

BRANZ Type Test

FI10808-01

AS ISO 9705 AND ISO 9705 FIRE TEST OF FBL-100

CLIENT
Tech Coatings NZ Limited
12 Tokomaru Street
Welbourn
New Plymouth, 4312
New Zealand

ilac-MRA IANZ ACCREDITED LABORATORY

All tests and procedures reported herein, unless indicated, have been performed in accordance with the laboratory's scope of accreditation

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TEST SUMMARY

Objective

The test was carried out in accordance with AS ISO 9705 – 2003 and ISO 9705:1993 for the purpose of determining the Group Number classification as required by the Building Codes of Australia and New Zealand respectively for the control of fire spread on interior wall and ceiling linings.

Test sponsor

Tech Coatings NZ Limited
12 Tokomaru Street
Welbourn
New Plymouth, 4312
New Zealand

Description of test specimen

The product submitted by the client for testing was identified by the client as FBI-100 Intumescent Coating System applied to substrate type 1 material in accordance with MBIE C/VM2 Appendix A1.6 Table A2. The type 1 substrate was 9 mm Plywood

Date of test

18 October 2018

Test results

The rate of heat release exceeded 1 MW at 753 seconds.

A maximum smoke production rate of 12.80 m^2/s was recorded at 675 seconds. The maximum 60 second running average smoke production rate (SPR60 peak) was determined to be 10.39 m^2/s at 672 seconds.

LIMITATION

The results reported here relate only to the items tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

NATA

IANZ

TO WHOM IT MAY CONCERN

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(iii) recommends and promotes the acceptance by users in its economy of endorsed* certificates and reports,

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Signed:

Jennifer Evans
NATA CEO

Date: 24 March 2014

Dr Llewellyn Richards
IANZ CEO

Date: 24th March 2014

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SIGNATORIES

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DOCUMENT REVISION STATUS

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1. TEST METHOD

The test was carried out in accordance with AS ISO 9705 – 2003 and ISO 9705:1993 (the standard) except as follows:

- Smoke measurement was carried out using a helium-neon laser instead of a white light system. This was not expected to adversely affect the results.
- Heat flux at the floor was not measured.

In the preface to AS ISO 9705 – 2003 it contains the following statement. “This Standard is identical with and has been reproduced from ISO 9705:1993, *Fire tests—Full-scale room test for surface products*.” This establishes that the two standards are identical and that therefore the results reported herein are applicable under both standards.

The test was undertaken to establish compliance with:

- The National Construction Code (NCC) Volume One Specification C1.10 of the Building Code of Australia (BCA) (AS 5637.1); in respect to the fire performance of wall and ceiling linings, through testing in accordance with AS ISO 9705.
- The New Zealand Building Code C/VM2 Appendix A (ISO 9705) in respect to the fire performance of wall and ceiling linings.

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2. DESCRIPTION OF THE TEST SPECIMEN

2.1 General

This test comprised three walls (excluding that containing the door) and the ceiling lined with the test specimen.

2.2 Specimen Selection

BRANZ was not involved in the selection of the materials submitted for testing.

The test materials used for construction of the test specimen were supplied to the laboratory by the client and the client was also responsible for the installation of the test specimen.

2.3 Description of Specimen

The product submitted by the client for testing was identified by the client as FBl-100 Intumescent Coating System applied to substrate type 1 material in accordance with MBIE C/VM2 Appendix A1.6 Table A2. The type 1 substrate was 9 mm Plywood

2.4 Installation of Specimen

A lightweight steel stud frame was installed against the three full walls and ceiling of the test room and lined on the interior face with nominally 9 mm Ecoply plywood screwed to the steel frame.

The FBL-100 Intumescent Coating System was applied to the 9 mm plywood with a mean DFT of 310 microns with a standard deviation of 38 microns as shown in Figure 1.

Figure 1: Completed installation

2.5 Specimen Conditioning

The specimen was not subjected to any special conditioning.

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3. EXPERIMENTAL PROCEDURE

3.1 Test Standard

The test was carried out according to the test specifications and procedure described in AS ISO 9705-2003 and ISO 9705:1993 'Fire tests – Full-scale room test for surface products' (the test standard), with variations as noted in Section 1 above.

