a combustible substrate may contribute to the flame spread and heat release.

The hierarchy for air gaps is as follows:

Tested	Coverage
40mm ventilated cavity	Ventilated and non-ventilated cavities and no air gap
40mm unventilated cavity	Non ventilated cavities and no air gap
No air gap	No air gap only

Products tested free standing (with an 80mm air gap) do not cover any of the above end-use applications and should be tested in full separately.

A backing board, a calcium silicate board in accordance with EN 13823, should always be used

behind the substrate.

4.1.4 Surface coatings (Non-FR)

Coatings on wood products may degrade the fire classification, especially those that are thick and have multiple coatings. Surface coated wood products other than floorings are not included in the CWT classification of products and must be fire tested.

4.1.5 Joints

The presence of joints with open gaps can have an effect on the performance of untreated wood products.

4.1.6 Other parameters

Other parameters such as wood species, surface profile, surface texture and the aspect of orientation have less influence on the reaction to fire performance of untreated wood products, as long as the parameters mentioned above are being controlled.

4.1.7 Wood floorings

The behaviour described above is also true of wood floorings in most respects, but the wood species has more influence, especially for uncoated wood floorings. Ordinary non-fire retardant coatings on wood floorings to EN 14342 may improve the fire classification, at least for coatings less than 100 g/m² (Decision 2006/213).

4.2 Fire retardant impregnated treated wood products

Fire-retardant impregnation treatments may considerably improve the reaction to fire properties of wood products, and may enable the treated wood product to achieve the highest reaction to fire classification for combustible products, i.e. class B. In addition to the influences for untreated wood products (see section 4.1), the following influencing factors apply:

4.2.1 Fire retardant chemical

The fire retardant chemical is very important for the reaction to fire classification, since some chemicals are more effective than others. Commercial fire retardant chemicals are usually a mixture of fire retardant agents that may be more efficient than single agents.

4.2.2 Amount of fire retardant chemical

The amount of fire retardant chemical is critical for the reaction to fire performance of wood products. The type of wood product, wood species, thickness and application method largely determines the amount of active substance in the final product.

The amount of fire retardant chemical in the treated wood product to be tested must be determined in kg/m³ and is often referred to as a ‘retention level’. It shall be determined either as the amount of impregnation liquid in kg/m³ together with the concentration of chemicals in the liquid in %, or as the amount of remaining chemical in the wood product expressed in kg/m³. This applies to all application methods defined in 4.2.3 – 4.2.6.

4.2.3 Application method

The application method used for fire retardant treatment has a major influence on the reaction to fire performance as do the treatability characteristics and thickness of different wood species of solid wood or wood based panels. This often occurs at a third party treatment house post manufacture.

4.2.4 Vacuum pressure impregnation

Vacuum pressure impregnation involves sequentially drawing a vacuum on the wood to be treated, immersing it in liquid whilst still under vacuum, applying a positive pressure, draining the vessel at the end of the pressure period and (optionally) applying a final vacuum. After treatment, the wood product is dried, often in a kiln, prior to use.

4.2.5 Immersion

The wood product is immersed in the fire retardant solution, sometimes for several hours. This

procedure may be repeated several times.

4.2.6 Incorporation during manufacturing

Wood-based panels to EN 13986 are often fire retardant treated during their ordinary manufacturing process. Two options are used: impregnation of the wood (particles, veneer) or including fire retardant as an additive to the glue. Incorporation during manufacturing is often used for some types of wood-based panels, e.g. particleboard, MDF and OSB.

4.2.7 Density

The correlation between reaction to fire performance and density for fire retardant treated solid wood and wood based panels does not constitute a safe relationship. Density cannot be used as the basis for deriving the required retentions across multiple species of fire retardant impregnated solid wood and wood based panels. It has the potential to seriously under-predict the retention of fire retardant needed to achieve the target fire classification.

4.2.8 Wood species

The wood species has a larger and more variable influence on the reaction to fire performance of fire retardant treated wood products than on untreated wood products.

Different wood species have different anatomical characteristics, permeability, heartwood/sapwood ratios, and resin contents. These differences will result in different fire retardant distributions and surface treatment levels creating differences in burning characteristics between species irrespective of density and it is not possible to cross over classification between species unless it has been demonstrated that it is safe to do so (see 5.1).

4.2.9 Type of wood-based panel

The type of wood-based panel according to EN 13986 has similar influence on the reaction to fire performance as the wood species (see 4.2.8). Types of wood based panel are:

- Solid Wood Panels
- LVL – Laminated Veneer Lumber (for non-structural)
- Plywood
- OSB – Oriented Strand Board
- Particleboard
- Cement Bonded Particle Board
- Fibre board (dry and wet processed)

Within each product type there are parameters that need to be taken into account, for instance plywood's can have differing species of facing and core veneers and changing these can have an effect on the fire performance.

4.2.10 Additional Surface coatings

Ordinary surface coatings on fire retardant treated wood products may degrade the fire classification considerably from what could be achieved by the fire retardant treatment without a coating, except for low amounts on wood floorings. FIGRA, TSP and SMOGRA values are particularly sensitive to surface coatings. Additional surface coatings are often needed to maintain the durability of reaction to fire properties of fire retardant wood products for exterior applications.

Care should also be observed when applying FR coatings to fire retardant wood products as they may not have a proven performance on a fire retardant treated wood product. All surface coated fire retardant wood products need additional fire testing to be included in a classification.

