



CHARTERED PROFESSIONAL FIRE SAFETY ENGINEERS

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Conqueror 100mm C-Panel PRODUCT EVALUATION

IGNS-5338 I01R00

DOCUMENT REVISION HISTORY

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* The expiry of the report is dependent on the validity of the National Construction Code (NCC 2016). Should an amendment be made to the NCC 2016 a review of the validity of this report should occur.

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CONDITIONS AND LIMITATIONS

The report does not provide guidance in respect of areas, which are used for bulk storage, processing of flammable liquids, explosive materials, multiple fire ignitions or sabotage of existing fire safety systems.

Apart from where noted in the specific sections of this report, we have not verified information provided by external parties and assume that the remainder of the building will comply with the DtS provisions of the NCC Volume 1 – BCA.

Any application of the content of this report should be made taking into full account the following items:

1. observations of the building fire safety systems and fire hazards listed in this report have been based on examination of documentation made available by the design team.
2. any change in the information referenced including building design as detailed in this report to suit future re-organisation or planning will require further evaluation to confirm compliance with the intent of the design objectives.
3. the data, methodologies, calculations and conclusions documented within this report specifically relate to the building and must not be used for any other purpose.
4. specifically, the report does not consider property damage; e.g. building and contents damage caused by fire, potential increased insurance liability and loss of business continuity.
5. this report considers a single point of fire as a source of ignition.
6. the design complies with the current DtS provisions of the BCA except for the specific performance solutions identified within this report.
7. figures provided within the report are indicative only. Full and appropriate detail is expected to be provided within discipline specific engineering specifications and associated detail design drawings by others.
8. all of the fire safety systems are assumed to be designed, installed and operate in accordance with the appropriate Australian Standards, other design codes, legislation and regulations relevant to the project unless specifically stated otherwise.
9. for a satisfactory level of fire safety to be achieved, regular testing and maintenance of all fire safety systems and measures, including management-in-use systems, is essential and is assumed in the conclusion of this evaluation.

Potential risks of incendiary are limited in the scope of engineering design. Conventional building design can only provide limited protection against malicious attack; for example, large scale incendiary and multiple ignition sources can potentially overwhelm some fire safety systems.

Strategies such as security, housekeeping and other management procedures may be more effective than additional fire protection in addressing arson events.

This report is applicable to the Product only. It does not consider property damage to the building as a result of the performance solutions addressed in the evaluations.

A number of issues within the NCC Volume 1 – BCA are interpretive in nature. Where these issues are encountered, interpretations are made that are consistent with standard industry practice.

This report is prepared in good faith and with due care for information purposes only, and should not be relied upon as providing any warranty or guarantee. In particular, attention is drawn to the nature of the inspection and investigations undertaken and the limitations these impose in determining with accuracy the state of the building, its services or equipment and life safety.

Ignis Solutions' involvement in the Project is limited to the role outlined in section 2 'Scope of Service' of the Letter. This report reflects that role. Any reliance on, or use of, this report for purposes outside the scope of service is at the user's own risk.

Ignis Solutions shall not be held liable for any loss or damage resulting from any defect of the building or its services or equipment or for any non compliance of the building or its services or equipment with any legislative or operational requirement, whether or not such defect or non-compliance is referred to or reported upon in this report, unless such defect or non-compliance should have been apparent to a competent engineer undertaking the evaluation of the type undertaken for the purpose of preparation of this report.

Ignis Solutions has carefully reviewed and applied to the best of our ability the requirements of local Legislation, the NCC and the International Fire Engineering Guidelines.

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Part

A

executive summary

1 EXECUTIVE SUMMARY

1.1 General

Ignis Solutions has been engaged by Conqueror International to evaluate the Conqueror 100mm C-Panel for use on buildings under the National Construction Code – Building Code of Australia –Volume One 2016 with an applicable use and likely performance of a Fire Resistance Level for Australian application and Fire Resistance Rating for New Zealand Application. These two classifications are considered equivalent based on the initial testing. This evaluation will focus on the Building Code of Australia. Application of the Fire Resistance Level in Australia or the Fire Resistance Rating in New Zealand will require review by the project design team and appropriately qualified engineers.