3.2 Test Date and Initial Conditions

The test was conducted on the 18th October 2018, supervised by Mr P Collier.

The initial conditions in the laboratory were 17.2 ºC, 39% relative humidity and 102.2 kPa atmospheric pressure.

The horizontal wind speed at a horizontal distance of 1 m from the centre of the doorway did not exceed 0.5 m/s.

3.3 Fire Test Room

The fire test room consisted of four walls at right angles, a floor and ceiling with the following nominal dimensions – 3.6 m long x 2.4 m wide x 2.4 m high. A doorway was located in the centre of one of the 2.4 m x 2.4 m walls and this had nominal dimensions 2.0 m high x 0.8 m wide. The opening discharged into a steel hood for the collection of all combustion products connected to an exhaust system that allowed gas sampling and light obscuration measurements to be done.

The test room was constructed of nominally 150 mm thick, lightweight concrete panels with a density of 560 kg/m³.

3.4 Ignition Source

The ignition source was a propane gas sand diffusion burner with a square (0.17 x 0.17 m) top surface at a height of 0.35 m above floor level. The burner was placed on the floor in a corner opposite to the doorway opening, and positioned as close as possible to the specimen in the corner wall. The test programme was to control the gas flow to the gas flow to the burner to generate a heat output of 100 kW for 10 minutes followed by 300 kW for a further 10 minutes after which the test would be stopped.

3.5 Gas Analysis

The products of combustion from the test room were collected in the hood and exhausted through a duct 0.4 m in diameter. Instrumentation in the duct included a sampling probe to take off gas samples for analysis.

Gas samples taken from the duct were analysed and the oxygen consumption was measured using an enhanced SERVOMEX 4100 paramagnetic oxygen analyser. The oxygen mole fraction was corrected for any changes in barometric pressure during the period of the test using output from an absolute pressure transducer. Carbon dioxide concentrations were also measured with an infrared CO_2 sensor fitted within the same chassis as the oxygen analyser.

3.6 Flow Volume Monitoring

The duct instrumentation section contained a bi-directional probe connected to a differential pressure transducer. A 1.5 mm type K thermocouple was located with its tip close to the open end of the bi-directional probe. This was used for volume flow monitoring.

3.7 Optical Density

Smoke obscuration measurements of exhaust gases in the duct were taken using a 0.5 mW Helium-neon laser system with photometric detector fitted to a rigid cradle. The laser was aligned to fall on a photodetector system, on the opposite side of the duct. A compensating detector was situated on the laser side of the duct to act as a reference. A 1.5 mm type K thermocouple was located with its tip close to the laser beam. These were used for smoke obscuration and production measurements.

3.8 Heat Flux Instrumentation

Heat flux measurements were not recorded.

3.9 Data Recording

Data recording logging at 3-second intervals was commenced at least 2 minutes before ignition of the burner and continued (till after extinguishment).