4.2.11 Wood floorings

The factors influencing the fire retardant treatment of wood floorings are similar to those for other wood products.

4.2.12 Veneers and glues

Care must be taken with veneers and glues when used as part of the wood product, either as a surface covering or with plywood type wood products. Any change in the species and number of

veneers can have an effect on the fire performance. Particular attention should be made to detail these parameters in the product specification within test reports and the field of application in classification reports.

4.2.13 Joints and Orientation

The presence of joints in fire retardant impregnated wood products can affect the fire performance. Additionally the type of joint can have an effect i.e. tongue and groove, butt joints or expansion joints (≤ 2mm). Gaps larger than small expansion joints (> 2mm) could have a significant effect on the performance of the system. Furthermore the orientation of jointed products can have an effect on the fire performance, for instance solid wood panelling and cladding may be fixed horizontal or vertically and testing in just one orientation does not cover the other.

4.2.14 Colour

A range of colours is often offered for fire retardant products, these are usually applied as stains/pigments included in the impregnation treatments. Additional colours can have an influence on the fire performance of fire retardant wood products.

4.2.15 Surface Finish

The surface finish of the wood product prior to treatment can have a significant effect on the fire performance post treatment. For instance the performance of planed wood products could be different to rough sawn.

4.3 Fire retardant surface coated wood products

Fire-retardant surface coated treatments may considerably improve the reaction to fire properties of wood products, and may enable the treated wood product to achieve the highest reaction to fire classification for combustible products, i.e. class B. In addition to the influences for untreated wood products (see section 4.1), the following influencing factors apply.

4.3.1 Fire retardant chemical

The fire retardant chemical is very important for the reaction to fire classification, since some chemicals are more effective than others.

4.3.2 Amount of fire retardant chemical

The amount of fire retardant chemical coating is critical for the reaction to fire performance of wood products. The type of wood product, thickness and application method largely determines the amount of active substance required on the final product. The amount of fire retardant chemical applied to the wood product to be tested must be determined in g/m².

4.3.3 Application

This document covers only surface treatment applied in an industrial process with a supporting quality system and factory production control in place to ensure the manufacturer, or subcontracted treatment house, has complete control over the fire retardant treatment applied and that there are checks in place to ascertain the fire performance of the product. The method of application can have a significant impact on the resulting classification, such as spray, roller or brush application. For certification purposes, all details of the application process shall be declared including any forced drying that may be used.

Only film-forming surface applied products can be deemed as surface applied in regards to this guidance. Some surface applied products make a claim that they will “impregnate” the wood surface, without pressure being applied. The extended field of application rules in section 5.1 should be applied to these products and they are deemed as an impregnation. Some surface applied products may be applied through a process involving incising of the timber for greater penetration depth, for these products the extended field of application rules in section 5.1 should be applied and they are deemed as an impregnation.

4.3.4 Additional Surface coatings (non-FR)

Ordinary surface coatings on fire retardant treated wood products may degrade the fire classification considerably from what could be achieved by the fire retardant treatment without a coating. Similarly wood products with ordinary coatings which then have a fire retardant coating applied will likely not perform to the level of that expected of a fire retardant applied to an uncoated wood product. FIGRA, TSP and SMOGRA values are particularly sensitive to additional non fire retardant surface coatings. Additional surface coatings are often needed to maintain the durability of reaction to fire properties of fire retardant wood products for exterior applications.

Care should also be observed when applying FR coatings to fire retardant wood products as they may not have a proven performance on a fire retardant treated wood product. Surface coated wood products need additional fire testing to be included in a classification.

4.3.5 Wood floorings

The factors influencing the fire retardant treatment of wood floorings are similar to those for other wood products.

4.3.6 Joints and Orientation

The presence of joints in fire retardant coated wood products can affect the fire performance. Additionally, the type of joint can have an effect i.e. tongue and groove, butt joints or expansion joints (≤ 2mm). Gaps larger than small expansion joints (> 2mm) could have a significant effect on the performance of the system. Furthermore, the orientation of jointed products can have an effect on the fire performance, for instance coated solid wood panelling and cladding may be fixed horizontal or

vertically and testing in just one orientation does not cover the other.

4.3.7 Colour

A range of colours is often offered for fire retardant surface coated wood products. A change in colours can have an influence on the fire performance of fire retardant wood products.

4.3.8 Surface Finish

The surface finish of the wood product prior to treatment can have a significant effect on the fire performance post treatment. For instance, the performance of planed wood products could be different to rough sawn.

5 Testing and classification of fire retardant treated wood product EXAP rules

The wood product to be tested shall be representative for the product being placed on the market, including the characteristics mentioned below.

5.1 Fire retardant impregnated wood products

5.1.1 Fire testing

The instructions below for fire testing are applicable for EN 13823, EN ISO 9239-1 (for wood floorings) and for EN ISO 11925-2.

It is very likely that the EN ISO 11925-2 testing will be successful as most untreated wood products achieve a class D or E, however it is not possible to base a classification document on EN 13823 or EN ISO 9239-1 evidence alone and this would be in direct conflict with section 8.2 of EN 13501-1. EN ISO 11925-2 testing on just the worst performing EN 13823 or EN ISO 9239-1 specimen type/configuration should be undertaken and this used to support the classification. Further testing would be required to include coverage for edge exposure in the same way. This will in many cases greatly reduce the quantity of EN ISO 11925-2 testing required.

