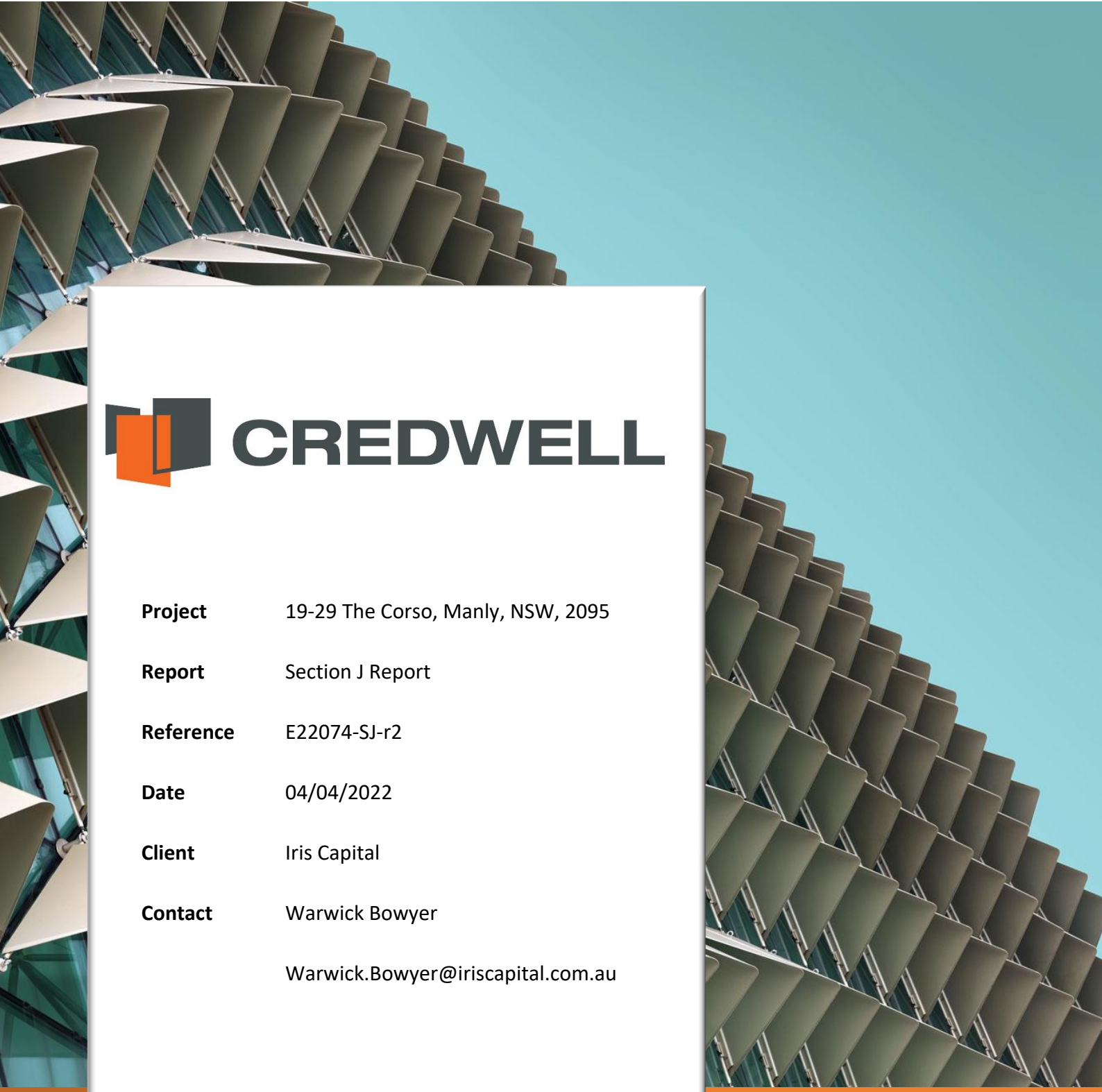

CREDWELL

Project	19-29 The Corso, Manly, NSW, 2095
Report	Section J Report
Reference	E22074-SJ-r2
Date	04/04/2022
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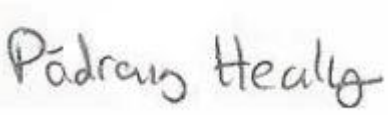
Document Control

Reference/Revision	Date	Description	Section J Energy Efficiency Assessment
E22074-SJ-r2	4/04/2022	**Prepared by**	
			Edward Wu
			ESD/ Sustainability Engineer
		Approved by	
			Padraig Healy
			Director

Contents

1 Executive Summary

Credwell Energy has been engaged to review the proposed cladding replacement for 19-23 The Corso, Manly against the Deemed-to-Satisfy requirements for the National Construction Code 2019 provisions for energy efficiency under Section J (NCC 2019, Part J).

This report nominates the relevant NCC Section J requirements or 'deemed to satisfy' compliance provisions and possible areas in which alternative performance-based design solutions can be adopted where compliance with the nominated prescriptive provisions may not be practically achievable.

Section J	Building fabric on envelope	Compliance
J0	**Energy Efficiency**	Refer to section 4.1. Thermal Breaks
J1	**Roof solar absorptance**	N/A. Roof SA
	Roof	N/A. Roof total R-value Thermal Calculation
	External Wall (Metal cladding etc)	Min total R-value of R1.40 including thermal bridging. Method 2 - Total Facade Calculations Wall Thermal Bridging Calculation
	Solar Admittance of Externally Facing Wall-Glazing Construction	Must not be greater than 0.13. Solar Admittance
	Suspended/Exposed Floor	N/A. Floor Total R-value
	Proposed glazing to the North & West to comply	Total (Including frame) U-value/SHGC: • West Glazing U-value 7.5 & SHGC 0.75 or less. • North Glazing U-value 7.5 & SHGC 0.35 or less. Method 2 - Total U-value Calculations Method 2 - SHGC Calculations
J3	**Building Sealing**	Refer to section 4.3. Building Sealing
J5	**Air-Conditioning & Ventilation Systems**	Refer to section 4.5. AC & Ventilation
J6	**Artificial Lighting & Power**	Refer to section 4.6. Artificial Lighting
J7	**Heated Water Supply and Swimming Pool & Spa Pool Plant**	Refer to section 4.7. Heated Water
J8	**Facilities for Energy Monitoring**	Refer to section 4.8. Energy Monitoring

Subject to satisfaction of the provisions outlined in this report, this development will comply with the requirements of Section J of NCC 2019.

