Assessment of the group number and average specific extinction area (ASEA) for Hoop Pine plywood in accordance with AS 5637.1-2015

Assessment Report

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Client: Austral Plywoods Pty Ltd

Commercial-in-confidence

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1 Introduction

This report is an assessment of the group number and average specific extinction area (ASEA) for Hoop Pine plywood in accordance with AS 5637.1-2015.

This report is prepared for the purpose of meeting the evidence of suitability requirements of Specification A2.3 for FRL.

This report reviews and confirms the extent to which the reference fire resistance tests listed in section 2 meet the requirements of the standard fire test standards listed in section 4 of the report. The proposed variations to the tested construction presented in section 3 are subject to an analysis in Appendix B and the conclusions are presented in Section 5 of this report.

The field of applicability of the results of this assessment report is presented in Section 6.

2 Supporting Data

This assessment report refers to the following report(s) to support the analysis and conclusions of this report.

Report Reference	Test Standard	Outline of Test Specimen
FNK 9157	AS/NZS 3837-1998	A cone calorimeter test in accordance on a set of 5-ply Hoop pine plywood specimens undertaken at 50kW/m^2

This test was conducted by CSIRO and sponsored by Plywood Association of Australasia Ltd. Plywood Association of Australasia Ltd has provided permission to use this report.

3 Proposed Variations

The proposed construction shall be the wall and ceiling lining as tested in FNK 9157 and with the following requirements:

- The surface may include holes not exceeding 8mm in width or 10mm in depth and the total area of the holes may not exceed 30%
- The thickness of the plywood may increase though not decrease from that tested

4 Referenced Standards

Standards:

AS/NZS 3837-1998	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter
AS 5637.1-2015	Determination of fire hazard properties – Wall and ceiling linings

5 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Testing Authority that the tested prototypes described in Section 2 when varied as described in Section 3 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of section 7, validity of section 8 and limitation of section 9.

Group Number	**3**
Average Specific Extinction Area	**82.4 m^2/Kg**

6 Direct Field of Application of Results

The results of this assessment are applicable to wall and ceiling linings as defined in the NCC.

7 Requirements

This report details the test conditions and expected results that specific elements of the construction described herein would achieve when tested in accordance with AS/NZS 3837- 1998.

It is required that joints between panels shall not form gaps exceeding 8mm in width or 10mm in depth.

Any further variations with respect to size, surface characteristics, symmetry, thickness, composition or joints other than those identified in this report, may invalidate the conclusions drawn in this report

8 Term of Validity

This assessment report will lapse on 31st July 2023. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

9 Limitations

The conclusions of this assessment report may be used to directly assess the fire resistance performance under such conditions, but it should be recognised that a single test method will not provide a full assessment of the fire hazard under all fire conditions.

Because of the nature of fire resistance testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced assessment can therefore only relate only to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report is reviewed on or, before, the stated expiry date.

The information contained in this assessment report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

Appendix A Supporting Test Data

A.1. CSIRO Sponsored Investigation report numbered FNK 9157

On 16 May 2008, CSRIO conducted a cone calorimeter test in accordance with AS/NZS 3837-1998 on a set of 5-ply Hoop pine plywood specimens.

The specimens had a nominal thickness of 12.1mm, with a nominal density between 400kg/m^2 to 600kg/m^2. All test specimens were exposed in the horizontal orientation with the standard pilot operating. Nominally 100 x 100-mm specimens were tested as supplied. Specimens were tested with the use of an edge frame. The edge frame reduces the test surface area to 0.0088m^2, and this is the area used in calculations. For the test, specimens were wrapped in aluminium foil so that the four edges and the bottom of the specimen were covered. The foil formed a shallow tray that retained any molten material during testing. Three specimens were tested at an irradiance level of 50kW/m^2. The nominal exhaust system flow rate for all tests was 0.024m^3/s.