5.1.2 Clear identification of fire retardant chemical

The fire retardant chemical shall be clearly identified. Exact formulations are not needed, but the manufacturer is required to supply sufficient information to clearly identify the concentration of the active substance and the treatment used. The notified certification body shall verify the identity of the fire retardant.

5.1.3 Application method

The application method shall be specified in terms of all process parameters (pressure, temperature, duration, etc.) of vacuum pressure impregnation, immersion or incorporation during the manufacturing process (see 4.2.3 – 4.2.6).

5.1.4 Amount of fire retardant chemical

The amount of fire retardant chemical in the treated wood product is in many cases a consequence of the application method and the type of wood product treated, including wood species and its possible content of heartwood that is hard to impregnate. The quantity of chemical required to reach a specific classification can change as other parameters change, particularly as thickness and species of the wood product change.

NOTE
The recommended procedure for impregnated wood is to choose wood with an even density and a sapwood/heartwood ratio representative for the wood species to be tested. Each individual board should be marked and weighed before and after impregnation and the amount of fire retardant calculated for each board. For solid wood the end grain of each board should be cut off (at least 100 mm) and not used for testing. For panel products every edge of each board should be cut off (at least 100 mm) and not used for testing.

Boards with an even and representative amount of chemicals shall be selected by the certification body and used for the fire testing. The manufacturer is responsible for the supply of products with a representative amount of fire retardant chemicals for the testing.

If the amount of fire retardant chemicals in different boards (measured in kg/m³) varies by more than 15%, a special mounting procedure in the SBI test (EN 13823) is recommended: The first 30 cm of the long and the short wing, measured horizontally from the SBI corner, shall be mounted with the boards with the least amount of fire retardants. The rest of the wings shall be mounted with the boards with the greatest amount of fire retardants.

The information above should be declared to the notified product certification body and should be included in the test reports. The same principle applies for other wood products, e.g. those that are fire retardant treated during the manufacturing process as wood based panels, or by immersion.

5.1.5 Wood species, FR quantity and thickness

It is likely that for a given FR impregnation treatment there will be a wide range of wood products for which the manufacturer would require test evidence. A system for covering a wider range of wood products or parameters is required to reduce the potential level of testing required. The following approach gives a method for extending the field of application using indicative evidence to support changes in:

- Wood species and/or wood panel product
- Thickness
- FR Chemical quantity

If the method below is not used, then the standard approach using EXAP rules in EN 15725 must be used.

- '**Parent**' – a triplicate set of specimens at the lowest thickness and to a given fixed retention on which the classification is based
- '**Child**' – a single indicative identical in setup to the 'parent' but with a greater thickness and lesser retention. The 'child' is used to increase the classification to a set thickness with a lower retention. This allows a line to be drawn and provides evidence for the required retention at a given thickness between the 'parent' and 'child' without further testing (see figure 1 in Appendix 1). The 'child' must have the same euroclass as the parent[1], if the smoke is a lesser class any thickness greater than the 'parent' must be classified with the lesser smoke class[2].
- '**Family**' – The 'family' includes the 'parent' and 'child', the line between them and a +/- 10% retention adoption zone above and below the line (see figure 3 in Appendix 1).
- '**Orphan**' – A single indicative test on a different species/wood panel product which must fall within the 'family' and maintains the Euroclass. The orphan must have the same test setup as the 'parent' and 'child' (especially in respect to substrate and air gap). The orphan does not have to have a better performance in terms of THR and FIGRA but must be the same Euroclass[3].
- Thickness - For a given species/wood product where the FR quantity remains the same as thickness increases (measured in kg/m³) then the euroclass performance (excluding smoke) will be maintained as the thickness increases without further testing. If further testing is not

[1] If the 'child' result is borderline, i.e. it has a $FIGRA_{02}$ greater than 96w/s and a THR_{600s} of greater than 6MJ for euroclass B, or a $FIGRA_{04}$ greater than 200w/s and a THR_{600s} of greater than 12MJ for euroclass C, then either another indicative test must be conducted to validate the result (in accordance with FSG recommendation 028) or 20% must be added to the retention.

[2] As an example if the 'parent' is an S1 and the 'child' is an s2 then the parent can be classified as s1 but anything with a thickness between the 'parent' and 'child' must be an s2 and anything thicker than the 'child' must be an s3.

[3] If the 'orphan' result is borderline, i.e. it has a $FIGRA_{02}$ greater than 96w/s and a THR_{600s} of greater than 6MJ for euroclass B, or a $FIGRA_{04}$ greater than 200w/s and a THR_{600s} of greater than 12MJ for euroclass C, then 20% must be added to the retention. A successful 'orphan' test does not allow the new species/wood panel product to be adopted into the 'family', if thinner thicknesses are to be covered a new 'family' must be started with a new 'parent' at the thinnest thickness. It is however possible to use the successful 'orphan' within the 'family' to classify greater thicknesses but only the same fixed retention. If the retention is to be reduced at greater thicknesses a new family based on the new species/wood product must be started.

conducted at a greater thickness with the same retention then the smoke classification must be increased by one for greater thicknesses (for instance an ‘s1’ increases to an ‘s2’, and ‘s2’ increases to an ‘s3’ at any greater thickness than that tested)[4].