Only the new works are to comply with the NCC.

This application includes 25, 27 and 29 The Corso for the purpose of subdivision, as there are no works proposed, there is no requirement for any additional treatments to these sections of the site.

N-B - Click on the hyperlinks to go to each detailed section

2 Introduction

Section J of the NCC sets regulations for energy efficiencies for all types of buildings with respect to the building's construction, design, and activity.

The objective of the NCC Section J is to reduce the greenhouse gas emissions. Section J requires that a building, including its services, must have features to the degree necessary that facilitate the efficient use of energy.

The NCC offers two compliance methods that differ in complexity and flexibility. The two compliance methods are:

- Deemed-to-Satisfy (DTS) Compliance.
- JV3 - Verification using a referenced building.

This report provides an assessment of building according to DTS provisions. The following works were carried out to assess DTS compliance:

- Determine the applicable NCC Section J requirement for the climate zone and building class.
- Provide recommendations to achieve compliance with DTS provisions.

2.1 Limitations

This report does not include, nor imply, any audit, assessment or upgrading of:

1. Sections B, C, D, E, F, G, H, and I of the NCC;
2. The structural design of the building;
3. The capacity or design of any electrical, fire, hydraulic or mechanical services; and
4. The Disability (Access to Premises – Building) Standards 2010 and the Disability Discrimination Act 1992 (Cth);
5. Volume 3 of the NCC – The Plumbing Code.
6. This report does not include, nor imply, any assessment of or compliance with:
7. Any Development Consent conditions;
8. The Liquor Licencing Act 1997;
9. The Work Health and Safety Act 2011;
10. The Swimming Pools Act 1992; and

2.2 Reviewed Documentation

This assessment is based on drawings:

Drawing Name	Number	Revision	Issue
Ground and 1st Floor Plans – Proposed	DA-15	E	14/03/2022
2nd and 3rd Floor Plans – Proposed	DA-16	E	14/03/2022
Roof Plan – Proposed	DA-17	E	14/03/2022
Proposed – Elevations North and South	DA-18	D	17/03/2022
Proposed – Elevations East and West	DA-19	D	17/03/2022
Proposed – Sections	DA-20	D	17/03/2022

3 Building Description

For the purposes of the NCC, the building is described as follows:

3.1 Classification

Class	Use	Area
6	Retail/Café	Ground Floor

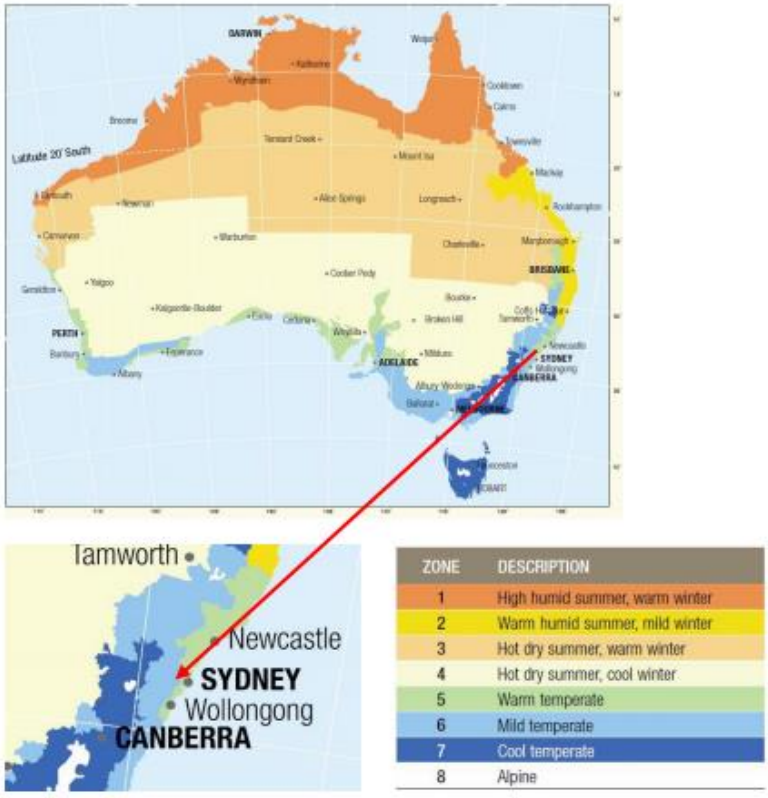
3.2 Thermal Envelope

The thermal envelope of the building is described as follows and as per the marked-up floor plan in Appendix B Building Envelope.

3.3 Climate Zone

The climate zone is defined by the NCC as 'an area for specific locations, having energy efficiency provisions based upon a range of similar climatic characteristics.

The development will be located at Manly being within the Northern Beaches Council NSW government area which is within Climate Zone 5 (Warm temperate) of the National Construction Code.



Climate Zone for the development – Source: NCC Climate Zone Map

4 Detailed Assessment

4.1 Part J0 - Energy Efficiency

J0.0 - Deemed-to-Satisfy Provisions

(a) To comply with the DTS requirements of Section J and thus the Performance Requirement of Section J (JP1) the following clauses must be applied:

(i) J0.2 to J0.5; and
(ii) J1.1 to J1.6; and
(iii) J3.1 to J3.7; and
(iv) J5.1 to J5.12; and
(v) J6.1 to J6.8; and
(vi) J7.1 to J7.4; and
(vii) J8.1 to J8.3.

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J0.1 - Application of Section J

The Performance Requirement is satisfied by complying with -

(a) for reducing the heating or cooling loads -
  (i) of a Sole-occupancy units or a Class 4 (only dwelling in a building), J0.2 to J0.5 and;
  (ii) for a Class 2-9 building Parts J1-J3; and
(b) for A/C and ventilation, Part J5; and
(c) for artificial lighting and power, Part J6; and
(d) for heated water supply and swimming pool and spa pool plant, Part J7; and
(e) for facilities for monitoring, Part J8.

