



**Delta MW and EPS-FR Panel Class 10a  
Awning and Patio Roof System**

**Fire Engineering Report**

**Revision 1-4**

## Report Issue Authorisation

<b>Project Title</b>	Delta MW and EPS-FR Panel Class 10a Awning and Patio System
<b>File Name</b>	A21007 J004 - Delta MW and EPS-FR Awning and Patio Roof System FER js rev 1-4

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## Revision/verification history

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1-4	17/01/2023	FER	Jacob Sherwin 	Dr Paul Clancy 
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1-1	01/11/2021	FER	Dirk van der Walt 	Dr Paul Clancy 
1-0	21/10/2021	FER	Dirk van der Walt 	Dr Paul Clancy 

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# 1 Summary

## 1.1 General

SOTERA has been engaged to carry out fire engineering assessment of the proposed performance solution for the project:

Client: Delta Panels Pty Ltd

Project Title: Delta MW and EPS-FR Panel Awning and Patio System

This summary gives the proposed performance solution and BCA issues. The main body of the report provides the detailed documentary evidence justifying the performance solutions. To avoid errors in duplication material may not be repeated. The main body of the report must be read in conjunction with this summary.

## 1.2 Brief Description of Application

This fire engineering report is intended to assess the generic application of Delta mineral wool (MW) and expanded polystyrene (EPS-FR) panel awning and patio system when used as a Class 10a structure (awning or patio roof) attached or adjacent to a Class 1a building positioned within 900 mm of a site boundary pursuant to NCC 2022 Housing Provisions Standard & Volume 2.

## 1.3 Fire Safety Systems

(A) Performance solution systems:

- (a) This performance solution is solely applicable to a roofing system incorporating Panel Type I and Panel Type II in the orientation (and observing the dimensional constraint) indicated in Figure 3-4. The roofing system may be supported by a non-combustible supporting structure and have non-combustible plumbing fixtures (gutters and downpipes). Panel Type I and Panel Type II may comprise of either the DeltaTrim™ system profile or DeltaOrb™ system profile and shall adhere fully to the overall system requirements outlined within Section 3.
- (b) All components used in the awning construction shall be compliant with Section 3. The components shall not be modified except with the written authorisation of the manufacturer and SOTERA.
- (c) The following restrictions apply for the Class 10a awning or patio roof installation:
- (d) Two or more sides (making up at least one third of the awning perimeter) shall be “open”; that is the roof covering shall be more than 500 mm from another building or allotment boundary on at least two sides without enclosing these sides with a wall, privacy screen or the like within 500mm of the edge of the roof covering. A boundary along a road or public space such as parklands, lakes, rivers and the like (where the construction of buildings is unlikely) may be considered open regardless of proximity to the boundary subject to no vertical obstruction (wall, privacy screen or the like) within 500 mm of the edge of the roof covering.
- (e) The awning structure shall not provide direct vertical support to any part of the adjacent Class 1 building.
- (f) The section of the Delta MW and EPS-FR Panel awning and patio roof system which is located within 900 mm of a site boundary shall be Panel Type I and consist solely of non-combustible components (subject to (d)) including:
  - (i) DeltaTrim-MW or DeltaOrb-MW panels
  - (ii) Steel fixtures, gutters and the like
  - (iii) Steel columns, beams, purlins and the like
  - (iv) Metallic flashing

- (g) The following restrictions shall apply to Panel Type I:
- (i) Each lamina shall be non-combustible. For clarity this includes low carbon steel (see AS1530.1 test in Section C.2) or mineral wool (see AS1530.1 test in Section C.1). As permitted under Section 3.3.2, low carbon steel from any manufacturer may be used and the steel may include a surface finish not exceeding 1 mm thickness with a spread of flame index no greater than 0.
  - (ii) Each adhesive layer may not exceed 1 mm in thickness and the total combined thickness of adhesive layers shall not exceed 2 mm.
  - (iii) The spread of flame index and the smoke developed index of the bonded laminated material as a whole shall not exceed 0 and 3 respectively (refer to AS1530.3 test certificates given in Section Appendix D ).

Unless detailed otherwise above, all other systems shall be in accordance with the DtS provisions.

## 1.4 Variations to DtS Provisions and Performance Requirements

Table 1-1 lists the variations to the DtS requirements and the performance requirements as agreed by stakeholders.

**Table 1-1 Variations from BCA-DtS provisions and performance requirements.**

DtS reference	Issue	Performance Requirements	IFEG Subsystems
9.2.4(1)(a)	Use of a Class 10a structure located between a Class 1 building and an allotment boundary (that is not a boundary with a road or other public space) and positioned within 900 mm of the allotment boundary without a fire rated wall (FRL 60/60/60) between the Class 1 building and allotment boundary.	H3P1(1)	A – Fire initiation and development and control  B – Smoke development and spread and control

## 1.5 Details of Standards Referenced in Report

The details of any acts, regulations, codes or standards which this report may reference are given in Table 1-2.

**Table 1-2. Details of Standards - informative.**

Reference in this Report	Year Version	Title
NCC	NCC 2022	ABCB National Construction Code 2022, Building Code of Australia – Housing Provisions Standard.
NCC	NCC 2022	ABCB National Construction Code 2022, Building Code of Australia – Volume 2.

## 2 Scope and Limitations

### 2.1 General

SOTERA has been engaged to carry out fire engineering assessment of the proposed performance solution for the project:

Client:	Delta Panels Pty Ltd
Project Title:	Delta MW and EPS-FR Panel Awning and Patio System

The following Fire Engineering Assessment has been conducted in order to address issues of variation from the Deemed-to-Satisfy (DtS) provisions of the National Construction Code 2022 Housing Provisions Standard & Volume 2 (ABCB 2022); hereafter referred to simply as the NCC. The fire engineering evaluation has been carried out in accordance with the methodologies defined in the International Fire Engineering Guidelines (IFEG 2005). This assessment considers the performance solution to show compliance with the performance requirements of the NCC. The evaluation methodology was based on direct compliance with performance requirements and/or equivalence to the deemed-to-satisfy provisions of the NCC as allowed under Part A2G1. This is supported by qualitative and quantitative evaluation analyses as allowed under Part A2G2 of the NCC.

### 2.2 Summary of Developments in Fire Engineering Report

**Rev 1-4:** This report has been updated to reflect the new version of the NCC, NCC 2022 which supersedes the outgoing NCC 2019 Amendment 1. The report is updated with regards to the applicable NCC 2022 clauses and performance requirements throughout.

**Rev 1-3:** Following further comments received from CertMark, the report has been updated to incorporate minor wording changes and to remove reference to the concession provided under NCC 3.7.1.1(e).

**Rev 1-2:** This report has been updated following CertMark Technical Assessment of DeltaTrim-MW & DeltaOrb-MW Panels issue 1.0 dated 24/03/2022.

Main updates include:

- Reference to the AS1530.1 test for low carbon steel has been added to Section 2.4.
- Section 3.3.2 has been updated to reference the AS1530.1 test for low carbon steel given in Section C.2 and extrapolate these results to any low carbon steel.
- Section 4.4(j)(d)(i) has been updated to clarify that low carbon steel is permissible for use as a lamina in the DeltaOrb™ MW or DeltaTrim™ MW panels with reference to the AS1530.1 test for low carbon steel given in Section C.2.
- Description labels in Figure 3-1 has been updated to reference the specific delta system depicted.
- Section 1.3 has been updated accordingly.
- Section 4.9(y) and (z) has been updated to clarify the core material of each system referenced (i.e. MW or EPS-FR).

**Rev 1-1:** Following review by the client, the following changes have been made:

- Bottom skin thickness for mineral wool panels has been changed from 0.60 mm to 0.55 mm throughout, consistent with fire test data given in Section D.7. Specifications given in Appendix E have been updated.
- Top skin thickness has been changed from 0.5 mm to 0.42 mm throughout consistent with fire test data given in Section D.5.

**Rev 1-0:** This report aims to inform stakeholders to facilitate agreement on performance solutions. Information and agreement is sought on matters including: critical building and occupant characteristics,

proposed details of performance solutions, DtS variations, issues, hazards, design fires and scenarios, methodologies and acceptability criteria.

### 2.3 Scope of Project.

The assessment relates to the final state of the building. This assessment and report does not address any issues of variation from deemed-to-satisfy requirements and occupant safety that may arise as a result of partial completion and partial occupation of the building. Analysis of intentional fire incidents such as arson is not contemplated as part of this assessment.

This assessment will address the issues of variation from deemed-to-satisfy provisions of the BCA, which are identified in the summary of this report (Section 1). The assessment is concerned primarily with the life safety of occupants. The fire safety systems to achieve this are outlined in the report in principle. The assessment does not consider property protection, business continuity issues, environmental protection and insurance requirements unless specifically identified within this report.

This assessment only addresses the specific issues identified in the context that the remainder of the building is fully compliant with the deemed-to-satisfy provisions of the NCC.

### 2.4 Supporting Information

The fire engineering assessment described in this report is based on the following information:

- i) CSIRO Certificate of Test: AS1530.1-1994 fire test certificate for Mineral Wool / Rockwool, Report No. FNC12604.
- ii) CSIRO Certificate of Test: AS1530.1-1994 combustibility test for low carbon steel manufactured by Bluescope Australia No. FNC12440.
- iii) AWTA Product Testing: AS1530.3-1999 Test Report for DeltaOrb-EPS-FR, Test Number 19-003621.
- iv) AWTA Product Testing: AS1530.3-1999 Test Report for DeltaTrim-EPS-FR, Test Number 19-003623.
- v) AWTA Product Testing: AS1530.3-1999 Test Report for DeltaOrb-MW, Test Number 21-003529.
- vi) AWTA Product Testing: AS1530.3-1999 Test Report for DeltaTrim-MW, Test Number 21-003527.
- vii) CSIRO Certificate of Test: AS1530.3-1999 fire test certificate for Bluescope ZINCALUME Steel, Report No. FNE11602.
- viii) CSIRO Certificate of Test: AS1530.3-1999 fire test certificate for UniCote pre-painted steel sheeting, Report No. FNE11809A.
- ix) AWTA Product Testing: AS1530.3-1999 Test Report for Uni Zinc Rigid Panel, Test Number 20-000776.
- x) AWTA Product Testing: AS1530.3-1999 Test Report for MagnaFlow Coated Steel Panel, Test Number 19-002186.
- xi) Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21.
- xii) DeltaTrim-MW Specifications (from <https://www.deltapanel.com.au/downloads-delta-panels> accessed 19/10/2021).
- xiii) DeltaOrb-MW Specifications (from <https://www.deltapanel.com.au/downloads-delta-panels> accessed 19/10/2021).
- xiv) DeltaTrim-EPS-FR Specifications (from <https://www.deltapanel.com.au/downloads-delta-panels> accessed 19/10/2021).
- xv) DeltaOrb-EPS-FR Specifications (from <https://www.deltapanel.com.au/downloads-delta-panels> accessed 19/10/2021).



xvi) Architectural drawings referenced in Table 2-1.

**Table 2-1. List of drawings relied upon.**

<b>Drawn by:</b>	Delta Panels Pty Ltd	
<b>Drawing No</b>	<b>Title</b>	<b>Revision</b>
PATIO ON BOUNDARY MW_2	-	A

## 2.5 Stakeholders

This report may be relied on by the following stakeholders:

Client:	Delta Panels Pty Ltd 731 Boundary Rd, Richlands QLD 4076 John Guy Phone: 07 3271 2170 Email: johnguy@deltapanel.com
Certifying Authority:	CertMark International PO Box 7144, Sippy Downs QLD 4556 Phone: 07 5445 2199 Email: talissa@CertMark.org
Fire Engineer:	SOTERA Pty Ltd 225 Wickham Terrace, Spring Hill, QLD 4000 Dirk van der Walt Phone: 07 5562 0022 Email: dirk.vanderwalt@sotera.com.au

This report should not be relied on by other parties without the consent of the Client and SOTERA.

## 2.6 Limitations

The scope of this report is limited to the performance solutions described in the summary of this report; Section 1. The general scope of the report is based on the agreed fee proposals dated 9<sup>th</sup> February 2021 and subsequent acceptance of the scope from the client.

This report has been developed generally in accordance with standards, guidelines, practices and review procedures generally accepted in the building design and construction, and fire engineering communities.

The fire engineering assessment and the subsequent recommendations reflect the reasonable and practical efforts of SOTERA. The extent to which the fire safety requirements are implemented will affect the probability of achieving adequate fire safety margins. It is important to note, however, that SOTERA cannot guarantee that fire ignition and fire damage will not occur.

This report is an assessment specifically of the performance issues highlighted in Table 1-1 in the summary of this report.

### 3 Delta MW and EPS-FR Awning and Patio Roof System

#### 3.1 Description of Application

This fire engineering report documents the assessment of the Delta MW and EPS-FR panel awning and patio system when used as a Class 10a structure (awning or patio) attached or adjacent to a Class 1a building positioned less than 900 mm from the site boundary pursuant to NCC 2022 Housing Provisions Standard & Volume 2 and installed to the requirements of Section 4.4.

#### 3.2 Description of System

The Delta MW and EPS-FR roofing system comprises:

- a) A sandwich panel roof system (Figure 3-1 to Figure 3-4) with 1 x Panel Type I (see located adjacent to and parallel with the allotment boundary, and any number of Panel Type II located more than 900 mm away from the site boundary).
- b) Non-combustible support structure
- c) Non-combustible plumbing fixtures (gutters and downpipes)

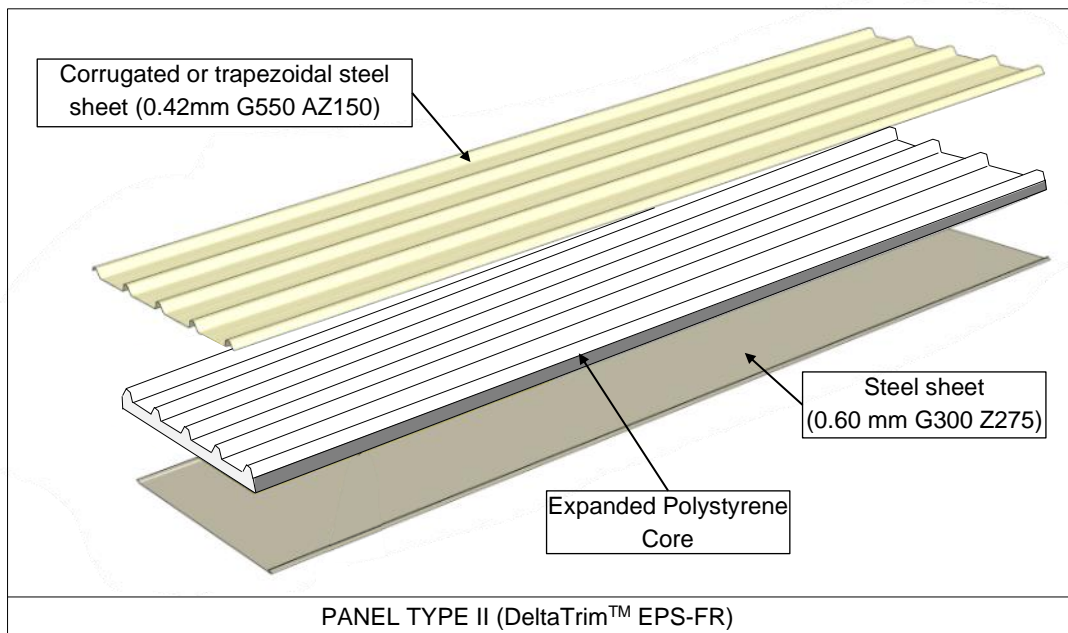
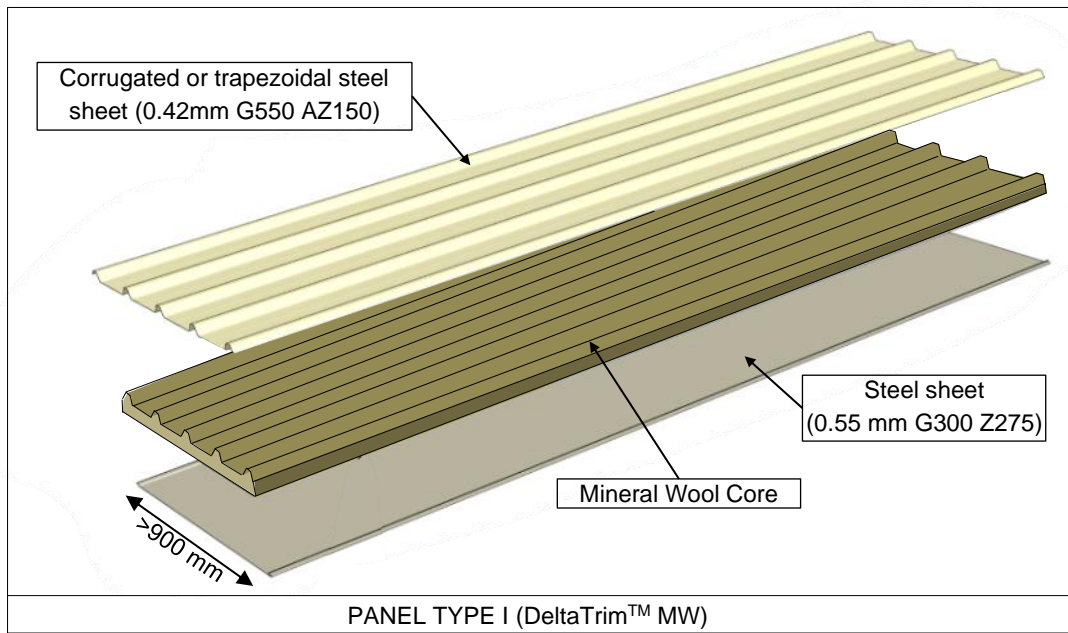
The Delta MW and EPS-FR sandwich panel roof system comprises two sandwich panel types:

1. Panel Type I – MW core sandwiched between steel outer facings (0.42mm G550 AZ150 steel upper facing and 0.55 mm G300 Z275 Steel lower facing – see Figure 3-1) with a minimum panel width of 900 mm.
2. Panel Type II – EPS-FR core sandwiched between steel outer facings (0.42mm G550 AZ150 steel upper facing and 0.60 mm G300 Z275 Steel lower facing – see Figure 3-1).

Delta Panels produce each of the panel types (Panel Type I and Panel Type II) in two variations (see Figure 3-2), one with a trapezoidal upper facing (referred to as the DeltaTrim™ system) and one with a corrugated upper facing (referred to as the DeltaOrb™ system). The composition of the facing material for both the DeltaTrim™ and DeltaOrb™ systems are identical, it is only the profile of the upper facing that is varied.

Based on the assessment provided in Section 3.3.2, the profile of the upper facing does not have any significant effect on fire performance and response to fire for DeltaOrb™ and DeltaTrim™ panels. As such, the DeltaOrb™ and DeltaTrim™ systems may be used interchangeably for Panel Type I and Panel Type II.

Material specifications as given by Delta Panels is quoted in Table 3-1.



■ Mineral Wool    □ Expanded Polystyrene – Fire Retardant (EPS-FR)

Figure 3-1. Sketch of Panel Type I and Panel Type II (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).

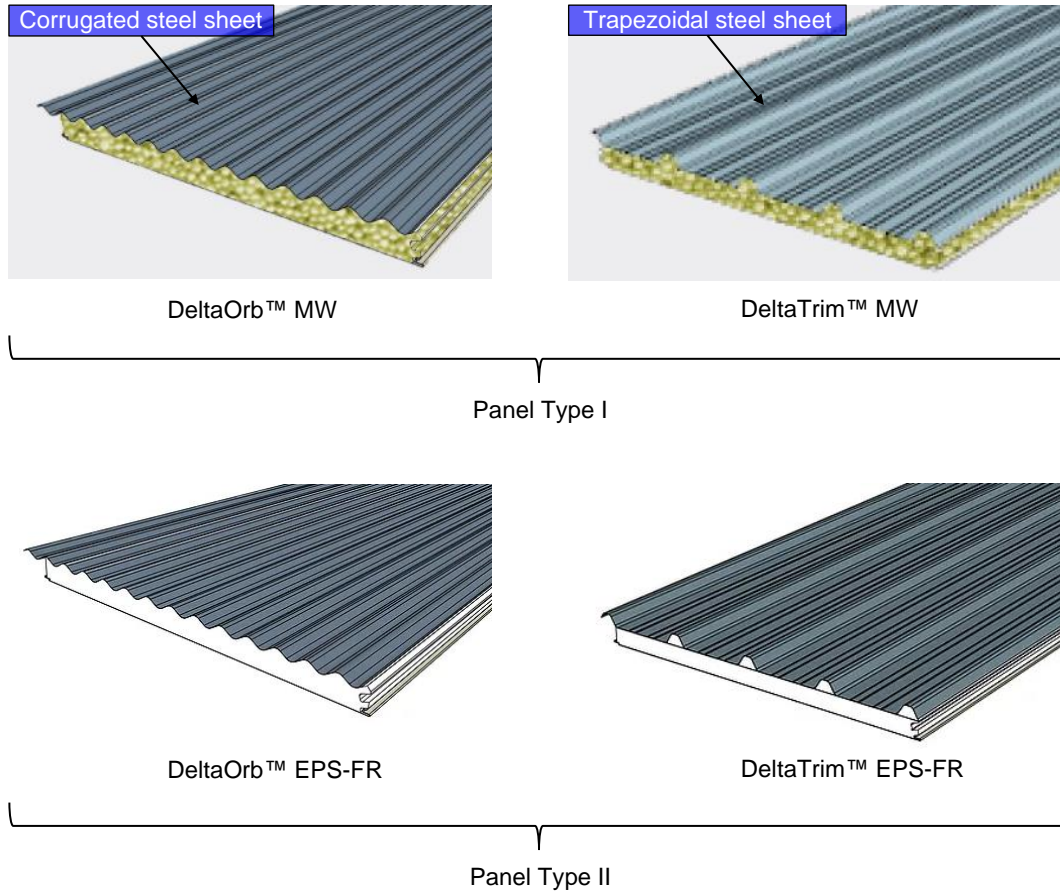


Figure 3-2. Illustration of DeltaOrb™ and DeltaTrim™ systems for Panel Type I and Panel Type II showing the difference in top skin (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).

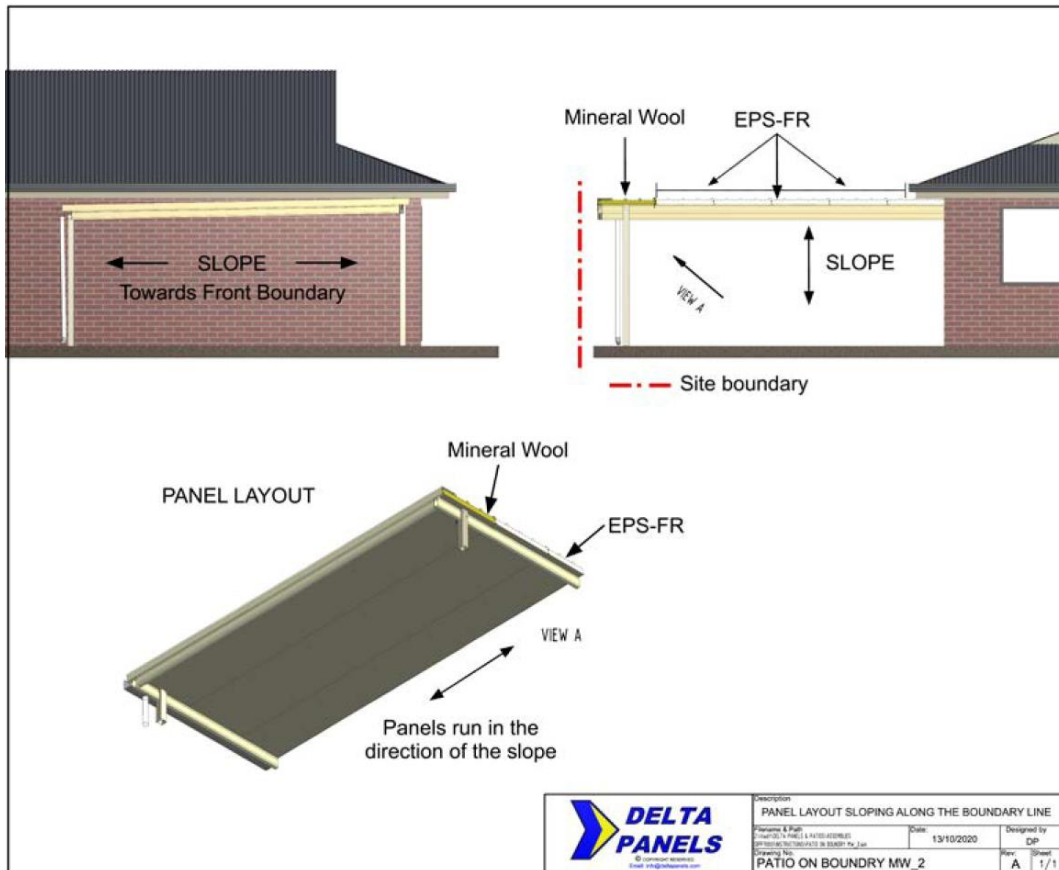


Figure 3-3. Delta MW and EPS-FR system sloping towards the site boundary (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).