This method can only be used if the items detailed in sections 5.1.3, 5.1.4, 5.1.6, 5.1.7, 5.1.8, 5.1.9, 5.1.10, 5.11 & 5.12 remain constant, any change in these items would require a new ‘family’ to be tested. Appendix 1 contains worked examples of the above.

[4] In its most simple form testing on just the ‘parent’ set of three specimens can be used to cover any greater thickness at the same fixed retention.

5.1.6 Substrate

The substrate for the fire testing is the product behind the fire retardant treated wood product. The substrate can be chosen according to EN 13238 which will give greater coverage in the classification or it can be client/end use specific. It is not possible with Impregnation treatments to use an impregnated standard substrate and go on to use the standard substrate rules.

5.1.7 Air gap

The same principles as for the testing of untreated wood products apply. An air gap between the tested product and the substrate is a worse case than mounting without an air gap. Tests with an air gap are equally valid for mounting without an air gap for the same substrate.

A ventilated air gap is more severe than an unventilated air gap, since it allows for ventilation behind the tested wood product. The hierarchy for air gaps is as follows:

Tested	Coverage
40mm ventilated cavity	Ventilated and non-ventilated cavities and no air gap
40mm unventilated cavity	Non ventilated cavities and no air gap
No air gap	No air gap only

Products tested free standing (with an 80mm air gap) do not cover any of the above end use applications and should be tested in full separately.

5.1.8 Additional Surface coatings

Ordinary surface coatings on fire retardant treated wood products need additional fire testing to be included in a classification. At least one single test according to EN 13823 or EN ISO 9239-1 shall be performed per surface coating at a specified amount as used in practice. This test must be conducted on the worst performing SBI result on which the classification is based on. If this single test meets the test criteria, the coated product may be included in the classification already achieved. If it does not meet the criteria, full testing shall be performed for the coated product.

Additional Fire Retardant coatings applied to fire retardant treated wood products must also be tested as evidence gained for their performance will often be on untreated substrates and it may be found that when tested on a fire retardant wood product the smoke performance is affected.

5.1.9 Veneers and glues

Care must be taken with veneers and glues when used as part of the wood product, either as a surface covering to wood products such as MDF or particle boards, or in the construction of plywood type wood products. Any change in the species, thickness, density and number of veneers can have a great effect on the fire performance. Particular attention should be made to detail these parameters in the product specification within test reports and the field of application in classification reports.

5.1.10 Mounting and Fixing

Further rules on mounting and fixing are given in the relevant harmonised product standard listed in section 2.1, these rules should be followed.

5.1.11 Joints and Orientation

When a product is tested with horizontal and/or vertical joints these must be in accordance with EN 13823. The type of joint tested, i.e. tongue and groove or butt joints, must be documented in the field of application of the classification report. Furthermore the orientation of jointed products like solid wood panelling and cladding must be detailed (i.e. horizontal and/or vertical), testing in just one orientation does not cover the other without further testing. Testing with joints gives coverage for no joints. Testing with an expansion gap of 2mm covers for butt joints with no gap but not tongue and groove.

5.1.12 Colour ranges

If a range of additional colours is required then the worst performing colour must first be determined and this used for all tests. This can be determined by testing all colours using the ISO 5660-1 cone calorimeter or by the method detailed in EGOLF recommendation 003-2016.

5.1.13 Test report

The test report shall specify all items under 5.1.1 - 5.1.12.

5.2 Fire retardant surface coated wood products

5.2.1 Fire testing

The instructions below for fire testing are applicable for EN 13823, EN ISO 9239-1 (for wood floorings) and for EN ISO 11925-2.

It is very likely that the EN ISO 11925-2 testing will be successful as most untreated wood products achieve a class D or E, however it is not possible to base a classification document on EN 13823 or EN ISO 9239-1 evidence alone and this would be in direct conflict with section 8.2 of EN 13501-1. Testing on the worst performing EN 13823 or EN ISO 9239-1 specimen type/configuration should be undertaken and this used to support the classification. Further testing would be required to include coverage for edge exposure in the same way. This will in many cases greatly reduce the quantity of EN ISO 11925-2 testing required.

5.2.2 Clear identification of fire retardant chemical

The fire retardant chemical shall be clearly identified. Exact formulations are not needed, but the manufacturer should supply sufficient information to clearly identify the concentration of the active substance and the treatment used. This is also required for certification purposes.

The nature of the surface treatment shall be specified, liquid or paint. The method of application must be specified, such as spray, roller or brush application. For certification purposes, all details of the application process shall be declared including any forced drying that may be used.

5.2.3 Amount of fire retardant chemical

The results of improved reaction to fire performance may be applicable to greater amounts of fire retardant chemicals, but not to lesser amounts.

Indicative testing with different amounts of fire retardant chemicals may be used and the most suitable amounts chosen for further testing. At least two and preferably three levels should be used.

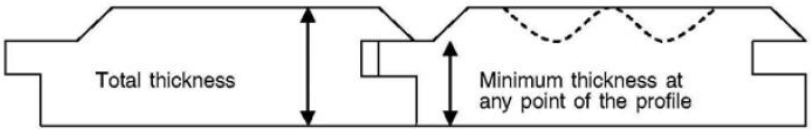
The amount of fire retardant chemicals on the final product to be tested shall be specified in g/m².

