Consulting Engineers

Panelok™ Wall System
Panelok™ Building Systems

Performance Solution Report

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Prepared For: John Hammond

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Executive Summary

G&P Consulting Engineers have been appointed by John Hammond of Panelok™ Building Systems to undertake a Performance Solution assessment for the patented Panelok™ Wall Panel system that has been developed to meet the Performance Requirements of the NCC Volume 2 2019 Amendment 1.

This Performance Solution assessment report will evaluate the performance provisions, and demonstrate that the proposed performance solutions will comply with the relevant Performance Requirements of the National Construction Code (NCC) and Building Code of Australia (BCA).

The following Deemed-to Satisfy departure (Performance Solutions) have been identified by the Relevant Building Surveyor (RBS) and are addressed in this report:

Table 1 Proposed Performance Solutions and Reference Criteria

Proposed Performance Solution	Building Code of Australia	
	DtS Provision	Performance Requirement
To permit the use of the Panelok™ Wall Panel system against the Performance Requirement P2.2.2 of the National Construction Code 2019 (NCC) – Volume 2, Amendment 1		P2.2.2 (Weatherproofing)

On the basis of the assessment methods considered in this assessment report, it is considered that the above Deemed-to-Satisfy (DtS) departures comply with the Performance Requirements of the NCC and BCA, with the inclusion of the following specification or required performance measures:

Table 2: Specification of Required Performance Measures

Method	Performance Standard
Within the construction of the building	<u>Performance Solution 1 – Panelok™ Wall System</u> The external walls are proposed to be constructed of 100mm Structural Insulated Panel System (SIPS) with an 80mm EPS, which makes up the Panelok™ Wall Panel System. Panelok™ Wall Panels are an SIPS wall panel of 80mm thick EPS thermal core, with a 10mm Bamboo Fibre Cement (BFC) Sheet to the exterior of the SIPS panel each side of the wall panel. The wall panels will be finished off with either wall cladding, paint or render finish. The cladding finish alternative will be either horizontal or vertical cladding, fixed to the external face of the wall panels in accordance with the cladding manufacturers guidelines. All wall claddings are to meet the profile and fixing requirements of DtS provision Part 3.5.4.2. Paint and render finishes will be done in accordance with AS2311: 2017. Each Panelok™ Wall Panel will be applied with a coating of Panelok™ Impreg Sealer to both the exterior and interior of the wall panels as per the manufacturer's specifications for a coating thickness of 180g/m2. Panelok™ Ultra-Flex will be applied to all panel joins, both vertical panel to panel joins, and the joins at windows in accordance with the Panelok™ specifications and installation guidelines. The application of both the Panelok™ Impreg Sealer

	to interior and exterior of wall panels, and the Panelok™ Ultra-Flex to all panel joins will provide the SIPS wall panel system with a weatherproof coating to the exterior of the building. The SIPS wall panels will have a damp proof course applied at the base of the Panelok™ Wall Panel in accordance with the requirements of AS4773.2:2015 Masonry in Small Buildings, Table 5.2. The damp proof course will be of a material that complies with AS2904. The damp proof course will be installed beneath the wall bottom plate channel, and extend to the inside face of the interior BFC in accordance with AS4773.1: 2015. The SIPS panels will be finished with a selection of either cladding, paint or render finishes. The cladding finish will be either horizontal or vertical wall cladding that meets the Acceptable Construction requirements of Part 3.5.4.2 of the NCC 2019 Volume 2 Amendment 1. Horizontal or vertical H3 treated timber battens are screw fixed to the steel channel panel to panel connectors using tek screws according to the Panelok™ installation guidelines. All timber battens are to be sized and located according to the cladding manufacturers requirements. To achieve compliance with DtS Provision Part 3.5.4.2, timber battens will be spaced no more than 600mm spacings. Where 900mm and 1100mm SIPS wall panels are used, intermediate timber battens are to be fixed mid-span to the wall panels using SikaBond 145 Super Grip, and screw fixed at the top and bottom wall plates in accordance with Panelok™ installation guidelines. For the render or paint finish alternatives, render finish will be applied in accordance with AS5146.3 Clause 2.8.4 and paint finishes will be applied in accordance with AS2311:2017 and will be UV resistant.

This report is limited to the variations from the deemed-to-satisfy provisions of the BCA as outlined above. The building is otherwise assumed to comply fully with all other deemed-to-satisfy provisions of the BCA and the Building Regulations. The scope of this report does not extend to any other variations from the deemed-to-satisfy provisions of the BCA. It is assumed that all other parts of the building will be provided and maintained as required by the BCA Acceptable Construction Provisions.

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1 Introduction

1.1 Scope

Panelok Building Systems Pty Ltd (PBS) have appointed G&P Consulting Engineers (G&P) to evaluate the proposal for the use of the proprietary expanded polystyrene (EPS) wall system, which is a Structural Insulated Panel System (SIPS) developed by PBS, also known as Panelok Wall Panels. The proposed use of the Panelok Wall Panels is for external wall construction of residential dwellings.

G&P acknowledge the client has submitted a design which does not achieve compliance with the Deemed-to- Satisfy provisions of the National Construction Code (NCC) and Building Code of Australia (BCA) 2019 Volume 2 Amendment 1 Performance Requirements.

Pursuant to Part A2 of the NCC, compliance is achieved by complying with the performance requirements.

This report is only to be used for Panelok Wall Panels for use in a residential dwelling of building classification 1a in accordance with BCA 2019 Volume 2 Amendment 1. The report is to be used to support current Panelok Wall Panel specifications. Further changes to the design or specification of the panels, or a change in use of the panels may affect the evaluation. G&P takes no responsibility for any issues associated with the misuse of this report.

1.2 Relevant Legislation

The primary legislation applicable to the proposal of Panelok™ Wall Panels is the State Government building regulations, which references the National Construction Code (BCA/NCC). The NCC is a performance based document, where compliance can be demonstrated by either of the two approaches;

- Meeting the relevant performance requirements, or
- Meeting the prescriptive requirements of the deemed-to-satisfy provisions.

The deemed-to-satisfy (DtS) provisions, provides an acceptable level of safety. Variations from the DtS provisions may be addressed by a performance solution, to determine if it complies with the relevant BCA performance provisions as determined in accordance with Part A of the BCA.

BCA Clause A2.2 requires a performance solution to either comply with the Performance Requirements or be at least equivalent to the DtS Provisions.

The evaluation of a proposed Performance Solution can be undertaken using a variety of methods. The evaluation process is defined in Clause A2.2(2) of the BCA. One or more, or a combination of the evaluation methods are adopted to determine whether the proposed Performance Solution complies with the Performance Requirements of the BCA. The relevant Performance Requirements are determined in accordance with Clause A2.2(3) of the BCA. Compliance with Performance Requirements is undertaken in accordance with A2.2(1) of the BCA.