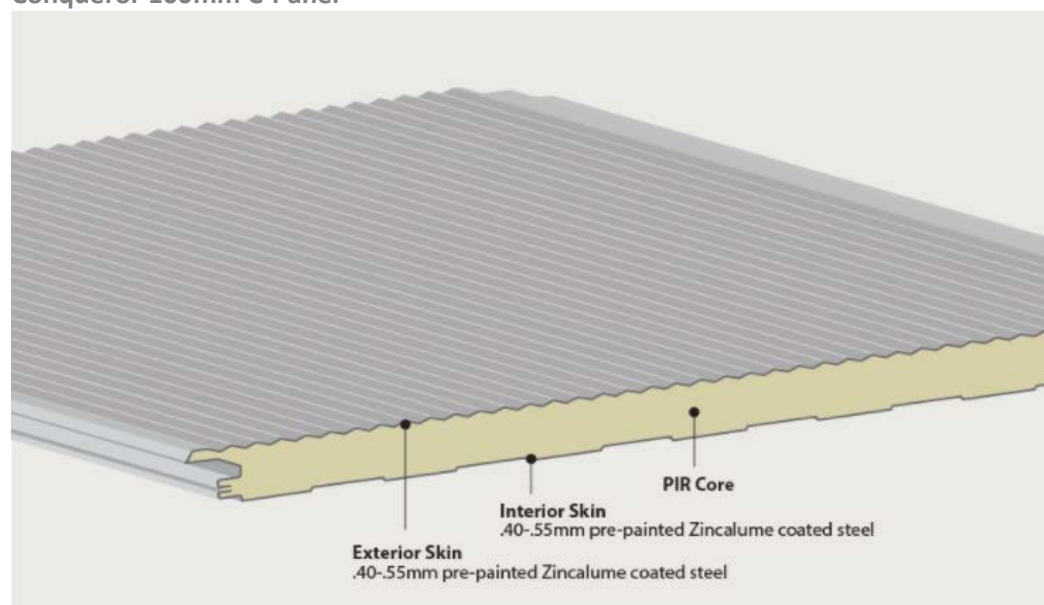
Provision A0.1 details that a Building Solution will comply with the BCA if it satisfies the Performance Requirements. A building solution as defined by the BCA means a solution, which complies with the Performance Requirements and is an Alternative Solution or a solution, which complies with the Deemed-to Satisfy provisions or a combination of both.

The Conqueror 100mm C-Panel consists of two steel skins with a PIR Insulation Core. The following evaluation considers the testing in accordance with AS 1530.4.

The Conqueror 100mm C-Panel can be applied as an internal fire wall within buildings of Type A, B or C construction or as an external fire wall for buildings of Type C construction only.

FIGURE 1:

Conqueror 100mm C-Panel



Source: Conqueror

Fixing Method: The Conqueror 100mm C-Panel is to be fixed to the surrounding structure where it is installed vertically and sandwiched between two L angles on the top, bottom and either side of the panels to the adjacent structure.

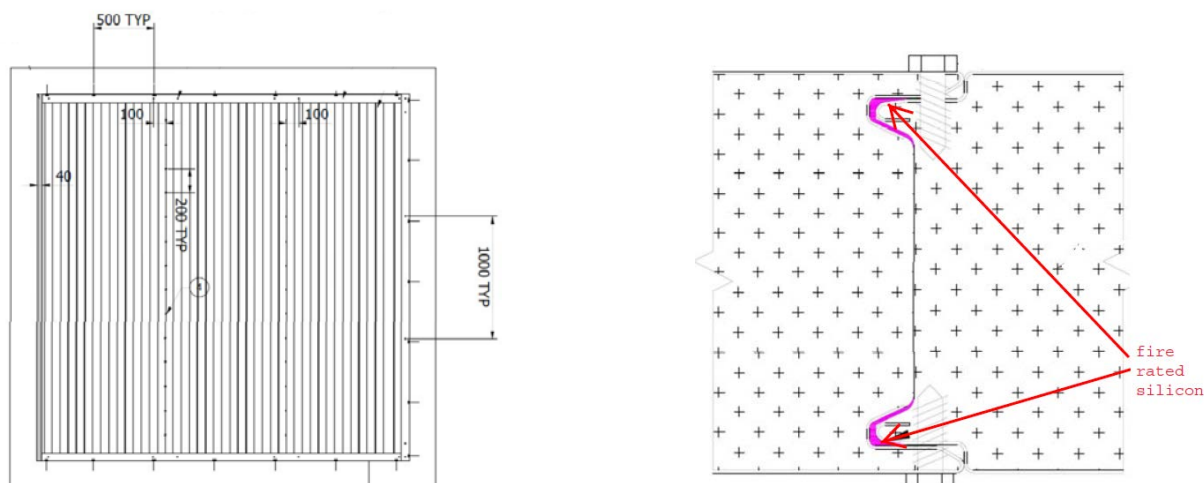
The panels are to be fixed together with 6mm x 22mm stich screws at nominal 200mm centres on both sides of the panel. A fire rated intumescent sealant is to be applied between the gap of the tongue and groove of the joint.