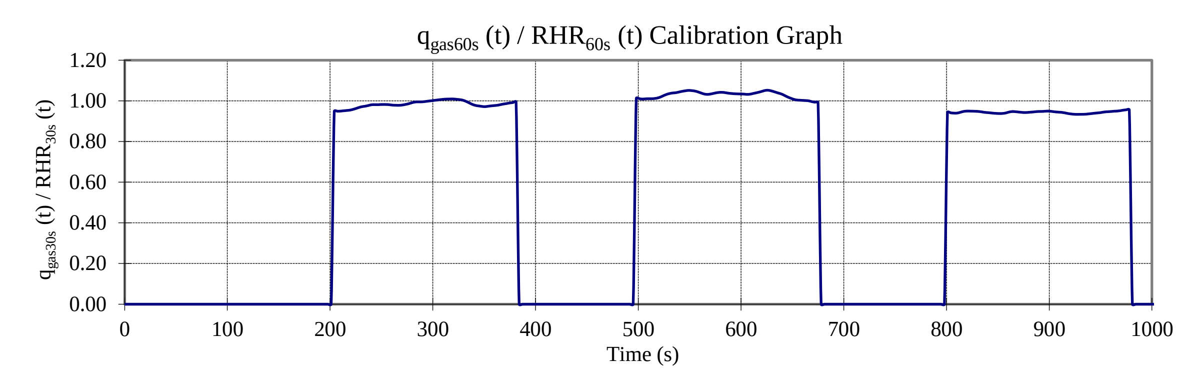
4. SYSTEM PERFORMANCE

4.1 Calibration

Prior to the product test, a calibration was performed with the burner positioned directly beneath the hood and output adjusted to 0 kW for 2 minutes, then 100 kW for 5 minutes, then 300 kW for 5 minutes, then 100 kW for 5 minutes and then 0 kW for 3 minutes. Data was collected at 3 second intervals. The ratio of the average mass flow per unit area to mass flow per unit area in the centre of the exhaust duct that resulted in the least difference in the heat release rate calculated from the measured oxygen consumption, and that calculated from the metered gas input was determined. This value (k_t=0.826 was then used in subsequent calculations of heat release rate for the actual product test.

At steady state conditions, the difference between the mean rate of heat release over 1 minute calculated from the measured oxygen consumption and that calculated from the metered gas input did not exceed ± 5% for the first 100 kW and the 300 kW levels of heat output. The calibration results are shown in Figure 2.

Figure 2: Calibration results for 100/300/100 kW burner output



4.2 System Response

The time delay of the oxygen analyser, as determined by the time difference between a 2.5 K change in the duct temperature and a 0.05% change in the oxygen concentration, determined during the calibration procedure, was 14.25 seconds. The oxygen mole fractions were corrected on the basis of this delay time before calculating the heat release rate.

The response time of the oxygen analyser, found as the time between a 10% and 90% change in the measured oxygen concentration, determined during the calibration procedure, was 12.75 seconds.

The time delay of the CO/CO_2 analyser, as determined by the time difference between a 2.5 K change in the duct temperature and a 0.02% change in the carbon dioxide concentration, determined during the calibration procedure, was 10.5 seconds. The carbon dioxide and carbon monoxide mole fractions were corrected on the basis of this delay time before calculating the heat release rate.

The response time of the CO/CO_2 analyser, found as the time between a 10% and 90% change in the measured carbon dioxide concentration, determined during the calibration procedure, was 12 seconds.

5. RESULTS

5.1 Observations

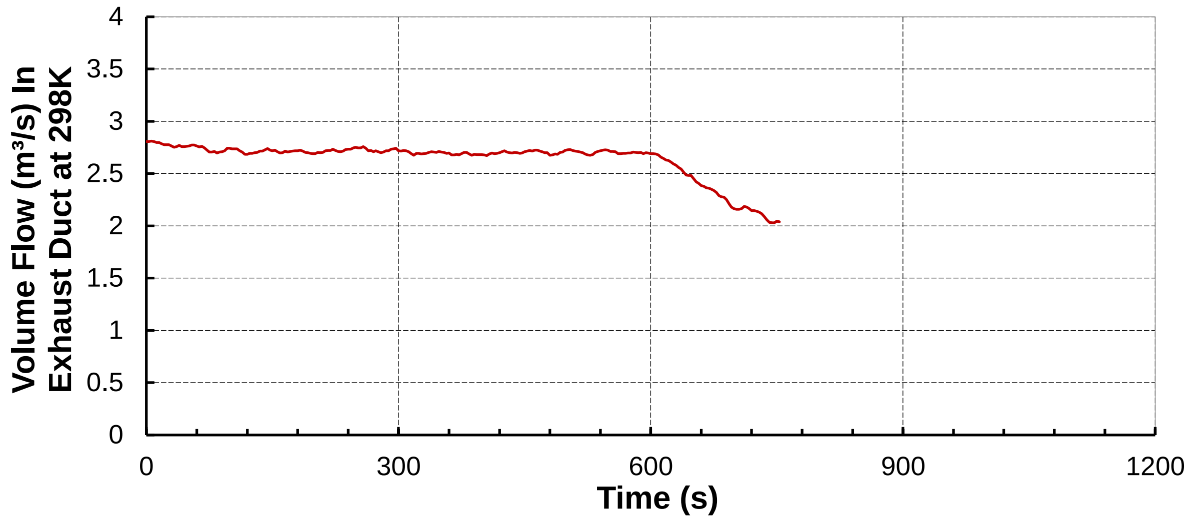
Time Min:sec	Description
0:10	Burner plume had reached ceiling.
0:30	There was blackening of the paint within the burner plume. The first indications of the establishment of a hot smoke layer were visible at the 1,600 mm elevation.
1:15	Smoke was beginning to flow out of the doorway and the hot layer level had dropped to 1,500 mm.
2:00	The blackening of the paint in the burner plume was now 200 to 250 mm out from the corner and on the ceiling at a radius of 300 mm from the burner corner.
2:30	The smoke layer level had stabilised with the blackening of the paint in the burner plume increasing in blackness and slowly increasing in distance outward from the corner.
3:00	There was a steady flow of smoke out of the doorway and the smoke in the hot layer was inhibiting combustion in the burner plume.
3:30	There was no visible pockets of flaming on the walls within the burner plume, but the charring and blackness was incrementally increasing outwards from the corner.
4:30	Steady conditions with no changes.
5:30	Some blistering of the paint within the burner plume was now visible, which are the origins of very small intermittent pockets of flaming.
7:00	Steady conditions with no changes.
7:45	There was a slight increase in smoke and on the corner walls in the plume isolated and intermittent pockets of burning had increased
9:15	There was now progressively more flaming on the paint/plywood within the burner plume.
10:00	The burner HRR was increased to 300 kW and the ceiling plume stretched across the ceiling to the left side wall and a similar distance towards the doorway. The smoke increased in density and flaming was progressively established over the preheated ceiling and upper parts of the walls.
10:30	Flaming on the previously charred surface within the plume was now well established and the density of smoke had increased considerably.
11:00	Radiated heat from the room was increasing, the flow smoke through the doorway was pulsating and increasing in density.
11:45	Flaming had progressed over the entire ceiling and onto the wall surfaces in the hot layer zone now down to 1,500 mm above floor level.
12:00	A level of relative stability had been reached with the fire spread at a HRR of approximately 800 kW.
12:05	The flaming on the walls was moving slowly but progressively downwards and flaming was periodically exiting the doorway.
12:33	The flaming continued to progress downwards on the walls and a HRR 1,000 kW was exceeded. End of Test.