An alternative for surface applied products is to declare the amount of fire retardant chemical in the treatment liquid, the application procedure and the amount of liquid applied. This shall be specified in ml/m².

5.2.4 Wood products for surface treatment

The wood product to which the surface treatment is applied is very important when testing surface treated products. A classification based on the coating being applied to either the plywood or particle board standard substrates described in EN 13238 can be used. The rules for substrates in EN 13238 can then be applied. This means that surface treatments on a standard wood product (untreated particle board 12 ± 2 mm with density 680 ± 50 kg/m³ or untreated plywood 9 ± 1 mm with density 450 ± 50 kg/m³) can be used. The results are then applicable to all wood products with densities of at least 75% of the wood product used for the surface treatment at the thickness tested or greater and at the application rate tested. This method can only be used with the following additional rules:

- A single EN 13823 test (or EN ISO 9239-1 for flooring) must be performed on the thinnest actual wood product to be manufactured and this used to support the full testing on a standard wood based substrate in accordance with EN 13238.
- To include thinner products, full testing must be undertaken to establish classification and application rate.
- In the case of cladding products manufactured in accordance with EN 14915 the minimum thickness at any point of the profile must not be less than the total thickness allowed for in EN 13238 i.e. 10mm for test evidence on particle board and 8mm for evidence on plywood (see diagram below). Additionally the minimum thickness at any point of the profiled area on the exposed side of the panel must not be thinner than 2/3 of the total thickness and not cover more than 20% of the plane area, or 25% when measured on both exposed and unexposed sides of the panel. Furthermore the coated standard substrate when tested must have vertical and horizontal but joints in accordance with EN 13823. Testing in this way covers for vertical or horizontal orientation in end use.



Surface treatment of a specific wood product may also be tested, but the test results are then applicable only to that wood product/wood species at the tested thickness and density and the rules above cannot be used.

5.2.5 Thickness

If a standard substrate is used for testing the rules given in EN 13238 can be used.

If one of the standard substrates from EN 13823 is not being used the following applies; for thickness ranges that differ by more than 3mm testing shall be performed at the least thickness, greatest thickness and at a middle thickness and a further 2 tests conducted on the worst performing on which to base the classification.

If the thickness range to be covered differs by ≤3mm only the thinnest thickness needs to be tested.

Full testing at 24mm covers for all greater thicknesses, however when using this rule for covering greater thicknesses than 24mm the smoke class must be increased by one (i.e. an ‘s1’ increases to an ‘s2’, and ‘s2’ increases to an ‘s3’ at any greater thickness than that tested).

If thicknesses greater than 24mm are to be covered and the manufacturer would like to maintain the smoke class then a single indicative EN 13823 test can be conducted on the thickest product in order to show the smoke class is unaltered.

5.2.6 Substrate and compound substrates

With surface applied products it is possible to use 'compound substrates' (2 substrates). For instance if the surface treatment is tested on a standard substrate in accordance with EN 13238 it is possible to test with a further substrate behind this (either with or without an air gap). The standard substrate rules apply to both substrates.

5.2.7 Air gap

The same principles as for the testing of untreated wood products apply. An air gap between the tested product and the substrate is a worse case than mounting without an air gap. Tests with an air gap are equally valid for mounting without an air gap for the same substrate.

A ventilated air gap is more severe than an unventilated air gap, since it allows for ventilation behind the tested wood product.

The hierarchy for air gaps is as follows:

Tested	Coverage
40mm ventilated cavity	Ventilated and non-ventilated cavities and no air gap
40mm unventilated cavity	Non ventilated cavities and no air gap
No air gap	No air gap only

Products tested free standing (with an 80mm air gap) do not cover any of the above end use applications and should be tested in full separately.

5.2.8 Additional surface coatings

Ordinary surface coatings on fire retardant treated wood products need additional fire testing to be included in a classification. At least one single test according to EN 13823 or EN ISO 9239-1 shall be performed per surface coating at a specified amount as used in practice. This test must be conducted on the worst performing SBI result on which the classification is based on. If this single test meets the test criteria, the coated product may be included in the classification already achieved. If it does not meet the criteria, full testing shall be performed for the coated product.

Additional Fire Retardant coatings applied to fire retardant treated wood products must also be tested in the same way as evidence gained for their performance will often be on untreated substrates and it may be found that when tested on a fire retardant wood product the smoke performance is affected.

5.2.9 Mounting and Fixing

Further rules on mounting and fixing are given in the relevant harmonised product standard listed in section 2.1, these rules should be followed.

5.2.10 Joints and Orientation

When a product is tested with horizontal and/or vertical joints these must be in accordance with EN 13823. The type of joint tested, i.e. tongue and groove or butt joints, must be documented in the field of application of the classification report. Furthermore the orientation of jointed products like solid wood panelling and cladding must be detailed (i.e. horizontal and/or vertical), testing in just one orientation does not cover the other without further testing. Testing with joints gives coverage for no joints. Testing with an expansion gap of 2mm covers for butt joints with no gap but not tongue and groove. These rules are for cases where the method in 5.2.4 is not used.

5.2.11 Colour ranges

If a range of additional colours is required then the worst performing colour must first be determined and this used for all tests. This can be determined by testing all colours using the ISO 5660-1 cone calorimeter or by the method detailed in EGOLF recommendation 003-2016.

5.2.12 Test report

The test report shall specify all items under 5.2.1 - 5.2.11.