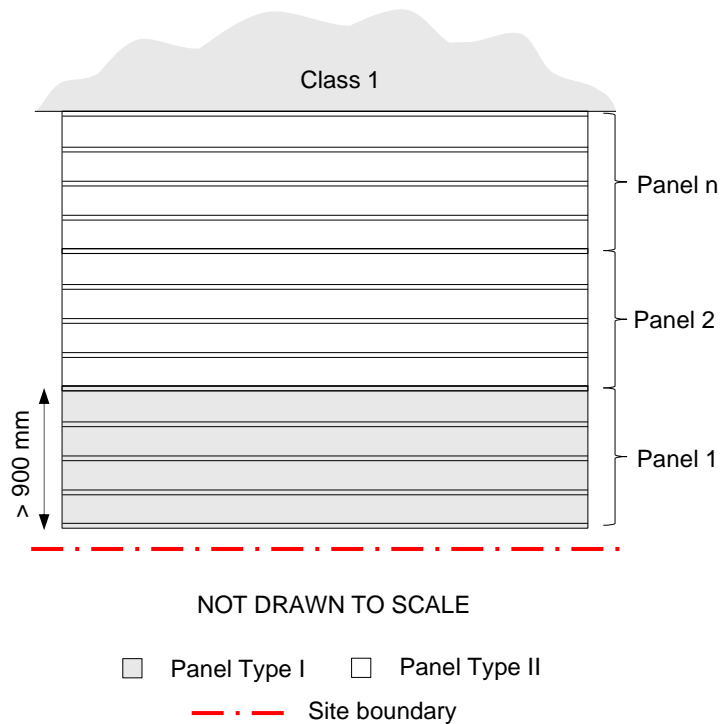


Figure 3-4. Sketch illustrating Panel Type I and Panel Type II orientation to the site boundary.

**Table 3-1. Manufacturers material specification (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).**

Steel skin detail for Panel Type I	Top skin	0.42mm / G550 AZ150
	Bottom skin	0.55mm / G300 Z275
Steel skin detail for Panel Type II	Top skin	0.42mm / G550 AZ150
	Bottom skin	0.60mm / G300 Z275
Core material	Panel Type I - Mineral wool	
	Panel Type II - SL grade Polystyrene with fire retardant	
Thermal conductivity	Panel Type I - Min. 0.042 W/mK @ 23.0°C	
	Panel Type II - Min. 0.0363 W/mK @ 23.0°C	
Panel Type I R Value @22.5°C	75 mm Panel	2.08
	100 mm Panel	2.78
	125 mm Panel	3.48
	150 mm Panel	4.17
Panel Type II R Value @22.5°C	75 mm Panel	2.50
	100 mm Panel	3.30
	125 mm Panel	4.20
	150 mm Panel	5.00
Sheet coverage	1000 mm	
Length (mm)	Min. of 1800 mm (cut to length)	
Thickness (mm)	75, 100, 125, 150	

**Table 3-2. DeltaOrb™ fixing details (crest fixing only, one fixing every second crest) – (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).**

Panel Thickness	Fixing into steel
<b>75</b>	Tek 14 x 135 Hex Head Screw
<b>100</b>	Tek 14 x 150 Hex Head Screw
<b>125</b>	Tek 14 x 175 Hex Head Screw
<b>150</b>	Tek 14 x 200 Hex Head Screw

\*Use cyclone plate and neo washer on each fixing. Upon installation the overlap needs to be stitch screwed or riveted every 300mm

**Table 3-3. DeltaTrim™ fixing details (crest fixing only, one fixing every second crest) – (from Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21).**

Panel Thickness	Fixing into steel
75	Tek 14 x 150 Hex Head Screw
100	Tek 14 x 175 Hex Head Screw
125	Tek 14 x 200 Hex Head Screw
150	Tek 14 x 230 Hex Head Screw

\*Use cyclone plate and neo washer on each fixing. Upon installation the overlap needs to be stitch screwed or riveted every 300mm

### 3.3 Fire Test Certificates

#### 3.3.1 Summary of Relevant Fire Test Certificates

Relevant fire test certificates referenced within this assessment are given in Table 3-4.

Three test methods are referenced, AS1530.1 and AS1530.3.

AS1530.1 specifies a test method for the determination of combustibility of a building material (this test method is material specific, each component of a system is tested separately). This test identifies whether a material is deemed combustible or not.

AS1530.3 sets out a test method for the assessment of building materials and components according to their tendency to ignite, propagate flame, release smoke and release heat following ignition. (This test is not material specific, components may be tested as a system). This test assesses each of these characteristics during the incipient stage of fire, providing an index rating to indicate the severity of each of these characteristics.

**Table 3-4. Applicable fire test certificates.**

Mineral Wool (MW)			
Test	Report	Test Specimen	Relevant Performance
1. AS1530.1:1994	CSIRO Report No. FNC12604 (refer to Section C.1)	50 mm thickness, 100 kg/m <sup>3</sup>	Not deemed combustible
2. AS1530.3:1999	AWTA Test No. 21-003527 (refer to Section D.4)	Pre-painted steel skins (DeltaTrim™) bonded to a MW core.	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 3
3. AS1530.3:1999	AWTA Test No. 21-003529 (refer to Section D.3)	Pre-painted steel skins (DeltaOrb™) bonded to a MW core.	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0

Smoke Developed: 3

**Sandwich Panel with Expanded Polystyrene (EPS-FR) Core**

Test	Report	Test Specimen	Relevant Performance
4. AS1530.3:1999	AWTA Test No. 19-003621 (refer to Section D.1)	Pre-painted steel skins (DeltaOrb™) bonded to an EPS-FR core with fire retardant.	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 2
5. AS1530.3:1999	AWTA Test No. 19-003623 (refer to Section D.2)	Pre-painted steel skins (DeltaTrim™) bonded to an EPS-FR core with fire retardant.	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 2

6. INTENTIONALLY LEFT BLANK

**Coated Steel Facings**

Test	Report	Test Specimen	Relevant Performance
7. AS1530.3:1999	CSIRO Report No. FNE11602 (refer to Section D.5)	BlueScope ZINCALUME Steel (0.42 mm nominal thickness)	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 2
8. AS1530.3:1999	AWTA Test No. 19-002186 (refer to Section D.6)	MagnaFlow Coated Steel Panel (nominal mass per unit density 7850 kg/m <sup>3</sup> )	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 3
9. AS1530.3:1999	CSIRO Report No. FNE11809A (refer to Section D.7)	UniCote steel (0.55 mm nominal thickness)	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 2
10. AS1530.3:1999	AWTA Test No. 20-000776 (refer to Section D.8)	UniZinc (low carbon steel) Rigid Panel (< 1 mm nominal thickness)	Indices: Ignitability: 0 Spread of Flame: 0 Heat Evolved: 0 Smoke Developed: 0-1



Low Carbon Steel			
Test	Report	Test Specimen	Relevant Performance
11. AS1530.1:1994	CSIRO Report No. FNC12440 (refer to Section C.2)	Low Carbon Steel Manufactured by Bluescope Australia	Not deemed combustible

### 3.3.2 Extrapolation of Fire Test Results

All relevant fire testing referenced within this report are given in Table 3-4 with a summary of the fire performance achieved in each case.

A number of coated steel and steel-alloy sheet metals have been tested to AS1530.3:1999 both independently and as part of a sandwich panel. When tested independently (tests 7 to 10 in Table 3-4), the test results obtained for each AS1530.3 index (Ignitability, Spread of Flame, Heat Evolved and Smoke Developed) are almost identical with only a small variance in the Smoke Developed Index. In all cases, the AS1530.3 results are within the following value range:

- Ignitability Index: 0
- Spread of Flame Index: 0
- Heat Evolved Index: 0
- Smoke Developed Index: 0-3

When the AS1530.3 test is repeated with the steel facings bonded either side of a material deemed not combustible under AS1530.1, in this case mineral wool (tests 1, 2 & 3 in Table 3-4), the results give a near identical outcome to tests 7 to 10 in Table 3-4, that is:

- Ignitability Index: 0
- Spread of Flame Index: 0
- Heat Evolved Index: 0
- Smoke Developed Index: 2-3

Similarly, when the AS1530.3 test is repeated with the steel facings bonded either side of a combustible EPS-FR core material (tests 4 and 5 in Table 3-4), the results again provide a near identical outcome to tests 7 to 10 in Table 3-4, that is:

- Ignitability Index: 0
- Spread of Flame Index: 0
- Heat Evolved Index: 0
- Smoke Developed Index: 2

Based on these results and with reference to the tested facings and substrates, the tested indices are independent of the substrate to which the coated metallic facings are bonded. The results are indicative only of the fire performance of the coated metallic facings during the early stages of fire development, before involvement of the substrate. As such, the test results are independent of the thickness of the core material used (substrate) to which the coated metallic facings are bonded.

Furthermore, the AS1530.3 results in tests 2, 3, 4 & 5 (Table 3-4) indicate that the DeltaOrb™ system and the DeltaTrim™ system achieves identical early fire hazard performance. Based on these results, the differing profiles of the DeltaOrb™ and DeltaTrim™ systems do not appear to have any significant effect on the achieved fire performance of the panels. As such, the DeltaOrb™ and DeltaTrim™ panels may be used interchangeably and the outcomes of this assessment remain applicable to both panel types.

The AS1530.1 test provides determination of combustibility for each material independently. The mineral wool has been tested to AS1530.1 (test 1 in Table 3-4) and is deemed not combustible.

Low carbon steel is widely accepted as a non-combustible construction material. This is also confirmed by an AS1530.1 test for low carbon steel manufactured by Bluescope Australia (test 11 in Table 3-4) in which the test outcome demonstrates that the material (low carbon steel) is not deemed combustible. The NCC Guide further alludes to this in a number of cases by explicitly stating - “non-combustible materials (such as steel)”. On this basis, low carbon steel is assumed to be non-combustible, regardless of who the manufacturer is or whether the manufacturer has tested the material to AS1530.1.

This assessment is based on the assumption that EPS-FR is combustible and has the thermal characteristics outlined in Table 3-5. The values given in Table 3-5 were obtained through bench-scale testing that was undertaken by the University of Queensland (UQ) and is available in the UQ cladding material library as sample INS04.

**Table 3-5. Key thermal properties of EPS-FR in the University of Queensland Cladding Material Library under sample ID INS04.**

Criteria	Symbol	Unit	INS04 (99% EPS-FR Core)
Gross heat of combustion	$\Delta H_c$	$\frac{kJ}{g}$	39.20
Critical heat flux for ignition	$\dot{q}''_{cr}$	$\frac{kW}{m^2}$	20.50
Ignition temperature	$T_{ig}$	°C	434
Peak HRRPUA (average) at:	$\dot{q}''_p$	$\frac{kW}{m^2}$	
At Heat flux of 35 kW/m <sup>2</sup>			228.06
At Heat flux of 50 kW/m <sup>2</sup>			291.11
At Heat flux of 60 kW/m <sup>2</sup>			332.23
Total energy released (average) at:	$Q_t$	$\frac{MJ}{m^2}$	
At Heat flux of 35 kW/m <sup>2</sup>			28.43
At Heat flux of 50 kW/m <sup>2</sup>			28.22
At Heat flux of 60 kW/m <sup>2</sup>			24.52

## 4 Delta MW and EPS-FR Awning or Patio Roof System within 900 mm of a Site Boundary

### 4.1 Assessment Task Defined

#### 4.1.1 Background

This performance solution assesses the use of a roofing system consisting of Panel Type I and Panel Type II in the orientation (and observing the dimensional constraint) indicated in Figure 3-4, when used as an awning or patio roof attached to a Class 1 building and positioned less than 900 mm from the allotment boundary.

#### 4.1.2 Issue

Where a Class 10a structure is located between a Class 1 building and an allotment boundary (that is not a boundary with a road or other public space) and positioned within 900 mm of the allotment boundary, NCC 9.2.4(1)(a) requires that a fire rated wall (FRL 60/60/60) be provided between the Class 1 building and allotment boundary; see Figure 4-1.

It is proposed to have no fire wall protection between the awning or patio and the site boundary when positioned less than 900 mm from the site boundary in variation to NCC 9.2.4(1)(a).

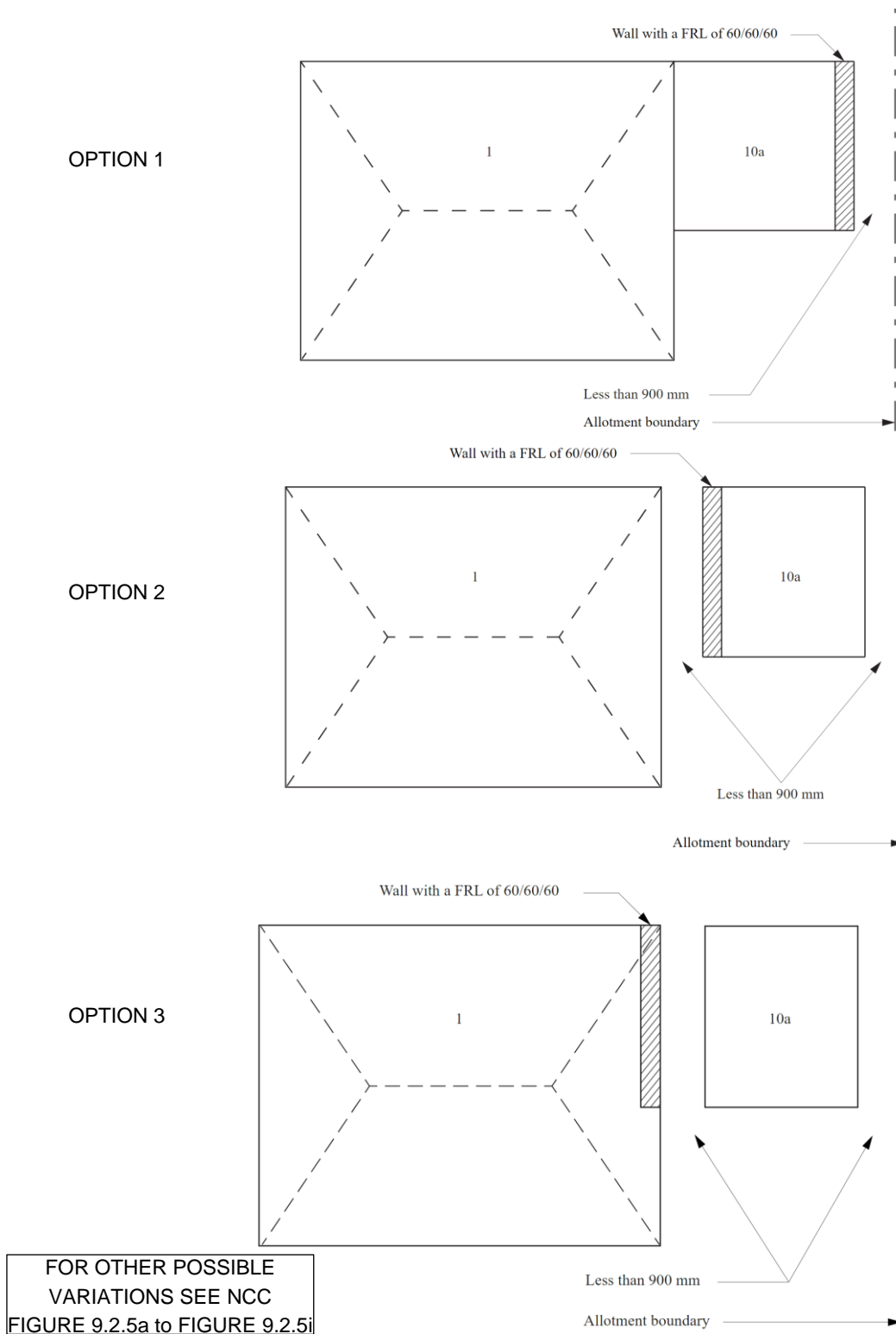


Figure 4-1. Fire rated wall (FRL 60/60/60) required where a Class 10a structure is located between a Class 1 building and an allotment boundary (that is not a boundary with a road or other public space) and positioned within 900 mm of the allotment boundary (adapted from NCC Figures 9.2.5a to FIGURE 9.2.5i).

## 4.2 Hazards

### 4.2.1 Specific Hazard

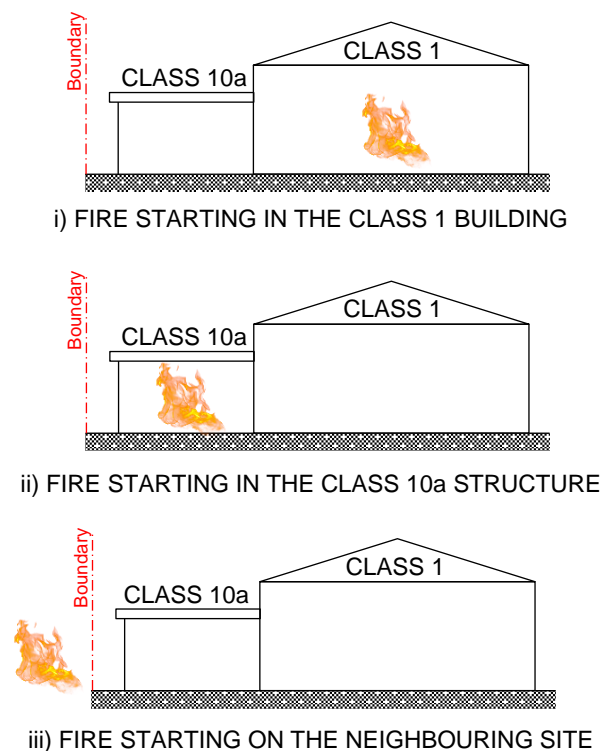
The NCC Schedule 3 defines fire hazard as the danger in terms of potential harm and degree of exposure arising from the start and spread of fire and the smoke and gases that are thereby generated. As such, the BCA definition of a hazard relates to the potential for occupants to be exposed to heat and/or smoke.

The intent of NCC 9.2.4 & 9.2.9 is to reduce the risk of fire spread between Class 1 buildings on neighbouring allotments as per performance requirement H3P1(1). The hazard associated with the variations to NCC 9.2.4 & 9.2.9 is the potential for fire spread between buildings to expose occupants to heat and/or smoke.

Whether the Delta MW and EPS-FR roof system when used within 900 mm of a site boundary presents an unacceptable risk of fire spread between buildings (which could significantly increase the hazard of building occupants becoming exposed to heat and/or smoke) must be assessed.

The identified hazard shall be considered in three fire scenarios (see Figure 4-2):

- i) Fire starting in the Class 1 building.
- ii) Fire starting below/in the Class 10a structure.
- iii) Fire starting on the neighbouring site.



**Figure 4-2. Fire scenarios to be considered to assess the identified hazard.**

#### 4.2.2 General Hazard

The following statistics indicating type and severity of domestic fires was obtained from Dowling and Ramsay (1997), Australian Bureau of Statistics: Home Fire Safety (2000), Fire Statistics UK (2002):

- 70% of fires are caused by the misuse of equipment including cooking appliances, candles, heaters, electrical appliances
- 20% of fires are due to arson
- 10% of fires are due to electrical faults
- 3% of fires start outside
- 2.2% of fires, which start inside, spread beyond the building of origin
- 76% of reported fires do not spread beyond the room of origin whether by good fortune or by occupant intervention
- 80% of fires are not reported to the fire brigade. They are extinguished by occupants while the fires are small
- 30% of fires start in kitchens, 10% in bedrooms i.e. approximately 3% per bedroom.

From the above statistics it is evident that only a small fraction of reported residential home fires start outside the building and an even smaller fraction of fires that start inside the building, spread beyond the building of fire origin. Unreported fires (which make up approximately 80% of all fires) are typically those that are extinguished, further reducing the number of fires that spread beyond the building of fire origin. Based on the statistics, as the building contains fire load of a relatively small scale, it is unlikely that a fire within the building will spread to the neighbouring building and as a result, the hazard of occupants being exposed to heat and/or smoke is low.

#### 4.3 Performance to be Assessed

The performance solution must be assessed for whether it mitigates the identified hazards to performance requirement:

H3P1 – Spread of Fire:

- (1) A Class 1 building must be protected from the spread of fire such that the probability of a building not being able to withstand the design heat flux of 92.6 kW/m<sup>2</sup> for a period of 60 minutes shall not exceed 0.01, when located within 900 mm from the allotment boundary or within 1.8 m from another building on the same allotment from –
  - (i) Another building other than an associated Class 10 building; and
  - (ii) The allotment boundary, other than a boundary adjoining a road or public space.

#### 4.4 Systems

The systems proposed are:

- (h) This performance solution is solely applicable to a roofing system incorporating Panel Type I and Panel Type II in the orientation (and observing the dimensional constraint) indicated in Figure 3-4. The roofing system may be supported by a non-combustible supporting structure and have non-combustible plumbing fixtures (gutters and downpipes). Panel Type I and Panel Type II may comprise of either the DeltaTrim™ system profile or DeltaOrb™ system profile and shall adhere fully to the overall system requirements outlined within Section 3.
- (i) All components used in the awning construction shall be compliant with Section 3. The components shall not be modified except with the written authorisation of the manufacturer and SOTERA.
- (j) The following restrictions apply for the Class 10a awning or patio roof installation:

- (a) Two or more sides (making up at least one third of the awning perimeter) shall be “open”; that is the roof covering shall be more than 500 mm from another building or allotment boundary on at least two sides without enclosing these sides with a wall, privacy screen or the like within 500mm of the edge of the roof covering. A boundary along a road or public space such as parklands, lakes, rivers and the like (where the construction of buildings is unlikely) may be considered open regardless of proximity to the boundary subject to no vertical obstruction (wall, privacy screen or the like) within 500 mm of the edge of the roof covering.
- (b) The awning structure shall not provide direct vertical support to any part of the adjacent Class 1 building.
- (c) The sandwich panel which is located within 900 mm of a site boundary shall be Panel Type I and consist solely of non-combustible components (subject to (d)) including:
  - (i) DeltaTrim-MW or DeltaOrb-MW panels
  - (ii) Steel fixtures, gutters and the like
  - (iii) Steel columns, beams, purlins and the like
  - (iv) Metallic flashing
- (d) The following restrictions shall apply to Panel Type I:
  - (i) Each lamina shall be non-combustible. For clarity this includes low carbon steel (see AS1530.1 test in Section C.2) or mineral wool (see AS1530.1 test in Section C.1). As permitted under Section 3.3.2, low carbon steel from any manufacturer may be used and the steel may include a surface finish not exceeding 1 mm thickness with a spread of flame index no greater than 0.
  - (ii) Each adhesive layer may not exceed 1 mm in thickness and the total combined thickness of adhesive layers shall not exceed 2 mm.
  - (iii) The spread of flame index and the smoke developed index of the bonded laminated material as a whole shall not exceed 0 and 3 respectively (refer to AS1530.3 test certificates given in Section Appendix D ).

