ASSESSMENT REPORT

Assessment of timber veneers on Medium Density Fibreboard (MDF), Pyrotech flame retardant MDF, FLAMEBLOCK™ FRMDF and particleboard substrates for use as wall and ceiling linings with respect to the requirements of the Building Code of Australia Specification C1.10a

EWFA Report No:

45982.9

Report Sponsor:

Timber Development Association NSW Ltd
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Testing. Advising. Assuring.

DOCUMENT REVISION STATUS

Date Issued	Issue No	Description
25/09/06	45982.1	Initial Issue
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4/5/10	45982.4	Typographical amendment
7/7/10	45982.5	Typographical amendment
19/5/2011	45982.6	Inclusion of Pyrotech flame retardant MDF as a substrate
12/8/2011	45982.7	Inclusion of FLAMEBLOCK™ FRMDF flame retardant MDF as a substrate
15/8/2011	45982.8	Typographical amendment
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CONTENTS

1 INTRODUCTION

This report was prepared at the request of the Timber Development Association NSW Ltd (TDA) as an assessment of the Fire Hazard performance of timber veneers on Medium Density Fibreboard (MDF), Pyrotech flame retardant MDF (a fire retardant medium density fibreboard, FLAMEBLOCK™ FRMDF flame retardant MDF (details of which have been recorded and are kept on file), and particleboard substrates for use as wall and ceiling linings in accordance with the requirements of specification C1.10a of the Building Code of Australia 2010 (BCA).

Specification C1.10a requires testing to ISO 9705 “Fire tests – Full scale room test for surface products” or AS/NZS 3837:1998 “Method of test for heat and smoke release rates for material and products using an oxygen consumption calorimeter”. ISO 9705 is commonly referred to as the “ISO room fire test”,

The main outcome from AS/ISO 9705 is a time to flashover, which enables the determination of the material’s “Group Number” directly from Specification C1.10a

As an alternative to an ISO 9705 test the BCA permits testing to AS/NZS 3837:1998 (better known as the “Cone calorimeter test) in conjunction with the prediction method outlined in Specification A2.4 of the BCA.

The materials Group Number is an indication of its ‘time to flashover’ in the ISO room fire test. The Group Number may be gained directly from testing a material in the above-mentioned ISO room fire test, or alternatively be predicted using data obtained from testing of the material in the cone calorimeter.

The tested systems referred to in this report are described in Section 2 and are subject to the proposed variations described in Section 3 if tested in accordance with the referenced test method described in Section 4. The conclusions of the report are summarised in Section 5.

The validity of this assessment is conditional on compliance with Sections 7, 8 and 9 of this report.

Summaries of the test data on which this assessment is based are provided in the appendices together with a summary of the critical issues and the main points of argument leading to the assessment conclusions.

This report supersedes 45982.8 issued 15/8/2011.

2 TESTED PROTOTYPES

This assessment report is based on the reports summarised in Table 1 and 2 referring to tests in accordance with the requirements of Specification C1.10a of the BCA on various solid and plywood timber. The reports were sponsored by Timber Development Association NSW Ltd and undertaken by Warrington Fire Research Australia, CSIRO and BRANZ.

Table 1 – Referenced AS3837 Tests of Solid Timber

WFRA 499163j	WFRA 499163f	WFRA 499163t	WFRA 499140f
WFRA 499163b	WFRA 499163k	WFRA 499182l	WFRA 499163q
WFRA 499240d	WFRA 499140d	WFRA 499163r	WFRA 499182k
WFRA 499163i	WFRA 499163s	WFRA 499163d	WFRA 499182e
WFRA 499240b	WFRA 499182n	WFRA 499163p	WFRA 499163n
WFRA 499163h	WFRA 499163e	WFRA 499182j	WFRA 499182h
WFRA 499140a	WFRA 499240c	WFRA 499182b	WFRA 499240n
WFRA 499163l	WFRA 499163c	WFRA 499163u	WFRA 499240a
WFRA 499163v	WFRA 499163g	WFRA 499182m	WFRA 499182i
WFRA 499140e	WFRA 499182c	WFRA 499182d	FH4384
WFRA 499182f	WFRA 499140b	WFRA 499163a	FH4385
WFRA 499182g	WFRA 499163o	WFRA 499140c	FH4389
FH4391	FH4392	FH4393	FH4394
FH4390			

Each of the tests in Table 1 (prefixed WFRA) consisted of three specimens comprising two sections and included a tongue and groove joint with total specimen size nominally 100mm by 100mm. The specimen thicknesses were nominally 12mm or 19mm and the finish on the timber was smooth milled.

Each of the tests in Table 1 (prefixed FH) consisted of three specimens comprising one section with total specimen size nominally 100mm by 100mm. The specimen thicknesses were nominally 10mm and the finish on the timber was smooth milled.

CMIT 02/276) consisted of a series of tests on solid timber, MDF, Particleboard, and Plywood.