5.2 Test Results and Reduced Data

5.2.1 Duct flow

Time-volume flow in the exhaust duct is shown in Figure 3.

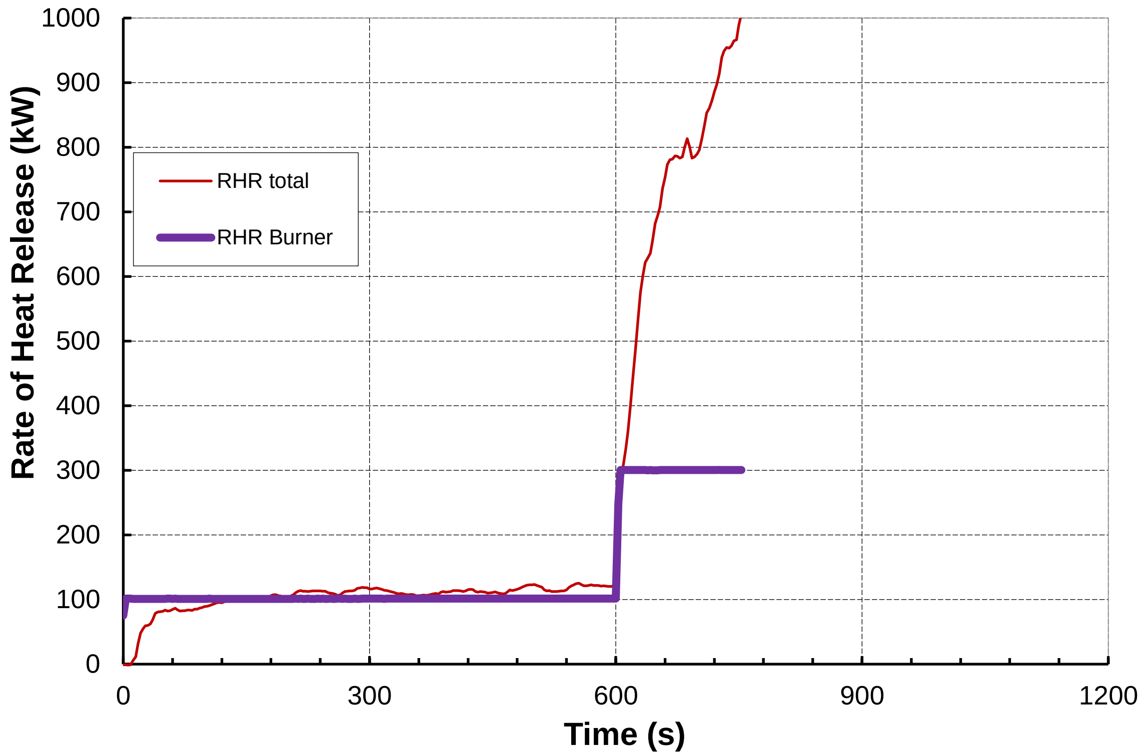
Figure 3: Volume flow at 298 K in exhaust duct