The panels are to be fixed to the L angles at the joint and offset 40mm from the joint on each side with fixings at 500mm centres. The angles are to be fixed to the surrounding structure at no greater than 1000mm centres.

The following image provides an indicative installation based on the above requirements.

FIGURE 2:

Conqueror 100mm C-Panel installation example



Source: Conqueror

1.2 Scope and Purpose

The Conqueror 100mm C-Panel is suitable to be used within the interior of the building as a fire separating wall or as an external wall for buildings of Type C construction. As the PIR insulation is of combustible construction the use is excluded from the external walls of buildings of Type A and B construction.

Internal Use

The Conqueror 100mm C-Panel is suitable for use as an internal fire separating wall where an FRL of at least -/90/30 is applied.

External Use

The Conqueror 100mm C-Panel is suitable to be used as an external wall in buildings of Type C construction where an FRL of at least -/90/30 achieved from the outside.

External Bushfire

The Conqueror 100mm C-Panel is suitable to be installed on the exposed components of an external wall of a building and maintain compliance with the requirements of AS 3959, Clause G5.2 and Part 3.7.4 of the BCA for bushfire prone areas up to BAL FZ.

1.3 National Construction Code Compliance

1.3.1 Volume One – Building Code of Australia

Clause A0.2 (a) evidence to support the use of a material meets the nominated Performance Requirements and Deemed-to-Satisfy Provisions complying with a combination of Performance Solutions and Deemed-to-Satisfy Solutions.

Clause A2.2 sub-clause (a)(iii) as evidence to support that the Conqueror 100mm C-Panel meets the nominated Performance Requirements and Deemed-to-Satisfy Provision under a certificate from a professional engineer.

Clause A2.3 Fire Resistance of building elements up to an FRL of at least -/90/30.

Performance Requirement CP1 – Structural adequacy – The Conqueror 100mm C-Panel resists the spread of fire with an FRL of at least -/90/30 when installed in accordance with the above fixing requirements.

Performance Requirement CP2 – Spread of Fire – The Conqueror 100mm C-Panel does not contribute to the spread of fire.

- Specification C1.1 Where an FRL of at least -/90/30 is applied as an internal wall within buildings of Type A, B or C construction or as an external wall for buildings of Type C construction only.

GP5.1 Bushfire

i. G5.2 Protection

1. AS 3959:2009 – Construction of buildings in bushfire-prone areas, section 4 BAL – Low to Section 9 BAL FZ.

1.3.2 Volume Two– Building Code of Australia

Clause 1.0.2 (a) evidence to support the use of a material meets the nominated Performance Requirements and Deemed-to-Satisfy Provisions complying with a combination of Performance Solutions and Deemed-to-Satisfy Solutions.

Performance Requirement P2.3.1 – Protection from the spread of fire – The Alpolic/fr does not contribute to the spread of fire.

P2.3.1 Resistance to the Spread of Fire

i. Part 3.7.4 Bushfire areas up to a Bushfire Attack Level (BAL) of 19.