Table 2 – Referenced AS/NZS3837 Tests of Particleboard and MDF

Report	Species	Total Thickness
WFRA 499240g	Medium Density Fibreboard (MDF)	12mm
WFRA 499240k	Particleboard	12mm
WFRA 2146200E	Medium Density Fibreboard (MDF)	12mm
CMIT 02/276	Medium Density Fibreboard (MDF)	12mm
FH4386	Medium Density Fibreboard (MDF) faced with PVA adhesive	6.5
FH4388	Medium Density Fibreboard (MDF) faced with Resorcinol adhesive	6.5

Table 3 – Referenced AS/NZS3837 Tests of Veneered Particleboard and MDF

Report	Species	Total Thickness
WFRA 499240H.1	0.6mm Ash, Alpine *(Eucalyptus Sieberi)* veneer on each side of 12mm thick MDF	13.5mm
WFRA 499240J.1	0.6mm Box, Brush *(Lopehostman confertus)* veneer on each side of 12mm thick MDF	13.5mm
WFRA 499240L.1	0.6mm Ash, Alpine *(Eucalyptus Sieberi)* veneer on each side 12mm thick Particleboard	13.5mm
WFRA 499240M.1	0.6mm Box, Brush *(Lopehostman confertus)* veneer on each side of 12mm Particleboard	13.5mm
CMIT 02/276	Tasmanian Oak Veneer on 12mm thick Particleboard	12mm

Each of the tests in Table 2 and 3 consisted of three specimens comprising of nominal size 100mm by 100mm. The specimen finish on the timber was smooth milled and pressed.

Table 4 – Referenced AS/ISO 9705 Test of Veneered Pyrotech flame retardant MDF

Report	Lining	Total Thickness
2557600	0.5mm Western Red Cedar veneer on each side of 12mm thick Pyrotech flame retardant MDF	

Report EWFA 2557600 was issued by Warrington Fire Research Pty Ltd or Exova Warringtonfire, and report CMIT 02/276 was issued by CSIRO Fire Science and Technology Laboratory. All reports were sponsored by Timber Development Association NSW Ltd, who has granted permission for reference of the test data in this report.

The results of the above mentioned reports are summarised in Appendix A.

Table 5 – Referenced AS/NZS3837 Tests of Veneered FLAMEBLOCK™ FRMDF

Report	**Species**	**Total Thickness**
EWA 23766-00b.1	FLAMEBLOCK™ FRMDF	12.2mm
EWA 23766-00d.1	0.6mm Grey Iron Bark timber veneer each side FLAMEBLOCK™ FRMDF	13.4mm
EWA 23766-00e.1	0.6mm *Radiata Pine* timber veneer each side of FLAMEBLOCK™ FRMDF	13.2mm
EWA 23766-00g.1	0.6mm Black Onyx timber veneer each side of FLAMEBLOCK™ FRMDF	13.4mm
EWA 23766-00i.1	0.6mm Anthracite timber veneer each side of FLAMEBLOCK™ FRMDF	13.2mm

3 VARIATION TO TESTED PROTOTYPES

3.1 TIMBER VENEERS ON MDF AND PARTICLE BOARD SUBSTRATES

It is proposed that timber veneers 0.5mm to 0.85mm thickness and density greater than 500kg/m^3 may applied to each side of Particleboard substrates having a dry density of nominally 700kg/m^3 and MDF having a dry density of 560kg/m^3 to 740kg/m^3 without detrimentally effecting the "group number" or "Average Specific Extinction Area" with respect to the referenced test procedures in Section 4.

Summary of Proposed Lining Construction

Substrate	
Material	**Particleboard** 6mm minimum thickness and a Dry Density nominally 700kg/m^3 **MDF** 6mm minimum thickness and a Dry Density 560kg/m^3 to 740kg/m^3
	Pyrotech flame retardant MDF 12mm minimum thickness and a Dry Density 560kg/m^3
	FLAMEBLOCK™ FRMDF 12mm minimum thickness and a Dry Density 710kg/m^3
Veneers for all Substrates	
Material	Unmodified untreated timber or CCA treated Radiata pine
Thickness	0.6mm to 0.85mm (Nominal)
Dry Density	Veneer density > 500kg/m^3 for Particleboard and MDF substrates and > 350kg/m^3 for Pyrotech flame retardant MDF substrates > 350kg/m^3 for FLAMEBLOCK™ FRMDF substrates
Adhesive Material	PVA or Resorcinol
Position of Veneers	A timber veneer shall be applied to each face, though does not have to be of the same species on each side

4 REFERENCED TEST PROCEDURES

Reference was made to Specification C1.10a, Clause 3 of Specification A2.4, AS/NZS 3837:1998 and AS/ISO 9705-2003.

5 FORMAL ASSESSMENT SUMMARY

On the basis of the discussion presented in this report it is the considered opinion of this test authority that if the tested specimens described in Section 2 had been configured as described in Section 3 they would achieve the performance stated below if tested in accordance with the test method referenced in Section 4, subject to the requirements in section 7

Lining Construction		Performance		
		Group Number	**Average Specific Extinction Area (m^2/kg)**	**SMOGRA (m^2/s)**
Substrate				
Material	**Particleboard** 6mm minimum thickness and Dry Density nominally 700kg/m^3 **MDF** 6mm minimum thickness and Dry Density 560kg/m^3 to 740kg/m^3	**3**	**<250**	**-**
	Pyrotech flame retardant MDF 12mm minimum thickness and Dry Density 560kg/m^3	**2**	**-**	**<100**
	FLAMEBLOCK™ FRMDF 12mm minimum thickness and Dry Density 710kg/m^3		**<250**	**-**
Veneers for all Substrates				
Material	Unmodified untreated timber or CCA treated Radiata pine			
Thickness	0.6mm to 0.85mm (Nominal)			
Dry Density	Veneer density > 500kg/m^3 for Particleboard and MDF substrates and > 350kg/m^3 for Pyrotech flame retardant MDF substrates and > 350kg/m^3 for FLAMEBLOCK™ FRMDF substrates			
Adhesive Material	PVA and Resorcinol			
Position of Veneers	A timber veneer shall be applied to each face, though does not have to be of the same species on each side			

6 DIRECT FIELD OF APPLICATION

This assessment applies to wall and ceiling linings of buildings that are required to have Fire Hazard Properties in accordance with BCA Specification C1.10a.