5.3 Fire classification

A fire classification can be determined for just the product and the conditions tested or for a range of products. Extension of the field of application in accordance with the rules established in this document shall be reported in an 'Extended Application Report' drafted in conformity with EN 15725: '*Extended application reports on the fire performance of construction products and building elements*'. The fire classification for a product range shall be decided by the worst fire performance within the range.

The classification report shall identify all items under 5.1.1 - 5.1.12 for impregnated wood products and 5.2.1 - 5.2.11 for surface coated wood products with the exception that 5.1.2 and 5.2.2 may be a brief description of the chemical used, to protect the manufacturer's confidentiality of the fire retardant product. The notified product certification body must hold on file the chemistry used.

In the case of fire retardant coated wood products where standard substrate rules have been used to cover a range of products, the products in manufacture which are to be covered by the classification must be detailed within the classification and EXAP report.

All of the above reports, i.e. EXAP reports and classification reports are issued by or on behalf of the notified product certification body.

5.4 Field of application

5.4.1 Direct field of application

The direct field of application covers only the product(s) tested.

5.4.2 Extended field of application

The extended field of application is reported in an extended application report. The extended field of application shall include the principles in items 5.1.1 – 5.1.12 or 5.2.1 – 5.2.11.

6 Durability of the reaction to fire performance of fire retardant treated wood products

The reaction to fire performance of fire retardant treated wood products may be reduced by exposure to wet and/or humid conditions, and the ability of treatments to continue to perform even when exposed to these conditions should be demonstrated.

Two aspects of fire durability of the fire-retardant treatment of wood-based products should be considered. One is the risk for high moisture content and migration of the fire-retardant chemicals within the wood product and salt crystallization on the product surface. These hygroscopic properties of the treated wood-based product can be evaluated by exposure to fluctuating conditions of temperature and relative humidity.

The other aspect is the risk for decreased fire performance due to loss of the fire-retardant chemicals by leaching in exterior applications, e.g. façade claddings. The retention of fire performance after weathering should be verified.

Notified bodies are recommended to inform their clients interested in fire retardant wood products about this topic.

A possible procedure for these durability aspects is defined in the standard EN 16755. It specifies performance classes and procedures to verify the performance.

7 Guidance for Notified Certification Bodies when using fire test evidence

7.1 General

The “manufacturer” (the organization placing the product on the market) is responsible for the product having the declared performance and for conducting the factory production control. If a manufacturer has its products treated with fire retardant by another organization, it shall have a contract with that organization to ensure that the treatment is carried out to appropriate standards, and with appropriate Factory Production Control (FPC). Alternatively, if an applicator of fire retardant treatments places the treated products on the market, it shall have a contract with the supplier of the wood or manufacturer of the wood-based products to ensure that the product meets the declared characteristics other than reaction to fire, and is produced with appropriate FPC.

It should be noted that application of fire retardants to existing products which may already have a DoP and CE mark applied can change the performance values of the product (for instance the structural, acoustic or vapour permeability values).

NOTE:
The manufacturer may need to obliterate the existing CE mark and at the very least a review of the effects of the treatment on the non-fire related declarations will be required in order to declare new values (should they have changed) and prepare a new DoP.

CE-marking of in situ applied fire retardant wood products (ETAG 028) is not included in this position paper.

7.2 Sampling and Auditing

For the sampling of fire retardant treated wood construction products the Notified Certification Body shall follow the guidance given in GNB AG position paper ‘Sampling in AVCP systems 1 and 1+’ (NB-CPR/15/639). The Notified Certification Body, or their appointed representative, shall always witness the application of the fire retardant chemical when selecting specimens for type testing.

Further guidance is required when sampling and auditing fire retardant impregnated wood products. This shall be conducted at the treatment plant. Section 5.1.4 shall be followed.

Appendix 1 – Worked examples

Example 1:

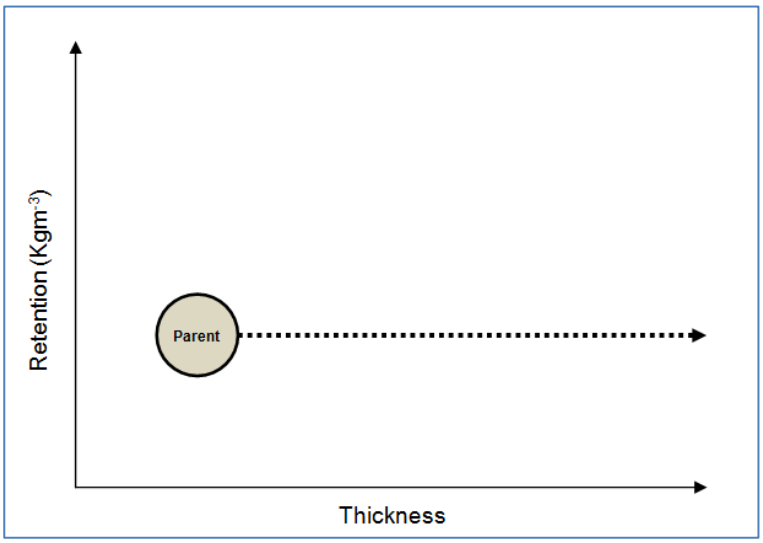


Figure 1 – Example of simple 'Parent'