1. AS 3959:2009 – Construction of buildings in bushfire-prone areas, section 4 BAL – Low to Section 9 BAL FZ.

1.3.3 State and Territory Variations

The Conqueror 100mm C-Panel can be used in all States and Territories within Australia. This includes the following variations:

Queensland

- Qld GP5.1, Qld G5.1, Qld 3.7.4.0

New South Wales

- NSW GP5.1, NSW G5.2, NSW 3.7.4.0

South Australia

- SA G5.1, SA G5.2, SA G5.3, SA P2.3.1(a)(ii) and SA 3.7.4.0

Tasmania

- Tas GP5.1, Tas G5.3 and Tas G5.4, Tas P2.3.4, Tas 3.7.4.

1.4 Sources of Information

The following information sources were used in the evaluation of the buildings:

- [1] National Construction Code – 2016 – Volume One – Building Code of Australia Class 2 to 9 Buildings.
- [2] Guide to the Building Code of Australia 2016 – Volume One, Class 2 to Class 9 Buildings’, Australian Building Codes Board, 2016 (the Guide).
- [3] National Construction Code – 2016 – Volume Two – Building Code of Australia Class 1 and 10 buildings.
- [4] International Fire Engineering Guidelines, Australian Building Codes Board, Canberra, 2005
- [5] Exova Warringtonfire AS 1530.4 test report 49700800.2 dated 21 June 2017

Part

B

conditions limitations and installation

2 FIRE SAFETY MEASURES

2.1 Conditions and Limitations

This evaluation is limited to the details within this evaluation report including the above compliance elements, product description and scope. This evaluation report is to be read, considered and used as a whole document.

The Conqueror 100mm C-Panel is approved to be installed in accordance with Clause 2.2 below.

2.2 Installation Requirements

The Conqueror 100mm C-Panel is to be fixed to the surrounding structure where it is installed vertically and sandwiched between two L angles on the top, bottom and either side of the panels to the adjacent structure.

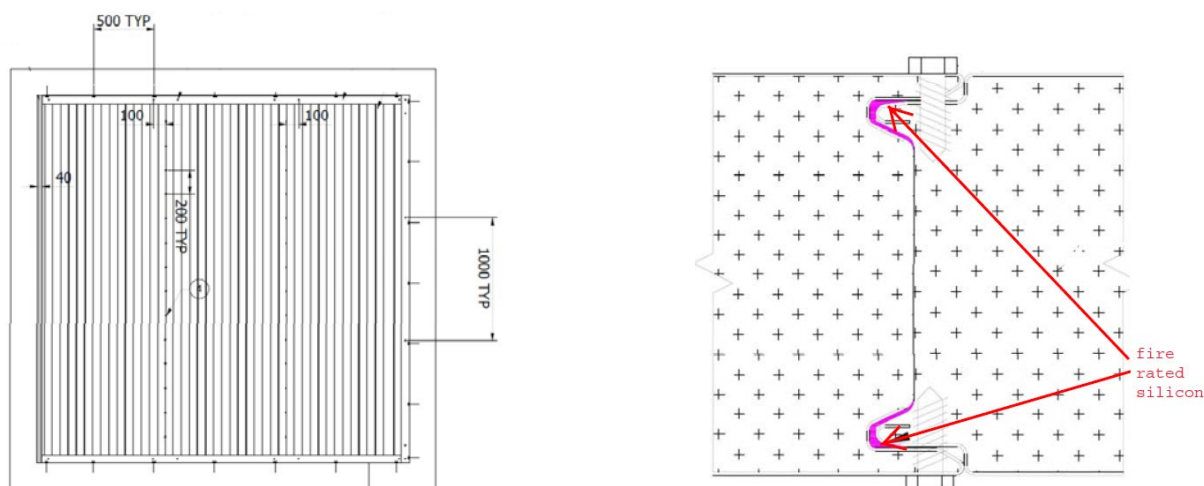
The panels are to be fixed together with 6mm x 22mm stitch screws at nominal 200mm centres on both sides of the panel. A fire rated intumescent sealant is to be applied between the gap of the tongue and groove of the joint.

The panels are to be fixed to the L angles at the joint and offset 40mm from the joint on each side with fixings at 500mm centres. The angles are to be fixed to the surrounding structure at no greater than 1000mm centres.

The following image provides an indicative installation based on the above requirements.