7 REQUIREMENTS

This report details the methods of construction, test conditions and assessed results that would be expected had the specific elements of construction described herein been tested in accordance with AS/NZS 3837:1998 or AS/ISO 9705-2003 as appropriate.

Any further variations with respect to size, constructional details, edge or end conditions, other than those identified in this report, may invalidate the conclusions drawn in this report.

8 VALIDITY

This assessment report does not provide an endorsement by Exova Warringtonfire Aus Pty Ltd of the actual products supplied.

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

Because of the nature of fire 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.

The assessment can therefore only relate 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 be reviewed on or, before, the stated expiry date.

The information contained in this 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.

9 AUTHORITY

9.1 APPLICANT UNDERTAKINGS AND CONDITIONS OF USE

By using this report as evidence of compliance or performance the applicant(s) confirms that:

- to their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the Standard against which this assessment is being made, and
- they agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test by a test authority in accordance with the Standard against which this assessment is being made and the results are not in agreement with this assessment, and
- they are not aware of any information that could adversely affect the conclusions of this assessment and if they subsequently become aware of any such information, agree to ask the assessing authority to withdraw the assessment.

9.2 GENERAL CONDITIONS OF USE

This report may only be reproduced in full without modifications by the report sponsor. Copies, extracts or abridgments of this report in any form shall not be published by other organisations or individuals without the permission of Exova Warringtonfire Aus Pty Ltd.

9.3 AUTHORISATION ON BEHALF OF EXOVA WARRINGTONFIRE AUS PTY LTD

Prepared by:	Reviewed by:
	
K. G. Nicholls	Steve Kettle

9.4 DATE OF ISSUE

19th September 2011

9.5 EXPIRY DATE

30th May 2016

APPENDIX A - SUMMARY OF SUPPORTING DATA

A.1 AS/NZS 3837:1998 TESTS CONDUCTED BY WFRA

Sponsor of Reports

Timber Development Association NSW Ltd, PO Box 154, St Leonards, NSW 1590

Test Laboratory

The tests were performed at AWTA laboratories under the technical control of Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong South, Victoria, 3175.

Test standards prescribed

AS/NZS 3837:1998.

Instrumentation

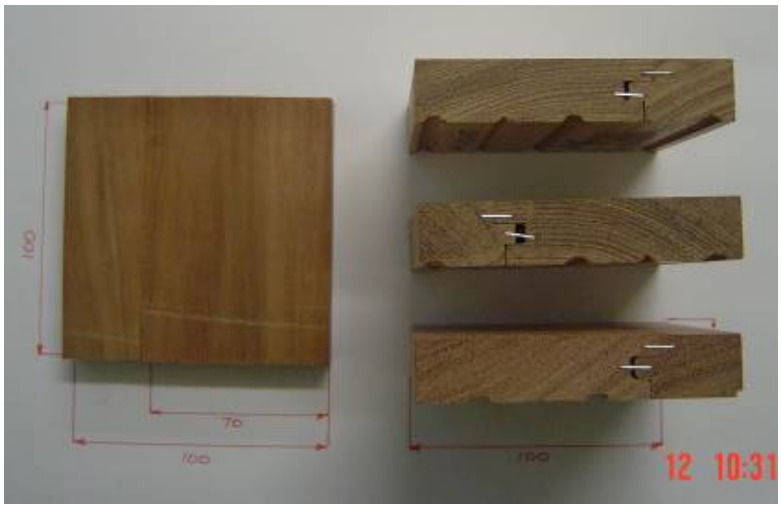
Instrumentation was provided in accordance with AS/NZS 3837:1998 as appropriate.

Test Procedures

The procedures for predicting: (i) a material's Group Number and (ii) the Average Specific Extinction Area, for the purposes of BCA Specification C1.10a, are given in Clause 3 of BCA Specification A2.4 Fire Hazard Properties.

General description of tested specimens

The solid timber tests specimens consisted of two sections nominally 100mm by 100mm of various thicknesses and included a join.



Typical Test Specimen Size and Joint Configuration

The MDF and Particleboard Specimens test specimens consisted of a single section nominally 100mm by 100mm of the thickness and species as shown below.

Report	Species	Total Thickness (mm)
WFRA 499240G	Medium Density Fibreboard (MDF) - 558(kg/m^3)	12
WFRA 499240K	Particleboard - 697(kg/m^3)	12
WFRA 2146200E	Medium Density Fibreboard (MDF) - 739(kg/m^3)	12
WFRA 499240H.1	0.6mm Ash, Alpine *(Eucalyptus delegatensis)* veneer on each side of 12mm thick MDF 558(kg/m^3)	13.5
WFRA 499240J.1	0.6mm Box, Brush *(Lopehostman confertus)* veneer on each side of 12mm thick MDF 558(kg/m^3)	13.5
WFRA 499240L.1	0.6mm Ash, Alpine *(Eucalyptus delegatensis)* veneer on each side 12mm thick Particleboard 697(kg/m^3)	13.5
WFRA 499240M.1	0.6mm Box, Brush *(Lopehostman confertus)* veneer on each side of 12mm thick Particleboard 697(kg/m^3)	13.5
WFRA 2146200A	0.85mm Calantas (*Toona Calantas)* veneer (480kg/m^3) on each side of 12mm thick (MDF) - 739(kg/m^3)	13.1
WFRA 2146200B	0.5mm Poplar (*Poplar Nigra)* (440kg/m^3) veneer on each side of 12mm thick (MDF) - 739(kg/m^3)	13.2
WFRA 2146200C	0.5mm Douglas Fir (*Psuedotsuga menziseii*) (530kg/m^3) Veneer on each side of 12mm thick (MDF) - 739(kg/m^3)	13.1
WFRA 2146200D	0.5mm New Gueinea Walnut (*Dracontomelum*) (540kg/m^3) veneer on each side of 12mm thick (MDF) - 739(kg/m^3)	13.1

The test specimens conditioned in accordance with BSEN 13238-2001 at a temperature of 23 +/- 2 ℃ and relative humidity of 50 +/- 5% for a continuous period of more than 48 hours prior to the conduct of these tests.