## 4.5 Methodology

The method of assessment is qualitative and quantitative to justify the risk and mitigate the hazard as identified in section 4.2.

Performance requirements are addressed comparatively in accordance with BCA A2G2(1)(b) and A2G2(2)(d).

Firstly, the DtS base case used for comparison must be established. The DtS base case shall present an equivalent DtS building which provides an acceptable benchmark against which to assess the proposed performance solution.

The DtS base case will consist of a Class 1 house with a DtS Class 10a structure attached to the house. The comparison case will consist of an identical Class 1 house, at an identical distance from the site boundary, with the proposed Class 10a structure attached to the house. Refer to Figure 4-3.

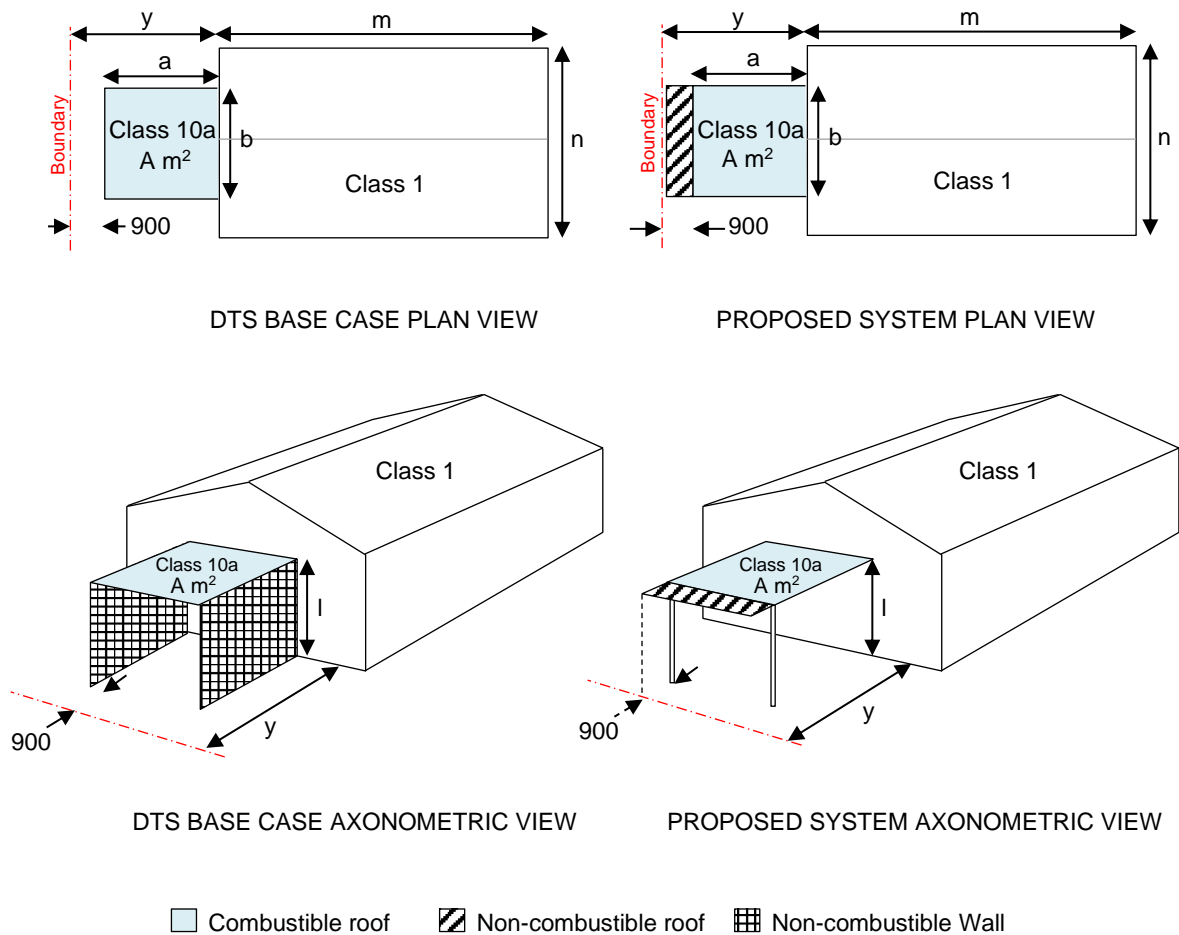


Figure 4-3. Illustration of DtS base case that will be used for comparison to the proposed system.

## 4.6 Acceptability Criteria

It shall be demonstrated comparatively that the Delta MW and EPS-FR roof system (when attached to a Class 1 building within 900 mm of the site boundary) does not increase the risk of fire spread between Class 1 to Class 9 buildings when compared to the DtS base case.

## 4.7 Design Fires

Three fire scenarios are to be considered; one within the Class 1 building, one within or below the Class 10a structure and one on the neighbouring allotment. The three design fires are described in Sections 4.7.1.1 to 4.7.1.3 below.

### 4.7.1.1 Design Fire 1: Fire Within or Below the Class 10a Structure

In the case of a Class 10a structure intended to be used for a patio or awning application, fire load is likely to be limited as it would not be fully protected from the weather. However, the patio or awning is able to house a wide range of fire loads which may include a combination combustibile goods such as external furnishings, storage of household goods, a laundry rack, gardening supplies and the like.

To quantify a worst credible design fire the following fire loads are considered:

- (k) Upholstered Sofas – 500 kW to 2900 kW as shown in Figure 4-4.



- (l) Staked chairs – 2250 kW Peak HRR for 12 chairs (upholstered seat with metal frame) in two stacks as shown in Figure 4-5.
- (m) Laundry – 400 kW peak HRR for 10 shirts hanging on a rail; see Figure 4-6.
- (n) Miscellaneous furnishings – timber desk with a peak HRR of 650 kW; see Figure 4-7.

Assuming that the patio contains a three-seater upholstered sofa, 12 upholstered chairs with metal frames in stacks of 6 chairs side by side, a laundry rack with 10 T-shirts and a timber desk approximating a small table; the combined peak HRR (if all fire loads reached their peak HRR simultaneously) is 6200 kW.

As the fire is expected to start from a single ignition source and potentially spread to surrounding objects if the fire grows to a large enough size, different objects would be within different stages of fire growth and decay. Assuming that all objects will ignite, grow and peak simultaneously is not a realistic fire scenario. As such, the overall fire size and intensity is likely to be far less than 6200 kW, so this peak HRR is conservative.

Due to the uncertainty of potential fire loads that can be placed below the Class 10a awning, a further safety margin of approximately 1.6 is applied to the peak HRR. The design fire is therefore taken as 10 MW. To put this into perspective, this is equivalent to a large passenger vehicle fire. Thus, a design fire with peak HRR of 10 MW provides a worst credible fire scenario for use in the assessment. To eliminate time dependency, a steady state fire at a heat release rate of 10 MW will be used for assessment purposes.

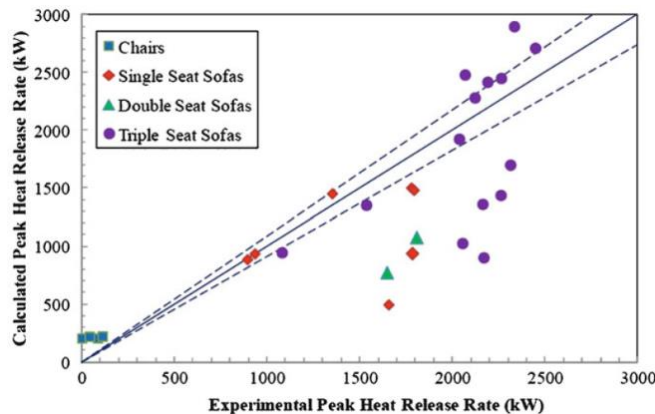


Figure 4-4. Peak HRR of upholstered sofas (SFPE handbook 2016).

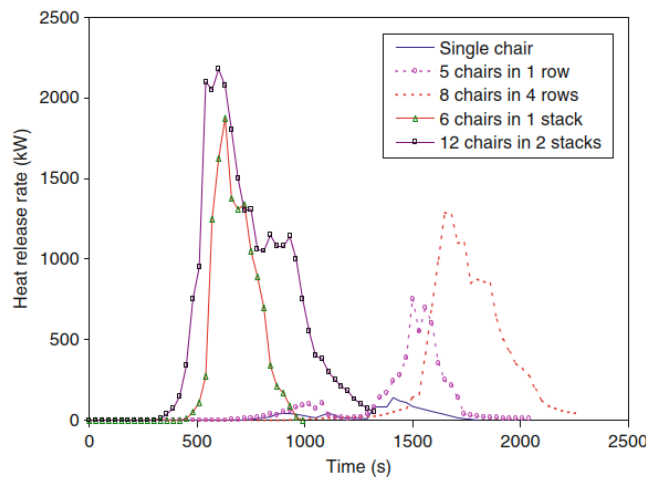


Figure 4-5. HRR of metal frame upholstered chairs (SFPE handbook 2016).

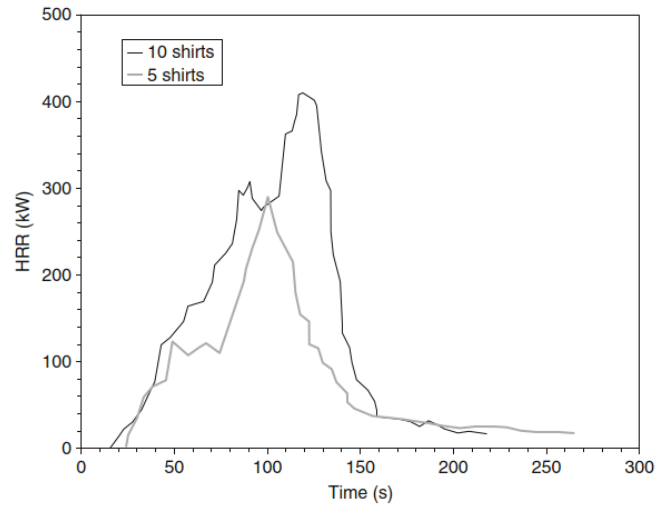


Figure 4-6. HRR of shirts hanging on a rail (SFPE handbook 2016).

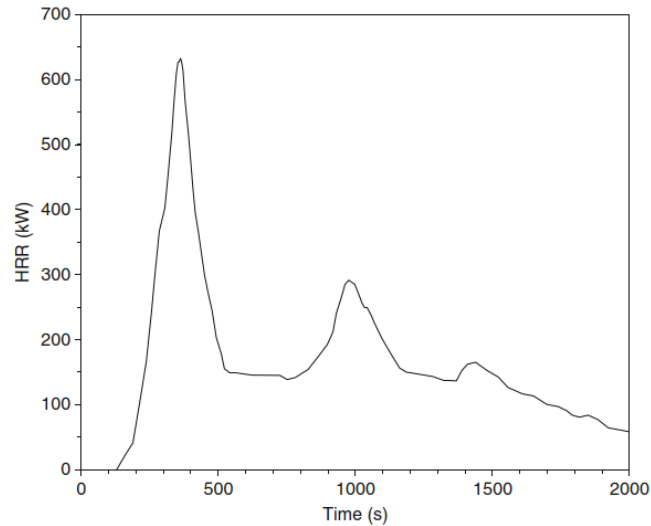
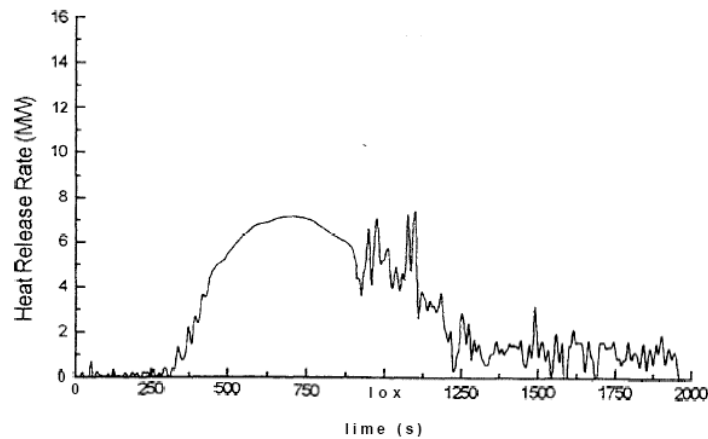


Figure 4-7. HRR of a 0.6 x 1.2 x 0.8 m wooden desk (SFPE Handbook 2016).

#### 4.7.1.2 Design Fire 2: Fire Within the Class 1 House

The peak heat release rate for a dwelling fire load is based on full-scale fire test data of a typical apartment fire (Alam and Beever, 1996) which is expected to have the same fire load density to that of a house. The measured heat release rate is given in Figure 4-8 and shows that a peak heat release rate of 7.5 MW is reached at flashover.



**Figure 4-8. Typical uncontrolled apartment fire (Alam and Beaver 1996).**

#### 4.7.1.3 Design Fire 3: Fire Spread from the Site Boundary to the Class 10a Structure

The fire source feature presented by the site boundary is taken as a radiating panel with transient temperature following the AS1530.4 standard fire time-temperature curve which increases to over 1050°C. This provides a more conservative assessment than simply assessing a NCC H3V3 fire source (equivalent to C1V1 in NCC Volume 1) with a constant heat flux of 80 kW/m<sup>2</sup> from the site boundary (which is equivalent to a radiating panel with a temperature of 817°C).

The standard fire curve is described by the equation:

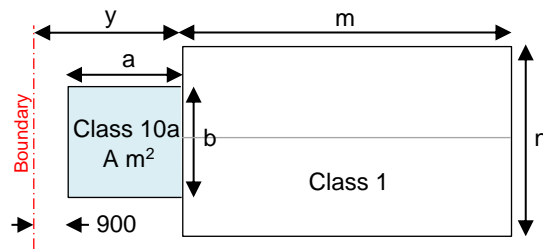
$$T = 345 \log_{10} \left( \frac{8t}{60 + 1} \right) + 20$$

## 4.8 Assessment

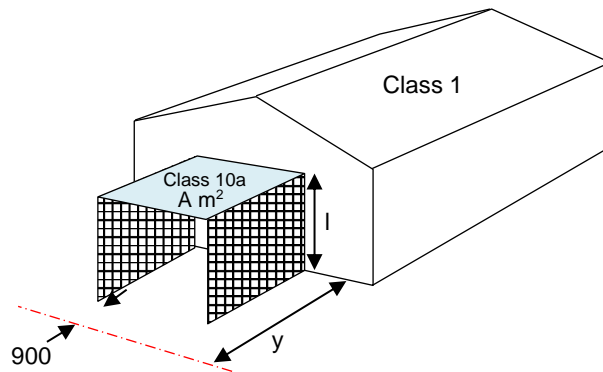
### 4.8.1 DtS Base Case

NCC does not restrict the combustibility of a Class 10a structure attached to a Class 1 structure if it is located more than 900 mm from the site boundary.

As such, the risk of fire spread from, or to the site boundary is mitigated to a DtS accepted level of risk (i.e. to the degree necessary) with a spatial separation of 900 mm regardless of ventilation conditions.



DTS BASE CASE PLAN VIEW

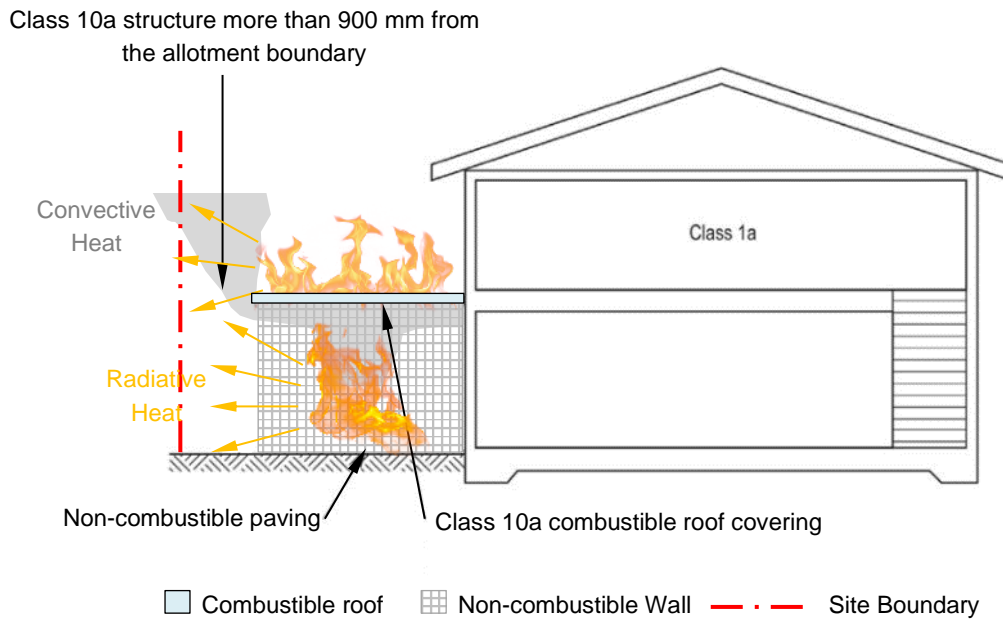


DTS BASE CASE AXONOMETRIC VIEW

Combustible roof
  Non-combustible Wall

**Figure 4-9. DtS base case: Class 10a structure with combustible roof enclosed along three sides located within 900 mm of the site boundary.**

Figure 4-10 illustrates the dominant mechanisms for heat transfer to the site boundary from a fire below the Class 10a structure for the DtS base case.

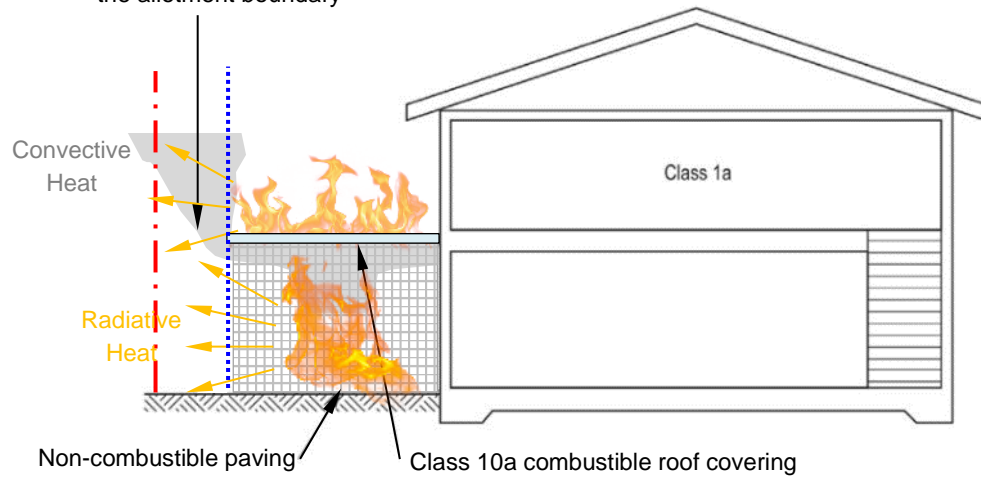


**Figure 4-10. DtS base case: Mechanisms for heat transfer from a fire below a combustible Class 10a awning more than 900 mm from the site boundary.**

#### 4.8.2 Assessment of the Delta MW and EPS-FR Roof System Against the Applicable DtS Configurations

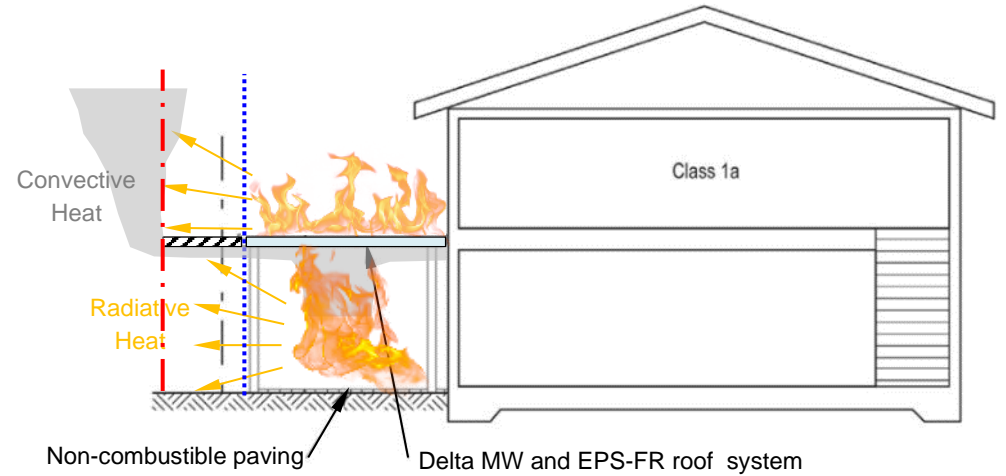
Figure 4-11 to Figure 4-13 indicates the dominant mechanisms for fire spread to the site boundary for the Delta MW and EPS-FR roof system when attached to a Class 1 building and positioned within 900mm of a site boundary in comparison to the DtS base case for each of the three fire scenarios.

Class 10a structure more than 900 mm from the allotment boundary



Combustible roof   
  Non-combustible Wall   
  Site Boundary   
  900 mm set back from site boundary

DTS BASE CASE



Combustible roof   
  Non-combustible roof   
  Site Boundary   
  900 mm set back from site boundary

PERFORMANCE SOLUTION CASE

THE DTS PROVISIONS DO NOT RESTRICT FIRE SPREAD FROM THE CLASS 10a STRUCTURE TO THE ASSOCIATED CLASS 1 HOUSE. AS SUCH, FIRE SPREAD TO THE ATTACHED HOUSE IS NOT CONSIDERED.

Figure 4-11. Fire scenario 1: Mechanisms for heat transfer from a fire below the Class 10a roof covering within 900 mm of the site boundary.

