
GUIDANCE DOCUMENT N: DATA REQUIREMENTS FOR LISTING THERMALLY MODIFIED WOOD WITH ENHANCED DURABILITY IN THE AWPAS STANDARDS

Jurisdiction: Technical Committee P-9

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This Guidance Document is not an AWPAS Standard. These are nonmandatory guidelines presented to aid the user in understanding the basic testing requirements for wood protection systems and to assist the AWPAS Technical Committees in the development of AWPAS Standards. The testing of products in accordance with this Guidance Document does not constitute conformance to any AWPAS Standard. No product can be considered to conform to an AWPAS Standard until it has been subjected to complete technical review and voting by AWPAS's Technical Committees, and procedural review and final action by the AWPAS Executive Committee pursuant to the AWPAS Technical Committee Regulations.

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1. GENERAL INFORMATION AND PURPOSE

Thermally modified woods having enhanced durability are listed in the AWPAS Standards by means of a proposal and supporting data package submitted to the appropriate AWPAS Technical Committee, followed by a discussion and voting process. The complete listing procedure is outlined in the AWPAS Technical Committee Regulations. The purpose of this Guidance Document is to guide proponents in the type of data to be included in a supporting data package to propose listing a new thermally modified wood having enhanced durability or modify the listing of an existing such system(s). A proponent should be familiar with the AWPAS Use Category System (UCS). Refer to the AWPAS Book of Standards for information on the UCS. For more specific guidance on standardization of wood protection systems, proposal sponsors are encouraged to interact with the appropriate Technical Committees early in the evaluation process. This can be initiated by asking Association Staff (see www.awpa.com for contact information) for the appropriate Technical Committee Chair to contact.

This document suggests certain data requirements for consideration of thermally modified woods having enhanced durability or modifications to the listing of such systems. While the proponent of a system is expected to provide all data suggested by this document, it is understood that it may not be possible to develop one or more types of data in some cases. In the event listed data is not submitted, the proponent shall provide justification for not doing so. Notwithstanding the statements in this document, the appropriate Technical Committee shall be the final arbiter of the type, quantity, and validity of the data needed for the listing of a system. For thermally modified woods, it is important to recognize that historical acceptance criteria (e.g., weight loss of <5%) may not be valid. In other cases, rating systems may have to be adapted to the specific modifications.

The format of the AWPAS Standard may also need to be altered from the usual one to allow for the particular thermal modification system. A proponent is cautioned to maintain as much similarity as possible in proposing a standard for a thermal modification system.

It is not appropriate to express retention for thermally modified woods using traditional units such as pounds per cubic foot. It may also not be possible to use traditional chemical analysis methods such as XRF for determining the degree of thermal modification. Therefore, the proponent is cautioned to provide a fully developed analytical procedure to assess the quality of the product for use on the modified wood and to provide details for measuring degree of modification/enhancement in whatever terminology is appropriate. The various tests submitted for consideration should show an efficacy dependence on degree of modification/enhancement similar to that of retention of typical chemical active ingredients.

After standardization of a new modification system, the proponents shall provide yearly data updates to the appropriate Technical Committee on critical field tests for a period of five years. Standards are then reaffirmed at 5 year intervals (see AWPAS Guidance Document I).

2. TYPES OF PROPOSALS

These guidelines cover three types of wood modification system proposals:

Type 1 – Listing of a new thermally modified wood in the AWWA Standards or making a major change to a previously standardized modified wood. Examples of major changes are radically altering the modification chemistry such that the product has significantly different performance attributes.

Type 2 – Listing an AWWA standardized thermally modified wood in a new use category or categories.

Type 3 – Minor alteration(s) to an AWWA standardized thermally modified wood. An example of a minor alteration would be changes in ratios of modifying agents in multi-component systems.

The distinction between major and minor alterations (*Type 1* and *Type 3* proposals) may be unclear at times. A proponent is encouraged to interact with the appropriate AWWA Technical Committee for guidance on how to classify a proposal (see Section 1, above).

Additives are not normally considered during the modification review process. It is the responsibility of the proponent to fully document the modification process and identify any additives, if present.

3. HOW TO USE THESE GUIDELINES

To use these guidelines, the proponent should:

1. Determine what type of proposal is being considered (see Section 2).
2. Decide in what Use Categories the thermally modified wood product will be used (see Section 2 of Standard U1 for descriptions of the different Use Categories).
3. Determine what other information should be included in the proposal and data package by referring to Section 4.
4. Depending on the proposal type and Use Categories of interest, determine the recommended performance data necessary by referring to Table 1. This Table is used in conjunction with Section 5, Methodology for Generating Performance Data, which describes the individual data guidelines in more detail.

4. GUIDELINES FOR ALL SUBMISSIONS

4.1 Information Suggested for All Type 1 Submissions – All *Type 1* proposals should include the following information:

4.1.1 Proposed wording for the modification listing in the appropriate Standard. The proponent should model the proposed wording on what is currently used in the relevant Standard.