J0.2 - Heating and cooling loads of sole-occupancy units of a Class 2 building or a Class 4 part

The sole-occupancy units of a Class 2 building or Class 4 part of a building must -

(a) for reducing the heating and cooling loads -
  (i) collectively achieve an average energy rating of not less than 6 stars*, including the separate heating and cooling limits; and
  (ii) individually achieve an energy rating if not less than 5 stars*, including the separate heating and cooling load limits*, and
  (iii) use the appropriate NatHERS approved software.

  ***Note in NSW BASIX applies and therefore Part J0.2 is not applicable.**

(b) for general thermal construction, comply with J1.2; and
(c) for thermal breaks, comply with J0.4 and J0.5; and
(d) for floor edge insulation, comply with J1.6 (b) and J1.6 (c); and
(e) for building sealing, comply with Part J3.

J0.3 - Ceiling fans - N/A

J0.4 - Roof thermal breaks - N/A

J0.5 - Wall thermal breaks

For compliance with J0.2(c), a wall that -

(a) does not have a wall lining or has a wall lining that is fixed directly to the same metal frame; and
(b) has a lightweight external cladding such as weatherboards, fibre-cement or metal sheeting fixed to a metal frame,

must have a thermal break, consisting of a material with an R-value of not less than R0.2, installed at all points of contact between the external cladding and the metal frame.

Compliance can be met by:

Wall thermal break	Compliance
Concrete Wall	N/A.
Lightweight metal external cladding fixed to a timber frame	N/A.
Lightweight metal external cladding with internal plasterboard on top hats	N/A.

4.2 Part J1 - Building Fabric

J1.1 - Application of part

The DTS provisions of this part apply to building elements forming the envelope of a Class 2 to 9 building other than J1.2(e), J1.3, J1.4, J1.5 and J1.6(a).

J1.2 - Thermal construction - general

(a) Insulation where it is required must comply with AS/NZS 4859.1 and be installed so that it -
  (i) abuts or overlaps adjoining insulation other than at supporting members such as studs, joists, furring channels, and the like where the insulation must be against the member; and
  (ii) forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that contribute to the thermal barrier; and
  (iii) does not affect safe or effective operation of a service or fitting.

(b) Where required, reflective insulation must be installed with -
  (i) the necessary airspace to achieve the required R-value between a reflective side of the reflective insulation and the building lining or cladding; and
  (ii) the reflective insulation must fit tight against any penetration, door or window opening; and
  (iii) the reflective insulation must be adequately supported by framing members; and
  (iv) each adjoining sheet of roll membrane overlapped 50mm or taped together.

(c) Where required, bulk insulation must be installed so that -
  (i) it maintains position and thickness, other than where it is compressed between cladding and supporting members, water pipes, electrical cabling or the like; and
  (ii) within a ceiling where there is no reflective or bulk insulation in the wall beneath, it overlaps the wall by 50mm or more.

(d) All materials are deemed to have properties as per table 2a of Specification J1.2.

(e) The required Total R-Value and Total System U-value, including allowance for thermal bridging must be calculated in accordance with AS/NZS 4859.2 for a roof or floor; determined in accordance with Spec J1.5a for wall-glazing construction or in accordance with Spec J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

The building envelope applicable to this report consists of any glazing-wall, floor or roof that separates a conditioned space or habitable room from the exterior of the building or a non-conditioned space. This may consist of an internal wall separating an unconditioned room from a conditioned room. *See Annexure B for the Building Envelope applicable to this building.*

A conditioned space means a space within a building, including a ceiling or under-floor supply air plenum or return air plenum, where the environment is likely, by the intended use of the space, to have its temperature controlled by air-conditioning.

Air-conditioning for the purposes of Section J, means a service that actively heats or cools the air within a space, but does not include a service that directly:

- heats or cools hot or cold rooms, or
- maintains specialised conditions for equipment or processes, where this is the main purpose of the service.

J1.3 - Roof and ceiling construction N/A

J1.0 - Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
  (i) J1.1 to J1.6; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J1.4 - Roof Lights N/A

J1.5 - Walls and glazing

(i) The Total System U-Value of wall-glazing construction must not be greater than –
  (i) for a Class 5 building other than a ward area, a value of U2.0; and
  ~~(ii) for a Class 3 or 9c building or a Class 9a ward area –~~
    ~~(a) in climate zone 5, a value of U2.0;~~

(ii) The Total System U-value of display glazing must be greater than U5.8.

(iii) The Total System U-value of wall-glazing construction must be calculated in accordance with Spec J1.5a.

Wall Thermal Bridging Calculation

(iv) Wall components of a wall-glazing construction must achieve a minimum Total R-value of -
  (i) Where the wall is less than 80% of the area of the wall-glazing construction, R1.0; or
  (ii) Where the wall is 80% or more of the area of the wall-glazing construction, the value specified in the table below.

Compliance can be met by:

Climate zone	Class 6
5	R1.4

Note: For the wall construction make-up and insulation requirements for this project please refer to Appendix A. Building Sealing

(v) The solar admittance of externally facing wall-glazing construction must not be greater than -

(i) For a Class 6 building, the values specified in the table below: and

~~(ii) For a Class 3 or 9c building or a Class 9a ward area, the values specified in the table below.~~

Compliance can be met by:

Class 6				
Climate zone	**Eastern SA**	**Northern SA**	**Southern SA**	**Western SA**
5	0.13	0.13	0.13	0.13

(vi) The solar admittance of a wall-glazing construction must be calculated in accordance with Specification J1.5a.

(vii) The Total System SHGC of display glazing must not be greater than 0.81 divided by the applicable shading factor specified in Clause 7 of Specification J1.5a.

Note: For the SHGC (glass type) requirements for this project please refer to Appendix A. Façade Calculations

Specification J1.5a - Calculation of U-value

There are two methods to calculate the U-value required. In this report method 1, 2 has been used to calculate the Total System U-value.

~~a) Method 1 - (Single Aspect) - For the purpose of this method, a wall-glazing construction only includes the walls and glazing facing a single aspect~~

~~OR~~

b) Method 2 - (Multiple Aspects) - For the purposes of this method, a wall-glazing construction includes the walls and glazing facing multiple aspects.