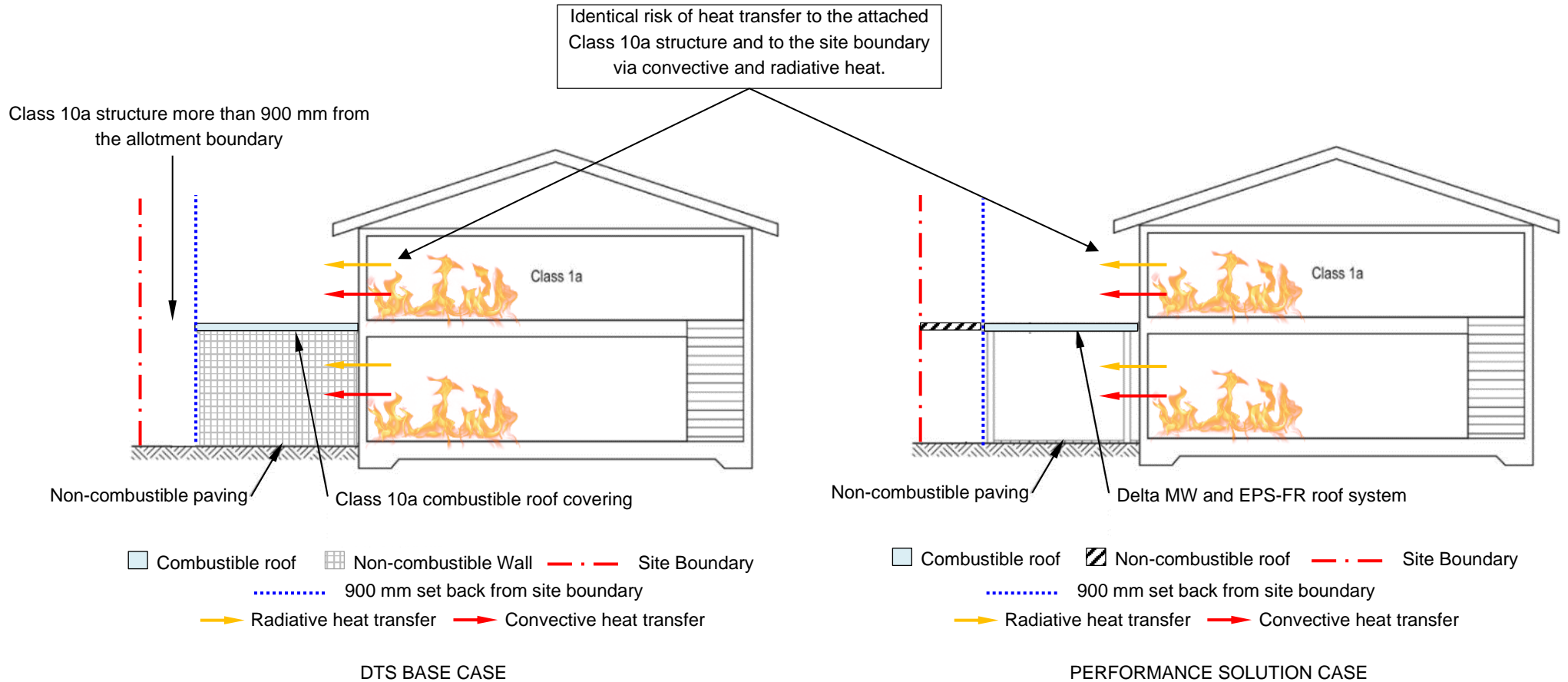
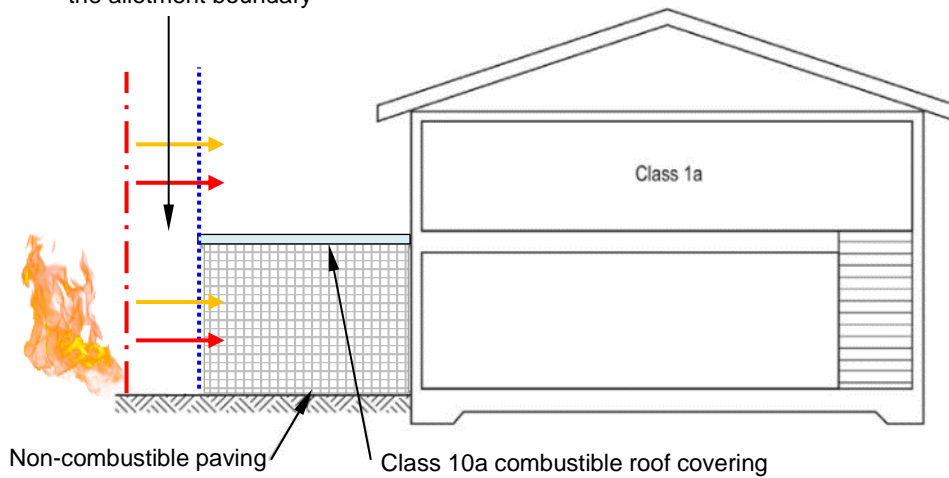


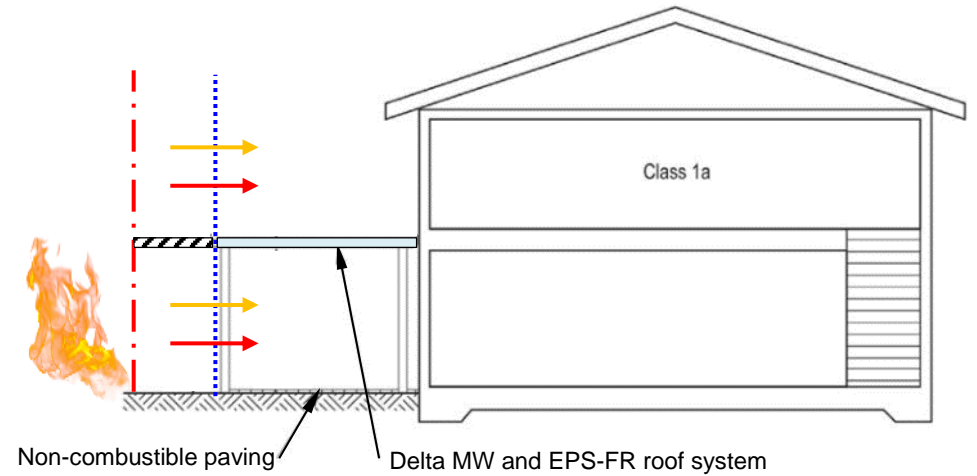
Figure 4-12. Fire scenario 2: Mechanisms for heat transfer from a Class 1 house fire to the attached Class 10a structure and site boundary.

Class 10a structure more than 900 mm from the allotment boundary



- Combustible roof    ▣ Non-combustible Wall    - . - . Site Boundary
- ..... 900 mm set back from site boundary
- Radiative heat transfer    → Convective heat transfer

DTS BASE CASE



- Combustible roof    ▨ Non-combustible roof    - . - . Site Boundary
- ..... 900 mm set back from site boundary
- Radiative heat transfer    → Convective heat transfer

PERFORMANCE SOLUTION CASE

Figure 4-13. Fire scenario 3: Mechanisms for heat transfer from the allotment boundary to the Class 10a structure and attached house.



#### 4.8.2.1 Fire Scenario 1: Fire Within or Below the Class 10a Structure

As can be seen from Figure 4-11, the radiative component of heat transfer to the site boundary (which includes design fire 1 in accordance with Section 4.7.1.1) is no worse for the performance solution case than for the DtS base case. However, due to the awning extending all the way to the site boundary, convective heat may spill directly to the site boundary which could increase the risk of fire spread to the neighbouring allotment.

To assess the combination of convective and radiative heat transfer to the site boundary for the Delta MW and EPS-FR system (performance solution case) compared to the DtS base case, an FDS analysis is undertaken in Appendix B .

As demonstrated by the results given in Appendix B , the Delta MW and EPS-FR roof system when installed to the requirements given in Section 4.4 does not present a greater hazard of fire spread to the site boundary than the DtS base case. Thus, the performance requirement is satisfied for this fire scenario.

#### 4.8.2.2 Fire Scenario 2: Fire Within the Class 1 House

As shown in Figure 4-12, in both the DtS case and in the performance solution case,

- (o) The Class 10a structure attached directly to the Class 1 building is combustible.
- (p) The Class 10a structure is attached to an identical Class 1 building with identical fire load.
- (q) The Class 1 building is located an identical distance from the site boundary.

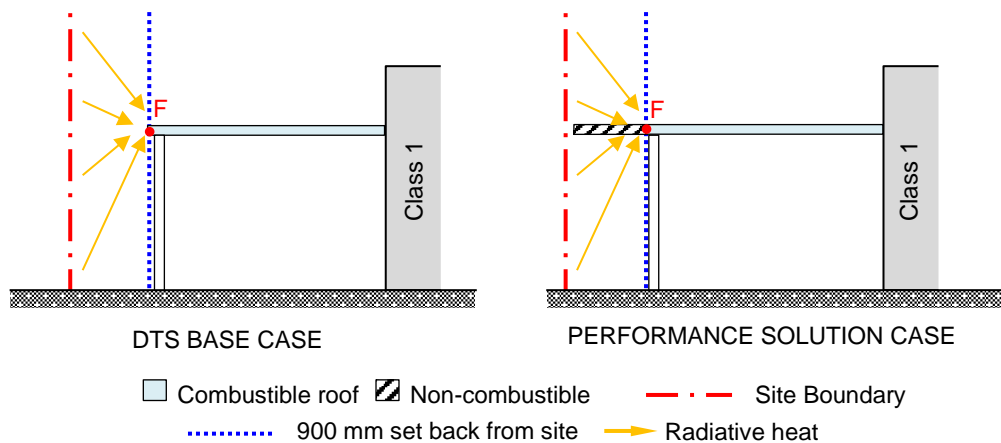
Thus, the potential for fire spread from the Class 1 building to the Class 10a structure is identical for the DtS base case and performance solution case. Heat transfer from the Class 1 building to the site boundary is also identical for the DtS base case and performance solution case. Any difference in the risk of fire spread from the subject allotment to the neighbouring allotment is therefore attributable to the Class 10a structure itself.

The assessment outlined in Appendix B therefore applies and the results demonstrate that the Delta MW and EPS-FR system when installed to the requirements given in Section 4.4 does not present a greater hazard of fire spread to the site boundary than the DtS base case. Thus, the performance requirement is satisfied for this fire scenario.

#### 4.8.2.3 Fire Scenario 3: Fire Spread from the Site Boundary to the Class 10a Structure

In this case the site boundary forms the fire source feature as discussed in Section 4.7.1.3. The incident radiation on the nearest point of the combustible roof system (point F in Figure 4-14) is considered for both the DtS base case and performance solution case. As the performance solution case has a non-combustible component within 900 mm of the site boundary, this may to some degree shield point F from radiation emitted from the site boundary. However, radiation received at point F for the performance solution case is at least equivalent to or less severe than the DtS base case.

However, heat conduction through the steel components forming part of the non-combustible portion of the roof system that is within 900 mm of the site boundary provides an additional mechanism for heat transfer to the combustible portion of the roof system. Convective heat can dissipate to sky and is not a dominant mechanism for heat transfer from the boundary to the Class 10a structure and is therefore ignored.



**Figure 4-14. Radiative heat transfer from the site boundary to the nearest point of the combustible roof covering for the DtS base case and performance solution case (point F).**

A 1-dimensional finite difference calculation is undertaken to assess the effect of conduction on heat transfer to the combustible portion of the roof system; refer to Appendix A. As shown in Figure 5-2, the results indicate that conductive heat attenuates quickly along the length of the steel rod and has no significant impact on the steel temperatures at a distance over 900 mm from the site boundary. The finite difference calculation assumes a solid rod with a cross section of 0.008 m<sup>2</sup> which far exceeds that of a lightweight roof purlin. As such the conduction assessment is conservative and conduction to a much lesser degree would be expected in a real fire condition.

Thus, conduction is not considered to present a dominant mechanism for heat transfer to the combustible component of the Delta MW and EPS-FR roof system.

The risk of fire spread from the site boundary to the combustible portion of the roof system is therefore demonstrated to be no worse than that of the DtS base case, therefore satisfying the performance requirement.

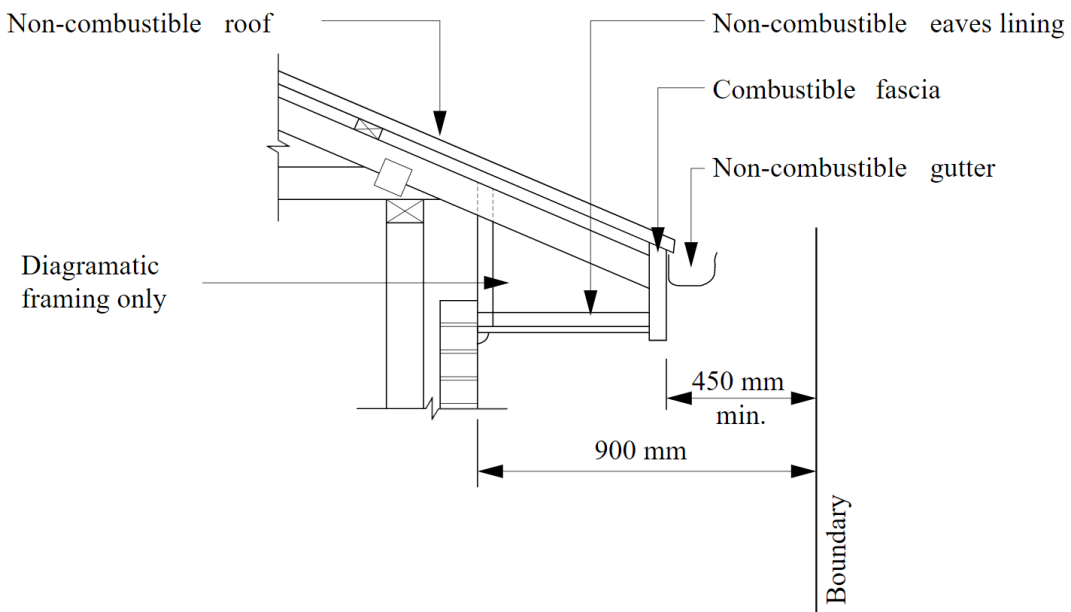
#### 4.8.2.4 Supplementary Discussion

NCC 9.2.9 (4) permits combustible fascia's within 900mm but not closer than 450 mm from the site boundary as shown in Figure 4-15. Furthermore, non-combustible plumbing fixtures may be fitted within the 450 mm region as it is not considered to increase the risk of fire spread between neighbouring building due to it being non-combustible.

This forms the basis of the proposed performance solution. The portion of the roof system which is combustible is suitably separated from the site boundary to the degree necessary to reduce the risk of fire spread between buildings. The non-combustible portion of the roof which (as demonstrated in Sections 4.8.2.1 to 4.8.2.3) does not increase the risk of fire spread between buildings and is therefore permitted to extend to the site boundary.

The assessment considers the potential for fire spread from the site boundary to a combustible component of the roof system and vice versa. The thickness of the core material of each roof panel does not impact the likelihood of fire spread from the site boundary to the roof, or from the roof to the site boundary (as the thickness would be identical for the DtS base case and the performance solution case). As such, increasing or decreasing the roof panel thickness does not increase the risk of fire spread between buildings when compared to the DtS base case. As such, the assessment is independent of the thickness of the core material used in the roof system.

The assessment has demonstrated achievement of performance requirement H3P1(1).



**Figure 4-15. Combustible fascia permitted up to but not closer than 450 mm to an allotment boundary (NCC Figure 9.2.9a).**

#### 4.9 Conclusion and Compliance

This fire engineering report confirms that the Delta MW and EPS-FR roof system which may comprise of;

- (r) 1 x Panel Type I (at least 900 mm in width) positioned parallel to the site boundary (see Figure 3-4),
- (s) Any number of Panel Type II located more than 900 mm from the site boundary (see Figure 3-4),
- (t) A non-combustible support structure,
- (u) Non-combustible plumbing fixtures (gutters and downpipes),
- (v) A width of 1000 mm,
- (w) cut to length (1800 mm minimum),
- (x) Panel Type I and Panel Type II may range in thickness from 75 mm -150 mm,
- (y) Panel Type I can be of the DeltaOrb™ MW or DeltaTrim™ MW system profiles with top skin consisting of 0.42mm G550 AZ150 steel and bottom skin consisting of 0.55mm G300 Z275 steel,
- (z) Panel Type II can be of the DeltaOrb™ EPS-FR or DeltaTrim™ EPS-FR system profiles with top skin consisting of 0.42mm G550 AZ150 steel and bottom skin consisting of 0.60 mm G300 Z275 steel

meet the performance requirements of H3P1(1) Volume 2, NCC 2022 when installed in accordance with the Delta Panels Mineral Wool – Awnings & Patio Brochure V20.10.21 and Section 4.4 of this report as a Class 10a structure (awning or patio roof) attached or adjacent to a Class 1a building positioned directly adjacent to the site boundary (i.e. less than 900 mm from the site boundary).

The comparative assessment has demonstrated qualitatively and quantitatively that the Delta MW and EPS-FR system (when installed to the requirements of Section 4.4) does not increase the risk of fire spread from or to an associated Class 1 building when compared to the DtS base case.

Performance requirement H3P1(1) is satisfied. The assessment is compliant in accordance with A2G2(1)(b) and A2G2(2)(d).

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SFPE Handbook (2003), “The SFPE Handbook of Fire Protection Engineering”, 3<sup>rd</sup> edition, published by National Fire Protection Association and Society of Fire Protection Engineers US.

SFPE Handbook (2016), “The SFPE Handbook of Fire Protection Engineering”, 5<sup>th</sup> edition, published by Society of Fire Protection Engineers.

Sun, P., Bisschop, R., Niu, H. and Huang, X., 2020. A review of battery fires in electric vehicles. Fire technology, pp.1-50.

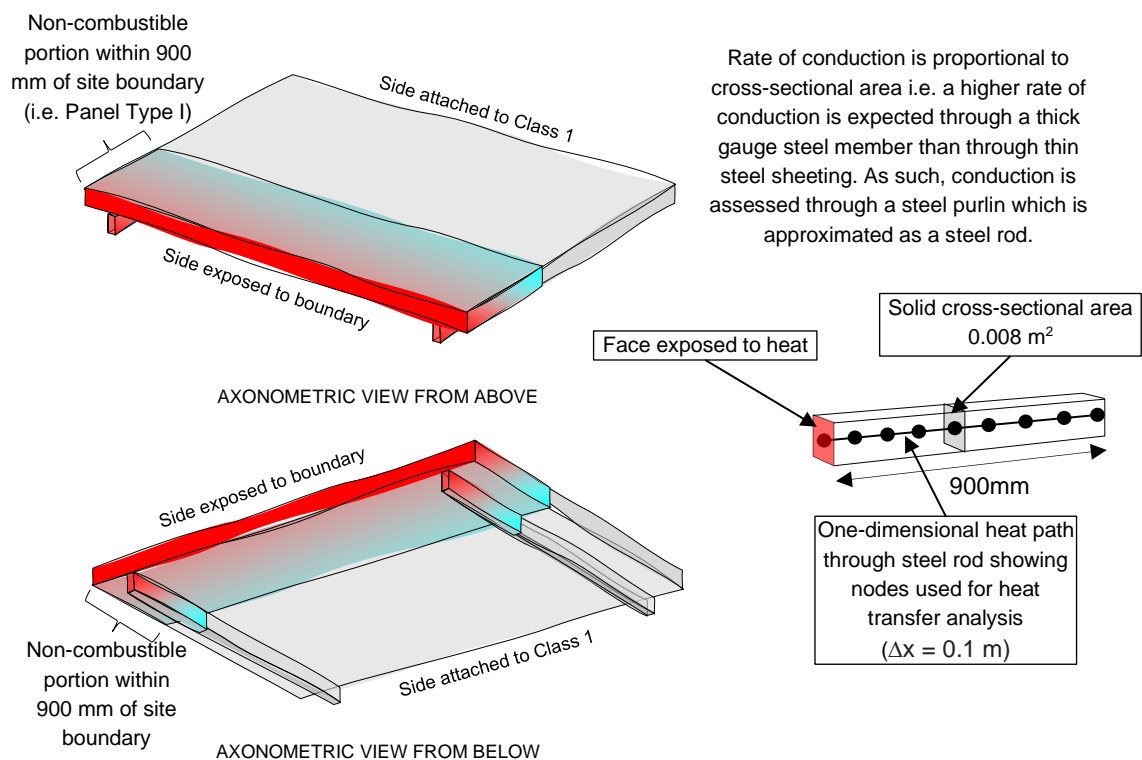
T. Alam, P Beever, “Flashover Fires – An Experimental Program”, CESARE Report 96-002, October 1996.

## Appendix A Assessment of Heat Conduction Through a Steel Member

### A.1 Introduction

A one-dimensional finite difference heat transfer calculation is undertaken to determine the temperature distribution through a steel purlin (approximated as a solid steel rod) when exposed on one face to a V2.3.1.3 fire source feature on the site boundary. The simplified model is shown in Figure 5-1.

The aim of the assessment is to establish whether conduction through a steel member along the Type I panel (metal facings, metal support structure or metal plumbing fixtures) of the Delta MW and EPS-FR roof system may result in ignition of the EPS-FR core within the adjacent Type II panel of the roof system.



**Figure 5-1. Finite Difference Heat Transfer Analysis Paths to assess heat transfer through a steel member via conduction.**

### A.2 Methodology

The finite difference heat transfer equation used for calculating the temperature distribution through the steel rod is given below:

$$T'_o = \left[ \frac{k_s A (T_{n-1} - T_n)}{\delta x_{n,n-1}} + \frac{k_s A (T_{n+1} - T_n)}{\delta x_{n+1,n}} - hA(T_o - 20) - \varepsilon \sigma A (T_o^4 - 293^4) \right] \times \frac{\delta t}{\rho c A \delta x_o} + T_o$$

For the above equation the notation is defined as follows:

variables:

$A$	= aggregate cross-sectional area of steel rod along the heat path (m <sup>2</sup> )
$c$	= specific heat (J/kgK)
$k$	= conductivity (W/mK)
$T$	= temperature (°C)
$t$	= time (s)
$x$	= distance (m)
$\rho$	= density (kg/m <sup>3</sup> )
$h$	= convective heat transfer coefficient (W/m <sup>2</sup> /K)
$\varepsilon$	= emissivity value
$\sigma$	= Stefan-Boltzmann (5.67 x 10 <sup>-8</sup> W/m <sup>2</sup> /K <sup>4</sup> )

prefix:  $\delta$  = small increment

subscripts:

$s$	= metal (steel)
$O$	= node at which temperature is being determined
$n-1$	= previous time step of node $O$
$n+1$	= next time step of node $O$

Using a spreadsheet, the temperature distribution through the steel rod is solved. The results are given in Figure 5-2. The thermal properties adopted are given in Table 5-1. More detailed explanation for explicit finite difference analysis of heat transfer can be found in Cengel et al (2011).

**Table 5-1. Material thermal properties (Drysdale 1999)**

	<b>Copper</b>
Conductivity, $k$ (W/mK)	45.8
Specific heat at constant pressure, $c$ (J/kgK)	460
Density $\rho$ (kg/m <sup>3</sup> )	7850
Emissivity	0.7

## A.2 Results & Conclusion

The temperature distribution through the steel rod after 60 minutes of exposure to standard fire is given in Figure 5-2.

The results indicate that conductive heat attenuates quickly along the length of the steel rod and has no significant impact on the steel temperatures at a distance over 900 mm from the site boundary.

Thus, conduction is not considered to present a dominant mechanism for heat transfer from a Type I panel to a Type II panel in the Delta MW and EPS-FR roof system.

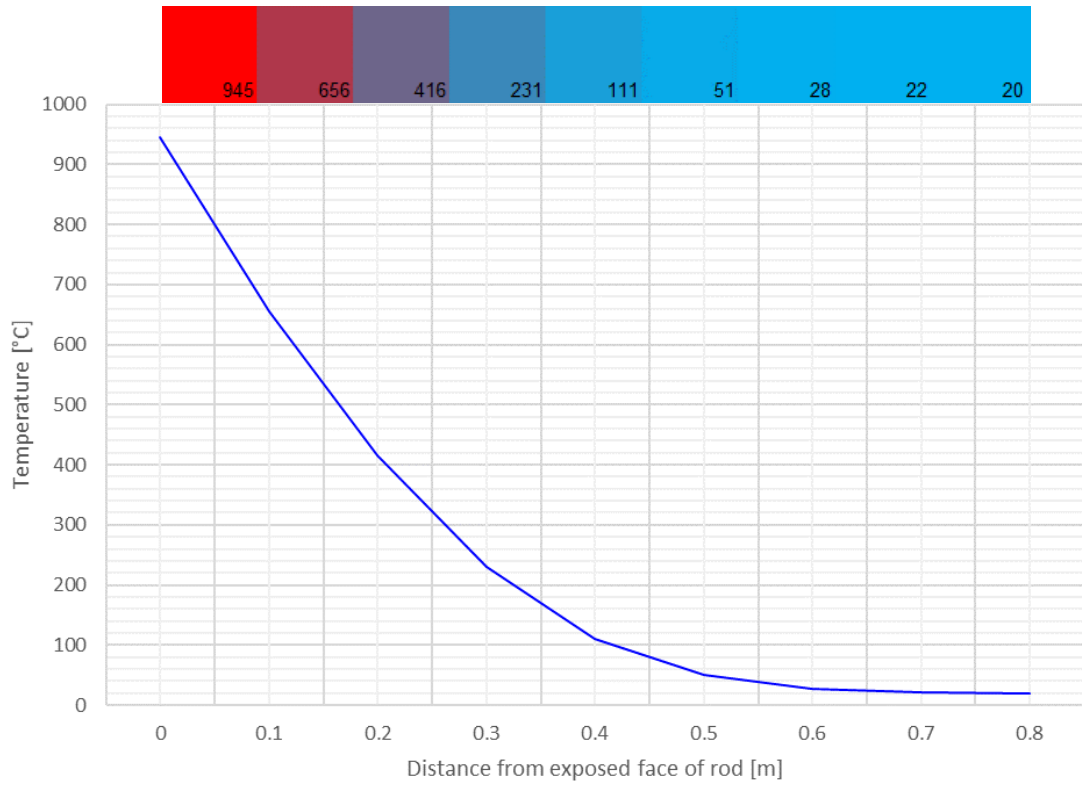


Figure 5-2. Temperature distribution through the steel rod after 60 minutes of exposure to standard fire.