5.2.2 Total heat release

The rate of heat release measured during the test and the contribution from the burner is shown in Figure 4. The rate of heat release exceeded 1 MW at 753 seconds.

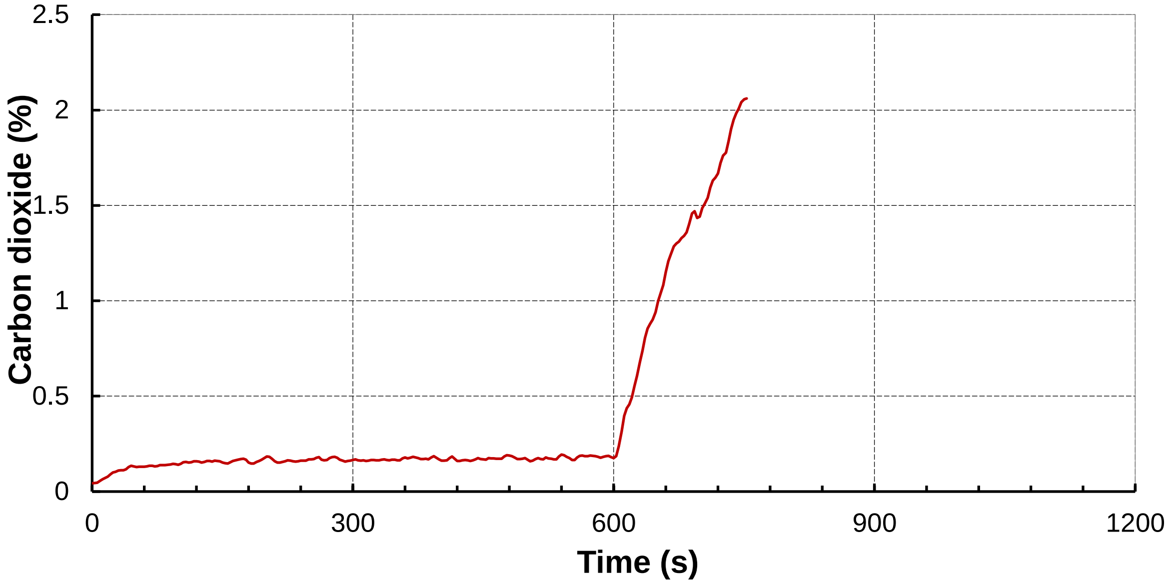
Figure 4: Rate of Heat Release



5.2.3 CO_2 concentration

The concentration of carbon dioxide measured during the test is shown in Figure 5. The peak CO_2 concentration of 2.06 % was recorded at 753 seconds.