1.3 Reference Documentation

This report has been prepared based on the following documentation provided:

Table 3: Reference Documentation

Document	Prepared by	Issue
Installation Guide Annexure 1 - Weatherproofing & Window Installation Guide Page 1 to 8	Panelok Building Systems	Revision 01, dated 29.09.2022
Shellcoat Guide Annexure 2 – Panelok Shellcoat Exterior Texture Application Guide Page 1 to 4	Panelok Building Systems	Revision 05, dated 23.11.2021
Horizontal Cladding Guide Annexure 3 – Panelok Horizontal Cladding Installation Guide Page 1 to 6	Panelok Building Systems	Revision 04, dated 23.11.2021
Vertical Cladding Guide Annexure 4 – Panelok Vertical Cladding Installation Guide Page 1 to 6	Panelok Building Systems	Revision 02, dated 23.11.2021
Thermal Performance Calculations – thermal certificate	James M Fricker Pty Ltd	Dated 22.05.2018
Building System Overview Panelok Building Systems – Modern Luxury Flat Packed Homes, page 1 to 16	Panelok Building Systems	Unknown revision and date
Company name registration Panelok Building Systems Pty Ltd, formerly GMI Homes Pty Ltd	Australian Securities & Investment Commission	Dated 28.10.2022
Water Penetration & Ultimate Strength Testing (NATA Accredited Laboratory No. 15147, Test No AZT0255.12	Azuma Design Pty Ltd	Dated 16.10.2012
Panelok Weatherproofing – FV1.1/BCA FP1.4 (Panelok Impreg Sealer and Panelok Ultra Flex water penetration test)	Nick Hill of Everhill Pty Ltd and LRM Products Pty Ltd	Dated 30.09.2022
LRM Products Pty Ltd & Liquid Rubber Manufacturing Pty Ltd ISO9001:2015 Certificate of Registration Certificate No. 4474	SCI QUAL International (JAS-ANZ register)	Issued 19-02-2022

1.4 Project Stakeholders

The project stakeholders are listed in the table below:

Table 4: Relevant Stakeholders

Contact	Organisation	Role
John Hammond	Panelok Building Systems Pty Ltd	Client

Jeremy Grosbois	G&P Consulting Engineers	Solutions Engineer & Building Consultant

1.5 Approval Authority

The project's referral authorities are listed in the table below:

Table 5: Referral Authorities

Contact	Organisation	Role
Unknown	Unknown	Relevant Building Surveyor

1.6 Report Limitations

There are limitations applicable to the advice that is presented in this report as follows:

G&P have prepared this report for the sole use of the nominated stakeholders and referral authorities, and is for the purpose documented within the report. This report is not to be relied upon by a third party, and G&P does not accept responsibility to any third party that may rely upon or use this document.

This report contains information and advice specific to the areas of the building expressed in Table 1 of this report. No liability is accepted in respect of design and construction issues falling outside the areas specifically addressed within this report. Further, other aspects of the building related to design and construction not specifically addressed in this report are outside the scope of this report.

In preparing this report, information provided by the client and other third parties have been relied upon. G&P accepts no responsibility or liability for any errors or omissions which may be incorporated into this document as a result.

The recommendations outlined in this report apply specifically to the project under consideration and must not be utilised for any other purpose. Any modifications or changes to the project from that described in the listed reference documentation may invalidate the advice provided in this document, which may require a revision.

2 Project Particulars

The building particulars described is provided as information only and is based upon the referenced documentation that is current at the time of writing this report.

It is the understanding of G&P that the design team, engineers and building surveyor are responsible for the compliance of all parts of the BCA DtC provisions except were described as a proposed Performance Solution in this report, or where the relevant building surveyor has granted a dispensation.

2.1 Building Characteristics

The Panelok™ Wall Panel system is an SIPS wall system that has been developed to improve the time to construct residential dwellings, and has been developed to provide the NCC performance requirements for use as external walls for such projects. The Panelok™ Wall Panel system is for use to single and double level dwellings above ground either founded on concrete footing systems or onto a framed subfloor system. The BCA occupancy classification of projects using the Panelok™ Wall Panel system is for a Class 1a building.

The Panelok™ Wall Panel system is a SIPS wall system of an EPS polystyrene centre and a Bamboo fibre cement sheet (BFC) to the exterior. In addition to this, the wall panels are fixed at the base with a steel bottom plate and has a steel top plate that interconnects the wall panels to the roof framing. The panels are joined together using the Panelok™ steel channel. This SIPS wall system has been tested for bracing, pressure load and axial load requirements suitable for the use of residential dwellings in accordance with AS1170.0 to AS1170.2 for structural design actions.

The Panelok™ Wall Panel system is for use with raft or waffle concrete footings to AS2870:2010 Residential Slabs & Footings, or framed subfloors, with the wall panels supporting a framed roof structure generally of timber or steel frame roof trusses. The wall panel system relies upon the use of compliant external wall cladding fixed over the SIPS wall panels, or to be coated using a render or paint finish.

Refer to Figure 1 and 2 for a typical use of the wall system on a framed sub-floor.