## Appendix B FDS Assessment

### B.1 Introduction

An FDS analysis is undertaken to assess the combined heat transfer to the site boundary for the Delta MW and EPS-FR roof system when compared to the DtS base case.

### B.2 Model Geometry

The model geometries for each of the three FDS models use are described in Figure 5-3, Figure 5-4 and Figure 5-5 and include:

1. Model 1: DtS base case.
2. Model 2: Delta MW and EPS-FR roof system with equivalent dimensions to Model 1 (performance solution case).
3. Model 3: Sensitivity case where the width of the awning in Model 2 is increased by 100%.

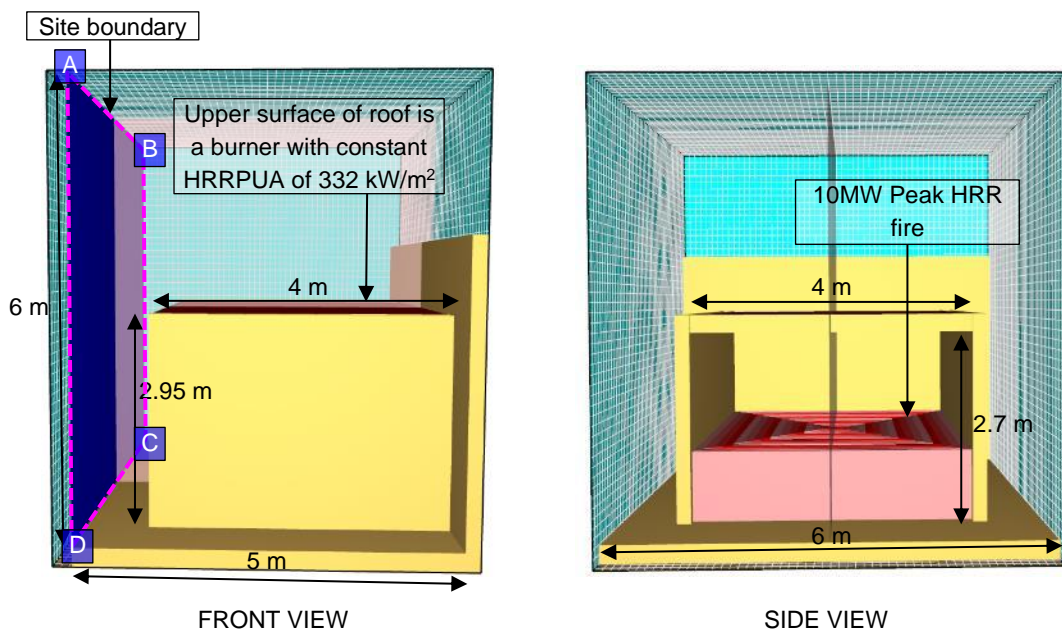


Figure 5-3. Model 1: Model geometry for DtS base case.



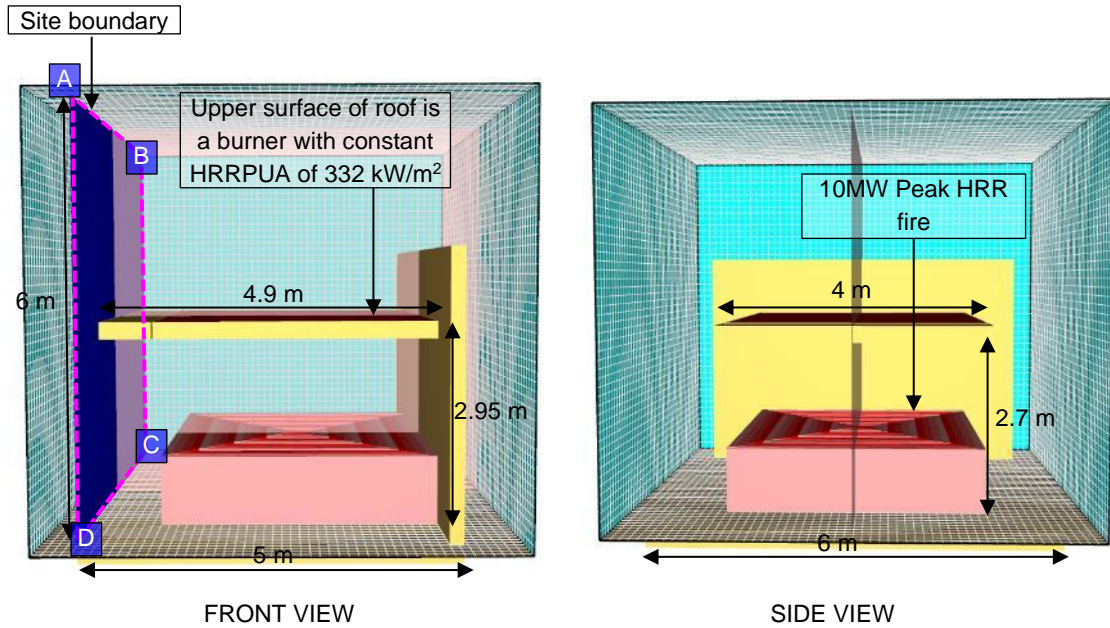


Figure 5-4. Model 2: Model geometry for a Delta MW and EPS-FR roof system (equivalent dimensions to DtS base case) located directly adjacent to the site boundary.

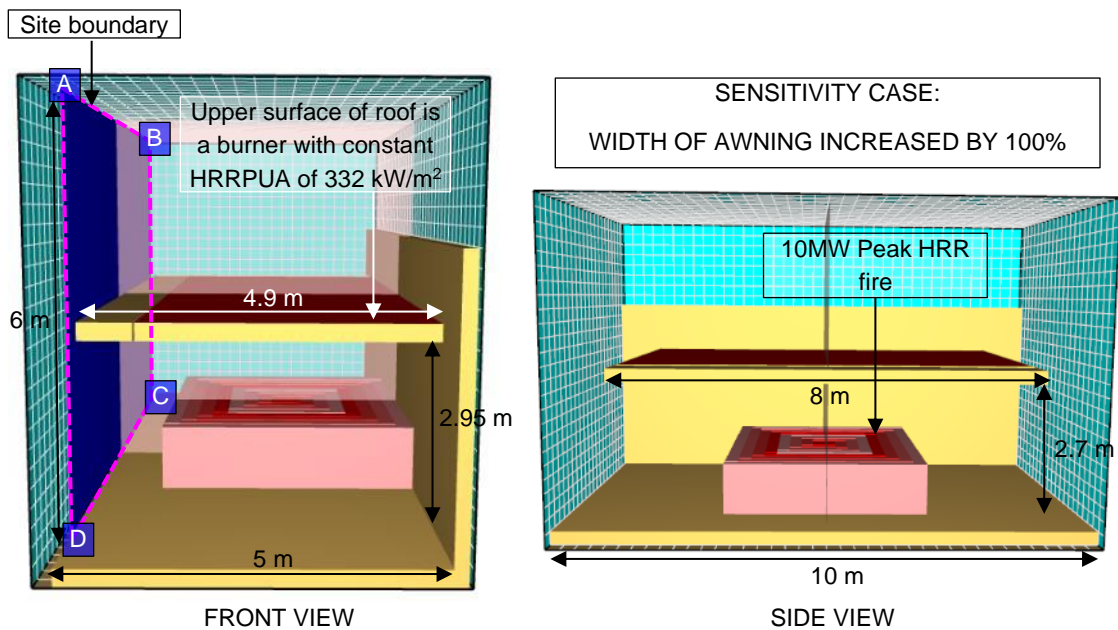


Figure 5-5. Model 3: Sensitivity Study - Model geometry for a Delta MW and EPS-FR roof assessing impact of awning width on heat transfer to the site boundary.

### B.3 Design Fire

The design fire is taken as the combined fire load of an EPS-FR core sandwich panel roof system and Design Fire 1 in accordance with Section 4.7.1.1.

For the EPS-FR core roof system, a heat release rate per unit area (HRRPUA) of 332 kW/m<sup>2</sup> is adopted which has been derived from bench-scale fire testing that was conducted by the University of Queensland

and is detailed within the UQ Cladding Materials Library. Figure 5-6 indicates the measured HRRPUA of EPS-FR when exposed to varying levels of heat flux. Conservatively, a constant HRRPUA of 332 kW/m<sup>2</sup> is used for the entire roof system (simulating the full upper surface of the roof burning at this peak HRRPUA continuously) as superimposed over Figure 5-6.

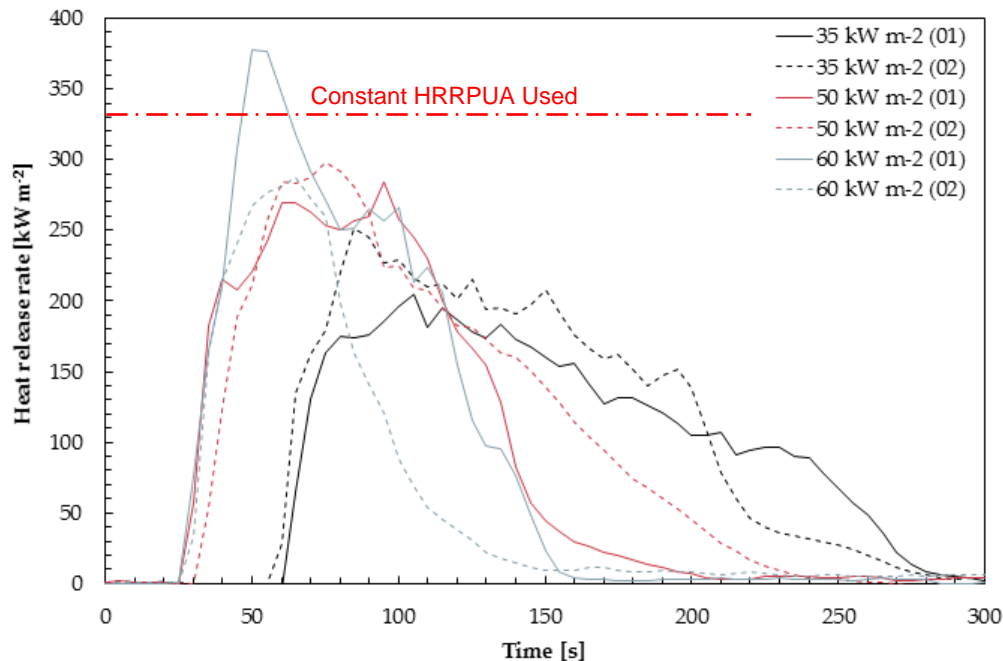


Figure 5-6. Heat release rate per unit area over time for EPS-FR when tested with 35, 50, 60 and 80 kW/m<sup>2</sup> (from the UQ Cladding Materials Library).

## B.4 Results & Conclusion

Results are shown in Figure 5-7, Figure 5-8 and Figure 5-9 which indicate the maximum adiabatic surface temperature (AST) and incident heat flux (IHF) on the site boundary when the fire is at steady state for each of the three models.

The results indicate that a much larger IHF and AST is reached on the site boundary for the DtS base case when compared to the Delta MW and EPS-FR roof system with equivalent dimensions, or the sensitivity case in which the width of the awning is increased by 100%.

The sensitivity case indicates that increasing the width of the awning also increase the AST and IHF. With a 100% increase in width, AST increased by approximately 30% and IHF increased by approximately 100%. This indicates that the increase in widths has a greater impact on radiative heat transfer than it has on convective heat transfer to the boundary. This is largely attributable to the larger combustible roof. Convective heat emanating from the combustible roof fire can rise to the sky without affecting the site boundary. However, as would be expected the radiative component increases proportionally with an increase the overall fire size.

That said, both the equivalent case and sensitivity case resulted in AST and IHF far lower than the DtS case. As such, the combined heat transfer to the site boundary for the Delta MW and EPS-FR system is at least equivalent to or better than DtS base case.

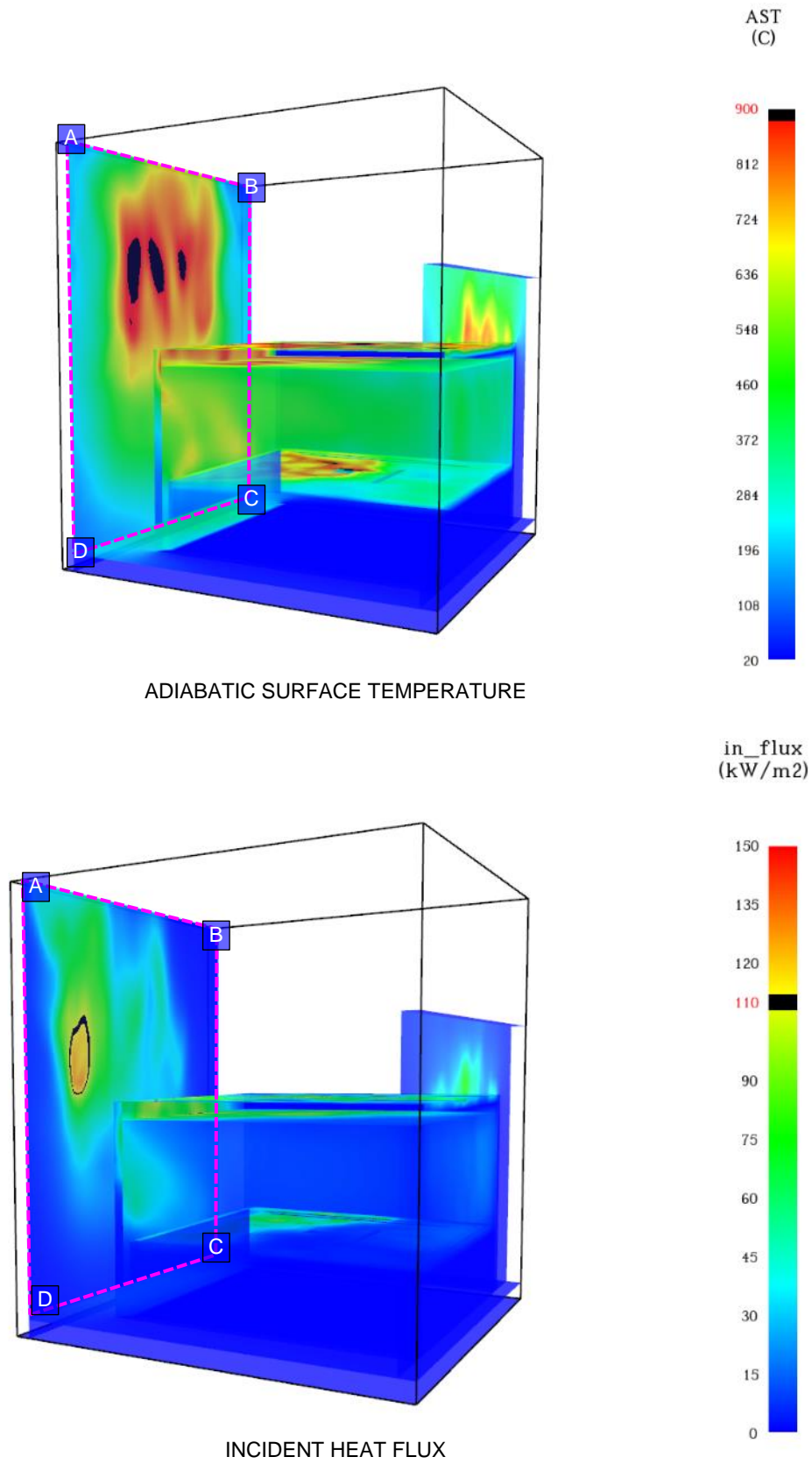
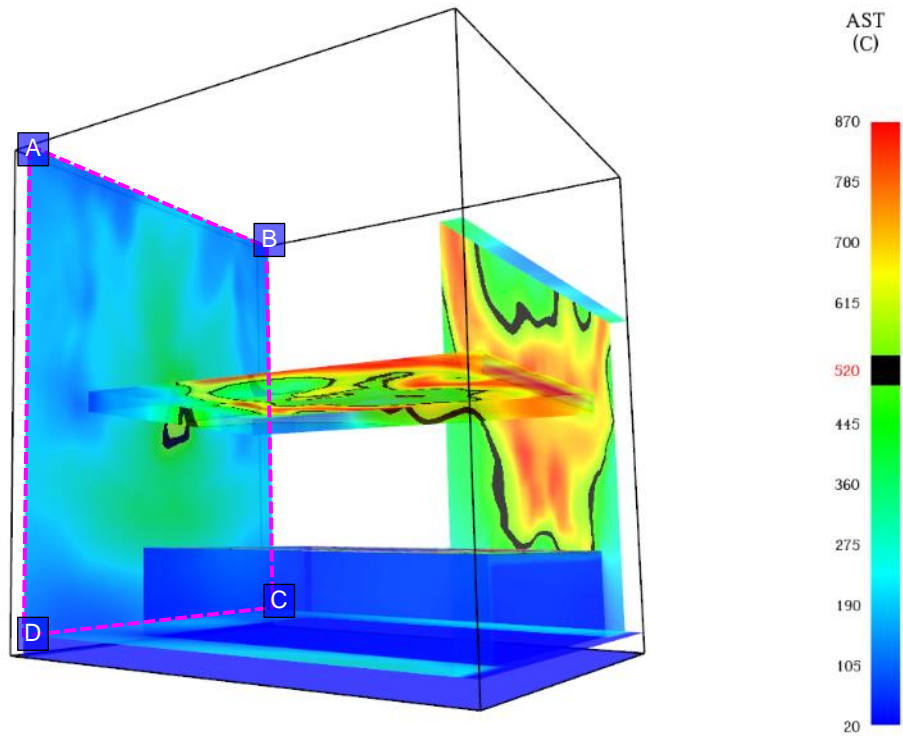
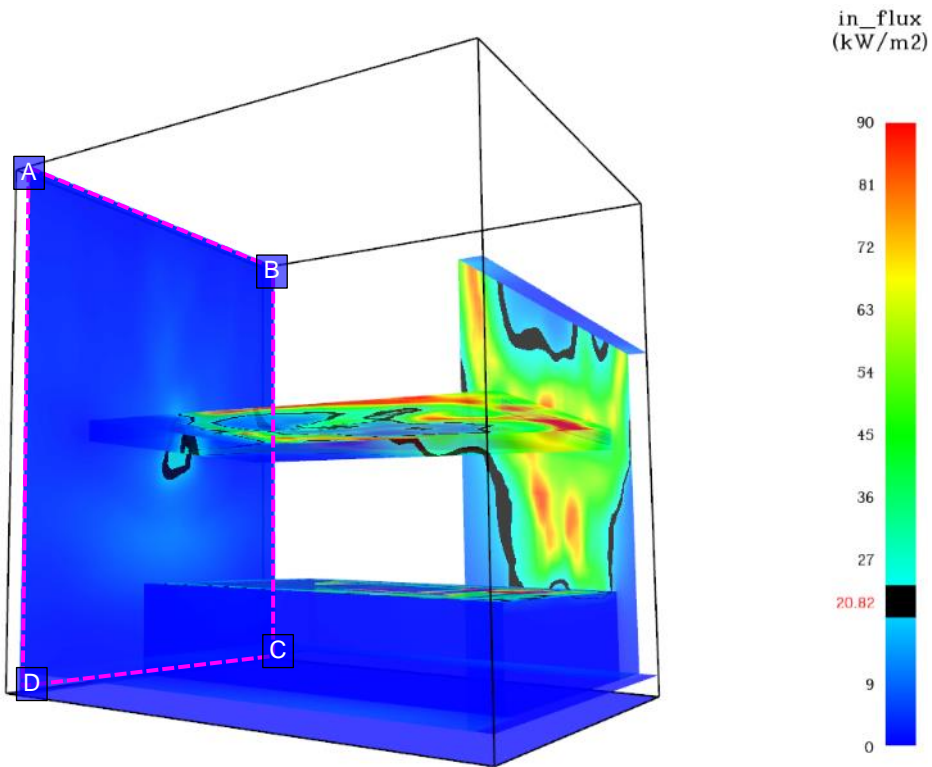


Figure 5-7. DtS base case results indicating adiabatic surface temperature (AST) and incident heat flux (IHF) on the site boundary (from Pyrosim Results).

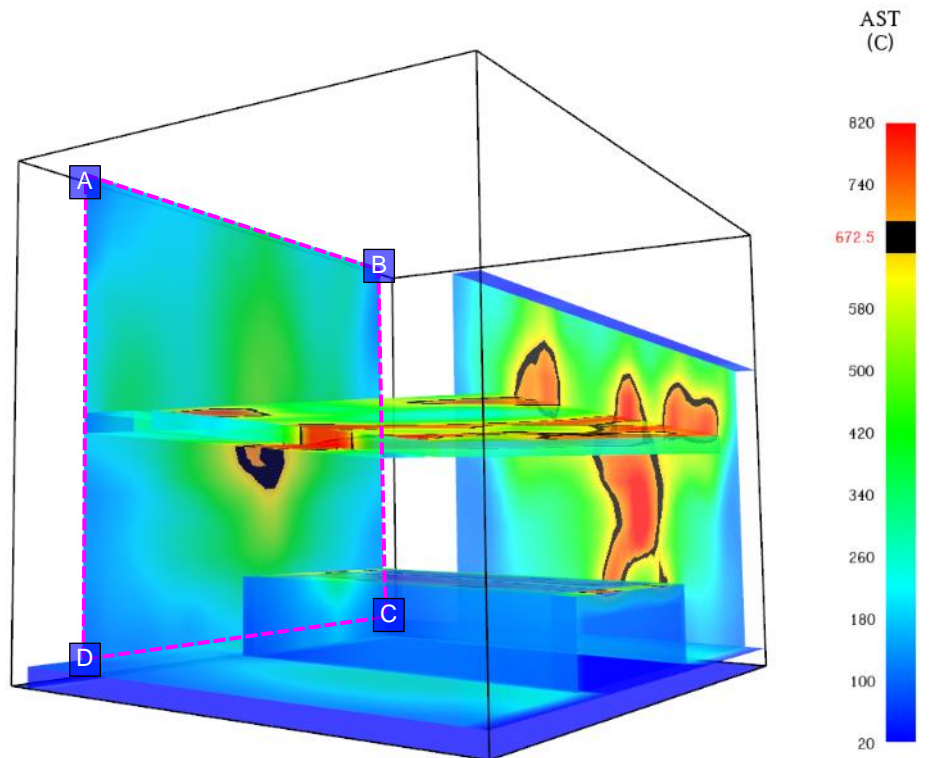


ADIABATIC SURFACE TEMPERATURE

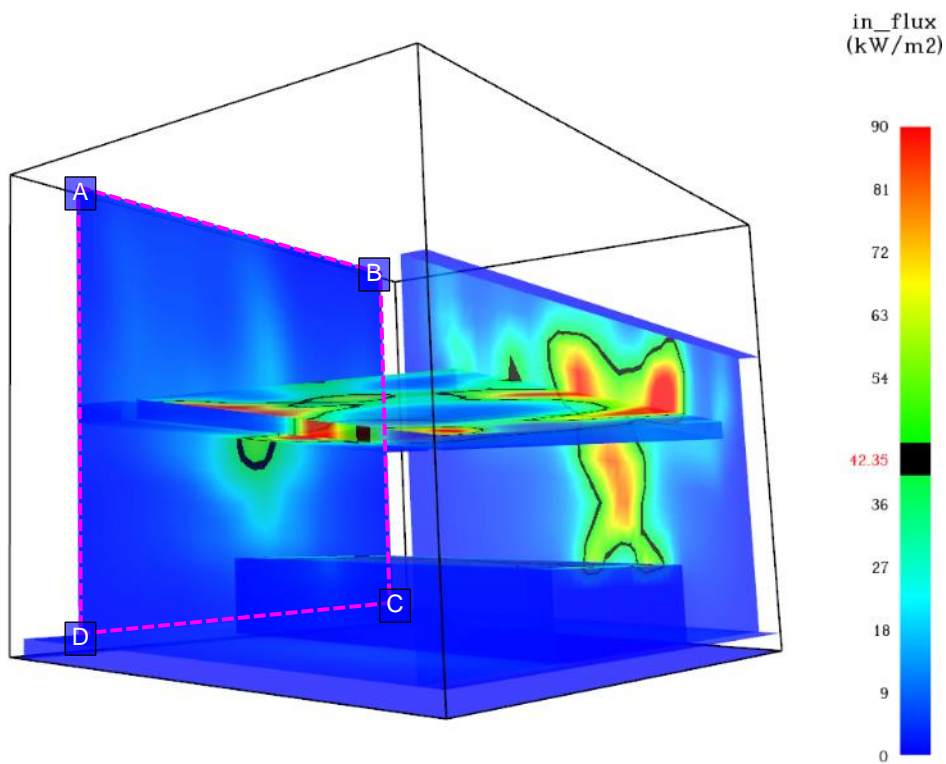


INCIDENT HEAT FLUX

Figure 5-8. Results for Delta MW and EPS-FR system with equivalent dimensions and fire to DtS base case indicating adiabatic surface temperature (AST) and incident heat flux (IHf) on the site boundary (from Pyrosim Results Viewer).