FIGURE 3:

Conqueror 100mm C-Panel installation example



Source: Conqueror

Part

C

performance solution



Fire Spread and Impact and Control Sub-system C

3 WALL FIRE RESISTANCE

3.1 Brief of Proposed Performance Solution

The BCA Clause A2.3, Specification A2.3, Clause C1.1 and Specification C1.1 details provisions for the establishment and application of a Fire Resistance Level. The Conqueror 100mm C-Panel has been tested to AS 1530.4 by Exova Warringtonfire and reported the test in accordance with BCA Clause A2.2(a)(i). This evaluation reviews the results of the test and establishes under the performance provisions that an FRL of at least -/90/30. This evaluation is provided as the thermocouples were required to be reversed after 5 minutes to record and after 60 minutes into the test the thermocouple tree collapsed. This evaluation provides a professional engineering performance analysis on the test inline with the BCA.

BCA Specification C1.1 Clause 3.1(b) and Clause 4.1(b) excludes combustible materials being used on an external wall of a building of Type A and B construction. The application of the Conqueror 100mm C-Panel is for internal FRL wall separation or external walls of buildings of Type C construction.

3.1.1 BCA Deemed-to-Satisfy Clauses

BCA Clause C1.1 details the type of construction required based on the class of building. See below:

FIGURE 4:

NCC – VOL 1 – CLAUSE C1.1

C1.1 Type of construction required

- (a) The minimum Type of *fire-resisting construction* of a building must be that specified in Table C1.1 and Specification C1.1, except as allowed for—
- (i) certain Class 2, 3 or 9c buildings in C1.5; and
 - (ii) a Class 4 part of a building located on the top *storey* in C1.3(b); and
 - (iii) *open spectator stands* and indoor sports stadiums in C1.7.
 - (iv) * * * * *

SA C1.1(a)(v)

- (b) Type A construction is the most fire-resistant and Type C the least fire-resistant of the Types of construction.

Table C1.1 TYPE OF CONSTRUCTION REQUIRED

| Rise in storeys | Class of building | |
|-----------------|-------------------|------------|
| | 2, 3, 9 | 5, 6, 7, 8 |
| 4 OR MORE | A | A |
| 3 | A | B |
| 2 | B | C |
| 1 | C | C |

Source: ABCB NCC Volume One – Building Code of Australia 2016

3.1.2 Intent of BCA Deemed-to-Satisfy Clause

The Guide to the BCA is indented as a reference manual to provide clarification to the BCA and should be read in conjunction with the BCA. The Guide to the BCA describes the intent of Clause C1.1 as:

FIGURE 5:

NCC – GUIDE TO VOL 1 – CLAUSE C1.1

C1.1 Type of construction required

| Intent |
|--|
| To establish the minimum fire-resisting construction required for Class 2–9 buildings. |

Source: ABCB NCC Volume One, Guide – Building Code of Australia 2016

The Guide to the BCA is intended as a reference manual to provide clarification to the BCA and should be read in conjunction with the BCA.

CP1 – Structural stability required during fire

The Guide to the BCA details that CP1 deals with the structural stability requirements during fire. CP1 does not make any reference to a fire-resistance level (FRL).

CP2 – Spread of fire

The Guide to the BCA details that CP2 deals with the spread of fire both within the building and between buildings. It aims to avoid a situation where fire either endangers occupants evacuating by way of exits, or impedes the capacity of emergency services personnel to access the building and fight the fire or rescue occupants. In addition, CP2 aims to minimise the risk of fire spreading from one building to another that could endanger the occupants of both buildings and impede the actions of the fire brigade.

The guide does detail that the term ‘to the degree necessary’ is used within CP2. This word usage is designed to provide flexibility in the way this provision is implemented. It means that the BCA recognises that different building elements require differing degrees of protection to avoid the spread of fire. The expression is intended to allow the appropriate authority to determine the degree of compliance necessary in each particular case after considering each building scenario.

3.1.3 BCA Performance Requirement

The relevant BCA Performance Requirement is CP1 and CP2 as detailed below:

FIGURE 6:

NCC – VOL 1 – PERFORMANCE REQUIREMENT CP1

CP1

A building must have elements which will, to the degree necessary, maintain structural stability during a fire appropriate to—

- (a) the function or use of the building; and
- (b) the *fire load*; and
- (c) the potential *fire intensity*; and
- (d) the *fire hazard*; and
- (e) the height of the building; and
- (f) its proximity to *other property*; and
- (g) any active *fire safety systems* installed in the building; and
- (h) the size of any *fire compartment*; and
- (i) *fire brigade* intervention; and
- (j) other elements they support; and
- (k) the *evacuation time*.