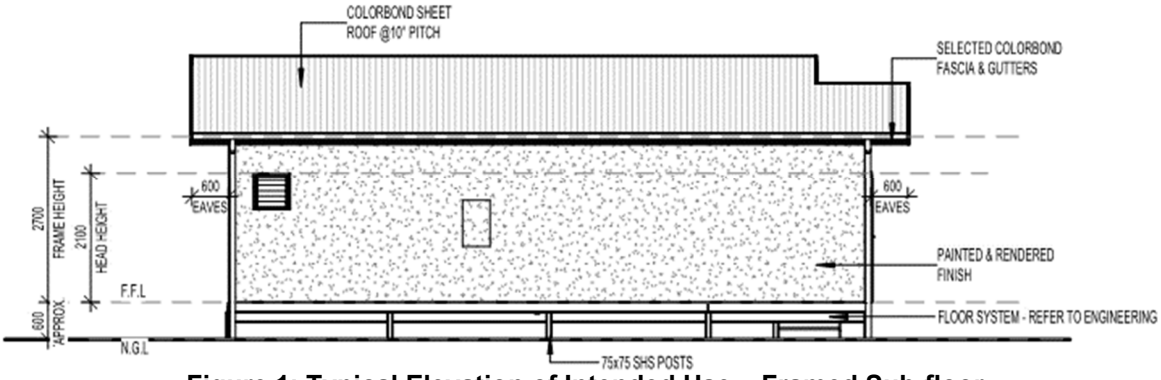


Figure 1: Typical Elevation of Intended Use – Framed Sub-floor

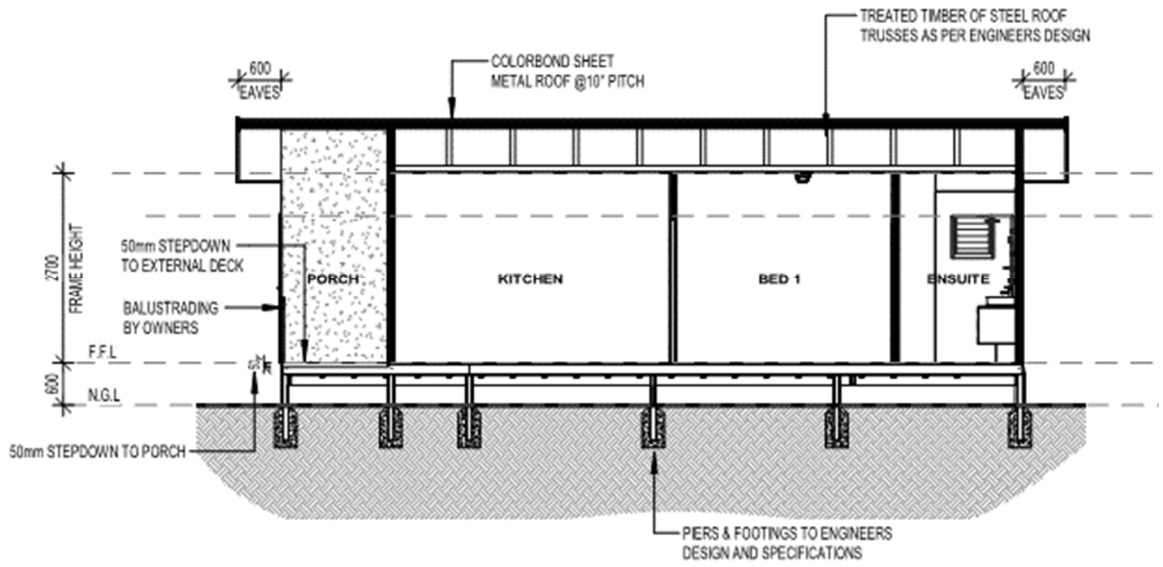


Figure 2: Section of Intended Use – Framed Sub-floor

The Panelok™ Wall Panel system is fixed at the base using the steel base channel, which is fixed either to a concrete footing system, or a framed sub-floor. Refer to Figure 3 illustrating the base plate fixing.

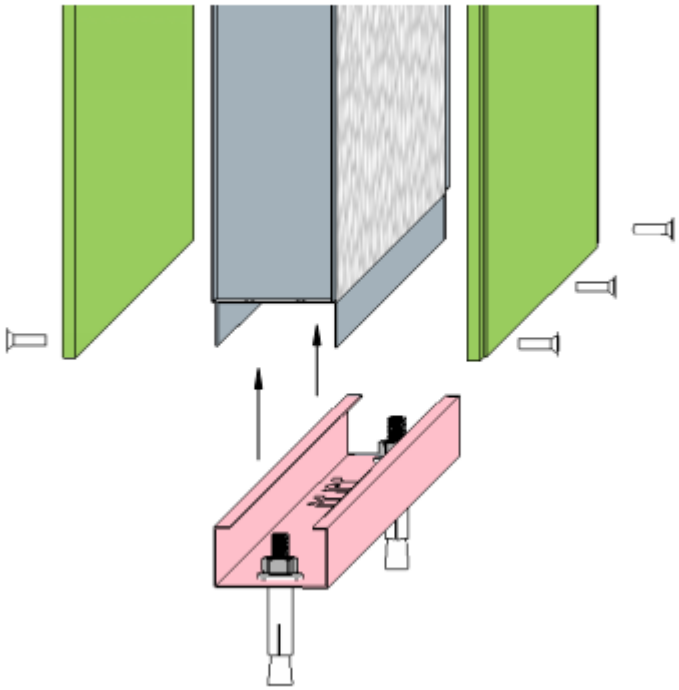


Figure 3: Typical Bottom Plate Fixing

The SIPS wall system is connected to the roof framing system via a wall top plate, which is a steel channel insert fixed to the external BFC exterior. Refer to Figure 4 for typical wall top plate fixing.

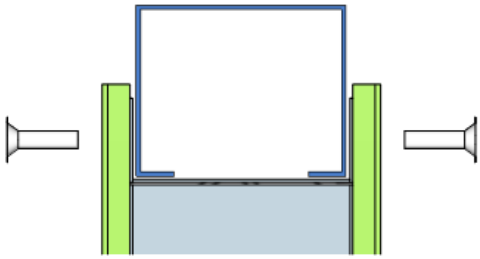
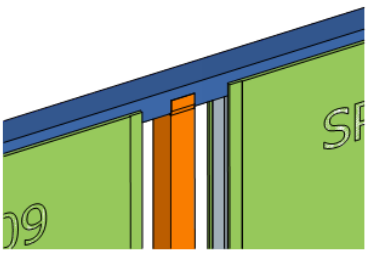
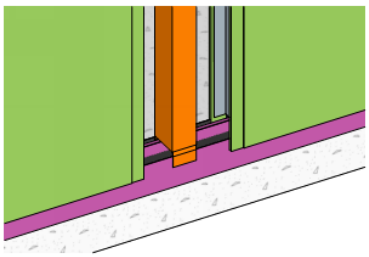


Figure 4: Typical Top Plate Fixing

Panels are fixed together using the structural join system. Refer to Figures 5 illustrating the panel join system via a steel channel insert. The external BCF to the exterior of the panels is joined to the steel channel with the prescribed fixings.

Top View





Bottom View

Figure 5: Typical Wall Panel Join

3 Performance Evaluation

3.1 Performance Solution 1 – Panelok™ Wall System

3.1.1 Introduction

The table below briefly describes the proposed Performance Solution, the relevant BCA deemed-to-satisfy clause and Performance Requirements;

Table 6: Proposed Performance Solution and DtS Provision

Performance Solution	Building Code of Australia	
	DtS Construction Provision	Performance Requirement
To permit the use of the Panelok™ Wall Panel system against the Performance Requirement P2.2.2 of the National Construction Code 2019 (NCC) – Volume 2, Amendment 1		P2.2.2 (Weatherproofing)

The purpose of this evaluation is to assess the performance requirement of the Panelok™ wall panel system, being a SIPS wall panel with alternative finishes of paint, render and external horizontal or vertical cladding fixed to the wall panels against the Performance Requirements P2.2.2 of the BCA Volume 2, Amendment 1 2019.

3.1.2 BCA Objective

To meet the Performance Requirements of the BCA, Roofs and walls (including windows, doors, and other openings in the walls) must prevent water penetration which could cause dangerous conditions, loss of amenity or undue dampness or deterioration of building elements.