ADIABATIC SURFACE TEMPERATURE



INCIDENT HEAT FLUX

Figure 5-9. Results for Delta MW and EPS-FR system sensitivity study with awning width increased by 100%, indicating adiabatic surface temperature (AST) and incident heat flux (IHF) on the site boundary (from Pyrosim Results Viewer).

## B.5 FDS Grid sensitivity

A grid sensitivity check has been performed to evaluate the grid dependence of the models. FDS uses a Large Eddy Simulation (LES) model for computation. The grid size allows the sub-grid scale stress model to accurately compute the viscous stress of the flow field. The following formula, as detailed in the NIST Fire Dynamics Simulator (Version 5) User's Guide, can be used to measure how well the flow field within FDS modelling is resolved:

$D/\delta x$  where,

$\delta x$  is the nominal size of a mesh cell

$D$  is a characteristic fire diameter;

$$D = \left( \frac{\dot{Q}}{(\rho_{\infty} \times C_p \times T_{\infty} \times \sqrt{g})} \right)^{2/5}$$

Where:  $\dot{Q}^*$  (kW) is the heat release rate

$\rho_{\infty}$  (kg/m<sup>3</sup>) is the density of ambient temperature – 1 kg/m<sup>3</sup>

$C_p$  (kg/kg.K) is the specific heat of the gas – 1.0 kg/kg.K

$T_{\infty}$  (K) is the ambient temperature – 293 K

$g$  (m/s<sup>2</sup>) is the acceleration due to gravity – 9.81 m/s<sup>2</sup>

The grid size used in the FDS modelling is 0.125 for Models 1 & 2; and 0.25 for Model 3.

$\delta x = 0.125; 0.25$  m

HRR of 15 MW will be used to decide the grid size.

$Q = 15000$  kW, gives  $D = 3.057$  m.

$D/\delta x = 3.057 / 0.125$

= 24.5

$D/\delta x = 3.057 / 0.25$

= 12.2

An acceptable value is considered to range from 4 to 16 with values higher than 16 presenting very high resolution. As stated in the FDS user guide (Pg. 45), the more cells spanning the characteristic fire the higher the resolution. These values are based on a validation study undertaken by the US Nuclear Regulatory Commission (McGrattan, Hill, Dreisbach, Joglar, Najafi, Peacock, Hamins, 2007).

The nominated grid sizes are within the acceptable range, with Models 1 and 2 being of very high resolution. Grid sensitivity is therefore acceptable to adequately resolve the plume field.

## B.6 FDS Inputs





Key input parameters for FDS modelling are given below in Table 5-2.

**Table 5-2 FDS key inputs**

<b>Input Parameter</b>	<b>Value</b>
Ambient air temperature	20 °C
Radiative heat fraction from fire	30 %
Convective heat fraction from fire	70 %
Mass extinction coefficient	8,700m <sup>2</sup> /kg (for flaming woods and plastics)
Fuel type	Polyurethane GM27

## Appendix C AS1530.1 Test Certificates

### C.1 Mineral Wool AS1530.1 Test Certificate

<h1>Certificate of Test</h1>													
QUOTE No.: NC8391	REPORT No.: FNC12604												
<b>COMBUSTIBILITY TEST FOR MATERIALS IN ACCORDANCE WITH AS 1530.1-1994</b>													
<b>TRADE NAME:</b>	Mineral Wool / Rock Wool												
<b>SPONSOR:</b>	Delta Panels Pty Ltd 731 Boundary Road RICHLANDS QLD 4077 AUSTRALIA												
<b>DESCRIPTION OF TEST SAMPLE:</b>	The sponsor described the tested specimen as a mineral wool insulation slab comprised of a silicate fibres, alkaline oxide, alkali earth oxide, Bakelite synthetic thermosetting resin binder and mineral oil.  Nominal thickness: 50 mm Nominal density: 100 kg/m <sup>3</sup> Colour: brown												
<b>TEST PROCEDURE:</b>	Five (5) samples were tested in accordance with Australian Standard 1530 Methods for fire tests on building materials, components and structures, Part 1- 1994: Combustibility Test for Materials.  An alternative suitable insulating material was used to fill the annular space between the furnace tubes, as specified in Clause 4.2 of ISO 1182:2010.												
<b>RESULTS:</b>	The following calculated results were obtained, refer also to Summary of measurements:												
	<table border="1"> <thead> <tr> <th>Arithmetic mean</th> <th><math>= \frac{\Sigma \text{results}}{5}</math></th> </tr> </thead> <tbody> <tr> <td>Mean furnace thermocouple temperature rise (°C)</td> <td>26.37</td> </tr> <tr> <td>Mean specimen centre thermocouple temperature rise (°C)</td> <td>253.80</td> </tr> <tr> <td>Mean specimen surface thermocouple temperature rise (°C)</td> <td>36.60</td> </tr> <tr> <td>Mean duration of sustained flaming (s)</td> <td>0</td> </tr> <tr> <td>Mean mass loss (%)</td> <td>6.04</td> </tr> </tbody> </table>	Arithmetic mean	$= \frac{\Sigma \text{results}}{5}$	Mean furnace thermocouple temperature rise (°C)	26.37	Mean specimen centre thermocouple temperature rise (°C)	253.80	Mean specimen surface thermocouple temperature rise (°C)	36.60	Mean duration of sustained flaming (s)	0	Mean mass loss (%)	6.04
Arithmetic mean	$= \frac{\Sigma \text{results}}{5}$												
Mean furnace thermocouple temperature rise (°C)	26.37												
Mean specimen centre thermocouple temperature rise (°C)	253.80												
Mean specimen surface thermocouple temperature rise (°C)	36.60												
Mean duration of sustained flaming (s)	0												
Mean mass loss (%)	6.04												
<b>DESIGNATION:</b>	The material is NOT deemed combustible according to the test criteria specified in Clause 3.4 of AS 1530.1-1994.												
These test results relate only to the behaviour of the test specimens of the material under the particular conditions of the test and they are not intended to be the sole criterion for assessing the potential fire hazard of the material in use.													
<b>DATE OF TEST:</b>	8 July 2020												
Issued on the 24 <sup>th</sup> day of July 2020 without alterations or additions.													
													
Faustin Molina Testing Officer	Stephen Smith Team Leader, Reaction to Fire & Façade Fire Laboratory												
<b>End of Report</b>													
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## SUMMARY OF MEASUREMENTS AND OBSERVATIONS OF SAMPLES UNDER TEST C12604

Parameters	Symbol or expression	Unit symbol	Sample Number				
			1	2	3	4	5
Initial specimen mass	$m_{si}$	g	7.52	8.15	7.09	7.82	8.87
Final specimen mass	$m_{sf}$	g	7.03	7.58	6.49	7.81	8.15
Mass loss	$\Delta m = \frac{M_{si} - M_{sf}}{M_{si}} \times 100$	%	6.52	6.99	8.46	0.13	8.12
Total duration of sustained flaming	Cumulative total of duration of flaming*	s	0	0	0	0	0
Initial furnace thermocouple temperature	$T_{fi}$	°C	748	747	746	754	748
Maximum furnace thermocouple temperature	$T_{fm}$	°C	816	802	818	803	798
Final furnace thermocouple temperature	$T_{ff}$	°C	782	781	785	782	775
Furnace thermocouple temperature rise	$\Delta T_f = T_{fm} - T_{ff}$	°C	34	21	33	21	23
Maximum specimen centre thermocouple temperature	$T_{cm}$	°C	1017	994	1039	1015	1049
Final specimen centre thermocouple temperature	$T_{cf}$	°C	762	762	776	773	772
Specimen centre thermocouple temperature rise	$\Delta T_c = T_{cm} - T_{cf}$	°C	255	232	263	242	277
Maximum specimen surface thermocouple temperature	$T_{sm}$	°C	816	818	829	835	834
Final specimen surface thermocouple temperature	$T_{sf}$	°C	780	785	790	801	793
Specimen surface thermocouple temperature rise	$\Delta T_s = T_{sm} - T_{sf}$	°C	36	33	39	34	41
Test duration	-	min	40	30	55	30	30

- Any individual duration flaming less than 5 seconds was discarded

End of Test Certificate

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## C.2 Low Carbon Steel AS1530.1 Test Certificates

## Certificate of Test

**QUOTE No.:** NC8205 **REPORT No.:** FNC12440

**COMBUSTIBILITY TEST FOR MATERIALS IN ACCORDANCE WITH AS 1530.1-1994**

**TRADE NAME:** Low Carbon Steel Manufactured by Bluescope Australia

**SPONSOR:** Bluescope Steel Limited  
Five Islands Road  
Sirius Building (#51)  
PORT KEMBLA NSW 2505  
AUSTRALIA

**DESCRIPTION OF TEST SAMPLE:** The sponsor described the tested specimen as low carbon steel.  
Nominal thickness: 4.38 mm (loose laid to form 50 mm)  
Nominal density: 7850 kg/m<sup>3</sup>  
Colour: grey

**TEST PROCEDURE:** Five (5) samples were tested in accordance with Australian Standard 1530 Methods for fire tests on building materials, components and structures, Part 1- 1994: Combustibility Test for Materials.  
An alternative suitable insulating material was used to fill the annular space between the furnace tubes, as specified in Clause 4.2 of ISO 1182:2010.

**RESULTS:** The following calculated results were obtained, refer also to Summary of measurements:


Arithmetic mean	$= \frac{\Sigma \text{results}}{5}$
Mean furnace thermocouple temperature rise (°C)	0.10
Mean specimen centre thermocouple temperature rise (°C)	0.06
Mean specimen surface thermocouple temperature rise (°C)	0.32
Mean duration of sustained flaming (s)	0
Mean mass loss (%)	0.06


**DESIGNATION:** The material is **NOT** deemed combustible according to the test criteria specified in Clause 3.4 of AS 1530.1-1994.

These test results relate only to the behaviour of the test specimens of the material under the particular conditions of the test and they are not intended to be the sole criterion for assessing the potential fire hazard of the material in use.


**DATE OF TEST:** 27 August 2019

Issued on the 9<sup>th</sup> day of September 2019 without alterations or additions.

  
Faustin Molina  
Testing Officer

  
Brett Roddy  
Group Leader, Fire Testing and Assessments

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## SUMMARY OF MEASUREMENTS AND OBSERVATIONS OF SAMPLES UNDER TEST C12440

Parameters	Symbol or expression	Unit symbol	Sample Number				
			1	2	3	4	5
Initial specimen mass	$m_{si}$	g	540.98	543.87	544.14	541.96	543.60
Final specimen mass	$m_{sf}$	g	540.82	543.84	544.00	541.15	543.21
Mass loss	$\Delta m = \frac{M_{si} - M_{sf}}{M_{si}} \times 100$	%	0.03	0.01	0.03	0.15	0.07
Total duration of sustained flaming	Cumulative total of duration of flaming*	s	0	0	0	0	0
Initial furnace thermocouple temperature	$T_{fi}$	°C	747	753	751	751	751
Maximum furnace thermocouple temperature	$T_{fm}$	°C	782	775	781	779	780
Final furnace thermocouple temperature	$T_{ff}$	°C	782	775	781	779	780
Furnace thermocouple temperature rise	$\Delta T_f = T_{fm} - T_{ff}$	°C	0	0	1	0	0
Maximum specimen centre thermocouple temperature	$T_{cm}$	°C	766	763	763	769	771
Final specimen centre thermocouple temperature	$T_{cf}$	°C	766	763	763	769	771
Specimen centre thermocouple temperature rise	$\Delta T_c = T_{cm} - T_{cf}$	°C	0	0	0	0	0
Maximum specimen surface thermocouple temperature	$T_{cm}$	°C	770	764	766	771	768
Final specimen surface thermocouple temperature	$T_{sf}$	°C	769	764	765	771	768
Specimen surface thermocouple temperature rise	$\Delta T_s = T_{cm} - T_{sf}$	°C	1	0	1	0	0
Test duration	-	min	105	85	75	85	85

\* Any individual duration flaming less than 5 seconds was discarded

End of Test Certificate

Page 2 of 2

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## Appendix D AS1530.3 Test Certificates

### D.1 DeltaOrb™ Facings Applied to EPS-FR Core AS1530.3 Test Certificate

# AWTA PRODUCT TESTING

Australian Wool Testing Authority Ltd - trading as AWTA Product Testing  
A.B.N 43 006 014 106

1st Floor, 191 Racecourse Road, Flemington, Victoria 3031  
P.O Box 240, North Melbourne, Victoria 3051  
Phone (03) 9371 2400 Fax (03) 9371 2499

## TEST REPORT

Client : Delta Panels Pty Ltd  
2828 Ipswich Road  
Darra QLD 4076

Test Number : 19-003621  
Issue Date : 30/07/2019  
Print Date : 30/07/2019

**Sample Description** Clients Ref : "DeltaOrb-EPS-FR"  
Rigid Panel  
End Use : Insulated Building Panel  
Nominal Composition : Pre-painted steel skins bonded to an expanded polystyrene core with fire retardant  
Nominal Mass per Unit Area/Density : 13.5kg/m3  
Nominal Thickness : 100mm

AS/NZS 1530.3-1999

**Methods for Fire Tests on Building Materials, Components and Structures  
Part 3: Simultaneous Determination of Ignitability,  
Flame Propagation, Heat Release and Smoke Release**

Face tested: Face  
Date tested: 30/07/2019

	Standard Error	Mean
Ignition time	Nil	Nil min
Flame propagation time	Nil	Nil sec
Heat release integral	Nil	Nil kJ/m <sup>2</sup>
Smoke release, log d	0.0862	-1.7720
Optical density, d		0.0185 / metre

Number of specimens ignited: 0  
Number of specimens tested: 6

Regulatory Indices:  
Ignitability Index 0 Range 0-20  
Spread of Flame Index 0 Range 0-10  
Heat Evolved Index 0 Range 0-10  
Smoke Developed Index 2 Range 0-10

174448 37201

Page 1 of 2

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- Performance & Approvals Testing

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MICHAEL A. JACKSON B.Sc.(Hons)  
MANAGING DIRECTOR

0204/11/06

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 P.O Box 240, North Melbourne, Victoria 3051  
 Phone (03) 9371 2400 Fax (03) 9371 2499

## TEST REPORT

Client : Delta Panels Pty Ltd  
 2828 Ipswich Road  
 Darra QLD 4076

Test Number : 19-003621  
 Issue Date : 30/07/2019  
 Print Date : 30/07/2019

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen. A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped in four places.

174448

37201

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MICHAEL A. JACKSON B.Sc. (Hons)  
 MANAGING DIRECTOR

## D.2 DeltaTrim™ Facings Bonded to EPS-FR Core AS1530.3 Test Certificate

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 P.O Box 240, North Melbourne, Victoria 3051  
 Phone (03) 9371 2400 Fax (03) 9371 2499

### TEST REPORT

Client : Delta Panels Pty Ltd  
 2828 Ipswich Road  
 Darra QLD 4076

Test Number : 19-003623  
 Issue Date : 31/07/2019  
 Print Date : 31/07/2019

**Sample Description** Clients Ref : DeltaTrim-EPS-FR  
 Rigid Panel  
 End Use : Insulated Building Panel  
 Nominal Composition : Pre-painted steel skins bonded to an expanded polystyrene core with fire retardant  
 Nominal Mass per Unit Area/Density : 13.5kg/m<sup>3</sup>  
 Nominal Thickness : 100mm

AS/NZS 1530.3-1999

#### Methods for Fire Tests on Building Materials, Components and Structures Part 3: Simultaneous Determination of Ignitability, Flame Propagation, Heat Release and Smoke Release

Face tested:	Face	
Date tested:	31/07/2019	
	Standard Error	Mean
Ignition time	Nil	Nil min
Flame propagation time	Nil	Nil sec
Heat release integral	Nil	Nil kJ/m <sup>2</sup>
Smoke release, log d	0.0579	-1.7469
Optical density, d		0.0188 / metre
Number of specimens ignited:		0
Number of specimens tested:		6
Regulatory Indices:		
Ignitability Index		0 Range 0-20
Spread of Flame Index		0 Range 0-10
Heat Evolved Index		0 Range 0-10
Smoke Developed Index		2 Range 0-10

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 MANAGING DIRECTOR

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 P.O Box 240, North Melbourne, Victoria 3051  
 Phone (03) 9371 2400 Fax (03) 9371 2499

**TEST REPORT**

Client : Delta Panels Pty Ltd  
 2828 Ipswich Road  
 Darra QLD 4076

Test Number : 19-003623  
 Issue Date : 31/07/2019  
 Print Date : 31/07/2019

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen. A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped in four places.

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## D.3 DeltaOrb™ Facings Bonded to MW Core AS1530.3 Test Certificate

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## TEST REPORT

Client : Delta Panels Pty Ltd  
2828 Ipswich Road  
Darra QLD 4076

Test Number : 21-003529  
Issue Date : 19/07/2021  
Print Date : 19/07/2021

**Sample Description** Clients Ref : "DeltaOrb - MW"  
Insulated building panel  
End Use : Insulated building panel  
Nominal Composition : Prepainted steel skins bonded to a non-combustible mineral wool core  
Nominal Mass per Unit Area/Density : 100kg/m<sup>3</sup>  
Nominal Thickness : 100mm

AS/NZS 1530.3-1999

**Methods for Fire Tests on Building Materials, Components and Structures  
Part 3: Simultaneous Determination of Ignitability,  
Flame Propagation, Heat Release and Smoke Release**

Face tested: Flat Face  
Date tested: 19-07-2021

	Standard Error	Mean
Ignition time	Nil	Nil min
Flame propagation time	Nil	Nil sec
Heat release integral	Nil	Nil kJ/m <sup>2</sup>
Smoke release, log d	0.0199	-1.4863
Optical density, d		0.0328 / metre
Number of specimens ignited:		0
Number of specimens tested:		6
Regulatory Indices:		
Ignitability Index		0 Range 0-20
Spread of Flame Index		0 Range 0-10
Heat Evolved Index		0 Range 0-10
Smoke Developed Index		3 Range 0-10

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## TEST REPORT

Client : Delta Panels Pty Ltd  
2828 Ipswich Road  
Darra QLD 4076

Test Number : 21-003529  
Issue Date : 19/07/2021  
Print Date : 19/07/2021

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen. A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped in four places.

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## D.4 DeltaTrim™ Facings Bonded to MW Core AS1530.3 Test Certificate

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## TEST REPORT

Client : Delta Panels Pty Ltd  
2828 Ipswich Road  
Darra QLD 4076

Test Number : 21-003527  
Issue Date : 19/07/2021  
Print Date : 19/07/2021

**Sample Description** Clients Ref : "DeltaTrim - MW"  
Insulated building panel  
End Use : Insulated building panel  
Nominal Composition : Prepainted steel skins bonded to a non-combustible mineral wool core  
Nominal Mass per Unit Area/Density : 100kg/m<sup>3</sup>  
Nominal Thickness : 100mm

AS/NZS 1530.3-1999

**Methods for Fire Tests on Building Materials, Components and Structures  
Part 3: Simultaneous Determination of Ignitability,  
Flame Propagation, Heat Release and Smoke Release**

Face tested:	Flat Face	
Date tested:	19-07-2021	
	Standard Error	Mean
Ignition time	Nil	Nil min
Flame propagation time	Nil	Nil sec
Heat release integral	Nil	Nil kJ/m <sup>2</sup>
Smoke release, log d	0.0138	-1.3967
Optical density, d		0.0402 / metre
Number of specimens ignited:		0
Number of specimens tested:		6
Regulatory Indices:		
Ignitability Index		0 Range 0-20
Spread of Flame Index		0 Range 0-10
Heat Evolved Index		0 Range 0-10
Smoke Developed Index		3 Range 0-10

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## TEST REPORT

Client : Delta Panels Pty Ltd  
2828 Ipswich Road  
Darra QLD 4076

Test Number : 21-003527  
Issue Date : 19/07/2021  
Print Date : 19/07/2021

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen. A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped in four places.

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MANAGING DIRECTOR

## D.5 Coated Sheet Steel (Zincalume 0.42mm) AS1530.3 Test Certificate

## Certificate of Test

Quote No.: NE7500

REPORT No.: FNE11602

## AS/NZS 1530.3:1999 SIMULTANEOUS DETERMINATION OF IGNITABILITY, FLAME PROPAGATION, HEAT RELEASE AND SMOKE RELEASE

TRADE NAME: BlueScope ZINCALUME Steel

SPONSOR: Bluescope Steel Limited  
Innovations Lab  
Old Port Road  
PORT KEMBLA NSW 2505  
AUSTRALIA

## DESCRIPTION OF SAMPLE:

The sponsor described the tested specimen as a metal-coated steel sheet with aluminium-zinc-magnesium alloy coating, resin coating and passivation layer on both sides.

Nominal thickness of steel sheet:	0.42 mm
Nominal thickness of aluminium-zinc-magnesium coating:	45 µm
Nominal thickness of passivation layer:	0.2 µm
Nominal thickness of resin layer:	3 µm
Nominal total thickness:	0.5 mm
Nominal total mass:	3.3 kg/m <sup>2</sup>
Nominal total density:	7800 kg/m <sup>3</sup>
Colour:	silver

TEST PROCEDURE: Six samples were tested in accordance with Australian Standard 1530, Method for fire tests on building components and structures, Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release, 1999. For the test, each sample was clamped to the specimen holder in four places.

RESULTS: The following means and standard errors were obtained:

Parameter	Mean	Standard Error
Ignition Time (min)	N/A	N/A
Flame Spread Time (s)	N/A	N/A
Heat Release Integral (kJ/m <sup>2</sup> )	N/A	N/A
Smoke Release (log <sub>10</sub> D)	-1.882	0.159

For regulatory purposes these figures correspond to the following indices:

Ignitability Index (0-20)	Spread of Flame Index (0-10)	Heat Evolved Index (0-10)	Smoke Developed Index (0-10)
0	0	0	2

The results of this fire test 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 fire conditions.