The above tests were conducted with the specimens located in a horizontal position. Throughout the above three tests the specimens were subjected to a constant radiant heat flux of 50kW/m^2.

For test results refer to section A3.

A.2 AS/NZS 3837:1998 TESTS CONDUCTED BY CMIT

Sponsor of Reports

Timber Development Association NSW Ltd**,** PO Box 154, St Leonards, NSW 1590

Test Laboratory

The tests were performed at CMIT

Test standards prescribed

AS/NZS 3837:1998.

Instrumentation

Instrumentation was provided in accordance with AS/NZS 3837:1998 as appropriate.

Test Procedures

The procedures for predicting: (i) a material's Group Number and (ii) the Average Specific Extinction Area, for the purposes of BCA Specification C1.10a, are given in Clause 3 of BCA Specification A2.4 Fire Hazard Properties.

General description of tested specimens

The solid timber tests specimens consisted of two sections nominally 100mm by 100mm of various thicknesses.

The MDF and Particleboard Specimens test specimens consisted of a single section nominally 100mm by 100mm of the thickness and species as shown below.

Report	Species	Total Thickness (mm)
5	Pine, Radiata – Pinus radiata	19
3	Ironbark, Red - Eucalyptus sideroxylon	19
2	Victorian Ash – Species not confirmed	12
1	Turpentine – Syncarpa glomulifera	19
4	Cedar, Western Red – Thuja plicata	12

The test specimens conditioned at a temperature of 23 +/- 2 ℃ and relative humidity of 50 +/- 5%.

The above tests were conducted with the specimens located in a horizontal position. Throughout the above three tests the specimens were subjected to a constant radiant heat flux of 50kW/m^2.

For test results refer to section A3.

A.3 TEST REPORTS - BRANZ

Report Sponsor

Timber Development Association NSW Ltd, PO Box 154, St Leonards, NSW 1590.

Test Laboratory

The tests were performed at BRANZ PTY LTD. Private Bag 50 908. Porirua 5240. Wellington, New Zealand

Test standards prescribed

AS/NZS 3837:1998.

Instrumentation

Instrumentation was provided in accordance with AS/NZS 3837:1998 as appropriate.

Test Procedures

The procedures for predicting: (i) a material's Group Number and (ii) the Average Specific Extinction Area, for the purposes of BCA Specification C1.10a, are given in Clause 3 of BCA Specification A2.4 Fire Hazard Properties.

General description of tested specimens

The test specimens generally consisted of single unjoined sections nominally 100mm by 100mm of various thicknesses.

The Western Red Cedar specimens (FH4389) were tested with profiles as listed below.

For the test specimens prefixed FH, they were generally conditioned at a temperature of 23 +/- 2 ℃ and relative humidity of 50 +/- 5% just prior to test.

The above tests were conducted with the specimens located in a horizontal position. Throughout the above three tests the specimens were subjected to a constant radiant heat flux of 50kW/m^2.

Test Results Solid Timber

Species	Nominal Thick. (mm)	Average Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	BRANZ Report No
Pine, Radiata – Pinus radiata (CCA Treated)	19.6	415	3	<250	FH4390
Oak, American - Quercus alba	10	756	3	<250	FH4394
Rosewood, Papua New Guinea - Pterocarpus indicus	10	535	3	<250	FH4391
Walnut, Black (American Walnut) - Juglans nigra	10	640	3	<250	FH4393.
Ash, Mountain – Eucalyptus regnans	10	570	3	<250	FH4385
Western Red Cedar – Thuja plicata	9	338	3	<250	FH4384

Species	Nominal Thick. (mm)	Average Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	BRANZ Report No
Western Red Cedar – Thuja plicata V-joint Profile	9	338	3	<250	FH4389
Western Red Cedar – Thuja plicata Shiplap Profile Indicative Single Specimen only	9	285	3	<250	FH4389
Western Red Cedar – Thuja plicata Regency Profile Indicative Single Specimen only	9	401	3	<250	FH4389

Test Results MDF faced with Adhesive

Species	Nominal Thick. (mm)	Average Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	BRANZ Report No
Medium Density Fibreboard (MDF) + PVA adhesive	6.5	768	3	109.3	FH4386
Medium Density Fibreboard (MDF) + PU adhesive	6.5	663	4	141	FH4387
Medium Density Fibreboard (MDF) + Resorcinol adhesive	6.5	751	3	81	FH4388

A.4 SUMMARY OF SOLID TIMBER TEST RESULTS

A summary of the solid timber test results from the referenced reports are presented below.