(i) The total System U-value of the wall component of a wall-glazing construction must be calculated as the inverse of the Total R-value, including allowance for thermal bridging, in accordance with -

(a) AS/NZS 4849.2; or

(b) Specification J1.5b for spandrel panels.

(ii) The Total System U-value of a wall-glazing construction must be calculated as the area-weighted average of the Total System U-Value of each of the components of the wall-glazing construction.

(iii) The total System U-value must not exceed the applicable value in the table above.

Specification J1.5a - Calculation of Solar Admittance

There are two methods to calculate the U-value required. In this report method 1, 2 has been used to calculate the Total System U-value.

(a) Method 1 - (Single Aspect) - The solar admittance of a wall-glazing construction must be calculated in accordance with the following formula:

$$SA = \frac{A_{W1} \times S_{W1} \times SHGC_{W1}}{A_{Wall}} + \frac{A_{W2} \times S_{W2} \times SHGC_{W2}}{A_{Wall}} + \cdots$$

where—
SA = the *wall-glazing construction solar admittance*; and
A_{W1}, $A_{W2, etc}$ = the area of each *glazing* element; and
S_{W1}, $S_{W2, etc}$ = the shading multiplier for each *glazing* element in accordance with Clause 7; and
$SHGC_{W1, W2, etc}$ = the *Total system SHGC* of each *glazing* element; and
A_{Wall} = the total *wall-glazing construction* area.

(i) The solar admittance of the wall-glazing construction must not exceed the applicable value in the table above.

~~OR~~

~~(b) Method 2 - (Multiple Aspects) - The solar admittance of a wall-glazing construction must achieve a representative air-conditioning value less than that achieved by the reference solar admittance, when using the following formula:~~

$$E_R = A_N \alpha_N SA_N + A_E \alpha_E SA_E + A_S \alpha_S SA_S + A_W \alpha_W SA_W$$

where—
E_R = the representative *air-conditioning* energy value; and
$A_{N, E, S, W}$ = the area of the *wall-glazing construction* facing each aspect; and
$\alpha_{N, E, S, W}$ = the *solar admittance* weighting coefficient of each aspect equal to—
(a) where the *glazing* area on an aspect is less than 20% of the *wall-glazing construction* area, 0; and
(b) the values in Table 6a and Table 6b; and
$SA_{N, E, S, W}$ = the *wall-glazing construction solar admittance* of each aspect—
(a) equal to the applicable value in J1.5(b) in the reference case; and
(b) calculated in accordance with Clause 5(a) in the proposed case.

~~N.B - Tables 6a or 6b can be located on page 393 of the NCC.~~

Shading

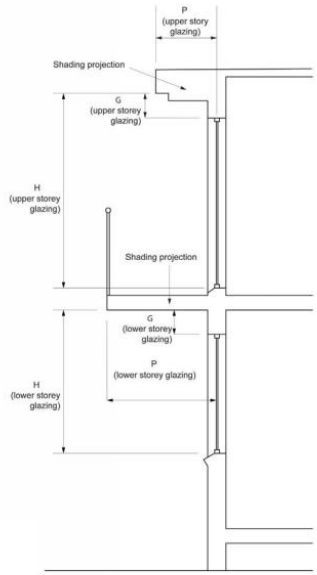
For the purpose of calculating solar admittance, the shading multiplier is -

(a) For shading provided by an external permanent projection that extends horizontally on both sides of the glazing for the same projection distance P, as shown in Figure 7 below -
  (i) the value in Table 7a for shading on the northern, eastern or western aspects; or
  (ii) the value in Table 7b for shading on the southern aspect; or

  N.B - tables 7a or 7b can be located on page 393/394 of the NCC.

(b) 0.35 for shading that is provided by an external shading device such as a shutter, blind, vertical or horizontal building screen with blades, battens or slats, which -
  (i) is capable of restricting at least 80% of the summer solar radiation; and
  (ii) if adjustable, will operate automatically in response to the level of solar radiation.

Figure 7 Permanent external shading - Measurement of P, G and H



Specification J1.5b - Spandrel Panel Thermal Performance N/A

J1.6 Floors - N/A

4.3 Part J3 - Building Sealing

J3.0 - Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
(ii) J3.1 to J3.7; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J3.1 - Application of part

The DTS provisions of this part apply to elements forming the envelope of a Class 2 to 9 building, other than:

(a) a building in climate zone 5 whereby the only means of air-conditioning is by using an evaporative cooler; or
(b) a permanent building opening, in a space where a gas appliance is located, that is necessary for the safe operation of a gas appliance; or
(c) a building or space where the mechanical ventilation required by Part F4 provides sufficient pressurisation to prevent infiltration.

J3.2 - Chimneys and flues - N/A

J3.3 - Roof Lights - N/A

J3.4 - Windows and doors

(a) A seal to restrict air infiltration must be fitted to each edge of a door, openable window or the like forming part of the envelope of a conditioned space or the external fabric of a habitable room or public area in climate zone 5.

(b) This does not apply to a window complying with AS2047; a fire door, a smoke door or a roller shutter door, roller shutter grille or other security door or device installed only for out of hours security.

(c) If a seal is required, then it must be a draft protection device for the bottom edge of an external swing door. For the other edges of an openable window or external door a foam or rubber compression strip, fibrous seal or the like.

(d) An entrance to a building, if leading to a conditioned space must have an airlock, self-closing, revolving door or the like other than where the conditioned space has a floor area of more than 50m2.

~~(e) A loading dock entrance, if leading to a conditioned space, must be fitted with a rapid roller door or the like. A rapid roller door means a door that opens and closes at a speed of not less than 0.5 m/s.~~

J3.5 - Exhaust fans

(a) A miscellaneous exhaust fan, such as a bathroom or domestic kitchen exhaust fan, must be fitted with a sealing device such as a self-closing damper or the like when serving a conditioned space or a habitable room in climate zone 5.

J3.6 - Construction of roofs, walls and floors

(a) Ceilings, walls, floors, and any opening such as a window frame, door frame, roof light frame or the like when forming the envelope or the external fabric of a habitable room or public area in climate zone 5 must be constructed to minimise air-leakage.; and

(b) They must be enclosed with internal lining systems that are close fitting at ceiling, wall and floor junctions or sealed at junctions or penetrations by caulking, skirting, architraves, cornices, or the like.