A full set of three SBIs is undertaken on species A at a thickness of 12mm and retention of 40kg/m³ and the results are a euroclass B-s1,d0, this is the 'parent'. A classification can now be written with the following euroclass and field of application:

Euroclass	B-s1,d0 (12mm) B-s2,d0 (>12mm)

Field of Application:

Species:	Species A
Thickness:	12mm and greater
Retention:	40Kg/m³

Example 2:

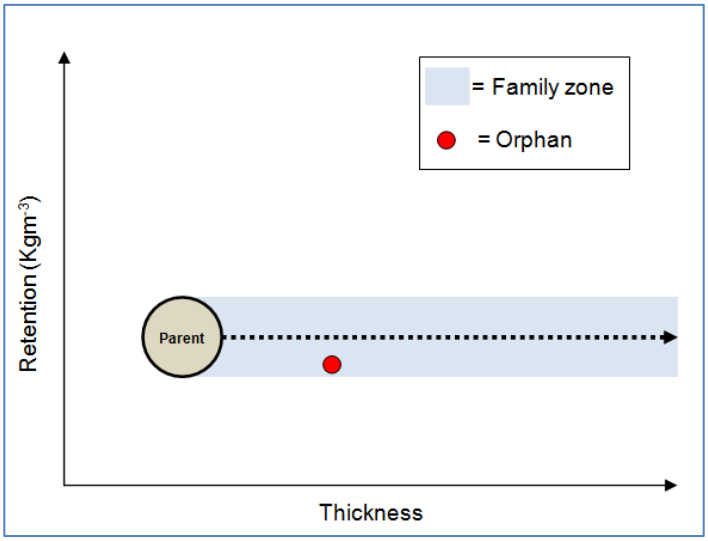


Figure 2 – Example of relationship between 'Parent', 'Orphan' and 'Family'

A full set of three SBIs is undertaken on species A at a thickness of 12mm and retention of 40kg/m³ and the results are a euroclass B-s1,d0, this is the 'parent'. An additional single indicative test on species B is undertaken at a thickness of 15mm and a retention of 38kg/m³ with a performance of B-s1,d0 (all FIGRA and THR values are not borderline) as this is a different species this is an 'orphan'. Both the thickness and the retention fall within the 'family' and as such this result can be adopted. A classification can now be written with the following euroclass and field of application[5]:

Euroclass Species A	B-s1,d0 (12mm – 18mm) B-s2,d0 (> 18mm)
Euroclass Species B	B-s1,d0 (15mm) B-s2,d0 (> 15mm)

Field of Application:

Thickness:	Species A: 12mm and greater Species B: 15mm and greater
Retention:	40 Kg/m³

[5] Note that the s1 smoke result from the 'orphan' at a greater thickness cannot be used to extend the s1 smoke class of the 'parent' to the greater thickness as it is a different species. Further note that the test retention of the 'orphan' has been raised to meet that of the 'parent' in the field of application. If the retention of the 'orphan' tested was above the line, while remaining within the 10% family zone (i.e. 43Kg/m³), then the retention for this species would not be lowered to that of the 'parent' species and it should remain at 43Kg/m³.

Example 3:

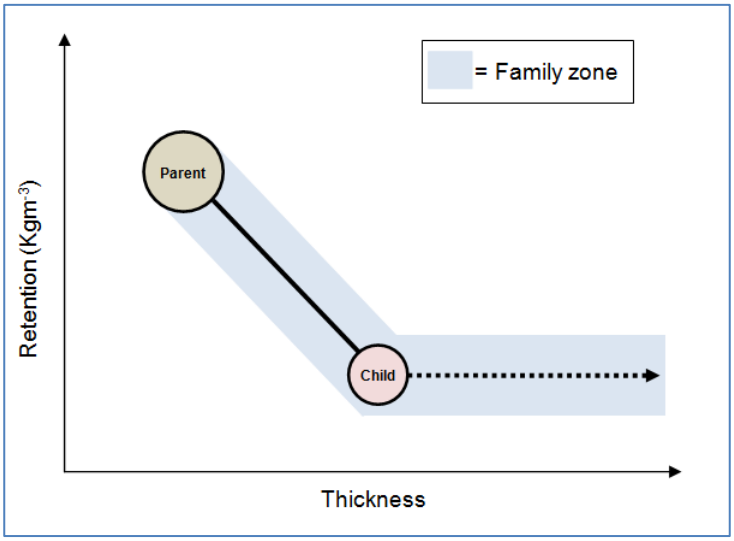
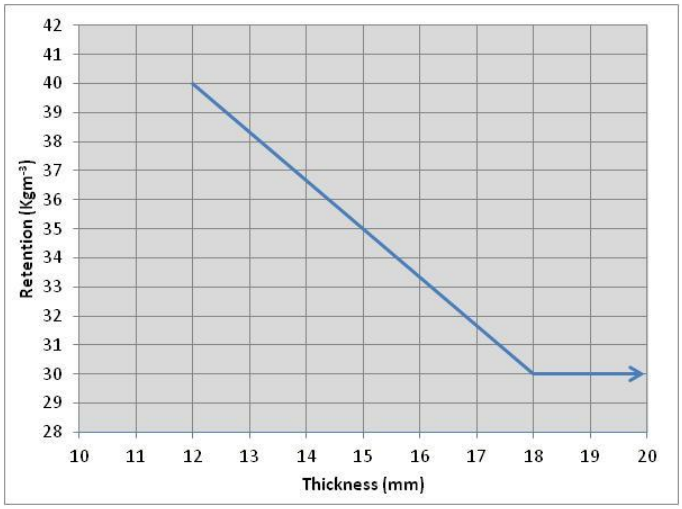