4.1.2 Listing of the proposed Use Categories and corresponding level of modification necessary for the use category.

4.1.3 Chemical and physical properties of the thermally modified wood. Pertinent information on the chemical and physical properties shall be provided. Particular emphasis should be placed on the physical and chemical structure of the thermally modified wood since these factors may affect long term performance. It may be helpful to discuss by-products or residuals as well. Some examples of relevant chemical and physical properties are density, hydrolytic stability, color change, and dimensional stability. Other, more appropriate characterization, should also be considered.

4.1.4 EPA registration status. A proposal to list a modification system can be made while still in the EPA registration process or in negotiation with the EPA as to its classification, but if such EPA registration is required then standardization cannot occur until registration or classification is complete (see Section 7.5.7 of the AWWA Technical Committee Regulations).

4.1.5 MSDS(s) for the modified wood. An appropriate MSDS listing shall be included with any submission.

4.1.6 Methods for determination of:

- A. Level of modification of wood as a quantitative measurement
- B. Gradient of the thermal modification throughout the wood

4.1.7 Treatability. At a minimum, information on the process temperature and time and relevant wood temperature gradients with any resulting modification gradient (see 4.1.3) resulting from laboratory, pilot production or manufacturing processes on southern pine sapwood (or other substrate for which the thermal modification is proposed) with the proposed wood modification system or process shall be provided.

4.1.8 Performance data as specified in Table 1 and Section 5.

4.2 Information Suggested for All Type 2 Submissions – All Type 2 proposals should include information as listed in Section 4.1.1, 4.1.2, and 4.1.8 above.

4.3 Information Suggested for All Type 3 Submissions – All Type 3 proposals should include information as listed in Section 4.1.3, 4.1.4, 4.1.5, 4.1.6, and 4.1.8 above.

4.4 Use of Control Treatments. All evaluations of thermally modified wood performance should include comparative information from untreated wood controls and at least one **standard reference preservative at levels that would be suitable for the intended application.**

4.5 Wood Species. If the thermal modification system or process is intended for use with softwoods, it is important to consider whether the eventual softwood to be used is highly permeable or refractory. If the intended softwood species will be permeable, then southern pine sapwood is preferred for performance evaluations. If the intended softwood species will be refractory, then Douglas-fir or Western hemlock are preferred for performance evaluations. If the modification system or process is to be used with hardwoods, representative species for the proposed commercial application(s) should be used for evaluating the performance of the product. In all cases, the data on the influence and differences of heartwood and sapwood shall also be presented.

4.6 Efficacy and Characterization. Levels of efficacy for thermally modified wood are evaluated by performance tests and are a critical part of the experimental design evaluated by AWPAs Committees. It is sometimes desirable to analyze and report hemicellulose levels for all 5 sugars both before and after thermal treatment at the levels at or close to the projected commercial use levels of the product. However, depending on the thermal-modification system under consideration, other means of characterizing the “level of efficacy” of various thermal modification processes may also be appropriate. In all cases, it is the responsibility of the proponent to characterize any such fundamental relationships or to provide appropriate scientific justification. For tests that evaluate the fungal and insect resistance of the thermal treatment, it is highly desirable to include levels that bracket the performance threshold. See AWPAs Standard E7, Section 6.4, for additional general guidance.

5. METHODOLOGY FOR GENERATING PERFORMANCE DATA

This section describes the performance testing requirements listed in Table 1 in more detail and gives some examples of methods to obtain the performance data. Standard test methods are not available for evaluating all of the performance criteria. Whenever standard methods are not available, nonstandard methods are suggested. Use of methods other than those suggested (or modified suggested methods) may also be acceptable provided they are based on sound experimental principles. A decision on the acceptability of data generated by new or modified test methods will be made by the particular AWPAs Technical Committee that has jurisdiction over listing the proposed modification system, product, or process. The name of the institution or company which performed the test should be stated. The use of third-party testing labs and agencies for critical tests is recommended.

The final decision on whether the data package supports the proposed modification system, product, or process lies with the appropriate Technical Committee. Data substitutions, for example long term field studies that preclude the necessity for certain accelerated laboratory testing, may be allowed by the Technical Committee. Allowing such data substitutions is the prerogative of the Technical Committee. Guidance on such issues can be obtained from the appropriate Technical Committee Chair. Contact information can be obtained from Association Staff (found at www.awpa.com).

5.1 Thermally Modified Wood Products Efficacy. This section refers to specialized considerations when evaluating the anti-fungal and/or anti-insect performance properties of thermally modified wood products.

5.1.1 Most thermally modified wood products contain mixtures of sapwood and heartwood. Samples should be large enough to ensure adequate representation of both or samples primarily composed of either sapwood or heartwood should both be evaluated.

5.1.2 When testing thermally modified wood products, the cutting of samples for biological testing may expose a relatively high proportion of material that would not be directly exposed to fungi or insects in full dimension products in service. Most or all of the cut surfaces should be sealed with a coating that will withstand any expansion of the material under the conditions of test. With some materials, epoxy resins are not flexible enough. Beeswax has been found to be a suitable material for this purpose.