Under BCA Volume 2, Amendment 1, Performance Requirements P2.2.2- Weatherproofing, must be satisfied.

Performance Requirement P2.2.2 advises that:

A roof and external wall (including openings around windows and doors) must prevent the penetration of water that could cause-

a) Unhealthy or dangerous conditions, or loss of amenity for occupants; and
b) Undue dampness or deterioration of building elements

The objective statement O2.2 for Damp & Weatherproofing states that:

a) Safeguard occupants from illness or injury and protect the building from damage caused by-
  i) Surface water; and
  ii) External moisture entering a building; and
  iii) The accumulation of internal moisture in a building; and
  iv) Discharge of swimming pool waste water; and
b) Protect other property from damage cause by-
  i) Redirected surface water; and
  ii) The discharge of swimming pool waste water.

The functional statements F2.2.2 states that:

A building is to be constructed to provide resistance to moisture from the outside and moisture rising from the ground.

Under the BCA Volume 2, Amendment 1, external timber and composite wall cladding to the external walls are considered to satisfy Performance Requirement P2.2.2 for weatherproofing where the Acceptable Construction Requirements listed under Part 3.5.4 – Weatherproofing of Timber and Composite Wall Cladding are satisfied.

Where the cladding finish alternative is used to the exterior of the SIPS wall panels, it will be to the requirements of the DtS Provisions of Part 3.5.4 Timber and composite wall cladding, and will achieve for weatherproofing of the SIPS Panelok™ Wall Panel system if it satisfies the requirements of Part 3.5.4.2 Timber wall cladding.

Part 3.5.4.2 Timber Wall Cladding

Clause 3.5.4.2 of the BCA details Acceptable Construction Requirements for timber wall cladding as follows:

Timber wall cladding must be installed as follows:

a) Splayed timber weatherboards must be fixed in accordance with Figure 3.5.4.1 and with a lap not less than-
- *i) 30mm for hardwood, Cypress and treated pine; and*
- *ii) 20mm for Western Red Cedar; and*
- *iii) 25mm for Baltic Pine.*

b) Profiled timber boards must be-
- *i) Fixed in a horizontal, vertical, or diagonal direction with the overlap and groove closely fitted, where provided; and*
- *ii) With tongue and groove profile, fixed with tongue edge up, where they are fixed in a horizontal or diagonal direction; and*
- *iii) Where fixed in a vertical or diagonal direction, provide with a vapour permeable sarking complying with AS 4200.1 (figure 3.5.4.2) installed behind boards with-*
  - *a. Each adjoining sheet or roll being-*
    - *i. Overlapped not less than 150mm; or*
    - *ii. Tapped together; and*
  - *b. Sarking fixed to supporting members at not more than 300mm centres.*

c) Splayed and profiled timber weatherboards must be fixed in accordance with Table 3.5.4.1 with –
- *i) One fixing at each stud or equivalent framing member for splayed timber weatherboards; and*
- *ii) One fixing provided at each stud or equivalent framing member for profiled timber board more than 130mm wide; and*
- *iii) Fixings located so that the fixing does not penetrate the top or thinner edge of the board beneath.*

3.1.3 Performance Solution Procedure

Under section A2.2 of the BCA, a Performance Solution is achieved by demonstrating-

a) Compliance with all relevant Performance Requirements; or

b) The solution is a least equivalent to the Deemed-to-satisfy provisions.

Furthermore, a Performance Solution must be shown to comply with the Performance Requirements through one or a combination of the following Assessment Methods:

a) Evidence of suitability in accordance with Part 5A that shows the use of a material, product, plumbing and drainage product, form of construction or design meets the relevant performance requirements.
b) Verification Method including the following:
i) The Verification Methods provided in the NCC.
ii) Other Verification Methods accepted by the appropriate authority that show compliance with the relevant Performance Requirements.
c) Expert Judgement.
d) Comparison with the Deemed-to-Satisfy Provisions.

The method of approach for this Performance Solution is outlined in the flowchart below.

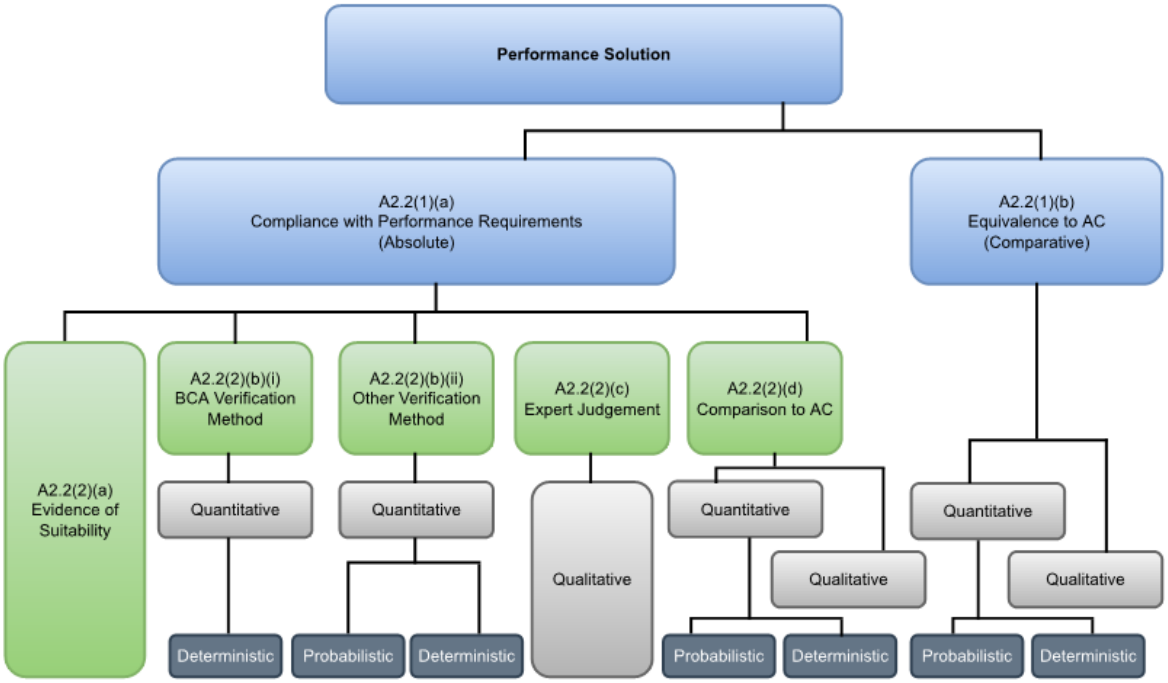


Figure 6 – Proposed Procedure

In accordance with A2- compliance with the NCC, a method for demonstration of compliance may come in the form of 'Evidence of Suitability'. Evidence of suitability in accordance with Part A5 that shows the use of a material, product, form of construction or design meets the relevant Performance Requirements.