A summary of the results obtained from the specimens

Criteria	Sample 1	Sample 2	Sample 3	Mean	SD
Irradiance (kW/m²)	50	50	50	50	
Time to sustained burning (s)	20	20	15	18.3	2.9
Test duration (s)	395	385	395	391.7	5.8
Thickness (mm)	12.1	11.97	12.31		
Specimen initial mass (g)	66.12	65.4	65.7	65.7	0.4
Mass remaining (g)	17.02	17.7	16.2	17	0.8
Mass loss (g)	49.1	47.7	49.5	48.8	0.9
Percent of mass pyrolysed (%)	74.26	72.94	75.34	74.2	1.2
Average rate of mass loss (g/m².s)	14.91	14.76	14.81	14.8	0.1
Peak Heat Release Rate(HRR) (kW/m²)	326.9	309.7	313.9	316.8	8.9
Average HRR (first 60s after ignition)	135.5	131.3	146	137.6	7.6
Average HRR (first 180s after ignition)	126.7	123.3	136.1	128.7	6.6
Average HRR (first 300s after ignition)	140.6	140.5	145.2	142.1	2.7
Total heat released (MJ/m²)	63.57	60.67	66.06	63.4	2.7
Average Effective Heat of Combustion (EHC) (MJ/kg)	11.39	11.19	11.74	11.4	0.3
Average specific extinction area (m²/kg)	72.6	93.8	80.9	82.4	10.7

Appendix B Analysis of Variations

B.1 Assessment of 5-ply Hoop pine plywood group number

In accordance with AS 5637.1-2015, section 5 which states that only materials for which there are correlations between cone calorimeter results and room test results shall be tested in the cone calorimeter for the purpose of determining a group number. If the material has confirmed correlation, the group number shall be determined by prediction in accordance with clause 4.4 using data obtained by testing the material in accordance with AS/NZS 3837.

AS 5637.1-2015 clause 5.3.3 gives examples of materials for which the correlation is permitted which include the following:

(a) painted or unpainted paper-faced gypsum plasterboard;
(b) solid timber and wood products such as particleboard and plywood; and
(c) rigid non-thermoplastic foams such as polyurethane

It is confirmed that the material under consideration and tested in FNK 9157 is plywood, therefore prediction in accordance with AS 5637.1-2015 clause 4.4 is considered appropriate.

Clause 4.4 provides guidance on the selection of appropriate test methods using the correlation of a particular material or composite. The path taken in this assessment is highlighted by the dashed arrow in the following diagram:

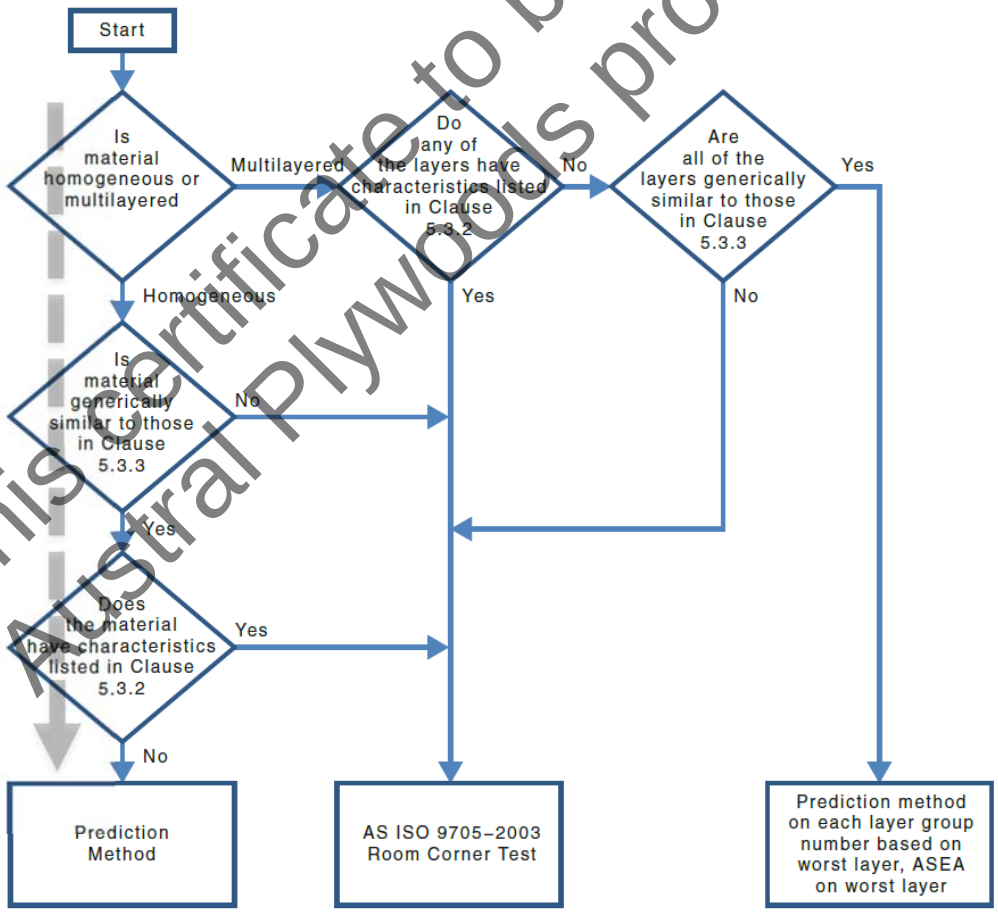

Figure B1: AS 5637.1-2015 clause 4.4 diagram

Is the material homogeneous or multi-layered? Homogeneous

While plywood is constructed from multiple layers of timber, for the purpose of this assessment 5-ply Hoop pine plywood is considered to be a homogeneous material. The reasoning behind this is that the identification of multi-layered material is intended to trigger the requirement to test each individual layer in isolation. Since 5-ply Hoop pine plywood is composed of layers of the same material, testing of each layer will not produce dissimilar results and is therefore redundant.

Is the material generically similar to those in clause 5.3.3? Yes

As discussed, it is confirmed that the wall and ceiling lining under consideration is 5-ply Hoop pine plywood, a material which is specifically listed in clause 5.3.3.

Does the material have characteristics listed in clause 5.3.2? No

Clause 5.3.2 lists unsuitable materials for which empirical correlations shall not be used which include the following:

(a) Materials with profiled facings not allowed by AS/NZS 3837;
(b) Materials that melt or shrink away from a flame;
(c) Materials with joints or openings; and
(d) Materials with a reflective surface

Profiled facings not allowed by AS/NZS 3837

AS/NZS 3837 clause 2.2.1.1 states that a product having one of the following surface characteristics is suitable for testing:

(a) An essentially flat exposed surface; or
(b) A surface irregularity which is evenly distributed over the exposed surface provided that–
(i) At least 50% of the surface of a representative 100mm square area lies within a depth of 10mm from a plane taken across the highest points on the exposed surface; or
(ii) For surfaces containing crack, fissures or holes not exceeding 8mm in width or 10mm in depth, the total area of such cracks, fissures or holes at the surface does not exceed 30% of a representative 100mm square area of the exposed surface

It is confirmed that the material under consideration is an essentially flat exposed surface and is therefore not considered a material with profiled facings which is not allowed by AS/NZS 3837.

Materials that melt or shrink away from a flame

As discussed, the wall and ceiling lining under consideration is 5-ply Hoop pine plywood and will not melt or shrink away from a flame.

Materials with joints or openings

The intended application for the material under consideration is for wall and ceiling linings. The material comes in the form of plywood panels which inevitably will require joints between panels when lining a large area such as a wall or ceiling.

AS 5637.1-2015 Appendix B3 in which it states:

"Wall systems in which fixings and joints play a critical part in the fire performance of the product are not suitable for testing in the cone calorimeter for the purpose of determining group numbers."

AS 5637.1-2015 does not specify limits on the joints or openings allowed. Therefore for the purpose of this assessment, the requirement of AS/NZS 3837 concerning profiled facings will be applied to joints. It is a condition of this assessment that joints between panels shall not form gaps exceeding 8mm in width and 10mm in depth.