5.1.3 Some thermally modified wood products incorporate binding agents with unreacted compounds or components (such as formaldehyde or sodium hydroxide) that may contribute to decay, mold, or termite resistance. If such components are anticipated to be lost in service, the test samples should be subjected to leaching or accelerated aging steps to remove these fugitive components prior to biological testing. Alternatively, the test method may be designed to promote loss of these fugitive components allowing sufficient time for biodeterioration to then occur.

5.1.4 Some thermally modified wood products incorporate processing parameters (such as high temperatures), binding agents (such as thermoplastics), or additives that prevent the wood component from reaching a suitable moisture content early enough in defined-duration laboratory tests for biodeterioration to be detectable before the recommended test period is over. If such components are anticipated to be lost in service, or if the wood component is anticipated to ultimately reach a suitable moisture content in service for biodeterioration to occur, the samples should be subjected to accelerated aging or pre-wetting procedure, or the test method should be extended sufficiently for biodeterioration to occur. To separate the effect of preservative from the effects of processing parameters, binding agents, or additives, controls should include both untreated composite and solid wood of the same species used to manufacture the composite.

5.1.5 Some thermally modified wood products are subjected to mechanical compression during processing and this material may irreversibly swell more than non-compressed wood products when exposed to conditions conducive to biodeterioration. Allowance should be made in the test design to ensure that such swelling does not interfere with the ability to remove the sample from the test assembly without physical damage.

5.1.6 Where efficacy tests rely on change in mechanical properties for assessing decay or termite resistance, a set of reference samples should, where possible, be exposed to the same environmental conditions but in the absence of the test organisms to assess the effects of the environmental conditions on mechanical properties.

5.2 Effect of Thermal Modification Processes on Wood Physical Properties. Preferred Methods: The preferred method depends on the type of material being considered. For general details on which evaluation or test methods to use, see Table 1, which refers the user to specific methods required by Guidance Document A. Many thermally modified wood products have historically been tested using comparable international test standards. When applicable a complete description of actual methods used shall be provided.

6. JURISDICTION

6.1 Technical Committee P-9 collaborates with other Technical Committees to determine which properties or parameters need to be evaluated for thermally modified wood for various use category.

6.2 Thermally Modified Wood processes and products recognized by Technical Committee P-9 are then individually addressed in AWWA Standards U1 and T1 for specific Commodity products by various T-Committees.

Table 1. Summary of data suggested to be included in a data package used to support a proposal to list a new thermally modified wood product, system, or process in the AWPAs Standards, make major or minor modifications to an AWPAs-listed system, or expand the applications for a listed system into new use categories. This table refers users to Guidance Document A for general evaluation and test methods, but in some instances the user is referred to Table 2 of this document for information on some composite-product specific test methods.

(M = Mandatory, R = Recommended)

TESTING REQUIREMENTS	Guidance Document A Section	UC1	UC2	UC3A	UC3B	UC4A-C	UC5A-C
Biological Efficacy							
Laboratory Efficacy Testing							
Soil Block	5.2.1.1		M	M	M	M	M
Soft-Rot	5.2.1.2					M	M
Termite	5.2.1.3	M	M	M	M	M	M
Soil Bed	5.2.2.1			R	R	R	R
Field Efficacy Testing							
Field Stakes	5.2.3.1			R	R	M	M
Post	5.2.3.2					R	R
Above-Ground	5.2.3.3		M	M	M		
Termite	5.3.3.4	M	M	M	M	M	M
Marine Panels	5.2.3.5						M
Physical Properties of Modified Wood							
Strength	(Table 2) ^a	M	M	M	M	M	M
Electrical Conductivity ^b	5.4.2				M	M	M
Hygroscopicity	5.4.3	M	M	M	M	M	M
Corrosivity of Thermally Modified Wood							
Treating Solution ^c	5.5	R	R	R	R	R	R
Modified Wood	5.4.4	M	M	M	M	M	M

^a Different performance test methods apply to different composite types (See Table 2 of this document for specific details).

^b This highly recommended test applies only to components of utility line structures and railway ties.

^c Some process solution are sometimes known to be corrosive and in such cases, data are required for listing processes, not the product.

Table 2: Listing of comparable international standards for various biological efficacy or physical properties testing.

TEST METHOD	USA (AWPA or ASTM)	CANADA	EN (Euro Stds.)	JAPAN	AUSTRALIA /NZ	CHINA
<i>Biological Efficacy</i>						
Laboratory Efficacy Testing						
Soil Block	E10					
Soft-Rot	E23					
Termite	E1					
Soil Bed	E14					
Field Efficacy Testing						
Field Stakes	E7					
Post	E8					
Above-Ground	E9					
Termite	E26					
Marine	E5					
<i>Physical Properties</i>						
Strength	D5516/D5664					
Electrical Conductivity ^a						
Hygroscopicity	D3201					
<i>Corrosivity</i>						
Treating Solution	E17					
Modified Wood	E12					

^a See Katz and Miller 1963, AWPAs Proc. Vol 59:204-217