Under part A5, Evidence of Suitability may be in the form of one of the following:

a) A current CodeMark Australia or CodeMark Certificate of Conformity.

b) A current Certificate of Accreditation.

c) A current certificate, other than a certificate described in (a) and (b), issued by a certification body stating that the properties and performance of a material, product, form of construction or design fulfil specific requirements of the BCA.

d) A report issued by an Accredited Testing Laboratory that-
e) Demonstrates that a material, product, or form of construction fulfils specific requirements of the BCA; and

ii) Sets out the tests the material, product or form of construction has been subjected to and the results of those tests and any other relevant information that has been relied upon demonstrate it fulfils specific requirements of the BCA.

e) A certificate or report from a professional engineer or other appropriately qualified person that-
i) certifies that a material, product, form of construction or design fulfils specific requirements of the BCA; and

ii) sets out the basis on which it is given and the extent to which relevant standards, specifications, rules, codes of practice or other publications have been relied upon to demonstrate it fulfils specific requirements of the BCA.

f) Another form of documentary evidence, such as but not limited to a Product Technical Statement, that-
i) demonstrates that a material, product, form of construction of design fulfils specific requirements of the BCA; and

ii) sets out the basis on which it is given and the extent to which relevant standards, specifications, rules, codes of practice or other publications have been relied upon to demonstrate it fulfils specific requirements of the BCA.

3.1.4 Design Criteria

External cladding systems must be able to resist actions that they may be reasonably subject to, including but not limited to; live and dead loads, rainwater, wind, earthquake, thermal actions. In particular though, they must be able to resist the penetration of water into a building, which may cause unhealthy or dangerous conditions, loss of amenity for occupants and undue dampness or deterioration of building elements risking the life and safety of the building occupants.

The external walls are proposed to be constructed of 100mm SIPS panels with an 80mm EPS centre, which make up the Panelok™ Wall Panel System. Panelok™ Wall Panels are a SIPS wall panel of 80mm thick EPS thermal core, with a 10mm Bamboo Fibre Cement (BFC) Sheet to the exterior of the SIPS panel each side of the wall panel. The wall panels will be finished off with either render, paint or cladding finish of horizontal or vertical cladding, fixed to the external face of the wall panels in accordance with the cladding manufacturers guidelines. All wall claddings are to meet the profile and fixing requirements of DtS provision Part 3.5.4.2.

Perimeter steel channels will be used to provide the mechanical fixings necessary to fix the wall panels at the top and base, and for the fixing of panel vertical joins.

Each Panelok™ Wall Panel will be applied with a coating of Panelok™ Impreg Sealer to both the exterior and interior of the wall panels as per the manufacturer's specifications for a coating thickness of 180g/m2.

All windows will be fixed to panel openings via the steel perimeter channels, and will be fixed to the wall openings as per the Panelok™ specifications using 2M10 Tek screws at 600 spacings around the perimeter of the window opening.

Panelok™ Ultra-Flex will be applied to all panel joins, both vertical panel to panel joins, and the joins at windows in accordance with the Panelok™ specifications and installation guidelines. The application of both the Panelok™ Impreg Sealer to interior and exterior of wall panels, and the Panelok™ Ultra-Flex to all panel joins will provide the SIPS wall panel system with a weatherproof coating to the exterior of the building. Figure 7 is an illustration of the Panelok™ Impreg Sealer and Ultra-Flex Sealer application to the wall panels.

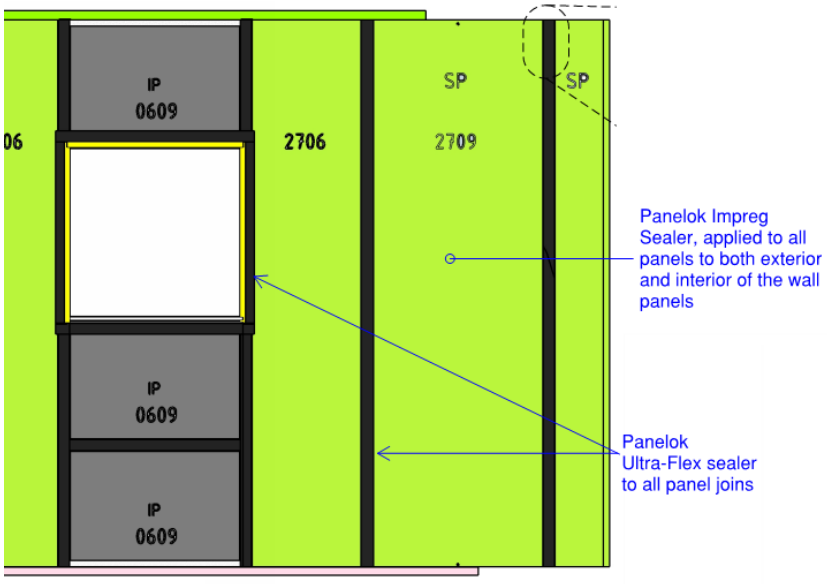


Figure 7 – Panelok™ Impreg Sealer & Ultra-Flex

In addition, all windows will be flashed with window flashing installed in accordance with the DtS Provisions of Part 3.5.4.6 of the NCC 2019 Volume 2 Amendment 1, and will be installed as per the compliant wall cladding manufacturers installation guidelines. Figure 8 provides the illustration of the window flashings, applied in accordance with the wall cladding installation requirements.

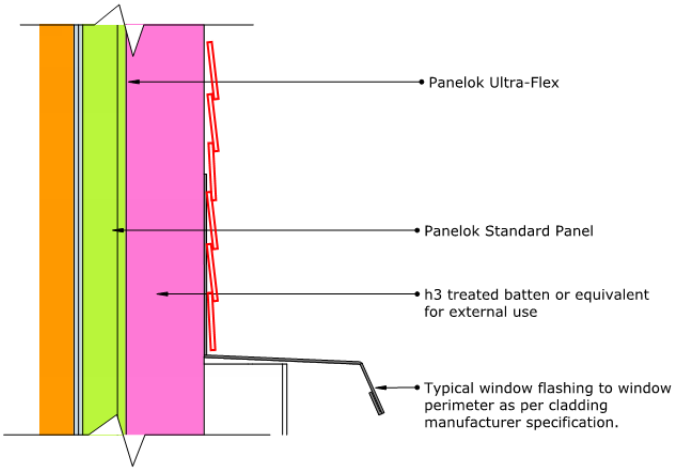


Figure 8 – Window Flashing detail

The SIPS wall panels will have a damp proof course applied at the base of the Panelok™ Wall Panel in accordance with the requirements of AS4773.2:2015 Masonry in Small Buildings, Table 5.2. The damp proof course will be of a material that complies with AS2904, and will comply with AS4773.2, table 5.2. The damp proof course will be installed beneath the wall bottom plate channel, and extend to the inside face of the interior BFC as shown in Figure 9.