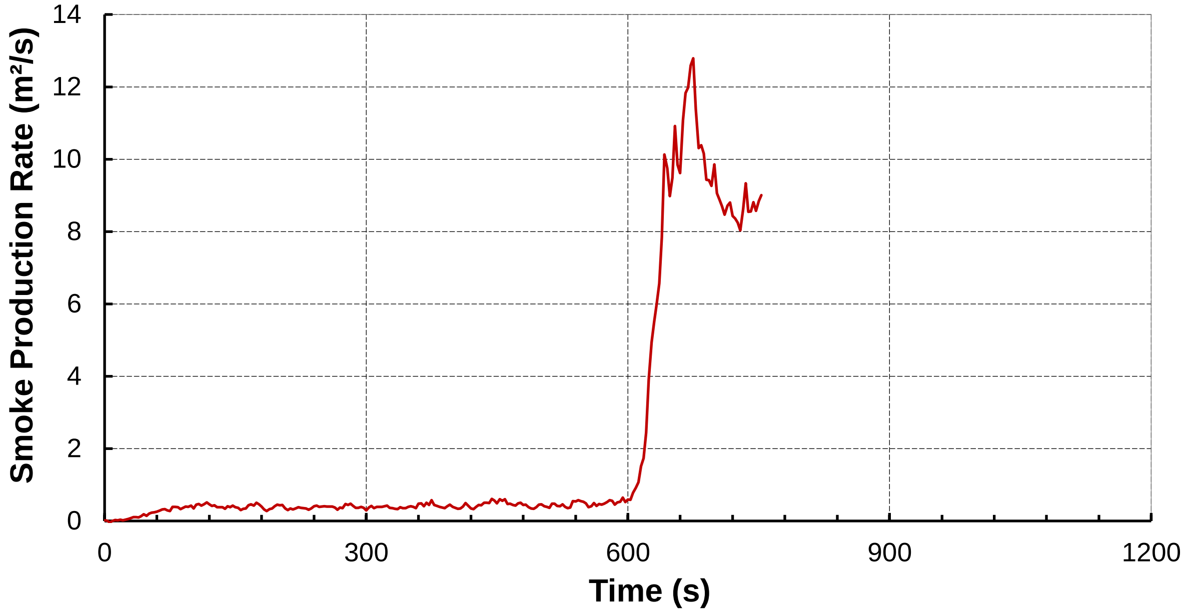
Figure 5: Carbon dioxide concentration



5.2.4 Optical density

The rate of production of light-obscuring smoke measured during the test is shown in Figure 6. A maximum smoke production rate of 12.80 m²/s was recorded at 675 seconds. The maximum 60 second running average smoke production rate (SPR60 peak) was determined to be 10.39 m^2/s at 672 seconds.

Figure 6: Smoke production rate



5.2.5 Heat flux

The heat flux was not measured.

6. PHOTOGRAPHS

Photograph 1: Prior to test

Photograph 2: At 10 seconds.

Photograph 3: At 15 seconds

Photograph 4: At 30 seconds

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Photograph 5: At 45 seconds

Photograph 6: At 60 seconds

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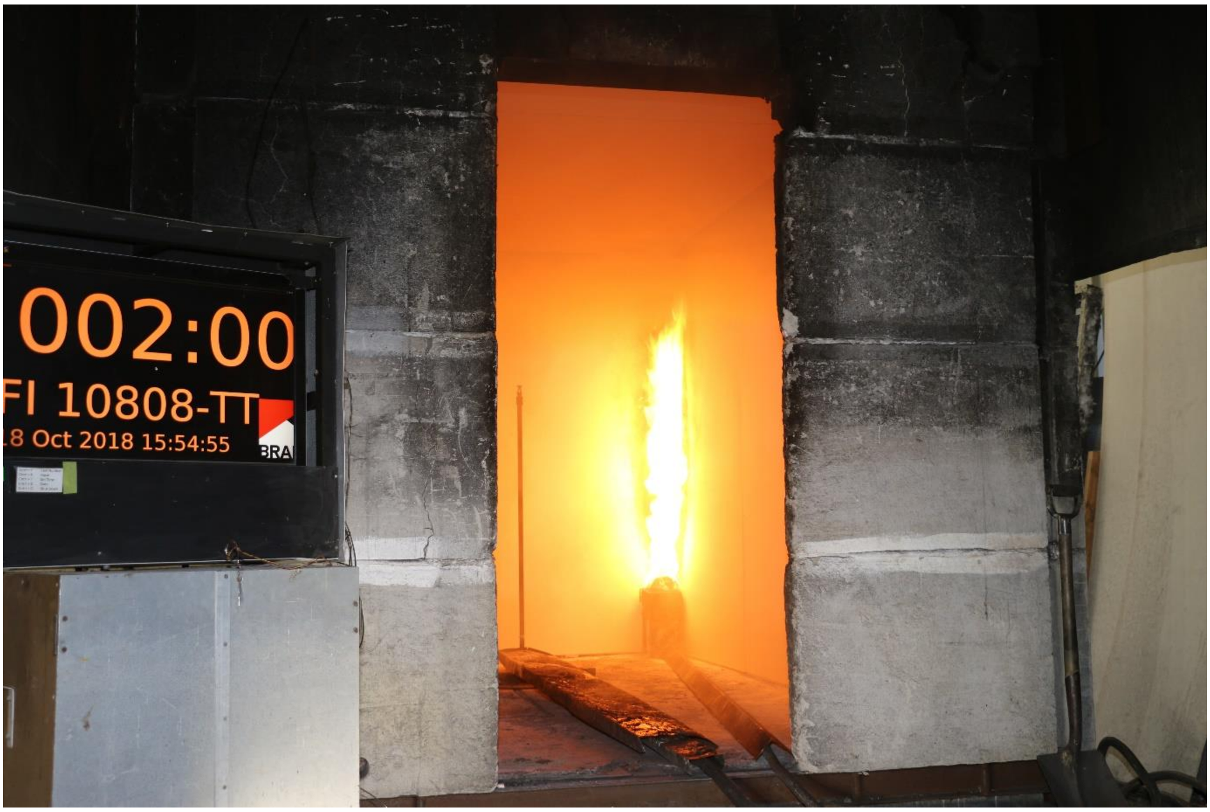
Photograph 7: At 90 seconds

