

BRANZ Type Test

FI 5466-TT ISSUE 2

ISO 9705 FIRE TEST AND NZBC VERIFICATION METHOD C/VM2 APPENDIX A PERFORMANCE OF 1.2 MM POLYCARBONATE CLADDING

CLIENT
PSP Limited
320 Rosedale Road
Albany
Auckland 0632
New Zealand

ACCREDITED LABORATORY

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

TEST SUMMARY

Objective

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

Test sponsor

PSP Limited
320 Rosedale Road
Albany
Auckland 0632
New Zealand

Description of test specimen

The product submitted by the client for testing was identified by the client as nominally 1.2 mm thick polycarbonate profile cladding with peaks 25 mm high at 150 mm pitch, with a weight of approximately 1.46 kg/m^2. The sheeting was fixed to lightweight steel framing within the test room.

Date of test

14th May 2014

Test results

Building Code Document	Group Number Classification
NZBC Verification Method C/VM2 Appendix A	1-S Average Smoke Production Rate was 0.3 m^2/s and therefore within the 5 m^2/s limit

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

Both NATA (National Association of Testing Authorities, Australia) and IANZ (International Accreditation New Zealand) are signatories to the ILAC Mutual Recognition Arrangement. Under the terms of this arrangement, each signatory:

(i) recognises within its scope of recognition of this Arrangement the accreditation of an organisation by other signatories as being equivalent to an accreditation by its own organisation,

(ii) accepts, for its own purposes, endorsed* certificates or reports issued by organisations accredited by other signatories on the same basis as it accepts endorsed* certificates or reports issued by its own accredited organisations,

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

* *The word "endorsed" means a certificate or report bearing an Arrangement signatory's accreditation symbol (or mark) preferably combined with the ILAC-MRA Mark.*

Signed:

Jennifer Evans
NATA CEO

Date: 24 March 2014

Dr Llewellyn Richards
IANZ CEO

Date: 24th March 2014

CONTENTS

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

FIGURES

PHOTOGRAPHS

SIGNATORIES

Author

P. C. R. Collier
Senior Fire Testing Engineer
IANZ Approved Signatory

Reviewer

P. N. Whiting
Senior Fire Engineer/Fire Testing Team Leader
IANZ Approved Signatory

DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	EXPIRY DATE	DESCRIPTION
1	16 May 2014	16 May 2019	Initial Issue
2	29 October 2019	29 October 2024	Re-issued for a further 5 years on the basis of supporting evidence supplied by the client

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

1. TEST METHOD

The test was carried out in accordance with 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.

The test was undertaken to establish compliance with the New Zealand Building Code C/VM2 (ISO 9705) in respect to the fire performance of wall and ceiling linings.

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 nominally 1.2 mm thick polycarbonate profile cladding with peaks 25 mm high at 150 mm pitch. A weighed sample had a unit weight of 1.46 kg/m^2. The outside surface is treated for UV protection. Figure 1 shows a detail of the roof and wall of the installed specimen.

The re-issue of this report as Issue 2 extends the review/expiry date for this report to remain publishable for the period identified in the report footer. The re-issue has been made on the basis of evidence provided by the client sufficient for BRANZ to consider the original test results remain representative of current product.

Figure 1: Installation detail

2.4 Installation of Specimen

A lightweight steel stud frame was installed against the three full walls and ceiling of the test room. Wall studs were nominally spaced at 600 mm between centres and ceiling battens at nominally 450 mm centres.

The walls of the test room were lined with nine sheets of the polycarbonate whereby the non-UV protected side was facing the inside of the room with the corrugations oriented vertically. The sheets were fixed with screws identified as; Fortress fasteners Class 4, Premium Plated, Hex W/F Supadrive W/NEO, 12g PLUS-13 x 55. Fixing was at the top, middle and bottom to the nogs/plates at nominal centres of 1200 mm where the peaks touched the framing typically at every second peak or 300 mm centres or less to secure joints between sheets.

Similarly, the three sheets fixed to the ceiling were fixed with the non-UV protected side facing downwards with the corrugations oriented in the longer 3600 mm direction. Sheets were screwed to the battens in no particular pattern at approximately 300 to 450 mm centres.