DATE OF TEST: 20 January 2016

Issued on the 3<sup>rd</sup> day of March 2016 without alterations or additions.

Heherson Alarde  
Testing Officer

Brett Roddy  
Team Leader, Fire Testing and Assessments

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## D.6 Coated Sheet Steel (MagnaFlow) AS1530.3 Test Certificate

## AWTA PRODUCT TESTING

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 Phone (03) 9371 2400 Fax (03) 9371 2499

## TEST REPORT

Client : Selection Steel Trading  
 64-66 Ventura Place  
 Dandenong South VIC 3175

Test Number : 19-002186  
 Issue Date : 9/05/2019  
 Print Date : 9/05/2019

Sample Description Clients Ref : "MagnaFlow"  
 Coated steel panel  
 Colour : Light Grey  
 End Use : Roofing & Cladding  
 Nominal Composition : Low carbon steel with metallic alloy coated substrate and organic top coating  
 Nominal Mass per Unit Area/Density : 7850kg/m<sup>3</sup>

AS/NZS 1530.3-1999

Methods for Fire Tests on Building Materials, Components and Structures  
 Part 3: Simultaneous Determination of Ignitability,  
 Flame Propagation, Heat Release and Smoke Release

Face tested: Light Grey Face

Date tested: 09/05/2019

	Standard Error	Mean	
Ignition time	Nil	Nil	min
Flame propagation time	Nil	Nil	sec
Heat release integral	Nil	Nil	kJ/m <sup>2</sup>
Smoke release, log d	0.0902	-1.3899	
Optical density, d		0.0445	/ metre
Number of specimens ignited:		0	
Number of specimens tested:		6	
Regulatory Indices:			
Ignitability Index		0	Range 0-20
Spread of Flame Index		0	Range 0-10
Heat Evolved Index		0	Range 0-10
Smoke Developed Index		3	Range 0-10

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 P.O Box 240, North Melbourne, Victoria 3051  
 Phone (03) 9371 2400 Fax (03) 9371 2499

**TEST REPORT**

**Client :** Selection Steel Trading  
 64-66 Ventura Place  
 Dandenong South VIC 3175

**Test Number :** 19-002186  
**Issue Date :** 9/05/2019  
**Print Date :** 9/05/2019

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen . A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped in four places.

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

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*[Signature]*

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*[Signature]*  
 MICHAEL A. JACKSON B.Sc. (Hons)  
 MANAGING DIRECTOR

## D.7 Coated Sheet Steel (UniCote 0.55mm) AS1530.3 Test Certificate

## Certificate of Test

Quote No.: NE7651

REPORT No.: FNE11809A

## AS/NZS 1530.3:1999 SIMULTANEOUS DETERMINATION OF IGNITABILITY, FLAME PROPAGATION, HEAT RELEASE AND SMOKE RELEASE

TRADE NAME: UniCote

SPONSOR: Selection Steel Trading Pty Ltd  
64-66 Ventura Place  
DANDENONG SOUTH VIC 3175  
AUSTRALIA

## DESCRIPTION OF SAMPLE:

The sponsor described the tested specimen as a pre painted steel product comprising of the following layers:  
 Layer 1: 18- $\mu$   $\pm$  2- $\mu$  paint finish coat  
 Layer 2: 7- $\mu$   $\pm$  1- $\mu$  chromate primer  
 Layer 3: 75-g/m<sup>2</sup> aluminium/zinc alloy coating  
 Layer 4: 0.55-mm steel core  
 Layer 5: 75-g/m<sup>2</sup> aluminium/zinc alloy coating  
 Layer 6: 5- $\mu$   $\pm$  1- $\mu$  primer  
 Layer 7: 5 $\mu$   $\pm$  1 $\mu$  Shadow Grey (standard colour) wash coat  
 Nominal total mass: 150-g/m<sup>2</sup>  
 Nominal thickness: 0.55-mm  
 Colour: Monolith (dark grey)

TEST PROCEDURE: Six samples were tested in accordance with Australian Standard 1530, Method for fire tests on building components and structures, Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release, 1999. For the test, each sample was clamped to the specimen holder in four places.

RESULTS: The following means and standard errors were obtained:

Parameter	Mean	Standard Error
Ignition Time (min)	N/A	N/A
Flame Spread Time (s)	N/A	N/A
Heat Release Integral	N/A	N/A
Smoke Release (log <sub>10</sub> D)	-1.498	0.042

For regulatory purposes these figures correspond to the following indices:


Ignitability Index (0-20)	Spread of Flame Index (0-10)	Heat Evolved Index (0-10)	Smoke Developed Index (0-10)
0	0	0	2

The results of this fire test 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 fire conditions.

DATE OF TEST: 12 October 2016

Issued on the 25<sup>th</sup> day of October 2016 without alterations or additions. Supersedes Report No. FNE11809 issued on 17<sup>th</sup> day of October 2016.

  
Heherson Alarde  
Testing Officer

  
Brett Roddy  
Team Leader, Fire Testing and Assessments

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## D.8 Coated Sheet Steel (UniZinc) AS1530.3 Test Certificate

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## TEST REPORT

Client : Selection Steel Trading  
 64-66 Ventura Place  
 Dandenong South VIC 3175

Test Number : 20-000776  
 Issue Date : 6/03/2020  
 Print Date : 10/03/2020

Sample Description Clients Ref : "Uni Zinc"  
 Rigid Panel  
 Colour : Silver  
 End Use : Roofing and Cladding  
 Nominal Composition : Low carbon steel with metallic alloy coated substrate (nominal 50 micron total on both sides)  
 Nominal Mass per Unit Area/Density : 7850 kg/m<sup>3</sup>  
 Nominal Thickness : <1mm

AS/NZS 1530.3-1999

Methods for Fire Tests on Building Materials, Components and Structures  
 Part 3: Simultaneous Determination of Ignitability,  
 Flame Propagation, Heat Release and Smoke Release

Face tested:	Face		
Date tested:	06/03/2020		
	Standard Error	Mean	
Ignition time	Nil	Nil	min
Flame propagation time	Nil	Nil	sec
Heat release integral	Nil	Nil	kJ/m <sup>2</sup>
Smoke release, log d	0.0929	-2.2106	
Optical density, d		0.0068	/ metre
Number of specimens ignited:		0	
Number of specimens tested:		6	
Regulatory Indices:			
Ignitability Index		0	Range 0-20
Spread of Flame Index		0	Range 0-10
Heat Evolved Index		0	Range 0-10
Smoke Developed Index		0-1	Range 0-10

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## TEST REPORT

**Client :** Selection Steel Trading  
 64-66 Ventura Place  
 Dandenong South VIC 3175

**Test Number :** 20-000776  
**Issue Date :** 6/03/2020  
**Print Date :** 10/03/2020

These results only apply to the specimen mounted, as described in this report. The result of this fire test 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 fire conditions.

The reaction of thin unsupported flexible materials to flame impingement can be assessed in accordance with AS 1530.2. Where materials of thickness less than 2mm that are sufficiently flexible to be bent by hand around a mandrel of 2mm diameter or less are subjected to the test described herein, they should also be subjected to the test in AS 1530.2.

Ignition is initiated by a pilot flame that is held near, but does not touch the specimen. A material that does not ignite during the standard test may ignite if contacted with a pilot flame during the test.

Each test specimen had an unattached backing of 4.5mm thick fibre reinforced cement board.

Each test specimen was clamped along all sides.

Smoke Developed Index is reported as 0-1 due to the inability of the smoke measurement equipment to resolve an index of zero.

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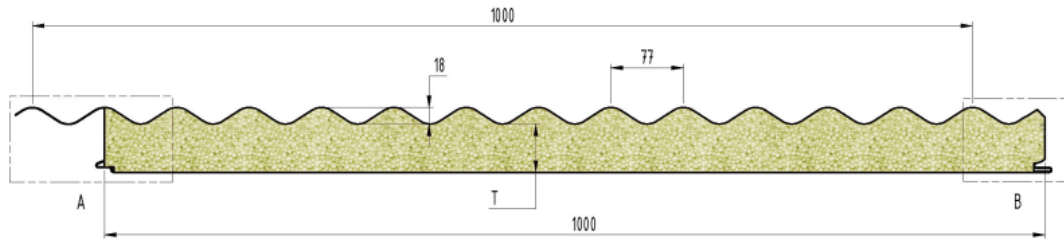
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 MANAGING DIRECTOR

## Appendix E Specifications

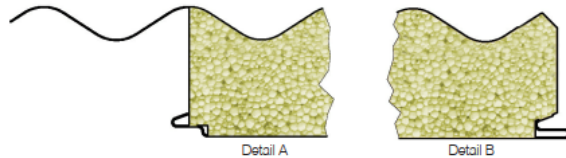
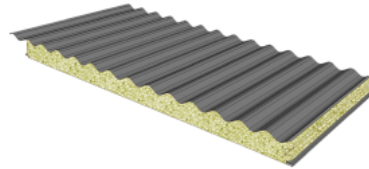
### E.1 DeltaOrb-MW



**DeltaOrb-MW** is an Insulated Roof Panel System, comprising of two pre-painted, roll-formed steel skins, with a roll-formed steel skins bonded to a non-combustible mineral wool core.

The top profile offers striking looks with all of the benefits of modern Insulated Panel technologies.

The bottom skin has a roll-formed tongue and groove edge.



Early Fire Hazard Properties AS 1530.3:1999		
AWTA Test Report 21-003529 19/07/21		
Index	Test Range	External Top Skin
Ignitability	0-20	0
Spread of Flame	0-10	0
Heat Evolved	0-10	0
Smoke Developed	0-10	3

Combustibility Test AS 1530.1-1994	
CSIRO Report no. FNC12604 dated 8/7/2020 tested five (5) samples of the Delta Panels supplied mineral wool sample and certified that the material is NOT deemed combustible according to the criteria specified in clause 3.4 of AS 1530.1-1994.	

Non-Combustible Building Material - Report	
The Delta Panels laminated mineral wool products are certified, by Milanovic Neale Consulting Engineers 28/8/2020, to meet the three performance criteria in the NCC (2019) 3.7.1.1(e)	

Sotera - FireX™ Car Port System	
The Sotera report A21007 J005 - DeltaFireX Car Port System FER dw rev 1-3 confirms that the FireX™ Car Port System meets the performance requirements of P2.3.1(a) Volume 2, NCC 2019 Amendment 1 when installed in accordance with the DeltaFireXRoof Brochure version v15.10.21 and section 4.4 of their report as a Class 10a structure (car port) attached or adjacent to a Class 1a building positioned directly adjacent to the site boundary (i.e.) less than 900 mm from the site boundary)	

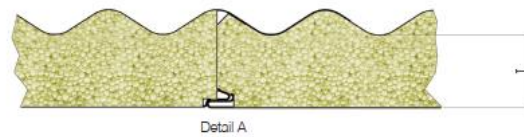
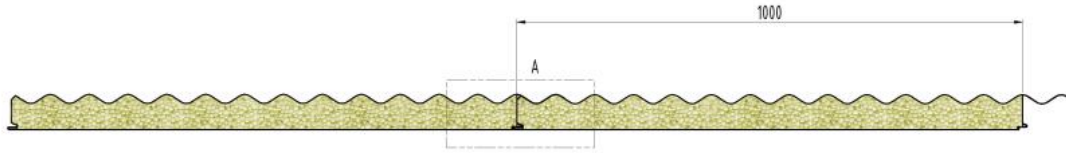
Sotera - Delta MW and EPS-FR Awning & Patio Roof System	
The Sotera report A21007 J004 - Delta MW and EPS-FR Awning and Patio Roof System FER dw rev 1-3, confirms that the Mineral Wool & EPS-FR Awning & Patio Roof System meets the performance requirements of P2.3.1(a) Volume 2, NCC 2019 Amendment 1 when installed in accordance with the Delta Mineral Wool Panels Brochure version V20.10.21 and section 4.4 of their report as a Class 10a structure (car port) attached or adjacent to a Class 1a building positioned directly adjacent to the site boundary (i.e.) less than 900 mm from the site boundary)	

<b>Steel Skin Details</b>	Top Skin	0.42mm / G550 AZ150
	Bottom Skin	0.55mm / G300 Z275
<b>Max. Skin Temperature</b>	78°C Dry Heat	
<b>Core Material Details</b>	Mineral Wool	
<b>Thermal Conductivity AS 1386.2/ASTM C 518</b>	0.0363 W/mK @23.0°C	
<b>Core Density</b>	100kg/m <sup>3</sup>	
<b>0.6mm Skin Weight (kg/m<sup>2</sup>)</b>	75mm Panel	18.50
	100mm Panel	21.00
	125mm Panel	23.50
	150mm Panel	26.00
<b>R Value</b>	75mm Panel	2.08
	100mm Panel	2.78
	125mm Panel	3.48
	150mm Panel	4.17
<b>Sheet Coverage</b>	1000mm	
<b>Length (mm)</b>	Cut to Length Min of 1800mm	
<b>Length Tolerance (mm)</b>	5mm+/-	
<b>Thickness (mm)</b>	75, 100, 125, 150	
<b>Minimum Roof Pitch</b>	Building Classes 1-9	- 5°
	Building Class 10	- 3°
<b>Flatness Standards</b>	0.40mm	Surface deformations can be apparent to the naked eye when observed in certain lighting conditions
	0.60mm	

Version Date: 27.04.2022

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**DeltaOrb-MW SPECIFICATIONS** **DELTA™ PANELS**



DeltaOrb-MW Single & Multi Span Non-Cyclonic Tabs				
Span	Pressure (kPa)			
	75mm	100mm	125mm	150mm
1800	2.29	3.27	4.24	5.49
2400	1.44	2.09	2.74	3.63
3000	0.94	1.34	1.73	2.33
3600	0.63	0.93	1.22	1.61
4200	0.46	0.67	0.91	1.16
4800	0.36	0.53	0.70	0.91
5400	0.28	0.43	0.56	0.74
6000		0.33	0.43	0.59

DeltaOrb-MW Acoustic Testing has been performed in compliance with the requirements of AS 1191-2002 "Acoustics - Method for Laboratory Measurement of Airborne Sound Insulation of Building Elements".

The procedures specified by AS 1276-1979 and AS/NZS ISO 717.1:2004 were used to calculate the Sound Transmission Class (STC) and the Weighted Sound Reduction Index (Rw) of DeltaOrb-MW.

DeltaOrb-MW is classed as trafficable when used in a roof application.

DeltaOrb-MW Acoustic Values			
Frequency		50mm	125mm
		100	15.41
	160	16.40	15.09
	200	18.81	17.70
	250	19.70	18.51
	315	21.39	19.40
	400	22.31	19.69
	630	23.40	19.10
	800	23.69	17.31
	1000	25.61	18.29
	1250	21.01	30.10
	1600	20.00	36.19
	2000	34.79	37.30
	2500	41.70	37.09
	3150	44.10	35.69
	5000	44.61	39.90
	<b>STC</b>	24.00	23.00
	<b>RW</b>	25.00	24.00

DeltaOrb-MW Fixing Details		
Crest fixing only. One fixing every second crest		
Panel Thickness (mm)	Fixing into Steel	Fixing into Timber
75	Tek 14 x 135 Hex Head Screw	T17 14 x 150 Hex Head Screw
100	Tek 14 x 150 Hex Head Screw	T17 14 x 175 Hex Head Screw
125	Tek 14 x 175 Hex Head Screw	T17 14 x 200 Hex Head Screw
150	Tek 14 x 200 Hex Head Screw	T17 14 x 230 Hex Head Screw

Use Cyclone Plate and Neo Washer on each fixing. Upon Installation the overlap needs to be stitch cored or riveted every 300mm.

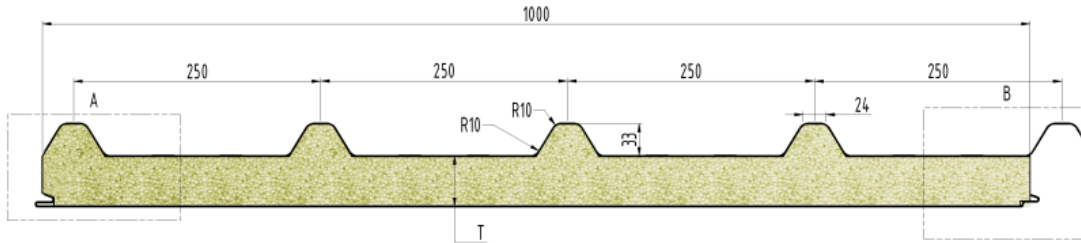


Please refer to the web page for the available colour range, paint finishes and relevant warranty conditions.

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E.2 DeltaTrim-MW



**DeltaTrim-MW** is an Insulated Roof Panel System, comprising of two pre-painted, roll-formed steel skins, with a roll-formed steel skins bonded to a non-combustible mineral wool core.

The top profile offers striking looks with all of the benefits of modern Insulated Panel technologies.

The bottom skin has a roll-formed tongue and groove edge.

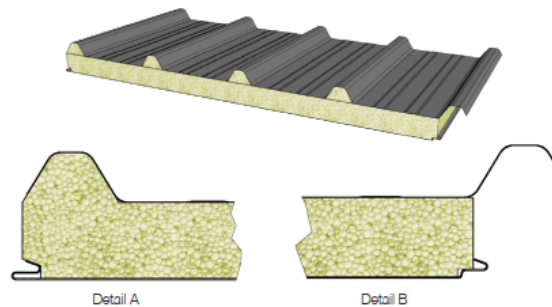
Early Fire Hazard Properties AS 1530.3:1999		
AWTA Test Report 21-003527 19/07/21		
Index	Test Range	External Top Skin
Ignitability	0-20	0
Spread of Flame	0-10	0
Heat Evolved	0-10	0
Smoke Developed	0-10	3

**Combustibility Test AS 1530.1-1994**  
 CSIRO Report no. FNC12604 dated 8/7/2020 tested five (5) samples of the Delta Panels supplied mineral wool sample and certified that the material is NOT deemed combustible according to the criteria specified in clause 3.4 of AS 1530.1-1994.

**Non-Combustible Building Material - Report**  
 The Delta Panels laminated mineral wool products are certified, by Milanovic Neale Consulting Engineers 28/8/2020, to meet the three performance criteria in the NCC (2019) 3.7.1.1(e)

**Sotera - FireX™ Car Port System**  
 The Sotera report A21007 J005 - DeltaFireX Car Port System FER dw rev 1-3 confirms that the FireX™ Car Port System meets the performance requirements of P2.3.1(a) Volume 2, NCC 2019 Amendment 1 when installed in accordance with the DeltaFireXRoof Brochure version v15.10.21 and section 4.4 of their report as a Class 10a structure (car port) attached or adjacent to a Class 1a building positioned directly adjacent to the site boundary (i.e.) less than 900 mm from the site boundary)

**Sotera - Delta MW and EPS-FR Awning & Patio Roof System**  
 The Sotera report A21007 J004 - Delta MW and EPS-FR Awning and Patio Roof System FER dw rev 1-3, confirms that the Mineral Wool & EPS-FR Awning & Patio Roof System meets the performance requirements of P2.3.1(a) Volume 2, NCC 2019 Amendment 1 when installed in accordance with the Delta Mineral Wool Panels Brochure version V20.10.21 and section 4.4 of their report as a Class 10a structure (car port) attached or adjacent to a Class 1a building positioned directly adjacent to the site boundary (i.e.) less than 900 mm from the site boundary)

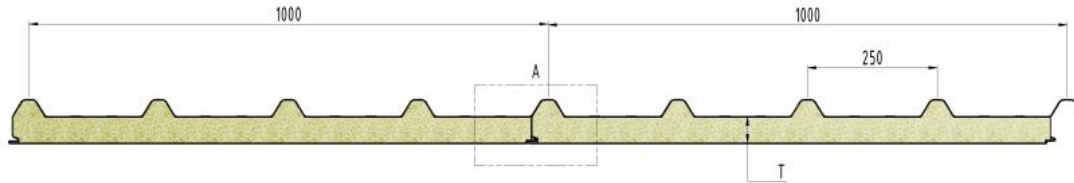


<b>Steel Skin Details</b>	Top Skin	0.42mm / G550 AZ150
	Bottom Skin	0.55mm / G300 Z275
<b>Max. Skin Temperature</b>	78°C Dry Heat	
<b>Core Material Details</b>	Mineral Wool	
<b>Thermal Conductivity AS 1386.2/ASTM C 518</b>	0.0363 W/mK @23.0°C	
<b>Core Density</b>	100kg/m <sup>3</sup>	
<b>0.6mm Skin Weight (kg/m<sup>2</sup>)</b>	75mm Panel	18.50
	100mm Panel	21.00
	125mm Panel	23.50
	150mm Panel	26.00
<b>R Value</b>	75mm Panel	2.08
	100mm Panel	2.78
	125mm Panel	3.48
	150mm Panel	4.17
<b>Sheet Coverage</b>	1000mm	
<b>Length (mm)</b>	Cut to Length Min of 1800mm	
<b>Length Tolerance (mm)</b>	5mm+/-	
<b>Thickness (mm)</b>	75, 100, 125, 150	
<b>Minimum Roof Pitch</b>	2°	
<b>Flatness Standards</b>	0.40mm	Surface deformations can be apparent to the naked eye when observed in certain lighting conditions
	0.60mm	

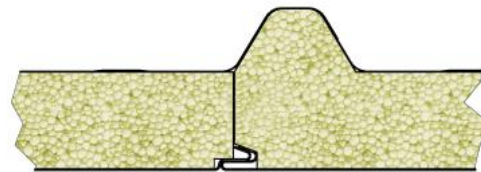
Version Date: 27.04.2022

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**DeltaTrim-MW SPECIFICATIONS**



DeltaTrim-MW Single & Multi Span Non-Cyclonic Tabs				
Span	Pressure (kPa)			
	75mm	100mm	125mm	150mm
1800	2.29	3.27	4.24	5.49
2400	1.44	2.09	2.74	3.63
3000	0.94	1.34	1.73	2.33
3600	0.63	0.93	1.22	1.61
4200	0.46	0.67	0.91	1.16
4800	0.36	0.53	0.70	0.91
5400	0.28	0.43	0.56	0.74
6000		0.33	0.43	0.59



Detail A

**DeltaTrim-MW** Acoustic Testing has been performed in compliance with the requirements of AS 1191-2002 "Acoustics - Method for Laboratory Measurement of Airborne Sound Insulation of Building Elements".

The procedures specified by AS 1276-1979 and AS/NZS ISO 717.1:2004 were used to calculate the Sound Transmission Class (STC) and the Weighted Sound Reduction Index (Rw) of **DeltaTrim-MW**.

**DeltaTrim-MW** is classed as trafficable when used in a roof application.

DeltaTrim-MW Acoustic Values			
Frequency		50mm	125mm
		100	15.41
	160	16.40	15.09
	200	18.81	17.70
	250	19.70	18.51
	315	21.39	19.40
	400	22.31	19.69
	630	23.40	19.10
	800	23.69	17.31
	1000	25.61	18.29
	1250	21.01	30.10
	1600	20.00	36.19
	2000	34.79	37.30
	2500	41.70	37.09
	3150	44.10	35.69
	5000	44.61	39.90
	<b>STC</b>	24.00	23.00
	<b>RW</b>	25.00	24.00

Please refer to the web page for the available colour range, paint finishes and relevant warranty conditions.