Source: ABCB NCC Volume One – Building Code of Australia 2016

FIGURE 7:

NCC – VOL 1 – PERFORMANCE REQUIREMENT CP2

CP2

- (a) A building must have elements which will, to the degree necessary, avoid the spread of fire—
 - (i) to *exits*; and
 - (ii) to *sole-occupancy units* and *public corridors*; and

Application:

CP2(a)(ii) only applies to a Class 2 or 3 building or Class 4 part of a building.

- (iii) between buildings; and
- (iv) in a building.
- (b) Avoidance of the spread of fire referred to in (a) must be appropriate to—
 - (i) the function or use of the building; and
 - (ii) the *fire load*; and
 - (iii) the potential *fire intensity*; and
 - (iv) the *fire hazard*; and
 - (v) the number of *storeys* in the building; and
 - (vi) its proximity to *other property*; and
 - (vii) any active *fire safety systems* installed in the building; and
 - (viii) the size of any *fire compartment*; and
 - (ix) *fire brigade* intervention; and
 - (x) other elements they support; and
 - (xi) the *evacuation time*.

Source: ABCB NCC Volume One – Building Code of Australia 2016

3.1.4 Relevant Element of Performance Requirement

Performance Requirements CP1(b), (c) and (d) and CP2(a)(iii)(iv), (b)(v), (vi) and (x) detailed above are

relevant.

3.1.5 Meeting the Performance Requirement

The Performance Requirement will be satisfied by A0.2 (c): a combination of (a) and (b) where (a) is a Performance Solution and (b) is a Deemed-to-Satisfy Solution.

3.1.6 Assessment Method

BCA Clause 0.5 (b)(ii) Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirement.

3.1.7 Methodology

The following methodologies will be applied to the evaluation:

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> Absolute | <input type="checkbox"/> Quantitative | <input checked="" type="checkbox"/> Deterministic |
| <input type="checkbox"/> Comparative | <input checked="" type="checkbox"/> Qualitative | <input type="checkbox"/> Probabilistic |

Absolute approach

As outlined in the International Fire Engineering Guideline an absolute approach is typically when an evaluation is carried out on an absolute basis, the results of the analysis of the trial design are matched, using the agreed acceptance criteria against the objectives or performance requirements without comparison to deemed-to-satisfy or prescriptive or “benchmark” designs.

Qualitative approach

A qualitative approach refers to descriptions or distinctions based on a quality or characteristic rather than on a quantity or measures value. The qualitative approach includes structured arguments to demonstrate compliance.

Deterministic approach

A deterministic approach is a methodology based on physical relationships derived from scientific theories and empirical results that for a given set of conditions will always produce the same outcome.

3.1.8 Acceptance Criteria

The acceptance criteria for this performance solution is that the proposed elements of the building have sufficient measures to limit fire spread and structural damage such that the BCA Performance Requirements CP1 and CP2 are satisfied to the degree necessary.

3.1.9 Identified Hazard

The potential hazard is that a fire incident may occur and the fire may spread beyond the compartment or building.

3.2 Performance Solution

The establishment of a fire resistance level within the BCA occurs through Clause A2.3 which requires the building element to have an FRL is to be determined in accordance with BCA Specification A2.3. BCA Specification A2.3 Clause 2(b) requires that the building element meets the requirements of the specification if it is identical with a prototype that has been submitted to the Standard Fire Test, and the FRL achieved by the prototype without the assistance of an active fire suppression system is confirmed in a report from a Registered Testing Authority.

AS 1530.4 – Fire-resistance tests on elements of construction – Methods for determination of the fire resistance of loadbearing elements of construction.

Each test is a full scale fire-resistance tests of elements of building construction following the standard fire curve. In most cases, a single test, carried out in accordance with either of these standards, establishes the fire-resistance for the element of construction concerned. The test subjects the material to a furnace where it is heated to the standard time/temperature rise curve. The size of the tested element under the standard test is to be 3m.