2.5 Specimen Conditioning

The specimen was not subjected to any special conditioning.

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

3. EXPERIMENTAL PROCEDURE

3.1 Test Standard

The test was carried out according to the test specifications and procedure described in 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 14th May 2014, supervised by Mr P Collier.

The initial conditions in the laboratory were 16.8 ºC, 73% relative humidity and 101.04 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 gas flow to the burner was controlled to generate a heat output of 100 kW for 10 minutes followed by 300 kW for a further 10 minutes after which the test was 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 CO2 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).

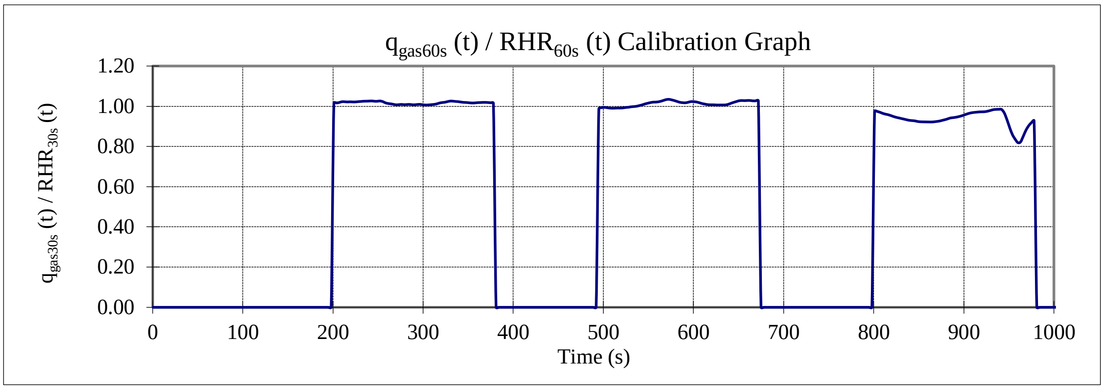
4. SYSTEM PERFORMANCE

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 calibration value (k_t=0.757) 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 12.75 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 7.5 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 30 seconds.

5. RESULTS

5.1 Observations

Time Min:sec	Description
0:15	Some slight deformation of the polycarbonate sheeting above the burner.
0:40	Polycarbonate sheeting had melted away from the corner and was dripping downwards. Flaming was partly entrained though the melted gap and in behind the sheeting.
1:20	Some drooping, buckling and falling down of the sheeting and general melting away from the burner flame was now evident accompanied by a build-up of smoke in the ceiling area above the door soffit.
1:44	Conditions in the room were now stable.
2:00	The smoke levels had built up further and there was some dipping of the sheeting into the burner.
3:00	Further build-up of smoke and the plastic had melted back marginally more from the burner corner and the sheet on the ceiling had become detached from the fixings and had softened and dropped about 1000 mm. Some minor ignition of the sheeting had established in the corner.
6:30	Large portions of the ceiling had softened, pulled over the fixings and dropped, but no significant ignition had occurred, the smoke levels had diminished as the sheet had continued to soften and recede from the hotter regions of the burner flame.
8:00	Large portions of the heat softened sheeting had continued to peel off the ceiling and has almost covered the sprinkler head upstand in the centre of the room.
9:30	The plastic sheeting had continued to peel off the ceiling but had not yet reached the floor.
10:00	Burner HRR increased to 300 kW.
10:20	The sheeting in the centre of the room had almost reached the floor. The sheeting in the corner across from the burner had started to droop as well.
11:00	A build-up of smoke in the ceiling above the door soffit was occurring again, accompanied with a resumed softening and dropping away of the sheeting.
11:15	The sheeting was now settling on the floor.
12:30	The sheeting on the walls in the heat affected zone coinciding with the accumulation of smoke had softened and was drooping down the walls as far as the hot/cooler layer interface indicating a clear demarcation line.
13:30	The entire ceiling had become detached and the drooping on the walls had reached mid height on the back wall and halfway along the side walls and then only to two thirds height closer to the door end.
17:30	No substantial change, the melt down or drooping of the lining had more or less ceased, although there was marginally more smoke exiting the doorway.
19:30	Sheeting has drooped down to floor level in the immediate burner corner, but still at mid height on the side walls.