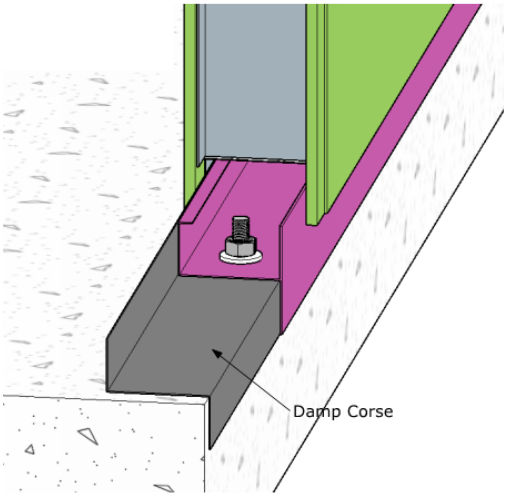


Figure 9 – Installation of Damp-Proof Course

The SIPS panels will be finished with either a paint or render finish, or a cladding finish. For the cladding finish either horizontal or vertical wall cladding that meets the Acceptable Construction requirements of Part 3.5.4.2 of the NCC 2019 Volume 2 Amendment 1 will be applied. Horizontal or vertical H3 treated timber battens are screw fixed to the steel channel panel to panel connectors using tek screws according to the Panelok™ installation guidelines. All timber battens are to be sized and located according to the cladding manufacturers requirements. To achieve compliance with DtS Provision Part 3.5.4.2, timber battens will be spaced no more than 600mm spacings. Where 900mm and 1100mm SIPS wall panels are used, intermediate timber battens are to be fixed mid-span to the wall panels using SikaBond 145 Super Grip, and screw fixed at the top and bottom wall plates in accordance with Panelok™ installation guidelines. Figure 10 is an illustration of the fixing of wall cladding to the timber batten and SIPS wall panels.

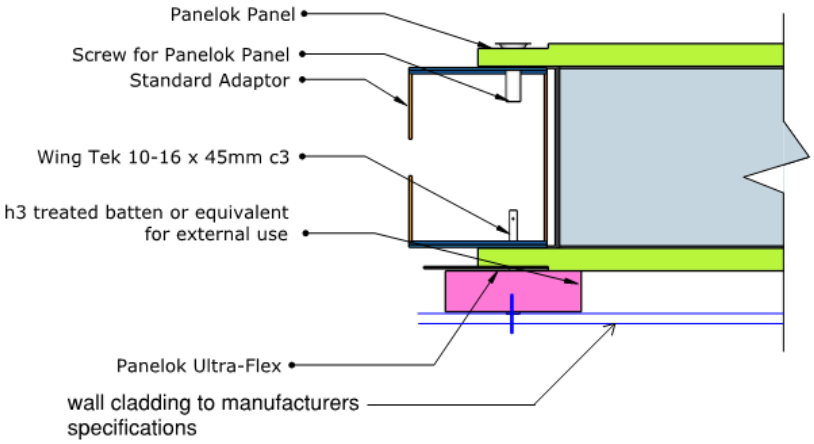


Figure 10 – Fixing of External Wall Cladding

Render finish will be UV resistant and will be applied in accordance with AS55146.3, clause 2.8.4 for external coatings to autoclaved aerated concrete panels. Similarly, the alternative for a paint finish can be used, where the paint finish will be applied in accordance with AS2311-2017 and will be UV resistant. The paint finish will be a three coat system and be applied in accordance with AS4773.2: 2015 clause 11.7

3.1.4.1 Panelok™ Impreg Sealer

The Panelok™ Impreg Sealer is a low viscosity Styrene Acrylic Copolymer, which forms a durable weatherproof membrane to exterior and interior face of the EPS wall panels. The Impreg Sealer, when applied to the Panelok™ BFC sheeting impregnates the entire depth of the BFC sheeting to 8mm penetration, and has been tested to have excellent adhesion to the BFC sheeting.

In accordance with AS4654.2: 2012 *Waterproofing membranes for external above-ground use (Design and Installation),* the Impreg Sealer is classified as a fully bonded membrane in accordance with clause 1.4 of AS4654.2. The Impreg Sealer has been tested by LRM Products Pty Ltd to withstand moisture penetration into the BFC sheeting subjected to a test specimen over a 24hr period. The results of the test provide results of no moisture absorption beyond the Impreg Sealer membrane and demonstrates full moisture repulsion properties. The testing has been recorded in the Panelok Weatherproofing Compliance BCA FP1.4 test report issued by LRM Products Pty Ltd.

AS4654.2-2012 sets out the requirements for the inspection and acceptance of waterproofing membranes in clause 2.16 as follows;

On completion of the installation of a membrane system, inspection and/or acceptance testing shall be conducted.
Note: A visual inspection should be conducted and/or one of the following test procedures undertaken:
a) For a liquid membrane system, the dry film thickness (DFT) to be tested by non-destructive means.
b) A controlled water test to be conducted for a minimum duration of 24hrs.

The Impreg Sealer has demonstrated acceptance with this testing requirements with full water repulsion over a 24hr period.

AS4654.1: 2012 *Waterproofing membranes for external above-ground use (Materials)*, Table 2.1 sets out the requirements for a fully bonded weatherproof membrane, which requires the membrane must demonstrate bond strength to the substrate. In addition, the following requirements must be demonstrated to assume compliance:

- Bond strength to the substrate
- Cyclic movement
- Elongation at break
- Heat Ageing
- Temperature resistance
- Tensile strength
- Thickness
- Durability

LRM Products have conducted testing that demonstrates that the Impreg Sealer permeates throughout the entire volume of the BFC sheet, and consequently adds to the structural strength of the sheeting. A hydraulic pull off test was performed on a BFC sheet that was applied with the

membrane, and also a BFC sheet that had no membrane applied. The testing demonstrates that the Impreg Sealer has permeated the full depth of the BFC substrate to 8mm depth. This test has demonstrated the membrane to be fully consolidated within the fabric of the substrate to the entire depth of the BFC sheeting. With the full consolidation of the membrane to the BFC sheeting demonstrated through testing, it has been proven that the requirements of table 2.1 for Bond strength, cyclic movement, elongation, tensile strength, thickness, and durability is satisfied. With the exclusion of Ultraviolet resistance, heat ageing and temperature resistance, the requirements of Table 2.1 of AS 4654.1: 2012 have been satisfied.

The provision of external wall cladding, paint or render finish to be applied to the external face of the SIPS wall panel satisfies the weatherproofing requirements for ultraviolet resistance, heat ageing and temperature resistance.