(c) These requirements do not apply to openings, grilles or the like require for smoke hazard management.

J3.7 - Evaporative coolers

(a) An evaporative cooler must be fitted with a self-closing damper or the like when serving a heated space or a habitable room or a public area of a building in climate zone 5.

4.4 Part J4 - N/A

4.5 Part J5 - Air-conditioning and ventilation systems

J5.0 - Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
(i) J5.1 to J5.12; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J5.1 - Application of part

The DTS provisions of this Part do not apply to a Class 8 electricity network substation.

J5.2 - Air-conditioning system control

(a) An air-conditioning system -
(i) must be capable of being deactivated when the building or part of a building served by that system is not occupied; and
(ii) when serving more than one air-conditioning zone or area with different heating or cooling needs, must -
(a) thermostatically control the temperature of each zone or area; and
(b) not control the temperature by mixing actively heated air and actively cooled air; and
(c) limit reheating to not more than -
(aa) for a fixed supply air rate, a 7.5K rise in temperature; and
(bb) for a variable supply air rate, a 7.5K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air is respectively decreased or increased; and
(iii) which provides the required mechanical ventilation must have an outdoor *air economy cycle* if the total air flow rate if any airside component of the air-conditioning system is greater than or equal to the figures in the table below.

Requirement for an outdoor air economy cycle	
Climate zone	**Total air flow rate requiring an economy cycle (L/s)**
5	3000

(iv) which contains more than one water heater, chiller or coil, must be capable of stopping the flow of water to those not operating: and
(v) with an airflow of more than 1000 L/s, must have a variable speed fan when its supply air quantity is capable of being varied: and
~~(vi) when serving a SOU in a Class 3 building, must not operate when any external door of the SOU that open to a balcony or the like, is open for more than one minute: and~~
(vii) must have the ability to use direct signals form the control components responsible for the delivery of comfort conditions in the building to regulate the operation of the central plant; and
(viii) must have a control dead band of not less than 2 degrees Celsius, except where a smaller range is required for specialised application; and

(ix) must be provided with balancing dampers and balancing valves that ensure the max design air or fluid flow is achieved but not exceeded by more than 15% above design at each -
  (a) component; or
  (b) group of components operating under a common control in a system containing multiple components,

  as required to meet the needs of the system at its max operating condition; and

(x) must have automatic variable temperature operation of heated water and chilled water circuits; and
(xi) when deactivated, must close any motorised outdoor air or return air damper that is not otherwise being actively controlled.

(b) When two or more air-conditioning systems serve the same space, they must use control sequences that prevent the systems form operating in opposing heating and cooling modes.

(c) Time switches -
  (i) A time switch must be provided to control an air conditioning system of more than 2kWr and a heater of more than 1kW(heating) used for air-conditioning.
  (ii) The time switch must be capable of switching electric power on or off at variable pre-programmed times and on variable pre-programmed days.
  (iii) These requirements do not apply to an air-conditioning system that servers only one SOU in a Class 2,3 or 9c building or a Class 4 part of a building or a conditioned space where air-conditioning is needed for 24-hour continuous use.

J5.3 - Mechanical ventilation system control

(a) General - A mechanical ventilation system, including one that is part of an air-conditioning system, must -
  (i) be capable of being deactivated when the building or part of the building served by that system is not occupied; and
  (ii) when serving a conditioned space, except in periods when evaporative cooling is being used -
    (a) where specified in the table below, have -
      (aa) an energy reclaiming system that preconditions outdoor air at a minimum sensible heat transfer effectiveness of 60%; or
      (bb)demand control ventilation in accordance with AS 1668.2 if appropriate to the application; and
    (b) not exceed the minimum outdoor air quality required by Part F4 by more than 20%; except where -
      (aa) additional unconditioned outdoor air is supplied for free cooling; or
      (bb) additional mechanical ventilation is needed to balance the required
        exhaust or process exhaust; or
      (cc) an energy reclaiming system preconditions all the outdoor air; and

(iii) For an airflow of more than 1000 L/s, have a variable speed fan unless the downstream airflow is required by Part F4 to be constant.

Required outdoor air treatment		
Climate zone	**Outdoor air flow (L/s)**	**Required measure**
5	>1000	Modulation control or energy reclaiming system

(b) Exhaust systems - An exhaust system with an air flow rate of more than 1000L/s must be capable of stopping the motor when the system is not needed, except for an exhaust system in a SOU unit in a Class 2,3 or 9c building.

(c) Carpark exhaust systems - Carpark exhaust systems must have a control system in accordance with -
(i) 4.11.2 of AS 1668.2; or
(ii) 4.11.3 of AS 1668.2.

(d) Time switches -
(i) A time switch must be provided to a mechanical ventilation system with an airflow rate of more than 1000 L/s
(ii) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.
(iii) The requirements of (i) and (ii) do not apply to -
(a) a mechanical ventilation system that serves -
(aa) only one SOU in a Class 2,3,9c building; or
(bb) a Class 4 part of a building; or
(b) a building where mechanical ventilation is needed for 24-hour occupancy.

J5.4 - Fan systems

(a) Fans, ductwork and duct components that form part of an air-conditioning system or mechanical ventilation system must -
(i) Separately comply with (b), (c), (d), and (e); or
(ii) Achieve a fan motor input power per unit flowrate lower than the fan motor input power per unit flowrate achieved when applying (b), (c), (d) and (e) together.

This report does not include the fan calculator as provided by ABCB or as described by J5.4 (a)(ii).

Below provides an overview of the efficiency, ductwork and pressure drop requirements.

(b) Fans -
(i) Fans in systems that have a static pressure on not more than 200Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

$\eta_{min} = 13 \times \ln(p) - 30;$

where - η_{min} = the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and

p = the static pressure of the system (Pa).

(ii) Fans in systems that have a static pressure above 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

η_{min} = 0.85 x (a x In(P) - b + N) / 100

where - η_{min} = the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and

P = the motor input power of the fan (kW); and

N = the minimum performance grade obtained from the corresponding table
below; and

a = regression coefficient a, obtained from the corresponding table below; and

b = regression coefficient b, obtained from the corresponding table below; and

In = natural logarithm

(iii) The requirements of (i) and (ii) do not apply to fans that need to be explosion proof.