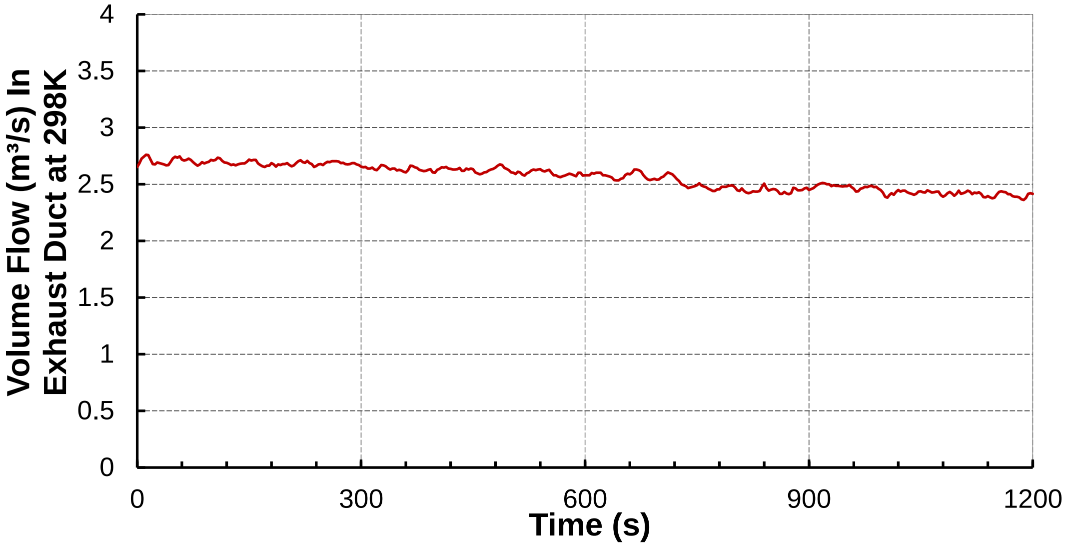
Time Min:sec	Description
20:00	End of test, burner extinguished.

5.2 Test Results and Reduced Data

5.2.1 Duct flow

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

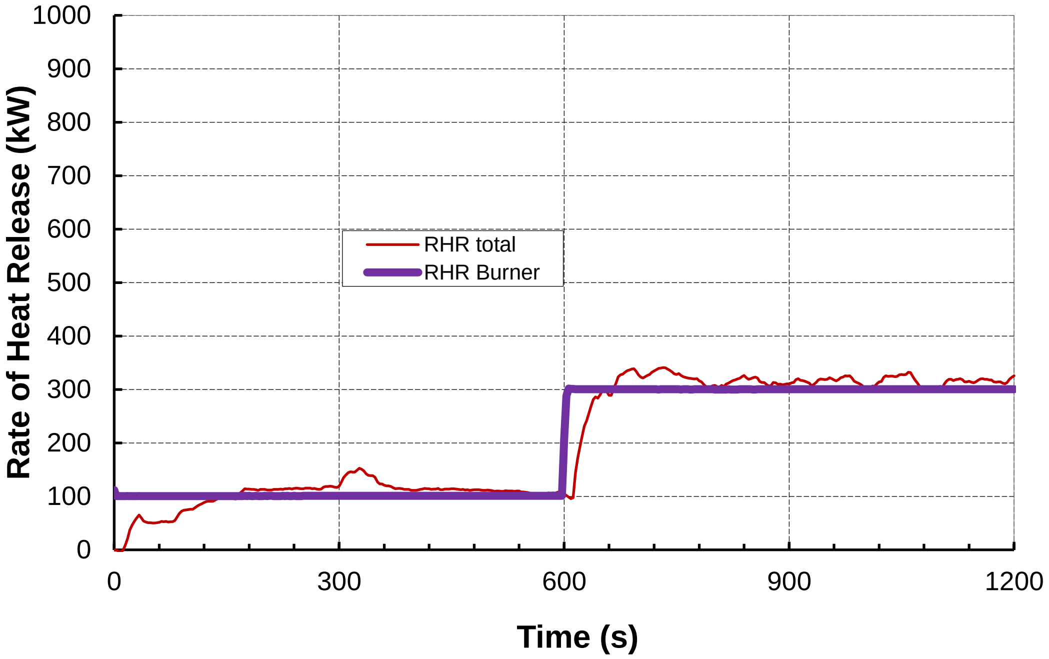
Figure 3: Volume flow at 298 K in exhaust duct