Species	Ave. Thick. (mm)	Ave Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	Report No
Ash, Alpine – Eucalyptus delegatensis	19.2	603	3	<250	499163j
Ash, Mountain – Eucalyptus regnans	19.5	686	3	<250	499163b
Ash, Mountain – Eucalyptus regnans	12.1	878	3	<250	499240d
Ash, Silvertop – Eucalyptus sieberi	19.6	838	3	<250	499163i
Ash, Silvertop – Eucalyptus sieberi	12.0	956	3	<250	499240b

Species	Ave. Thick. (mm)	Ave Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	Report No
Beech Myrtle – Northofagus cunnighamii	19.1	689	3	<250	499163h
Blackbutt – Eucalyptus pilularis	19.1	898	3	<250	499140a
Blackbutt, New England (1) - Eucalyptus andrewsii	19.1	939	3	<250	499163l
Blackbutt, New England (2) - Eucalyptus andrewsii	19.2	874	3	<250	499163v
Blackbutt, WA – Eucalyptus pantens	11.9	878	3	<250	499182g
Blackwood – Acacia melanoxylon	19.2	632	3	<250	499163f
Bloodwood Red – Corymbia gummifera	19.0	839	3	<250	499163k
Box, Brush – Lopehostman confertus	19.1	845	3	<250	499140d
Box, Grey – Eucalyptus microcarpa	19.0	1,112	3	<250	499163s
Box, Grey, Coast – Eucalyptus bosistoana	19.0	1119	3	<250	499182n
Brownbarrel – Eucalyptus fastigata	19.5	770	3	<250	499163e
Brownbarrel – Eucalyptus fastigata	12.2	743	3	<250	499240c
Cedar, Western Red – Thuja Plicata	12	-	3	<250	CMIT 02/276 (Spec 4)
Gum, Blue, Sydney - Eucalyptus saligna	19.1	733	3	<250	499163c
Gum, Blue, Southern (TAS) - Eucalyptus globulus	19.1	776	3	<250	499163g
Gum, Blue, Southern (VIC) - Eucalyptus globulus	19.3	937	3	<250	499163o
Gum, Manna – Eucalyptus viminalis	19.0	769	3	<250	499163t
Gum, Red, River - Eucalyptus camaldulensis	18.8	846	3	<250	499182l
Gum, Rose – Eucalyptus grandis	19.1	720	3	<250	499163r
Gum, Shining – Eucalyptus nitens	19.5	569	3	<250	499163d
Gum, Spotted – Corymbia maculata	19.2	989	3	<250	499163p

Species	Ave. Thick. (mm)	Ave Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	Report No
Gum, Sugar – Eucalyptus Cladocalyx	19.1	1031	3	<250	499182j
Gum, Yellow – Eucalyptus leucoxylon	19.1	1015	3	<250	499182b
Ironbark, Grey – Eucalyptus drepanophylla	19.0	1,086	3	<250	499163u
Ironbark, Red – Eucalyptus sideroxylon	19.2	1088	3	<250	499182 m
Ironbark, Red – Eucalyptus sideroxylon	19	-	3	<250	CMIT 02/276 (Spec 3)
Jarrah – Eucalyptus marginata	19.2	834	3	<250	499140c
Karri – Eucalyptus diversicolor	19.1	982	3	<250	499140f
Mahogany, Red – Eucalyptus resinifera	19.2	876	3	<250	499163q
Marri - Eucalyptus callophylla	11.9	814	3	<250	499182k
Merbau - Instia bijuga	19.0	860	3	<250	499182e
Messmate – Eucalyptus oblique	19.3	754	3	<250	499163n
Pine, Baltic - Picea abies	21.9	426	3	<250	499182h
Pine, Hoop – Araucaria cunninghamii	12.5	506	3	<250	499240n
Pine, Radiata – Pinus radiata	12.1	477	3	<250	499240a
Pine, Radiata – Pinus radiata	19.2	531	3	<250	499182i
Pine, Radiata – Pinus radiata	12	-	3	<250	CMIT 02/276 (Spec 5)
Pine, White Cypress - Callitris glaucophylla	20	667	3	<250	499163a
Sheoak, WA – Allocosuarina fraseriana	11.9	689	3	<250	499182d
Stringy Bark, Yellow - Eucalyptus muellerana	18.7	822	3	<250	499182c
Tallowwood – Eucalyptus microcorys	19.2	990	3	<250	499140b
Tasmanian Oak – *Species not confirmed*	19	-	3	<250	CMIT 02/276 (Spec 2)

Species	Ave. Thick. (mm)	Ave Density (kg/m^3)	Group No.	Average Specific Extinction Area (m^2/kg)	Report No
Turpentine – Syncarpa glomulifera	19.1	1072	3	<250	499140e
Turpentine – Syncarpa glomulifera	19	-	3	<250	CMIT 02/276 (Spec 1)
Wattle, Silver – Acacia dealbata	18.6	604	3	<250	499182f
Pine, Radiata – Pinus radiata (CCA Treated)	19		3	<250	
Oak, American – Quercus alba	10	756	3	<250	FH4394
Rosewood, Papua New Guinea - Pterocarpus indicus	10	535	3	<250	FH4391
Teak, Burmese – Tectona grandis	10	630	4	280	FH4392
Walnut, Black (American Walnut) - Juglans nigra	10	640	3	<250	FH4393.
Ash, Mountain – Eucalyptus regnans	10	570	3	<250	FH4385
Western Red Cedar – Thuja plicata	9	338	3	<250	FH4384
Western Red Cedar – Thuja plicata V-joint Profile	9	338	3	<250	FH4389
Western Red Cedar – Thuja plicata Shiplap Profile Indicative Single Specimen only	9	285	3	<250	FH4389
Western Red Cedar – Thuja plicata Regency Profile Indicative Single Specimen only	9	401	3	<250	FH4389

A.5 SUMMARY VENEERED MDF AND PARTICLEBOARD TEST RESULTS

Species	Ave Thick. (mm)	Ave Density (kg/m^3)	Group No.	Ave Specific Extinction Area (m^2/kg)	Report No
Medium Density Fibreboard (MDF)	12	558	3	<250	499240G
Medium Density Fibreboard (MDF)	12	739	3	<250	WFRA 2146200E
Medium Density Fibreboard (MDF)	12	-	3	<250	CMIT 02/276