Clause A1.1 of the BCA defines the Standard Fire Test as the fire-resistance tests of elements of building construction as described in AS 1530.4. The Standard Fire Test and the test measurements are detailed below. Based on the images below, the test being for a duration in the order of 105 seconds, aligns with the requirements of Clause A1.1, A2.3 and Specification A2.4.

FIGURE 8:

AS 1530.4 STANDARD TEMPERATURE CURVE AND ACTUAL TEST CURVE

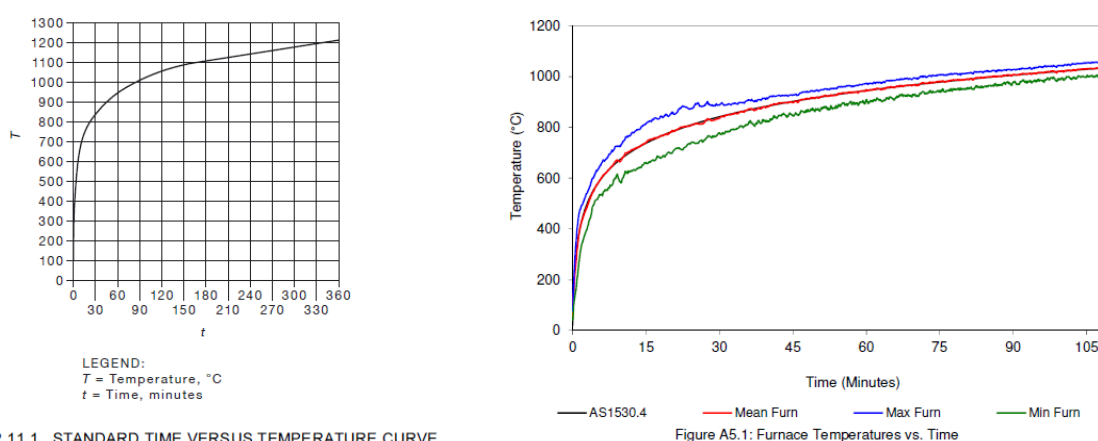


FIGURE 2.11.1 STANDARD TIME VERSUS TEMPERATURE CURVE

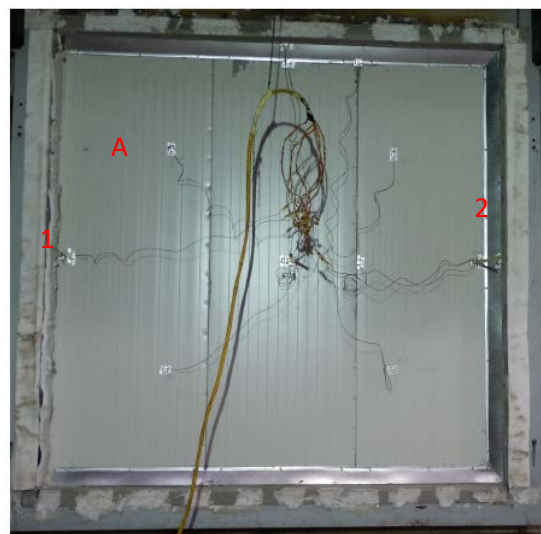
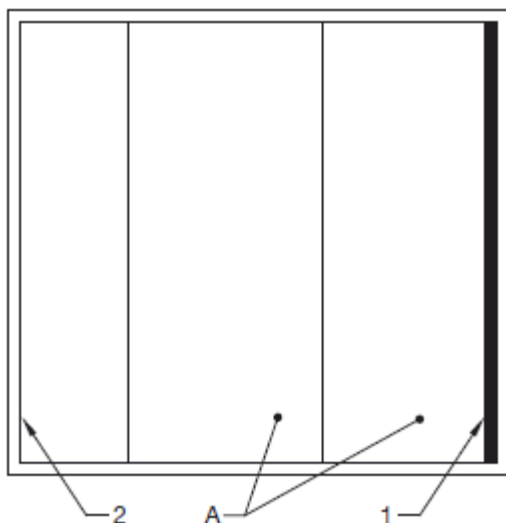
Source: AS 1530.4 and Exova Warringtonfire

In accordance with Clause 3.2 of AS 1530.4 the wall system shall be installed and tested in a manner representative of the intended application. Where the test specimen can incorporate at least two full width sheets, the outside edge of the full side board on the exposed face shall be unrestrained. This detail is provided below where A is the full size panel, 1 is the free edge and 2 is the fixed edge.