5.2.2 Total heat release

The total rate of heat release measured during the test and the contribution from the burner is shown in Figure 4. The peak rate of heat release did not exceed 1 MW during the test.

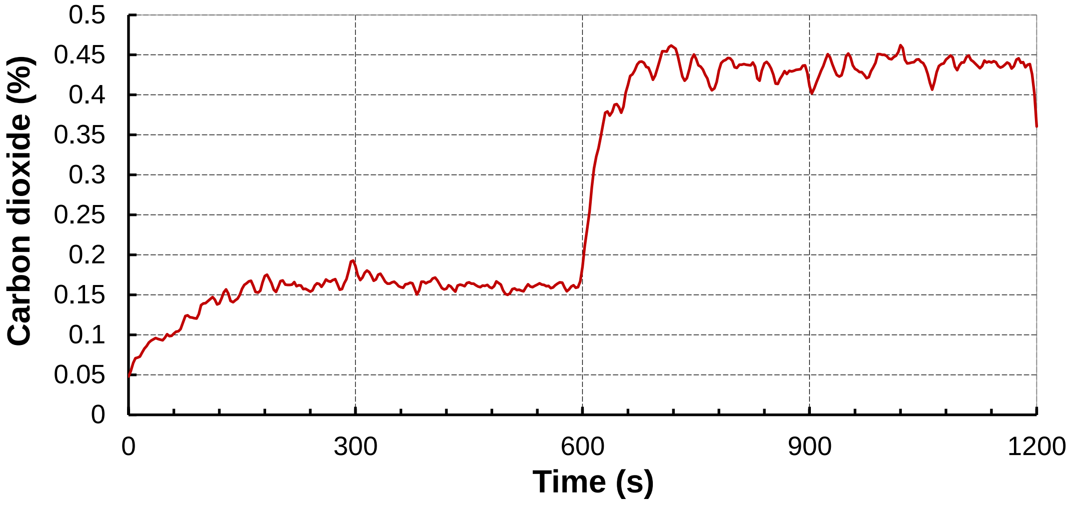
Figure 4: Rate of Heat Release



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 0.46 % was recorded at 1020 seconds.