Species	Ave Thick. (mm)	Ave Density (kg/m^3)	Group No.	Ave Specific Extinction Area (m^2/kg)	Report No
Particleboard	12	697	3	<250	499240K
0.6mm Ash, Alpine *(Eucalyptus delegatensis)* veneer on each side of 12mm MDF	13.5	596	3	<250	499240H.1
0.6mm Box, Brush *(Lopehostman confertus* veneer on each side of 12mm MDF	13.5	609	3	<250	499240J.1
0.6mm Ash, Alpine *(Eucalyptus delegatensis)* veneer on each side of 12mm Particleboard	13.5	700	3	<250	499240L.1
0.6mm Box, Brush *(Lopehostman confertus* veneer on each side of 12mm Particleboard	13.5	730	3	<250	499240M.1
0.85mm Calantas (*Toona Calantas)* veneer ($480kg/m^3$) on each side of 12mm (MDF) - $739(kg/m^3)$	13.1	755	3	<250	WFRA 2146200A
0.5mm Poplar (*Poplar Nigra)* ($440kg/m^3$) veneer on each side of 12mm (MDF) - $739(kg/m^3)$	13.2	757	3	<250	WFRA 2146200B
0.5mm Douglas Fir (*Psuedotsuga menziseii*) ($530kg/m^3$) veneer on each side of 12mm (MDF) - $739(kg/m^3)$	13.1	755	3	<250	WFRA 2146200C
0.5mm New Gueinea Walnut (*Dracontomelum*) ($540kg/m^3$) veneer on each side of 12mm (MDF) - $739(kg/m^3)$	13.1	763	3	<250	WFRA 2146200D
Victorian Ash (Species not confirmed) veneer on each side of 12mm (MDF)	12	-	3	<250	CMIT 02/276
Medium Density Fibreboard (MDF) + PVA Adhesive	6.5	768	3	109.3	FH4386
Medium Density Fibreboard (MDF) + PU Adhesive	6.5	663	4	141	FH4387
Medium Density Fibreboard (MDF)+ Resorcinol Adhesive	6.5	751	3	81	FH4388

A.6 TEST REPORT – EWFA 2557600

Sponsor of Reports

Timber Development Association NSW Ltd**,** PO Box 154, St Leonards, NSW 1590

Test Laboratory

Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong South, Victoria, 3175.

Test standards prescribed

AS ISO 9705-2003.

Instrumentation

Instrumentation was provided in accordance with AS ISO 9705-2003 as appropriate.

Test Procedures

The test was undertaken in accordance with AS ISO 9705-2003 with the specimen subjected to 100 kW for 600 seconds followed by 300 kW for 600 seconds or until flashover occurs. This heating regime is based on Clause 4(b) of BCA Specification C1.10a Fire Hazard Properties for the determination of group number.

The test procedure was subject to the variations outlined below.

Variation to the Test Procedures

During the 300 kW exposure part of the test (600-1200 seconds), the burner output temporarily dropped to zero. As this was after the specimen had partially flashed over, the specimen then went out until the burner came on again. This interrupted burner output delayed the time for the specimen to fully reach flashover.

The specimen reached flashover in accordance with AS ISO 9705 at 1155 seconds. If the burner had not gone out it is likely the flashover would have occurred at some time between 650 seconds and 1155 seconds. As it is unlikely that flashover would have occurred before 650 seconds it is considered that the variation would not have affected the group number when calculated in accordance with the methods described in section 4 of this report.

The SMOGRA RC value was calculated at 1155 seconds which included maximum values for smoke. It is likely if the burner did not go out and relight and the material flash over earlier the SMOGRA RC would be lower or similar to the measured value.

General description of tested specimens

The test specimen consisted of a fire test room with internal dimensions nominally 3600mm long × 2400mm wide × 2400mm high. The lining material was 12mm thick Pyrotech flame retardant MDF and incorporated a nominally 0.4mm Western Red Cedar veneer (Density nominally 350kg/m^3) adhered to each side with PVA adhesive. The lining was fixed to pine battens 31mm × 11mm at nominally 600mm centres in the field of the board and some edges. Sheets were typically joined using 54×19.5 (#10) joiner biscuits.

Test Results

Lining	Average Density (kg/m^3)	Flashover after	Group Number	SMOGRA$_{RC}$ (m^2/s)
Nominally 12mm Pyrotech flame retardant MDF with 0.4mm Western Red Cedar veneer adhered to each side with PVA adhesive	TBA	650-1000 seconds	2	6.5

A.7 AS3837-1998 TESTS CONDUCTED ON FLAMEBLOCK™ FRMDF

Sponsor of Reports

Briggs Veneers Pty Ltd, 409 Victoria St, Wetherill Park, NSW, 2164, Australia

Test Laboratory

The tests were performed at AWTA laboratories under the technical control of Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong South, Victoria, 3175.

Test standards prescribed

AS/NZS 3837-1998.

Test Procedures

The procedures for predicting: (i) a material's Group Number and (ii) the Average Specific Extinction Area, for the purposes of BCA Specification C1.10a, are given in Clause 3 of BCA Specification A2.4 Fire Hazard Properties.

General description of tested specimens

The solid timber test specimens consisted of two sections nominally 100mm by 100mm of various thicknesses. The test specimens conditioned at a temperature of 23 $\pm$ 2℃ and relative humidity of 50 + 5%.