Figure 3 – Example of relationship between 'Parent', 'Child' and 'Family'

A full set of three SBIs is undertaken on species A at a thickness of 12mm and retention of 40kg/m³ and the results are a euroclass B-s1,d0, this is the 'parent'. An additional single indicative test on species A is undertaken at a thickness of 18mm and a retention of 30kg/m³ with a performance of B-s1,d0 (all FIGRA and THR values are not borderline), as this result is the same euroclass as the 'parent' this test is now the 'child'. A classification can now be written with the following euroclass and field of application:

Euroclass	B-s1,d0 (12mm – 18mm) B-s2,d0 (> 18mm)

Field of Application:

Species:	Species A
Thickness:	12mm and greater
Retention:	

Example 4:

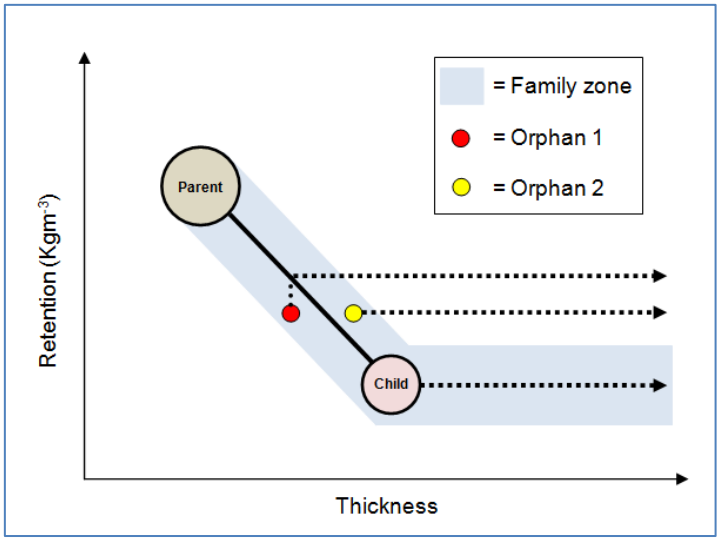


Figure 4 – Example of relationship between 'Parent', 'Child', 'Orphan' and 'Family'

A full set of three SBIs is undertaken on species A at a thickness of 12mm and retention of 40kg/m³ and the results are a euroclass B-s1,d0, this is the 'parent'. An additional single indicative test on species A is undertaken at a thickness of 18mm and a retention of 30kg/m³ with a performance of B-s1,d0 (all FIGRA and THR values are not borderline), as this result is the same euroclass as the 'parent' this test is now the 'child'.

An additional single indicative test on species B is undertaken (orphan 1) at a thickness of 15mm and a retention of 34kg/m³ with a performance of B-s1,d0 (all FIGRA and THR values are not borderline). Both the thickness and the retention fall within the 'family' and as such this result can be adopted[6].

An additional single indicative test on species C is undertaken (orphan 2) at a thickness of 17mm and a retention of 34kg/m³ with a performance of B-s2,d0 (all FIGRA and THR values are not borderline. Both the thickness and the retention fall within the 'family' and as such this result can be adopted[7].

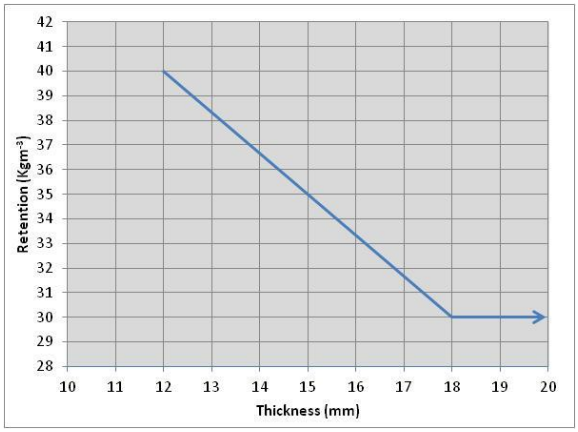
A classification can now be written with the following euroclass and field of application:

Euroclass Species A	B-s1,d0 (12mm – 18mm) B-s2,d0 (> 18mm)
Euroclass Species B	B-s1,d0 (15mm) B-s2,d0 (> 15mm)
Euroclass Species C	B-s2,d0 (17mm) B-s3,d0 (> 17mm)

[6] Note that the s1 smoke result from 'orphan 1' at a greater thickness cannot be used to extend the s1 smoke class of the 'parent' to the greater thickness as it is a different species. Further note that the test retention of the 'orphan' has been raised in the field of application to meet that of the line between 'parent' and 'child', in this case 35 Kg/m³.

[7] Note that the retention of 'orphan 2' tested was above the line at 34Kg/m³, this is within the 10% family zone (i.e. at 17mm the retention stated in the field of application is 31.5Kg/m³), the retention for this species in the field of application would not be lowered to meet the line between 'parent' and 'child' and that species should remain at 34Kg/m³.

Field of Application:

Thickness:	Species A: 12mm and greater Species B: 15mm and greater Species C: 17mm and greater
Retention:	Species A:  Species B: 35 Kg/m³ Species C: 34 Kg/m³