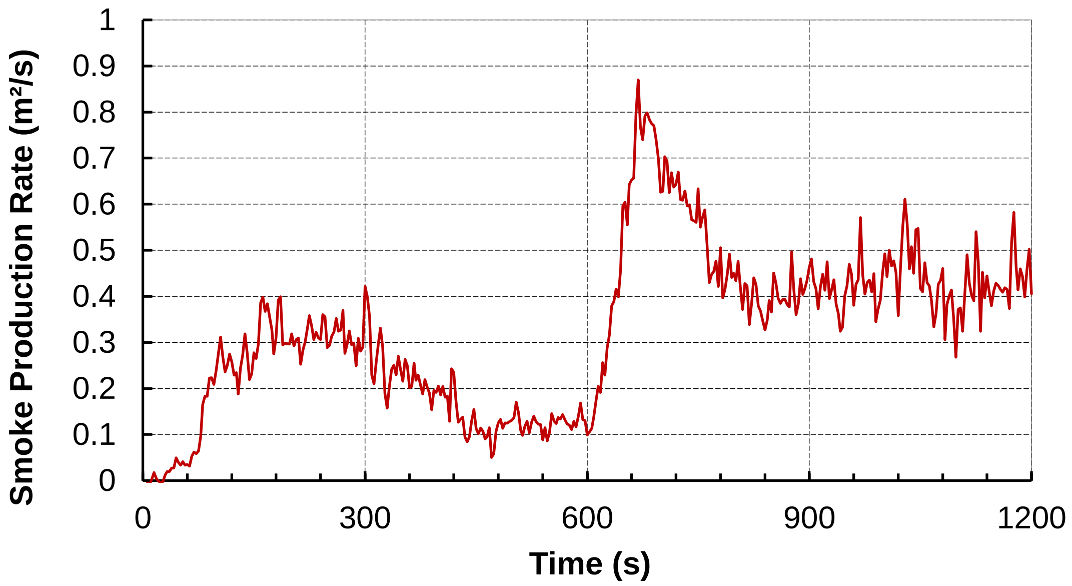
Figure 5: Carbon dioxide concentration



5.2.4 Optical density

The rate of production of light-obscuring smoke measured during the test is shown in Figure 6. A maximum of 0.87 m^2/s was recorded at 669 seconds. The maximum 60 second running average smoke production rate (SPR60 peak) was determined to be 0.72 m^2/s at 693 seconds.

Figure 6: Smoke production rate



5.2.5 Heat flux

The heat flux was not measured.

6. BUILDING CODE

The results were analysed in accordance with the building code and the test specimen's material group number and smoke growth rate index determined in accordance with:

- New Zealand Building Code Verification Method C/VM2 Appendix A: Establishing Group Numbers for lining materials.

6.1 Heat Release

The Group Number is to be determined by physical testing in accordance with the test standard.

The test standard describes a room fire test where the material or assembly is installed (in a representative manner to the intended end use) within a room with dimensions 3.6 m long x 2.4 m wide x 2.4 m high. The room has a single opening 2 m high x 0.8 m wide in one of the short walls. A propane gas burner located in a corner at the opposite end to the opening exposes the wall corner junction to a flame. The burner heat output is set to 100 kW for 10 minutes after which it is increased to 300 kW for a further 10 minutes. The oxygen concentration in the combustion gases from the room is measured and the rate of heat release from the room is calculated. The 'time to flashover' is determined when the total rate of heat release (from the burner and from the material/assembly being tested) exceeds 1000 kW, after which the test is terminated.

The Group number for a material or assembly is determined based on the 'time to flashover' as follows:

- Group 1 – does not reach flashover during the test
- Group 2 – reaches flashover after 10 minutes
- Group 3 – reaches flashover after 2 minutes, and before 10 minutes
- Group 4 – reaches flashover within 2 minutes.

6.2 Smoke Production

To be determined by physical testing in accordance with the standard as above.

6.2.1 New Zealand Building Code

The average smoke production rate (SPR) is to be determined over the period from 0 to 20 minutes for a Group 1 material and over the period from 0 to 10 minutes for a Group 2 material. The SPR is not used in relation to a Group 3 or 4 material.