The Impreg Sealer will be applied on both the external and internal face of the SIPS wall panels, and will be applied to the BFC sheeting specified by Panelok™.

The Panelok™ Wall Panel system achieves a thermal resistance rating of R2.41 according to the thermal report issued by James M Friker. With a thermally resistant wall panel, combined with the use of the Impreg Sealer applied to the internal face of the wall panels and a well ventilated building, the building will be sealed and breathable to resist the build-up of condensation to the inside of the external walls. This outcome will ensure there is no condensation build up to the inside of the building without the need for wall sarking (wall wrap) as otherwise required.

3.1.4.2 Panelok™ Ultra Flex Sealer

The Panelok™ Wall System will be sealed and weatherproofed at all panel joins, and joins of panels to windows. These joins will be weatherproofed with the application of the Panelok™ Ultra Flex sealant. Ultra Flex Sealer is a polymer modified bitumen emulsion flexible sealant that is the same product (equivalent) to the VersEseal Rapid Build flexible joint sealant developed by LRM Products Pty Ltd. The only variation being the Panelok Ultra Flex has been developed to be of a slightly thicker viscosity to the VersEseal Rapid Build. This change in viscosity was developed by LRM Products to assist in the application process with the vertical joins, and provide a rapid seal and build that Panelok™ requested for their wall system.

VersEseal Rapid Build (VRB) is used to provide a fully adhered seamless waterproof membrane for the waterproofing of plumbing pipes, foundations, waste water storage tanks, and water tanks or reservoir repairs. The VRB will be applied to 1mm-2mm thickness using a tapping tool or trowel as per LRM Products specifications and requirements setout in their product data sheet. VRB has proven to be compliant with AS4654.1:2012 with an elongation of 850%, well exceeding the standards requirement. Further to this it has passed the Abrasion resistance testing and temperature testing. The VRB sealer has also been tested to provide a tensile strength of 412kPa, which far exceeds the water penetration test pressure requirement of 420Pa for wall and window penetration set out in AS2047

The Panelok™ Ultra Flex will be applied to all panel and window joins as per the LRM Products installation guidelines and product data sheet. This will seal the SIPS walls system and provide the weatherproofing necessary to meet the Performance Requirement P2.2 of the NCC2019 Volume 2 Amendment 1.

3.1.4.3 Design Criteria Conclusion

The SIPS wall system will be treated with the describe weatherproofing system, that will allow the wall to repel moisture and allow the dwelling to maintain a dry environment. In addition to this, the

building will be well ventilated with a coating of Impreg Sealer to the internal of the building. This will provide a breathable water repellence of the building from external moisture and internal condensation, and preserve the SIPS panels, thereby weatherproofing the external walls.

The base of the wall panels will have a damp proof course to repel moisture at the base connection of the wall panels and will also be fitted with flashing over all window openings.

As an additional measure, the walls will be fitted with a finish of either paint, render or cladding. The cladding alternative will be vertical or horizontal cladding that is compliant with the Acceptable Construction Provisions of Part 3.5.4.2 of the NCC 2019 Volume 2 Amendment 1. The external cladding will be of an approved profile such as a James Hardie wall clad system, and will be installed in accordance with their relevant product data sheets to ensure compliance. These wall finishes will provide the necessary heat and UV resistance for the longevity of the Panelok™ Wall System.

3.1.5 Evaluation Method

Compliance with the Performance Requirements will be demonstrated through:

- Expert Judgement through the evaluation of the wall system design with regard to waterproofing, and prevention of water penetration to the interior of the building; and
- A qualitative and comparative evaluation will be undertaken, comparing the SIPS wall system with the Acceptable Construction Provision found in the BCA Volume 2 Amendment 1; and
- Evidence of suitability of the Panelok™ Impreg Sealer with evidence of relevant testing; and
- Evidence of suitability of the Panelok™ Ultra Flex with evidence of suitability provided by the VersEseal product data sheet issued by LRM Products.
- Evidence of suitability of the water penetration test pressure, provided by the Water Penetration & Ultimate Strength Testing (NATA Accredited Laboratory No. 15147, Test No AZT0255.12) by Azuma Design Pty Ltd.

3.1.6 Design Scenario

3.1.6.1 Comparison to Acceptable Construction

The proposed Performance Solution will be compared with a comparable design that fully complies with the Acceptable Construction Provisions of a building with the same class, use, number of levels and population characteristics as the proposed Performance Solution, except:

- The subject wall will be constructed of an SIPS wall system that complies with Acceptable Construction Clause 3.3.4.0 (Masonry), and have a damp proof course installed in accordance with AS4773.1 & AS4773.2.

3.1.7 Acceptance Criteria

The acceptance criterion for this Performance Solution is that the SIPS Wall design and selected product properties are demonstrated to meet the compliance requirements of AS4773.1 & AS4773.2, and are therefore deemed to fulfil the Performance Requirements P2.2.2 of the NCC Volume 2 Amendment 1 to prevent water penetration for waterproofing.

3.1.8 Evaluation

3.1.8.1 Comparison to AS4773.1 & AS4773.2

In accordance with the NCC and BCA Volume 2 Amendment 1, there are no DtS construction provisions for the construction of buildings using an SIPS wall system. As a consequence, the external walls of the buildings must demonstrate they will prevent water penetration into the interior of the building through a Performance Solution.
Acceptable Construction Provision of the NCC 2019 Volume 2 Amendment 1 Part 3.3.5 provides the acceptable construction of walls to meet the Performance Requirement P2.2.2 if the walls are constructed in accordance with AS 4773.1 and AS4773.2.

AS4773.1 Clause 14.8 provides the satisfactory requirements of the standard to provide resistance to moisture penetration. In particular, Clause 14.8.1 requires single leaf masonry to be coated with a weather-resistant coating:

> *AS 4773.1, Clause 14.8.1*
> *Where a habitable room has an external wall of single-leaf masonry that is not sheltered from the rain, the single-leaf masonry wall shall be protected on the outside face with a suitable weather-resistance coating.*

AS4773.1 Clause 14.8 further sets out the requirements for a damp-proof course to be provided to single leaf masonry in Clause 14.8.2:

> *AS4773.1, Clause 14.8.2*
> *Damp-proof courses (DPCs) Shall be provided to protect all masonry against rising ground water. The DPC shall be placed as low as possible in the wall and in no case higher than the finished floor level.*
> *The position of the DPC shall be not less than-*
>
> a. *150mm above the adjacent finished ground level;*
> b. *100mm above sandy well-drained areas that extend to the full depth of the footing system;*
> c. *75mm above the finished paved or concrete area; or*
> d. *50mm above finished paved or concreted area and protected from the direct effect of the weather by a carport, veranda or similar structure.*

In the construction of a single leaf masonry wall that is external and requires weatherproofing, under DtS Provision P3.3.5, the wall must be constructed in accordance with AS4773.1, Clause 14.8 for weatherproofing requirements. Compliance with AS4773.1 for weatherproofing satisfies the Performance Requirement P2.2 of the NCC 2019 Volume 2 Amendment 1.