The free edge was loosely filled with Kaowool. Any interaction or results associated with the free side are not included within this evaluation as it does not represent the final full installation of the wall system.

FIGURE 9:

AS 1530.4 FREE EDGE



Source: AS 1530.4

Clause 2.13 of AS 1530.4 establishes the criteria of failure under the three categories of Structural adequacy, Integrity and Insulation. The wall was not tested for loadbearing capacity and therefore excluded from the criteria.

Integrity

The failure in relation to integrity is deemed to have occurred when evaluated in accordance with the following:

- **Cotton pad test** – integrity failure is deemed to have occurred upon ignition of the cotton pad; or
- **Gap gauges** – a 6mm or 25mm gap gauge pass through the specimen; or
- **Flaming** – sustained flaming on the surface of the unexposed face for 10s or longer.

During the test cotton pad tests or gap gauges were not noted as presenting a fail. Excluding any interaction from the loose filled Kaowool, located on the left side of the test, the integrity of the recommended installation was not observed to have sustained continual flaming until 1 hour 50 minutes. With limited measurements from the test facility the integrity is limited to 90 minutes.

FIGURE 10:

FIRE TEST OBSERVATIONS AT 60 AND 90 MINUTES



Source: Exova Warringtonfire

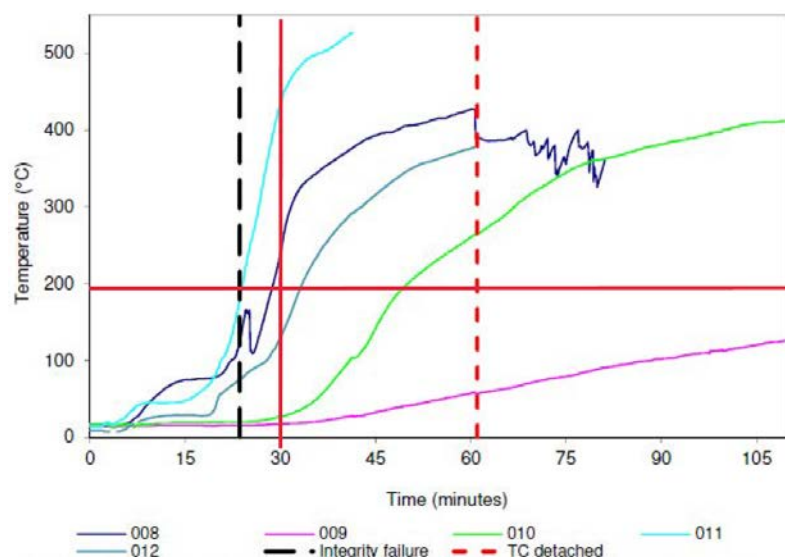
Insulation

The fail criteria for insulation occurs when the average temperature of the unexposed face of the test specimen exceeds the initial temperature by more than 140K or the temperature at any unexposed face of the test specimen exceeds the initial temperature by more than 180K.

Based on the measurements provided within the Exova test report, the average temperature of the measurements reached 137°C and exceeded 180K above the initial after 30 minutes. During the test the measurements of thermocouple 11 was considered questionable based on the early indication of smoke through the joint within 2 minutes. This questions the installation and fire rated silicon where the left had joint showed no smoke leakage. Smoke leakage on the top track occurred after 30 minutes. Based on the increased smoke leakage and temperature rise over the measured test the insulation is limited to 30 minutes.

FIGURE 11:

FIRE TEST MEASUREMENTS



Source: Exova Warringtonfire

3.3 Evaluation Summary

In the opinion of Ignis Solutions, the assessment has demonstrated that based on the testing and full installation requirements the likely Fire Resistance Level of the installation and the Performance Solution of the wall has the capacity to resist the spread of fire as evaluated and as such satisfies BCA Performance Requirement CP1(b), (c) and (d) and CP2(a)(iii)(iv), (b)(v), (vi) and (x) where a likely FRL of -/90/30 could be achieved with the full installation as detailed above.