(c) Ductwork -
  (i) The pressure drop in the index run across all straight sections of rigid ductwork and all sections of flexible ductwork must not exceed 1 Pa/m when averaged over the entire length of straight rigid duct and flexible duct. The pressure drop of flexible ductwork sections may be calculated as if the flexible ductwork is laid straight.
  (ii) Flexible ductwork must not account for more than 6m in length in any duct run.
  (iii) The upstream connection to ductwork bends, elbows and tees in the index run must have an equivalent diameter to the connected duct.
  (iv) Turning vanes must be included in all rigid ductwork elbows of 90 degrees or more in the index run except where -
    (a) the inclusion of turning vanes presents a fouling risk; or
    (b) a long radius bend in accordance with AS 4254.2 is used.

(d) Ductwork components in the index run -
  (i) The pressure drop across a coil must not exceed the value specified below.

  (ii) A high efficiency particulate arrestance (HEPA) air filter must not exceed the higher of -
    (a) a pressure drop of 200 Pa when clean; or
    (b) the filter design pressure drop when clean at an air velocity of 1.5 m/s.

  (iii) Any other air filter must not exceed -
    (a) the pressure drop specified in the table below when clean; or
    (b) the filter design pressure drop when clean at an air velocity of 2.5 m/s.

  (iv) The pressure drop across intake louvres must not exceed the higher of -
    (a) for single stage louvres, 30 Pa; and
    (b) for two stage louvres, 60 Pa; and
    (c) for acoustic louvres, 50 Pa; and
    (d) for other non-weatherproof louvres, 30 Pa.
  (v) The pressure drop across a variable air volume box, with the damper in the fully open position, must not exceed –
    (a) for units with electric reheat, 100 Pa; and
    (b) for other units, 25 Pa not including coil pressure losses
  (vi) Rooftop cowls must not exceed a pressure drop of 30 Pa.
  (vii) Attenuators must not exceed a pressure drop of 40 Pa.
  (viii) Fire dampers must not exceed a pressure drop of 15 Pa when open.
  (ix) Balancing and control dampers in the index run must not exceed a pressure drop of 25 Pa when in the fully open position.
  (x) Supply air diffusers and grilles must not exceed a pressure drop of 40 Pa.
  (xi) Exhaust grilles must not exceed a pressure drop of 30 Pa.
  (xii) Transfer ducts must not exceed a pressure drop of 12 Pa.
  (xiii) Door grilles must not exceed a pressure drop of 12 Pa.
  (xiv) Active chilled beams must not exceed a pressure drop of 150 Pa.

(e) The requirements of (a), (b), (c), and (d) do not apply to -
(i) fans in unducted air-conditioning systems with a supply air capacity of less than 1000 L/S; and
(ii) smoke spill fans, except where also used for air-conditioning or ventilation; and
(iii) the power for process-related components; and
(iv) kitchen exhaust systems.

J5.5 - Ductwork insulation

(a) Ductwork and fittings in an A/C system must be provided with insulation -
(i) complying with AS/NZS 4859.1; and
(ii) having an insulation R-value greater than or equal to -
(a) for flexible ductwork, 1.0; or
(b) for cushion boxes, that of the connecting ductwork; or
(c) that specified in the table below.

(b) Insulation must -
(i) be protected against the effects of weather and sunlight; and
(ii) be installed so that it -
(a) abuts adjoining to form a continuous barrier; and
(b) maintains its position and thickness, other than at flanges and supports; and
(iii) when conveying cooled air –
(a) be protected by a vapour barrier on the outside of the insulation; and
(b) where the vapour barrier is a membrane, be installed so that adjoining sheets of the membrane -
(aa) overlap by at least 50mm; and
(bb) are bonded or taped together

(c) The requirements of (a) do not apply to -
(i) ductwork and fittings located within the only or last room served by the system.
(ii) fittings that form part of the interface with the conditioned space; or
(iii) return air ductwork in, or passing through, a conditioned space; or
(iv) ductwork for outdoor air and exhaust air associated with the air-conditioning system; or
(v) the floor of an in-situ AHU; or
(vi) PAC, split systems, and VRF A/C equipment complying with MEPS; or
(vii) flexible fan connections.

(d) For the purposes of (a), (b) and (c), fittings -
(i) include non-active components of a ductwork system such as cushion boxes; and
(ii) exclude active components such as AHU components.

Ductwork and fittings - Minimum R-Value	
Location	**Climate zone 5**
Within a conditioned space	1.2
Where exposed to direct sunlight	3.0
All other locations	2.0

J5.6 - Ductwork sealing

Ductwork in an air-conditioning system with a capacity of 3,000 L/s or greater, not located within the only or last room served by the system, must be sealed against air loss in accordance with the duct sealing requirements of AS 4254.1 and AS 4254.2 for the static pressure in the system.

AS 4254 Part 1 details that all connections to flexible ductwork must be both air sealed with adhesive tape and fixed with drawbands or the like.

J5.7 - Pump Systems

(a) General - Pumps and pipework that form part of an air-conditioning system must either -
  (i) separately comply with (b), (c) and (d); or
  (ii) achieve a pump motor power per unit flowrate lower than the pump motor power per unit flowrate achieved when applying (b), (c) and (d) together.

(b) Circulator pumps - A glandless impeller pump, with a rated hydraulic power output of less than 2.5kW and that is used in closed loop systems must have an energy efficiency Index (EEI) not more than 0.27 calculated in accordance with European Union Commission Regulation No. 622/2012.

(c) Other pumps - Pumps that are in accordance with Articles 1 and 2 of European Union Commission Regulation No. 547/2012 must have a minimum efficiency index (MEI) of 0.4 or more when calculated in accordance with European Union Commission Regulation No. 547/2012.

(d) Pipework - Straight segments of pipework along the index run, forming part of an A/C system -
  (i) in pipework systems that do not have branches and have the same flow rate throughout the entire pipe network, must achieve an average pressure drop of not more than -
    (a) for constant speed systems, the values nominated in the corresponding table below.
    (b) for variable speed systems, the value nominated in the corresponding table below.
  (ii) in any other pipework system must achieve an average pressure drop of not more than -
    (a) for constant speed systems, the values nominated in the corresponding table below.
    (b) for variable speed systems, the value nominated in the corresponding table below.