For the case of the Panelok™ Wall System, which is a SIPS wall system, the wall panels will be protected with the weather proof coating of the Impreg Sealer over all the wall panels, and Ultra Flex Sealer to all panel and window joins. In addition to this, the weatherproofed panels will be provided with a protective coating of either paint, render or cladding. The cladding alternative will be horizontal or vertical cladding, fixed to the walls in accordance with Part 3.5.4.2 of the NCC requirements.

In addition, the SIPS wall panels will be provided with a Damp-proof course, that will be installed to meet the requirements of AS4773.1, Clause 14.8.2.

Therefore, the weatherproofing capabilities of the proposed SIPS wall panel system is comparable to the weatherproofing capabilities of a newly installed single leaf masonry wall. Therefore, the

Panelok™ Wall Panel system will satisfy the Performance Requirement P2.2.2, and the proposed Performance Solution satisfies the acceptance criterion.

3.1.8.2 Evidence of Suitability – Panelok™ Impreg Sealer

The Panelok™ Impreg Sealer has been tested by LRM Products Pty Ltd to justify use as a suitable weatherproof membrane to the SIPS panels. The testing has been recorded in the Panelok Weatherproofing Compliance BCA FP1.4 test report issued by LRM Products Pty Ltd. This testing has demonstrated to meet the performance requirements for a weatherproofing sealer stipulated in AS4654.2-2012 for use as a protected weatherproofing membrane.

The use of the Impreg Sealer as a weatherproofing membrane satisfies the Performance Requirement P2.2.2 of the NCC2019 Volume 2 Amendment 1.

3.1.8.3 Evidence of Suitability – VersEseal Product Data Sheets

The use of the VersEseal Rapid Build (VRB) for the weatherproofing of panel joins and window joins is a suitable method for moisture repulsion at the joins. The VersEseal Product Data Sheet issued by LRM Products Pty Ltd demonstrates the testing and material properties of the flexible sealant used to weatherproof the SIPS panel joins. The VRB Product Data Sheet demonstrates product suitability for elongation, tensile strength, abrasion resistance and water repulsion with the correct application of the VRB product.

With the evidence of suitability, the use of the VRB to provide weatherproofing of all panel joins and window joins satisfies the Performance Requirement P2.2 of the NCC2019 Volume 2 Amendment 1.

3.1.8.4 Evidence of Suitability – Water Penetration Test Pressure

Azuma Design Pty Ltd have provided laboratory testing in accordance with the NATA's accreditation requirements. The testing is for the water penetration test pressure of up to 450Pa test pressure applied for 15 minutes onto the window installation to the SIPS panels. The testing was done in accordance with AS4420.5, and satisfied the requirements for weatherproofing of windows to buildings in accordance with AS2047.

The testing is recorded within the Laboratory Report for test number AZT0255.12, with the testing performed in the NATA accredited laboratory No. 15147.

The window joins were sealed as per the Panelok™ installation guidelines and passed the requirements of AS2047 for weatherproofing of windows to buildings. With the evidence of suitability, the window joins satisfy the Performance Requirement P2.2 of the NCC2019 Volume 2 Amendment 1.

3.1.9 Summary

Based on the above evaluation, the following has been determined:

- Through expert judgement, the Panelok™ Wall System design has been deemed suitable to meet the Performance Requirements with regard to waterproofing, to prevent water penetration to the interior of the building.
- The weatherproofing of the SIPS wall system is comparable to the DtS provision Part 3.3.4.0 for a single leaf masonry construction, and is demonstrated to exceed the requirements of this Acceptable Construction Provision for weather proofing.

- The Panelok™ Impreg Sealer satisfies the weatherproofing requirements of a water repulsion membrane as evidence by Panelok Weatherproofing Compliance BCA FP1.4 test report issued by LRM Products Pty Ltd.
- The Panelok™ Ultra Flex (VersEseal Rapid Build) satisfies the weatherproofing requirements as a suitable water repulsion membrane at panel and window joins, as demonstrated in the VersEseal Rapid Build Product Data Sheet.
- The Panelok™ Wall System satisfyies weatherproofing requirements for window installation as demonstrated in the Laboratory Report for test number AZT0255.12 prepared by Azuma Design Pty Ltd

3.1.10 Conclusion

The evaluation undertaken, has determined that the design criteria will provide a product that has the property requirements for the performance deemed to fulfil the specific requirements of the NCC. It is our considered conclusion that the Performance Solution for the use of the Panelok™ Wall Panel system satisfies the Performance Requirements P2.2.2 of the NCC2019 Volume 2 Amendment 1.

The proposed Performance Solutions therefore satisfies the acceptance criterion.

4 References

ABCB. (2020) National Construction Code Series Volume 2 Amendment 1 – Building Code of Australia 2019. Canberra: Australian Building Codes Board.

Laboratory Report Test No. AZT0255.12 by Azuma Design Pty Ltd, dated 16-10-2012

VersEseal Rapid Build Product Data Sheet by LRM Product Pty Ltd, dated 27-04-2016

Thermal Performance Calculations by James M Fricker Pty Ltd, dated 22-05-2018

Panelok Weatherproofing Compliance – BCA FP1.4 laboratory testing by LRM Products Pty Ltd, dated 30-09-2022

Panelok Wall Panel Installation Guidelines Annexure 1 to 5 by Panelok Building Systems Pty Ltd

LRM Products Pty Ltd & Liquid Rubber Manufacturing Pty Ltd ISO9001:2015 Certificate of Registration Certificate No. 4474, dated 19-02-2022

AS2904: 1995 Damp-proof courses and flashing

AS4773.1: 2015 Masonry in small buildings Part 1 (Design)

AS4773.2: 2015 Masonry in small building Part 2 (Construction)

AS1170.0: 2002 Structural design actions Part 0 (General Principles)

AS1170.1: 2002 Structural design actions Part 1 (Permanent, imposed and other actions)

AS1170.2: 2021 Structural design actions Part 2 (Wind actions)

AS2810: 2020 Pains and varnishes – natural weather of coatings – exposure and assessment

AS4654.1: 2012 Waterproofing membranes for external above ground use Part 1 (Materials)

AS4654.2: 2012 Waterproofing membranes for external above ground use Part 2 (Design and installation)

AS2047: 2014 Windows and external glazed doors in buildings

AS4420.5: 2022 Metallic materials – Instrumented indentation test for hardness and materials parameters – Part 5 (Linear elastic dynamic instrumented indentation testing)

AS2311: 2017 Guide to the Painting of Buildings