The above tests were conducted with the specimens located in a horizontal position. Throughout the above three tests the specimens were subjected to a constant radiant heat flux of 50kW/m^2.

Summary of Briggs FLAMEBLOCK™ FRMDF Test Results

Species	Av. Thick. (mm)	Ave Density (kg/m3)	Group No.	Ave Specific Extinction Area (m^2/kg)	Report No
Briggs FLAMEBLOCK™ FRMDF	12.2mm	772	1	<250	EWA 23766-00b.1
0.6mm Grey Iron Bark timber veneer each side Briggs FLAMEBLOCK™ FRMDF	13.4mm	772	2	<250	EWA 23766-00d.1
0.6mm *Radiata Pine* timber veneer each side of Briggs FLAMEBLOCK™ FRMDF	13.2mm	772	1	<250	EWA 23766-00e.1
0.6mm Black Onyx timber veneer each side of Briggs FLAMEBLOCK™ FRMDF	13.4mm	772	2	<250	EWA 23766-00g.1
0.6mm Anthracite timber veneer each side of Briggs FLAMEBLOCK™ FRMDF	13.2mm	772	1	<250	EWA 23766-00i.1

APPENDIX B - ASSESSMENT OF SPECIFIC VARIATIONS

B.1 THE "GROUP NUMBER" FOR MDF AND PARTICLEBOARD SUBSTRATES WITH VENEERS

Proposal

It is proposed that timber veneers 0.5mm to 0.85mm thickness and density greater than 500kg/m3 may adhered with PVA or Resorcinol adhesive to each side of MDF and Particleboard substrates tested in WFRA 499240H.1, WFRA 499240L.1, WFRA 2146400B, FH4386, FH 4388 without detrimentally effecting the group number with respect to the referenced procedures in Section 4.

Discussion

The fire hazard performance of timbers species in the group 3 are compared with each other by how close to the result for IQ2 was to the limiting integral IQ2min ratio for each specimen in each test. For the purposes of this report this ratio is called the group number ratio.

The higher the group number ratio the closer to the next group number the particular specimen is, and therefore the poorer the performance. This measure is used in this report to compare the affect of veneers upon substrates of known performance.

The group number ratio for MDF and particleboard substrates of known density when tested in isolation is shown below.

Report	Specimen	Group Number Ratio
WFRA 499240G	MDF 12mm (558kg/m^3)	0.85
WFRA 2146200E	MDF 12mm (739kg/m^3)	0.94
WFRA 499240K	Particleboard 12mm (697kg/m^3)	0.83
FH4386	Medium Density Fibreboard (MDF) faced with PVA adhesive	0.99
FH4388	Medium Density Fibreboard (MDF) faced with Resorcinol adhesive	0.96

With reference to the test data for solid timber summarised in Appendix A, the timber species the highest group number ratio were selected as veneers and tested on particleboard and MDF substrates with PVA adhesive.

In addition timbers commonly used as veneers with intermediate densities were also used. The group number ratios for these tests are shown below.

Report	Specimen	Group Number Ratio
WFRA 499240H.1	0.6mm Ash, Alpine veneers on 12mm MDF	0.83
WFRA 499240J.1	0.6mm Box, Brush veneers 12mm MDF	0.89
WFRA 499240L.1	0.6mm Ash, Alpine veneers on 12mm Particleboard	0.80
WFRA 499240M.1	0.6mm Box, Brush veneers on 12mm Particleboard	0.89

Report	Specimen	Group Number Ratio
WFRA 2146200A	0.85mm Calantas veneers on 12mm thick MDF-739kg/m^3	0.83
WFRA 2146200B	0.5mm Poplar veneers on 12mm thick MDF-739kg/m^3	0.85
WFRA 2146200C	0.5mm Douglas Fir veneers on 12mm thick MDF-739kg/m^3	0.81
WFRA 2146200D	0.5mm New Guinea Walnut veneers on 12mm MDF-739kg/m^3	0.82

With reference to the above results it can be observed that the Group Number Ratio of the MDF or Particleboard tends to be reduced by the application of veneers and the results are significantly below the limiting value of 1 for Group 3 performance

With reference to the test results in Appendix A, it is confirmed for all the species of known density tested as solid timber the group number ratio was greater or within 2% of the value when tested as a veneer adhered to MDF or particleboard.

With reference to the test results in Appendix A it is confirmed for MDF and particleboard substrates, the group number ratio was greater or within 2% of the value when tested with a veneer.

Based on the above discussion it is considered that for the tested constructions the group number ratio is comparable to either the group number ratio of the veneer species or the substrate.

With reference to results of the reference tests, there is an apparent though weak relationship between density and group number ratio, and the minimum density of the referenced tests was 440 kg/m^3.

A conservative approach is proposed in this assessment to limit the applicability of the above conclusions to timber species that have densities greater than 500kg/m^3.

The timber species that yielded the highest group number ratio was solid Radiata Pine and MDF (739kg/m^3) of 0.9 and 0.94 respectively; therefore all tested species were otherwise within group 3.

The thickness of the proposed veneers of 0.5mm to 0.85mm is in the range of the tested specimens, and is not considered to significantly affect the group number ratio.

The proposed constructions include resorcinol adhesive. The methodology of this assessment is to consider a conservative approach of the adhesive being applied to the exposed surface of the material. This will amplify the effects of the adhesive with respect to the substrate and provide a ranking of the most reactive adhesives.

With reference to the specimens tested in B1.2.3, 6mm thick MDF was tested with the exposed face coated with PVA and Resorcinol adhesive. When tested they achieved group numbers 3, 4 and 3.