(e) The requirements of (d) do not apply to valves and fittings or where the smallest pipe size compliant with (d) results in a velocity of 0.7 m/s or less at design flow.

J5.8 - Pipework insulation

(a) Piping, vessels, heat exchangers and tanks containing heating or cooling fluid, where the fluid is held at a heated or cooled temperature, that are part of an A/C system, other than in appliances covered by MEPS, must be provided with insulation –
  (i) complying with AS/NZS 4859.1; and
  (ii) for piping of heating and cooling fluids, having an insulation R-value in accordance with the relevant table below.
  (iii) for vessels, heat exchangers or tanks, having an insulation R-value in accordance with the corresponding table below; and
  (iv) for refill or pressure relief piping, having an insulation R-value equal to the required insulation R-value of the connected pipe, vessel or tank within 500mm of the connection.

(b) Insulation must -
  (i) be protected against the effects of weather and sunlight; and
  (ii) be able to withstand the temperatures within the piping, vessel, heat exchanger or tank.

(c) Insulation provided to piping, vessels heat exchangers or tanks containing fluid cooling fluid must be protected by a vapour barrier on the outside of the insulation.

(d) The requirements of (a) and (b) do not apply to piping, vessels or heat exchangers -
  (i) located within the only or last room served by the system and downstream of the control device for the regulation of heating or cooling service to that room; or
  (ii) encased within a concrete slab or panel which is part of a heating or cooling system; or
  (iii) supplied as an integral part of a chiller, boiler or unitary A/C complying with the requirements of J5.9, J5.10 and J5.11; or
  (iv) inside an AHU, FCU, or the like.

(e) For the purposes of (a), (b), (c), and (d) -
  (i) heating fluids include refrigerant, heated water, steam and condensate; and
  (ii) cooling fluids include refrigerant, chilled water, brines and glycol mixtures, but do not include condenser cooling water.

Vessels, heat exchangers and tanks - Minimum R-Value	
Fluid temperature range	**Minimum insulation R-value**
Low temp chilled <= 2 degrees C	2.7
Chilled > 2-20 degrees C	1.8
Heated - >30-85 degrees C	3.0
High temp heated > 85 degrees C	3.0

J5.9 - Space heating

(a) A heater used for A/C or as part of an A/C system must be either a solar heater, a gas heater, a heat pump heater, a heater using reclaimed energy or an electric heater if the heating capacity is not more than the value specified in the table below.

Maximum electric heating capacity					
Floor area of the conditioned space	**W/m2 of floor area in climate zone 3**	**W/m2 of floor area in climate zone 4**	**W/m2 of floor area in climate zone 5**	**W/m2 of floor area in climate zone 6**	**W/m2 of floor area in climate zone 7**
<= 500m2	50	60	55	65	70
> 500 m2	40	50	45	55	60

~~J5.10 - Refrigerant chillers~~

~~An air-conditioning system refrigerant chiller must comply with MEPS and the full load operation energy efficiency ratio and integrated part load energy efficiency ratio in the tables below when determined in accordance with AHRI 551/591.~~

J5.11 - Unitary air-conditioning equipment

Unitary A/C equipment including PAC, split systems, and VRF systems must comply with MEPS and for a capacity greater than or equal to 65kWr -

(a) Where water cooled, have a minimum EER of 4.0 (Wr/Winput power) for cooling when tested in accordance with AS/NZS 3823.1.2. at test condition T1, where input power includes both compressor and fan input power; or

(b) Where air cooled, have a minimum EER of 2.9 (Wr/Winput power) for cooling when tested in accordance with AS/NZS 3823.1.2. at test condition T1, where input power includes both compressor and fan input power.

J5.12 - Heat rejection equipment - N/A

4.6 Part J6 - Artificial Lighting and Power

J6.0- Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
  (i) J6.1 to J6.8; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J6.1 - Application of part

J6.2, J6.3 and J6.5(a)(ii) do not apply to a Class 8 electricity network substation.

J6.2 - Artificial lighting

(a) In a SOU of a Class 2 building or a Class 4 part of a building – N/A

(b) In a building other than a SOU of a Class 2 building or a Class 4 part of a building –
  (i) for artificial lighting the aggregate design illumination power load must not exceed the sum of the allowances obtained by multiplying the area of each space by the maximum illumination power density in the table below; and
  (ii) the aggregate design illumination power load in (i) is the sum of the design illumination power loads in each of the spaces served; and
  (iii) where there are multiple lighting systems serving the same space, the design illumination power load for (ii) is -
    (a) the total illumination power load of all systems; or
    (b) where a control system permits only one system to operate at a time -
      (aa) based on the highest illumination power load; or
      (bb) determined by the formula - (H x T/2 + P x (100 – T/2)) / 100

      where - H = the highest illumination power load; and
        T = the time for which the maximum illumination power load will occur, expressed as a percentage; and
        P = the predominant illumination power load.

(c) The requirements of (a) and (b) do not apply to the following:
  (i) Emergency lighting provided in accordance with Part E4.
  (ii) Signage, display lighting within cabinets and display cases that are fixed in place.
  (iii) Lighting for accommodation within the residential part of a detention centre.
  (iv) A heater where the heater also emits light, such as in bathrooms.
  (v) Lighting of a specialist process nature such as in a surgical operating theatre, fume cupboard or clean workstation.
  (vi) Lighting of performances such as theatrical or sporting.
  (vii) Lighting for the permanent display and preservation of works of art or objects in a museum or gallery other than for retail sale, purchase or auction.
  (viii) Lighting installed solely to provide photosynthetically active radiation for indoor plant growth on green walls and the like.

(d) For the purposes of the table below, lighting timers, motion detectors, daylight sensors and dynamic lighting control devices must comply with Specification J6.

Maximum illumination power density	
Space	**Maximum illumination power density (W/m2)**
Control room, switch room and the like – constant monitoring	4.5
Corridors	5
Office – artificially lit to an ambient level 0f 200 lx or more	4.5
Office – artificially lit to an ambient level of less than 200 lx	2.5
Storage	1.5
Retail space – including a museum and gallery whose purpose is the sale of objects.	2.5
Toilet, locker room, staff room, rest room and the like	3

Note: The maximum illumination power density may be increased by dividing it by the illumination power density factor in the corresponding tables below and where the control device is not installed to comply with J6.3.