Photograph 8: At 120 seconds



Photograph 9: At 180 seconds

Photograph 10: At 240 seconds

Photograph 11: At 300 seconds

Photograph 12: At 360 seconds

Photograph 13: At 450 seconds

Photograph 14: At 510 seconds

Photograph 15: At 540 seconds

Photograph 16: At 570 seconds

Photograph 17: At 600 seconds

Photograph 18: At 608 seconds

Photograph 19: At 625 seconds

Photograph 20: At 630 seconds

Photograph 21: At 642 seconds

Photograph 22: At 660 seconds

Photograph 23: At 674 seconds

Photograph 24: At 679 seconds

Photograph 25: At 690 seconds

Photograph 26: At 705 seconds

Photograph 27: At 720 seconds

Photograph 28: At 739 seconds

Photograph 29: At 746 seconds

Photograph 30: At 755 seconds – end of test

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Photograph 31: After test

Photograph 32: After test - above burner

FI10808-01
GROUP CLASSIFICATION NUMBER

BRANZ

This is to certify that the specimen described below was tested by BRANZ for determination of Group Number Classification and SMOGRA in accordance with AS ISO 9705 – 2003 and Group Number Classification and Smoke Production Rate in accordance with ISO 9705:1993.

Test Sponsor

Tech Coatings NZ Limited
12 Tokomaru Street
Welbourn
New Plymouth, 4312
New Zealand

Date of test

18 October 2018

Reference BRANZ Test Report

FI10808-01 – issued 9/11/2018

Test specimen as described by the client

The product submitted by the client for testing was identified by the client as FBI-100 Intumescent Coating System applied to substrate type 1 material in accordance with MBIE C/VM2 Appendix A1.6 Table A2. The type 1 substrate was 9 mm Plywood

Group Number Classification in accordance with NCC Australia

Calculations were carried out as per AS 5637.1:2015. The Group Number Classification $SMOGRA_{RC}$ for the sample as described above is given in the table below.

Determination of Fire Hazard Properties

The specimen was deemed suitable for testing in accordance with AS 5637.1:2015 and testing was performed in accordance with AS ISO 9705 – 2003 for the purposes of Group Number Classification as specified in the NCC Volume One Specification C1.10 Clause 4.

Group Number Classification in accordance with the New Zealand Building Code

Calculations were carried out according to NZBC Verification Method C/VM2 Appendix A. The classification for the sample as described above is given in the table below.

Building Code Document	Group Number Classification
NCC Volume One Specification C1.10 Clause 4 determined in accordance with AS 5637.1:2015	2 The SMOGRA was 15.5 m^2/s^2 x 1000 and therefore within the 100 m^2/s^2 x 1000 limit
NZBC Verification Method C/VM2 Appendix A	2-S Average Smoke Production Rate was 0.4 m^2/s and therefore within the 5 m^2/s limit

Issued by

P. C. R. Collier
Senior Fire Testing Engineer
BRANZ

Reviewed by

P. N. Whiting
Senior Fire Testing Engineer/Team Leader
BRANZ

Regulatory authorities are advised to examine test reports before approving any product.

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Issue Date
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