When the results are analysed and the relevant ranking of the results with Group 3 are considered it is apparent that the addition of PVA and Resorcinol adhesive moved the results for bare MDF 5% and 2% closer to Group 4.

When the results for solid timber, particleboard and MDF presented in Appendix A are analysed it is confirmed that highest ranking of any of these was 0.94 for bare 12mm MDF and 0.96 for 6mm MDF with Resorcinol adhesive and 0.99 for 6mm MDF with PVA adhesive.

It therefore confirmed that when MDF is tested at 6mm with the adhesive exposed and not covered with a veneer, it still achieves a Group 3 rating.

This result represents a more severe case than the proposed 6mm MDF with a veneer adhered with adhesive.

With reference to the performance of solid timber shown in appendix A, it is confirmed that from all the species tested the Radiata pine had the highest ranking of all the species tested, though still has a ranking below that of the bare MDF.

Therefore it is considered conservative to that a result of Group 3 can be applied to the species and adhesives proposed in section 2.

Based on the above discussion and in absence of any foreseeable risk to reducing the group number the proposal is positively assessed.

B.2 THE "GROUP NUMBER" FOR PYROTECH AND FLAMEBLOCK™ FRMDF WITH VENEERS

Proposal

It is proposed that timber veneers 0.5mm to 0.85mm thickness and density greater than 350kg/m^3 may adhere with PVA or Resorcinol adhesive to each side of Pyrotech flame retardant MDF substrates tested in EWFA 2557600 or Briggs FLAMEBLOCK® FR MDF EWFA 23766-00b.1 without reducing the group number to value less than 2,

Discussion

With reference to the discussion in Appendix B1, by comparison of the integrals IQ_2 and IQ_{2min} for MDF with timber veneer and solid timber, it is found that the group number was unaffected by the addition of a timber veneer.

By calculation of the group number ratios for solid Western Red Cedar, and Radiata pine they are found to be 0.91 and 0.92 respectively and the highest group number ratios for any solid timber species tested.

The higher the group number ratio the closer to the next group number the particular specimen is, and therefore the poorer the performance. This measure is used in this report to compare the effect of veneers upon substrates of known performance.

Therefore it is expected that the group number of linings faced with Western Red Cedar would be similar or improved if replaced with any other of species tested in Appendix A

With reference to the AS/ISO 9705 test result EWFA 2557600 where FRMDF faced Western Red Cedar veneers achieved a group 2 result.

The proposed variation to the veneers essentially involves the introduction of timber veneers that have been shown by AS3837 to be of lower fire hazard that the tested veneer species, albeit only marginally.

Report EWFA 23766-00b.1 shows FLAMEBLOCK™ FRMDF without a veneer achieved a group 1 result. The other AS3837 test results listed in Appendix A show that veneered Briggs FLAMEBLOCK™ FRMDF achieved a group 1 or group 2 results.

The proposed variation to the veneers essentially involves the introduction of timber veneers that have been shown by AS3837 to be of lower fire hazard than the tested veneer species, albeit only marginally.

It is therefore expected that if the veneer on the specimen tested in EWFA 2557600 were to have been substituted for the any of the previously tested veneers, then a similar or, possibly slightly improved result would occur.

Based on the above discussion and in absence of any foreseeable risk to reducing the group number, the proposed variation is positively assessed for a group number of 2.

B.3 THE "AVERAGE SPECIFIC EXTINCTION AREA" FOR VARIOUS SUBSTRATES WITH VENEERS

Proposal

It is proposed that timber veneers 0.5mm to 0.85mm thickness and density greater than 500kg/m^3 may applied to each side of MDF and Particleboard substrates tested in WFRA 499240H.1, WFRA 499240L.1, WFRA 2146400B and EWFA 23766-00b.1 without exceeding the limiting "Average Specific Extinction Area" of 250 (m^2/kg) specified in the BCA.

Discussion

With reference to the tested data presented in Section 2, which is considered to provide a broad representation of the performance of MDF and particleboard substrates with timber veneers bonded with PVA adhesive. All tested specimens achieved an Average Specific Extinction Area of less than 250 (m^2/kg) in accordance with the Specification C1.10a by a significant margin.

Based on the above discussion and in absence of any foreseeable risk it is considered that the Average Specific Extinction Area would be unlikely to exceed 250 (m^2/kg) for the proposed veneered timber when adhered to the proposed substrates.

B.4 THE "$SMOGRA_{RC}$" VALUE FOR PYROTECH FLAME RETARDANT MDF SUBSTRATES WITH VENEERS

Proposal

It is proposed that timber veneers 0.5mm to 0.85mm thickness and density greater than 350kg/m^3 be applied to each side of Pyrotech flame retardant MDF substrates tested in EWFA 2557600 without exceeding the limiting "$SMOGRA_{RC}$" of 100 (m^2/s) specified in the BCA.

Discussion

With reference to the tested data presented in Section 2, which is considered to provide a broad representation of the performance of MDF and particleboard substrates with timber veneers bonded with PVA adhesive. All tested timber and veneered specimens achieved an Average Specific Extinction Area of less than 250 (m^2/kg) in accordance with the Specification C1.10a by a significant margin.

With reference to the AS/ISO 9705 test result EWFA 2557600 where FRMDF faced Western Red Cedar veneers achieved a $SMOGRA_{RC}$ result of 6.5 (m^2/s), which is less than the 100 (m^2/s) limit in Clause C1.10 a by a significant margin.

Based on the above discussion and in absence of any foreseeable risk it is considered that the $SMOGRA_{RC}$ would be unlikely to exceed 100 (m^2/s) for the proposed veneered timber when adhered to the proposed substrates.