DeltaTrim-MW Fixing Details		
Crest fixing only. One fixing every second crest		
Panel Thickness (mm)	Fixing into Steel	Fixing into Timber
75	Tek 14 x 150 Hex Head Screw	T17 14 x 150 Hex Head Screw
100	Tek 14 x 175 Hex Head Screw	T17 14 x 175 Hex Head Screw
125	Tek 14 x 200 Hex Head Screw	T17 14 x 200 Hex Head Screw
150	Tek 14 x 230 Hex Head Screw	T17 14 x 230 Hex Head Screw

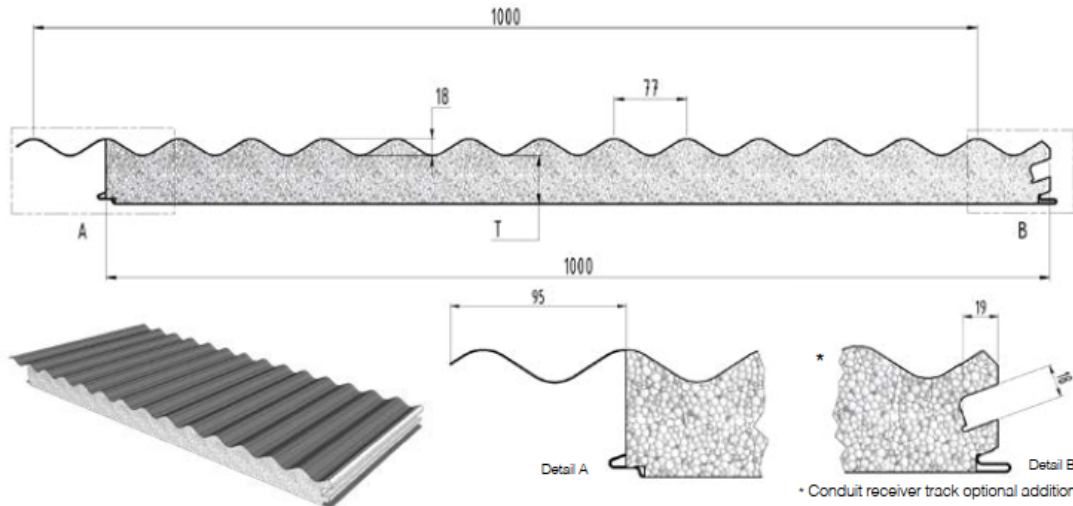
Use Cyclone Plate and Neo Washer on each fixing.  
Upon Installation the overlap needs to be stitch cored or riveted every 300mm.



Version Date: 27.04.2022

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E.3 DeltaOrb-EPS-FR



**DeltaOrb-EPS-FR** is an Insulated Roof Panel System, comprising of two pre-painted, roll-formed steel skins, with a fire retardant grade expanded polystyrene insulating core.

CodeMark Australia Certificate CM40309 certifies that DeltaOrb-EPS-FR complies with the stated BCA2019 performance requirements. Please refer to the certificate as displayed on our website for the exact details of the compliance.

The top profile offers striking looks with all of the benefits of modern insulated panel technologies while the bottom skin has a roll-formed tongue and groove joining edge.

**Recommendations**

- Patios
- Pergolas
- Carports
- Portable Buildings
- Home Extensions
- Commercial Buildings
- Residential Buildings
- Wineries
- Spray Booths

**Profiles Available (Underside Skin)**

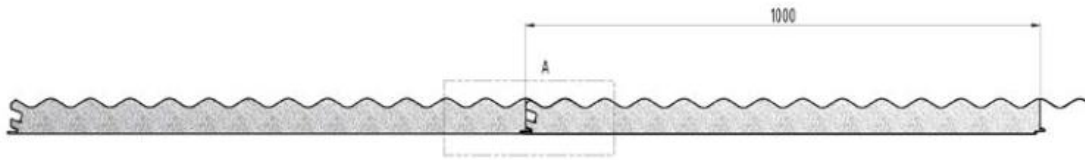
- Smooth & Elegance

Wind Category	Single Spans (mm)				
	Panel Thickness	3 Sides Open	2 Sides Open	1 Side Open	Fully Enclosed
N2 (W33)	50	5400	5000	4500	4300
	75	6500	5500	5000	4700
	100	7200	6200	5700	5500
N3 (W41)	50	4800	3800	3300	3000
	75	5500	4300	3900	3700
	100	6200	5000	4500	4300
N4 (W50)	50	4000	3300	3000	3000
	75	4600	3600	3400	3300
	100	5300	4100	3800	3500

<b>Steel Skin Details</b>	Top Skin	0.42mm / G550 AZ150
	Bottom Skin	0.60mm / G300 Z275
<b>Max. Skin Temperature</b>	78°C Dry Heat	
<b>Core Material Details</b>	SL Grade Polystyrene - Fire Retardant Grade	
<b>Thermal Conductivity AS 1388.2/ASTM C 518</b>	0.037 W/mK @22.5°C	
<b>Adhesive</b>	Thermosetting two-part adhesive	
<b>Core Density</b>	13.5kg/m³	
<b>Weight (kg/m²)</b>	50mm Panel	10.58
	75mm Panel	10.94
	100mm Panel	11.17
	125mm Panel	11.80
	150mm Panel	12.23
	175mm Panel	12.77
<b>R Value @ 22.5°C</b>	200mm Panel	13.31
	50mm Panel	1.4
	75mm Panel	2.0
	100mm Panel	2.7
	125mm Panel	3.4
	150mm Panel	4.1
<b>Certificate of Conformity</b>	175mm Panel	4.7
	200mm Panel	5.4
	CodeMark Australia Certificate - CM40309	
	<b>Sheet Coverage</b> 1000mm	
<b>Length (mm)</b>	Cut to Length Min of 1800mm	
<b>Length Tolerance (mm)</b>	5mm+/-	
<b>Thickness (mm)</b>	50, 75, 100, 125, 150, 175, 200	
<b>Minimum Roof Pitch</b>	Building Classes 1-9 - 5° Building Class 10 - 3°	
<b>Flatness Standards</b>	0.40mm	Surface deformations can be apparent to the naked eye when observed in certain lighting conditions
	0.60mm	

Version Date: 27.07.2021

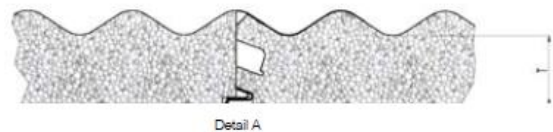
**DeltaOrb-EPS-FR**



**Exposure to the External Surface - AS 3959:2018**  
 BRANZ Fire Test Certificate 805 - 24-10-2018 - BAL40

**Early Fire Hazard Properties AS 1530.3:1999**  
 AWTA Test Report 18-006076 14-11-2018

Index	Test Range	External Top Skin
Ignitability	0-20	0
Spread of Flame	0-10	0
Heat Evolved	0-10	0
Smoke Developed	0-10	2



**DeltaOrb-EPS-FR** Acoustic Testing has been performed in compliance with the requirements of AS 1191-2002 "Acoustics - Method for Laboratory Measurement of Airborne Sound Insulation of Building Elements".

The procedures specified by AS 1276-1979 and AS/NZS ISO 717.1:2004 were used to calculate the Sound Transmission Class (STC) and the Weighted Sound Reduction Index (Rw) of **DeltaOrb-EPS-FR**.

**DeltaOrb-EPS-FR** is classed as trafficable when used in a roof application.

DeltaOrb-EPS-FR Acoustic Values			
		50mm	125mm
Frequency	100	15.41	15.00
	160	16.40	15.09
	200	18.81	17.70
	250	19.70	18.51
	315	21.39	19.40
	400	22.31	19.69
	630	23.40	19.10
	800	23.69	17.31
	1000	25.61	18.29
	1250	21.01	30.10
	1600	20.00	36.19
	2000	34.79	37.30
	2500	41.70	37.09
	3150	44.10	35.69
	5000	44.61	39.90
		<b>STC</b>	24.00
	<b>RW</b>	25.00	24.00

Please refer to the web page for the available colour range, paint finishes and relevant warranty conditions.

DeltaOrb-EPS-FR Fixing Details		
Crest fixing only. One fixing every second crest		
Panel Thickness (mm)	Fixing Into Steel	Fixing Into Timber
50	Tek 14 x 115 Hex Head Screw	T17 14 x 125 Hex Head Screw
76	Tek 14 x 135 Hex Head Screw	T17 14 x 150 Hex Head Screw
100	Tek 14 x 150 Hex Head Screw	T17 14 x 175 Hex Head Screw
125	Tek 14 x 175 Hex Head Screw	T17 14 x 200 Hex Head Screw
160	Tek 14 x 200 Hex Head Screw	T17 14 x 230 Hex Head Screw
175	Tek 14 x 230 Hex Head Screw	T17 14 x 265 Hex Head Screw
200	Tek 14 x 260 Hex Head Screw	T17 14 x 300 Hex Head Screw

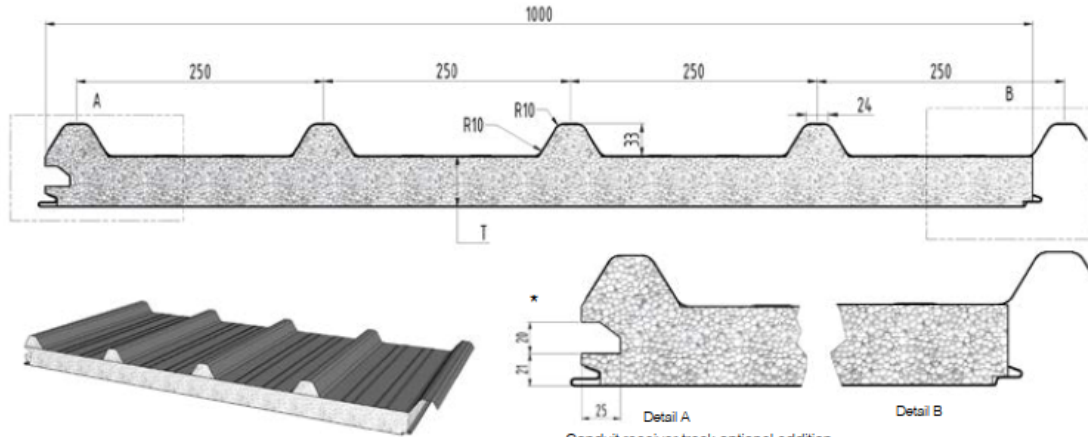
Use Cyclone Plate and Neo Washer on each fixing.  
 Upon installation the overlap needs to be stitch screwed or riveted every 300mm.



Version Date: 27.07.2021

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E.4 DeltaTrim-EPS-FR



\* Conduit receiver track optional addition

**DeltaTrim-EPS-FR** is an Insulated Roof Panel System, comprising of two pre-painted, roll-formed steel skins, with a fire retardant grade expanded polystyrene insulating core.

CodeMark Australia Certificate CM40309 certifies that DeltaTrim-EPS-FR complies with the stated BCA2019 performance requirements. Please refer to the certificate as displayed on our website for the exact details of the compliance.

The top profile offers striking looks with all of the benefits of modern insulated panel technologies while the bottom skin has a roll-formed tongue and groove joining edge.

**Recommendations**

- Patios
- Pergolas
- Carports
- Portable Buildings
- Home Extensions
- Commercial Buildings
- Residential Buildings
- Wineries
- Spray Booths

**Profiles Available (Underside Skin)**

- Smooth & Elegance

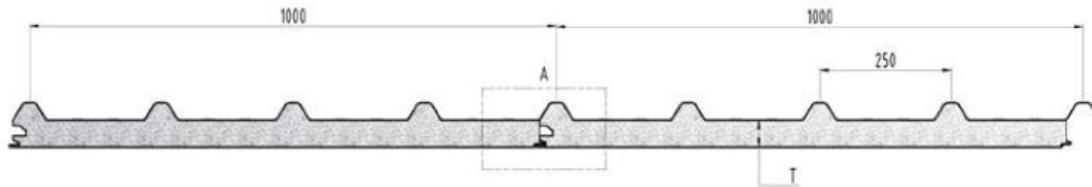
Single Spans (mm)					
Wind Category	Panel Thickness	3 Sides Open	2 Sides Open	1 Side Open	Fully Enclosed
N2 (W33)	50	5400	5000	4500	4300
	75	6500	5500	5000	4700
	100	7200	6200	5700	5500
N3 (W41)	50	4800	3800	3300	3000
	75	5500	4300	3900	3700
	100	6200	5000	4500	4300
N4 (W50)	50	4000	3300	3000	3000
	75	4600	3600	3400	3300
	100	5300	4100	3800	3500

<b>Steel Skin Details</b>	Top Skin	0.42mm / G550 AZ150
	Bottom Skin	0.60mm / G300 Z275
<b>Max. Skin Temperature</b>	78°C Dry Heat	
<b>Core Material Details</b>	SL Grade Polystyrene - Fire Retardant Grade	
<b>Thermal Conductivity AS 1386.2/ASTM C 518</b>	0.037 W/mK @22.5°C	
<b>Adhesive</b>	Thermosetting two-part adhesive	
<b>Core Density</b>	13.5kg/m <sup>3</sup>	
<b>Weight (kg/m<sup>2</sup>)</b>	50mm Panel	10.58
	75mm Panel	10.94
	100mm Panel	11.17
	125mm Panel	11.80
	150mm Panel	12.23
	175mm Panel	12.77
	200mm Panel	13.31
<b>R Value @ 22.5°C</b>	50mm Panel	1.4
	75mm Panel	2.0
	100mm Panel	2.7
	125mm Panel	3.4
	150mm Panel	4.1
	175mm Panel	4.7
<b>Certificate of Conformity</b>	CodeMark Australia Certificate - CM40309	
<b>Sheet Coverage</b>	1000mm	
<b>Length (mm)</b>	Cut to Length Min of 1800mm	
<b>Length Tolerance (mm)</b>	5mm+/-	
<b>Thickness (mm)</b>	50, 75, 100, 125, 150, 175, 200	
<b>Minimum Roof Pitch</b>	2°	
<b>Flatness Standards</b>	0.40mm	Surface deformations can be apparent to the naked eye when observed in certain lighting conditions
	0.60mm	

Version Date: 27.07.2021



**DeltaTrim-EPS-FR**



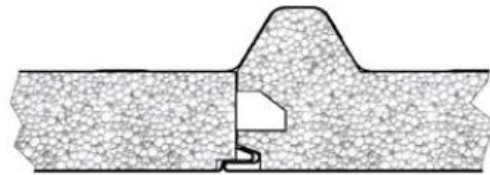
**Exposure to the External Surface - AS 3959:2018**

BRANZ Fire Test Certificate 805 - 24-10-2018 - BAL40

**Early Fire Hazard Properties AS 1530.3:1999**

AWTA Test Report 18-006076 14-11-2018

Index	Test Range	External Top Skin
Ignitability	0-20	0
Spread of Flame	0-10	0
Heat Evolved	0-10	0
Smoke Developed	0-10	2



Detail A

**DeltaTrim-EPS-FR** Acoustic Testing has been performed in compliance with the requirements of AS 1191-2002 "Acoustics - Method for Laboratory Measurement of Airborne Sound Insulation of Building Elements".

The procedures specified by AS 1276-1979 and AS/NZS ISO 717.1:2004 were used to calculate the Sound Transmission Class (STC) and the Weighted Sound Reduction Index (Rw) of **DeltaTrim-EPS-FR**.

**DeltaTrim-EPS-FR** is classed as trafficable when used in a roof application.

**DeltaTrim-EPS-FR Acoustic Values**

		50mm	125mm
Frequency	100	15.41	15.00
	160	16.40	15.09
	200	18.81	17.70
	250	19.70	18.51
	315	21.39	19.40
	400	22.31	19.69
	630	23.40	19.10
	800	23.69	17.31
	1000	25.61	18.29
	1250	21.01	30.10
	1600	20.00	36.19
	2000	34.79	37.30
	2500	41.70	37.09
	3150	44.10	35.69
	5000	44.61	39.90
		<b>STC</b>	24.00
	<b>RW</b>	25.00	24.00

Please refer to the web page for the available colour range, paint finishes and relevant warranty conditions.

**DeltaTrim-EPS-FR Fixing Details**

Crest fixing only. One fixing every second crest

Panel Thickness (mm)	Fixing Into Steel	Fixing Into Timber
50	Tek 14 x 135 Hex Head Sorew	T17 14 x 125 Hex Head Sorew
76	Tek 14 x 150 Hex Head Sorew	T17 14 x 150 Hex Head Sorew
100	Tek 14 x 175 Hex Head Sorew	T17 14 x 175 Hex Head Sorew
125	Tek 14 x 200 Hex Head Sorew	T17 14 x 200 Hex Head Sorew
150	Tek 14 x 230 Hex Head Sorew	T17 14 x 230 Hex Head Sorew
175	Tek 14 x 260 Hex Head Sorew	T17 14 x 265 Hex Head Sorew
200	Tek 14 x 260 Hex Head Sorew	T17 14 x 300 Hex Head Sorew

Use Cyclone Plate and Neo Washer on each fixing.

Upon Installation the overlap needs to be stitch screwed or riveted every 300mm.



Version Date: 27.07.2021

Delta Panels Pty Ltd

P: +61 07 3271 2170 E: info@deltapanel.com W: www.deltapanel.com A: 731 Boundary Road, Richlands, Qld 4077 ABN: 11 147 861 292

Appendix F Accreditation

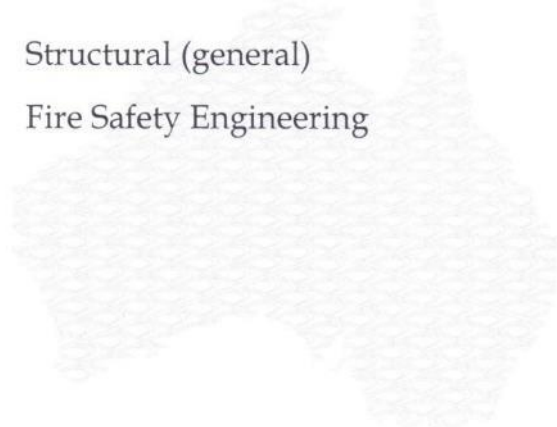
NATIONAL PROFESSIONAL ENGINEERS REGISTER

Registered Professional Engineer

This is to certify that:
Paul Clancy
MIEAust CPEng

has been registered in the following areas of practice from the dates shown

Table with 2 columns: Area of Practice, Date. Rows: Structural (general) 27/02/2007, Fire Safety Engineering 27/02/2007.



Handwritten signature of Michael J. Barron

Chair, National Engineering Registration Board

Handwritten signature of Michael J. Barron

Registrar, National Engineering Registration Board

Government, community and profession cooperating to maintain national registers in the community interest

For details see - http://www.nerb.org.au



The Association of Consulting Engineers Australia



THE ASSOCIATION OF PROFESSIONAL ENGINEERS, SCIENTISTS AND MANAGERS, AUSTRALIA



Certificate NOT valid without current membership card that states "National Professional Engineers Register (NPER)" against "REGISTRATION" in the left-hand column. This certificate is evidence that at the time of assessment the person named on the certificate demonstrated the qualifications and experience to practice competently in the stated area(s) of practice. When taken in conjunction with a current practice card the certificate also provides evidence of continued practice in the stated area(s) and a commitment to ethical standards and continuing professional development that is satisfactory to the profession.



NPER

NATIONAL PROFESSIONAL ENGINEERS REGISTER

136936

The National Professional Engineers Register is administered by

The Institution of Engineers, Australia

(This certificate does not imply membership of any of the sponsoring professional bodies)

## Appendix G Company Profile

### 1. Contact Details

Address	24 Watts Drive Varsity Lakes Qld 4227
Phone	07 5562 0022
Mobile	0439 632 886
Fax	07 5562 1466
Email	<a href="mailto:sotera@sotera.com.au">sotera@sotera.com.au</a>
Web	<a href="http://www.sotera.com.au">www.sotera.com.au</a>



### 2.0 Overview of Company

Sotera specialises in fire risk engineering. The consultancy does not design building services and thus does not have its interests comprised in recommending a cost-effective safe combination of fire services. The director of the company has been practising in Queensland and New South Wales for the past five years and since 1990 generally including research and consulting for overseas interests. It has successfully undertaken over 300 projects of all types with a near perfect approval record. The company is highly respected by QFRS and other building professionals. It is often invited onto challenging projects and to give seminars to professional institutes.

### 3.0 Staff

Dr Paul Clancy – Director, fire and structural engineering (PhD-fire, MEngSc – Struc Mgt)  
Mr Neelesh Chandiran – Fire and electrical engineering, BEng (Elec). MEng (Elec) MEng (Mgt)

### 4.0 Accreditations:

NPER Fire, Structures, CPEng, MIEAust – one of six in Queensland.  
RPEQ Fire Structural registration number 10045  
NSW Registration with Building Professionals Board C-10 Accredited Certifier – Fire Safety Engineering No BPB0747  
Victoria Fire Safety Engineer EF 30459

### 5.0 Projects

#### *Featured High Rise Buildings Classes 2, 3, 5, 6, 7a*

Soul: 75 storeys, Surfers Paradise  
Hilton Hotel Surfers Paradise, two towers 35 and 55 storeys on 5 level car park basement.  
The Oracle, Broadbeach: two towers 40 and 50 storeys on common podium  
Southport Central 2 and 3: two 40 storey towers on a 6 level basement car park

#### *Featured Medium Rise Buildings Classes 2, 3, 5, 6, 7a, 9b*

Riverpoint, West End, Brisbane: several apartment buildings to 6 and 7 storeys on a common basement car park.  
16-18 Eden Avenue, Rainbow Bay: 9 storey apartment building  
Emerald Lakes: several buildings to 9 storeys, offices, apartments, shops

#### *Community Housing Projects*

Brisbane Housing Company, Masters Street Newstead, 6 storey housing commission – smoke doors deleted from long corridors

Brisbane Housing Company, Danby Lane, Nundah, 6 storeys open balconies and stairs  
Elliot Avenue, Caboolture – travel distance extended from 6 to 20 m.  
Tree Tops, Burleigh Waters – apartments, 8 storeys, travel distance to exit extended from 6 to 20 m by means of ventilation  
Bond University Student Accommodation six storeys

*Featured Aged care*

Tall Trees Rochedale  
Grande Pacific, 25 storeys  
Stage 15 Gardens on Lindfield, Helensvale

*Shopping Centres*

Sandgate Shopping Centre, Bowser Road  
Harvey Norman, Village Square Browns Plains  
  
Novo Northlakes  
  
Bargara Shopping Centre  
  
South Gympie  
  
Nerang Fair

*Hospitals*

Royal Brisbane Womens Hospital  
Bundaberg Hospital – Emergency and Maternity  
North West Hospital Redevelopment, Stage 4

*Warehouses*

Repcos Brisbane Airport  
Toll Express, Brisbane Airport  
Rivergate Boat Storage Facility  
Billabong, Burleigh Heads  
Lot 130 Days Rd, Upper Coomera

*Other Featured Projects*

Mackay Convention Centre  
HMAS Penguin diving bases in Sydney  
University of Southern Queensland, Springfield Campus  
Quad Park sports stadium – rationalization of FRL's, EVACNET study  
Southport Marina

**6.0 Issues**

Separation of united buildings, rationalization of sprinklers, stairs and lifts in same shaft safe zones, travel distances, non-fire-isolated stairs through 3 or 4 levels, combined hydrant sprinkler flows, proximity to boundary, rationalisation of FRL's, discharge past windows, discharge of fire isolated exit not direct to open space, stair widths and overall building evacuation, deletion of sprinklers in car parks with non-compliant ventilation, deletion of stair pressurization, single exits

**7.0 Research – Paul Clancy**

1986-2006 Research and consulting senior lecturer Victoria University – projects for Forintek Canada, National Research Council Canada, Canadian Defense, National Assoc Forest Ind Australia, American Forest & Paper, Swedish Timber Research, National Building Fire Safety Systems Code, Australia, project coordinator. 35 papers (most reviewed) in major reports, international conferences, international journals in fire safety engineering including Fire Safety Journal, Fire and Materials, Fire Technology, and Fire Protection Engineering Journal.

Supervision of Masters and PhD students. \$700,000 in research grants (2/3 as an individual effort, 1/3 with a group)