7. CONCLUSION

7.1 New Zealand Building Code Classification

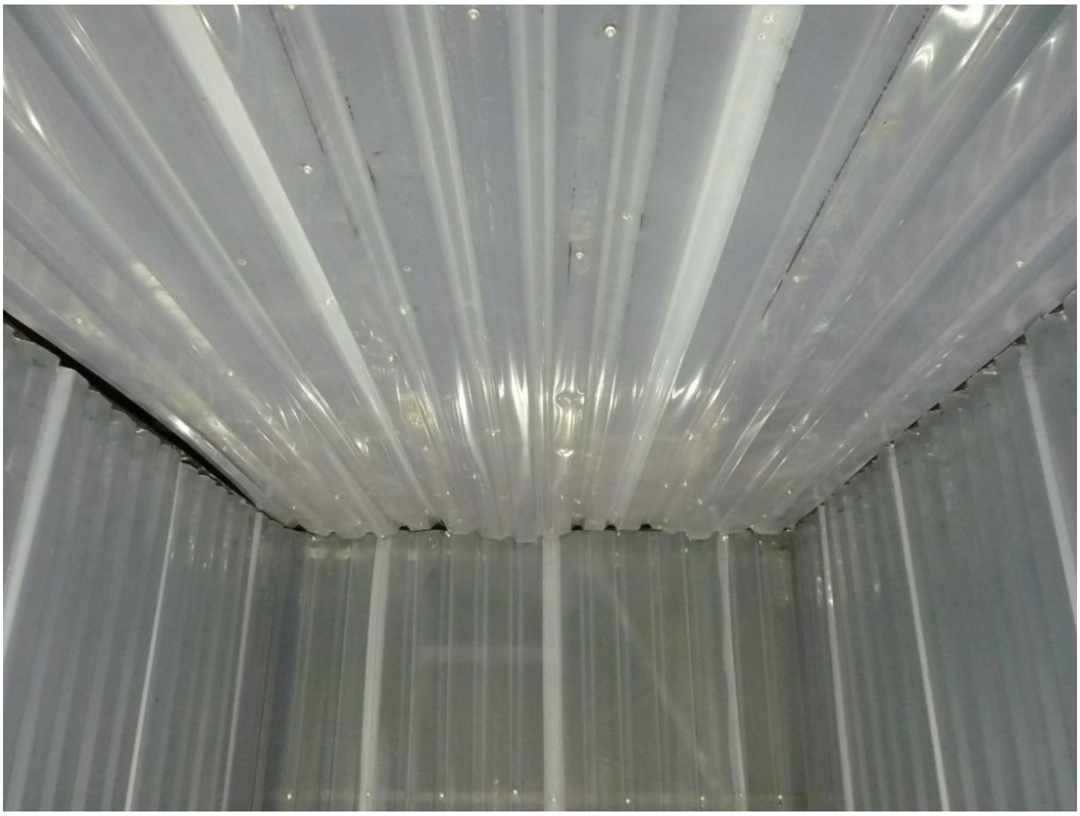
New Zealand Building Code		
Result	Group Number	SPR (m^2/s)
	1-S	0.3^+

$^+$The Smoke Production Rate (SPR) averaged over the period 0 to 20 minutes is not more than the 5.0 m^2/s limit and therefore the Group Number 1-S applies.

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

8. PHOTOGRAPHS

Photograph 1: Assembled specimen prior to test



Photograph 2: Assembled specimen prior to test

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

Photograph 3: Start of test

Photograph 4: Specimen at 38 seconds from start of test

Photograph 5: Specimen at 78 seconds from start of test

Photograph 6: Specimen at 129 seconds from start of test

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

Photograph 7: Specimen at 331 seconds from start of test

Photograph 8: Specimen at 616 seconds from start of test

Photograph 9: Specimen at 677 seconds from start of test

Photograph 10: Specimen at 709 seconds from start of test

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

Photograph 11: Specimen at 744 seconds from start of test

Photograph 12: Specimen at 772 seconds from start of test

Photograph 13: Specimen after end of test

Photograph 14: Specimen after end of test

branz.nz | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50 908, Porirua 5240, New Zealand | Phone +64 4237 1170 | branz@branz.co.nz

FI 5466-TT Issue 2
GROUP CLASSIFICATION NUMBER

BRANZ

This is to certify that the specimen described below was tested by BRANZ in accordance ISO 9705 for determination of Group Number Classification and Smoke Production Rate in accordance with NZBC Verification Method C/VM2 Appendix A.

Test Sponsor

PSP Limited
320 Rosedale Road
Albany
Auckland 0632
New Zealand

Date of test

14th May 2014

Reference BRANZ Test Report

FI 5466-TT Issue 2 – issued 29/10/2019

Test specimen as described by the client

The product submitted by the client for testing was identified by the client as nominally 1.2 mm thick polycarbonate profile cladding with peaks 25 mm high at 150 mm pitch. A weighed sample had a unit weight of 1.46 kg/m2. The outside surface is treated for UV protection.

Group Number Classification in accordance with the New Zealand Building Code

The specimen was tested in accordance with ISO 9705:1993 and 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
NZBC Verification Method C/VM2 Appendix A	1-S Average Smoke Production Rate was 0.3 m^2/s and therefore within the 5 m^2/s limit

Issued by

P. C. R. Collier
Senior Fire Testing Engineer
IANZ Approved Signatory

Reviewed by

P. N. Whiting
Senior Fire Engineer/Fire Testing Team Leader
IANZ Approved Signatory

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

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

Issue Date
29/10/2019

Expiry Date
29/10/2024