In light of this, joints between panels are not expected to play a critical part in the fire performance of the product and therefore the cone calorimeter test is considered appropriate for the purpose of determining group numbers.

Materials with a reflective surface

As discussed, the wall and ceiling lining under consideration is plywood and is not a material with a reflective surface.

Conclusion

Based on the discussion above, it is confirmed that the wall and ceiling lining under consideration and tested in FNK 9157 is essentially homogeneous, is the same as to those materials listed in clause 5.3.3 and does not have characteristics listed in clause 5.3.2. It is therefore considered that the prediction method in AS 5637.1-2015 using data obtained by testing the material in accordance with AS/NZS 3837 is appropriate for the determination of a Group Number.

AS/NZS 3837-1998 test specimen requirements

The AS/NZS 3837-1998 test standard imposes several requirements for what is deemed a suitable specimen. These requirements are summarised below:

Surface Characteristics

A product having one of the following surface characteristics is suitable for testing:

(a) An essentially flat exposed surface; or
(b) A surface irregularity which is evenly distributed over the exposed surface provided that –
    (iii) At least 50% of the surface of a representative 100mm square area lies within a depth of 10mm from a plane taken across the highest points on the exposed surface; or
    (iv) For surfaces containing crack, fissures or holes not exceeding 8mm in width or 10mm in depth, the total area of such cracks, fissures or holes at the surface does not exceed 30% of a representative 100mm square area of the exposed surface

Asymmetrical Products

A product may have faces which differ from each other or contain laminations of different materials arranged in a different order in relation to the two faces. If this is the case and either of the faces can be exposed in use, then the product is suitable for this test provided both faces are tested.

Composite Material

Composite specimens must be exposed in a manner typical of the end-use condition and prepared so that the sides are covered with the outer layer(s) or otherwise protected.

Dimensionally Unstable Materials

Materials that change their dimensions substantially when exposed to the cone radiation, e.g. materials that intumesce or shrink away from the cone radiator are not suitable because the irradiance on the surface of the specimen at the time of ignition may differ significantly from that set initially.

Specimen Size

Test specimens shall be 100mm by 100mm in the area, up to 50mm thick, and cut to be representative of the construction of the end-use product. For products of normal thickness greater than 50mm, the requisite specimens shall be obtained by cutting away the unexposed face to reduce the thickness to 50mm. For testing, the specimens shall be wrapped in a single layer of aluminium foil, shiny side toward the specimen, covering the sides and bottom.

Excessively thin materials may not prove suitable for the test method since insufficient data will be collected for the calculation of heat release rates. Products that are thinner than 6 mm shall be tested with a substrate representative of end-use conditions, such that the total specimen thickness is 6 mm

or more. In the case of specimens of less than 6 mm in thickness and which are used with an air space adjacent to the unexposed face, the specimens shall be mounted so that there is an air space of at least 12 mm between its unexposed face and the refractory fibre blanket. This is achieved by the use of a metal spacer frame.

Determination of group number of tested specimens

Tests of the material in FNK 9157 were conducted in accordance with AS/NZS 3837. FNK 9157 describes a test on 12.1 mm thick samples of 5-ply Hoop pine plywood.

Following the procedures of the prediction method in AS 5637.1-2015, it was calculated that the samples achieved Group 3 performance.

Determination of average specific extinction area

The tested samples in FNK 9157 achieved Average Specific Extinction Area of 82.4 m^2/kg.

B.2 Increase the thickness of 5-ply Hoop pine plywood

The proposed increase in thickness of the 5-ply Hoop pine plywood will not affect the surface reaction of the plywood. In fact, the increase in mass and moisture in the specimen as a result of the increase in thickness will slow down the heating rate of the specimen, thereby decrease the rate at which particulates and combustible volatiles are released from the specimen throughout the test. As a result, the specimen's group number and Average Specific Extinction Area of the thicker 5-ply Hoop pine plywood will not be inferior to that of the tested specimen.

Based on the above, it is expected that the group number predicted for 12.1mm thick 5-ply Hoop pine plywood will also apply to Hoop pine plywood at the tested thickness or thicker.

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