NB – Note above is an example of the Max illumination power density table. Please check the BCA for the full table.

J6.3 - Interior artificial lighting and power control

(a) All artificial lighting of a room or space must be individually operated by a switch, other control device, or a combination of both.

~~(b) An occupancy activated device, such as a room security device, a motion detector in accordance with Spec J6, or the like, must be provided in the SOU of a Class 3 building, other than where providing accommodation for people with a disability or the aged, to cut power to the artificial lighting, air-conditioner, local exhaust fans and bathroom heater when the SOU is unoccupied.~~

(c) An artificial lighting switch or other control device in (a) must:
- (i) If an artificial lighting switch, be located in a visible and easily accessed position in the room or space being switched or in an adjacent room or space form where 90% of the lighting being switched is visible; and
- (ii) For other than a single functional space such as a warehouse
  - ~~(a) not operate lighting for an area of more than 250m^2 in a Class 5 building: or~~
  - (b) not operate lighting for an area of more than 250m^2 for a space of 2000m^2 or less or 1000m^2 for a space more than 2000m^2 if in a Class 6 building.

(d) 95% of the light fittings in a building or storey of a building, other than a Class 2 or 3 building or a Class 4 part of a building of more than 250m^2 must be controlled by -
  (i) a time switch in accordance with Specification J6; or
  (ii) an occupant sensing device such as a security key card reader that registers a person entering and leaving the building or a motion detector in accordance with Specification J6.

(e) In a Class 6 building of more than 250m^2, artificial lighting in a natural lighting zone adjacent to windows must be separately controlled from artificial lighting not in a natural lighting zone in the same storey except where -
  (i) the room containing the natural lighting zone is not less than 202; or
  (ii) the room's natural lighting zone contains less than 4 luminaires: or
  (iii) 70% or more of the luminaires in the room are in the natural lighting zone.

(f) Artificial lighting in a fire-isolated stairway, fire isolated passageway or fire-isolated ramp, must be controlled by a motion detector in accordance with Specification J6.

(g) Artificial lighting in a foyer, corridor and other circulation spaces of more than 250W within a single zone and adjacent to windows must be controlled by a daylight sensor and dynamic lighting control device in accordance with Specification J6.

~~(h) Artificial lighting for daytime travel in the first 19m of travel in a carpark entry zone must be controlled by a daylight sensor in accordance with Specification J6.~~

(i) The requirements of (a), (b), (c), (d), (e), (f), (g) and (h) do not apply to the following:
  (i) Emergency lighting in accordance with Part E4.
  (ii) Where artificial lighting is needed for 24-hour occupancy such as for a manufacturing process, parts of a hospital, an airport control tower or within a detention centre.

(j) The requirements of (d) do not apply to the following:
  (i) Artificial lighting in a space where the sudden loss of artificial lighting would cause an unsafe situation such as -
    (a) In a patient care are in a Class 9a building or in a Class 9c building; or
    (b) a plant room or lift motor room; or
    (c) a workshop where power tools are used.
  (ii) A heater where the heater also emits light, such as in bathrooms.

~~J6.4 - Interior decorative and display lighting~~

~~Interior decorative and display lighting, such as for a foyer mural or art display, must be controlled separately from other artificial lighting by a manual switch for each area other than when the operating times of the displays are the same in several areas such as in a museum, art gallery or the like, in which case they may be combined.~~

~~(i) Where the interior decorative and display lighting exceeds 1kW then it must be controlled by a time switch.~~

~~(ii) Window display lighting must be controlled separately from other display lighting.~~

J6.5 - Exterior artificial lighting

(a) Exterior artificial lighting attached to or directed at the façade of a building, must –

(i) Be controlled by a daylight sensor or a time switch that is capable of switching on and off electric power to the system at variable pre-programmed times and on variable pre-programmed days; and

(ii) When the total lighting load exceeds 100W –

(a) LED's must be used for 90% of the total lighting load; or

(b) controlled by a motion detector in accordance with Spec J6; or

(c) when used for decorative purposes, such as façade lighting or signage lighting, have a separate switch in accordance with Spec J6.

(b) The requirements of (a)(ii) do not apply to emergency lighting in accordance with Part E4 and lighting around a detention centre.

J6.6 - Boiling water and chilled water storage units

Power supply to a boiling water or chilled water storage unit must be controlled by a time switch in accordance with Specification J6.

J6.7- Lifts

Lifts must -

(a) be configured to ensure artificial lighting and ventilation in the car are turned off when it is unused for 15 minutes; and

(b) achieve the idle and standby energy performance level in Table 6.7a; and

(c) achieve -

(i) the energy efficiency class in Table 6.7b; or

(ii) if a dedicated goods lift, energy efficiency class D in accordance with ISO25745-2.

Rated Load	**Idle and standby Note energy performance level in ac-accordance with ISO 25745-2**
Less than or equal to 800 kg	2
801 kg to less than or equal to 2000 kg	3
2001 kg to less than or equal to 4000 kg	4
Greater than 4000 kg	5

Usage Category in Accordance with ISO 25745-2	**Energy Efficiency Class in Accordance with ISO 25745**
1-4	C
>5	D

J6.8 - Escalators and moving walkways

~~Escalators and moving walkways must have the ability to slow to between 0.2 m/s and 0.05 m/s when unused for more than 15 minutes.~~

4.7 Part J7 - Heated water supply and swimming pool and spa pool plant

J7.0 - Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
(i) J7.1 to J7.4; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J7.1 - Application of part - N/A

J7.2 - Heated water supply

A heated water supply system for food preparation and sanitary purposes must be designed and installed in accordance with Part B2 of NCC Volume Three - Plumbing Code of Australia.

J7.3 - Swimming pool heating and pumping

7.4 - Spa pool heating and pumping

4.8 Part J8 - Facilities for Energy Monitoring

J8.0 - Deemed-to-Satisfy Provisions

(a) Where a DTS solution is proposed, the Performance Requirement is satisfied by complying with -
(i) 8.1 to J8.3; and

(b) Where a performance solution is proposed, the relevant performance requirements must be determined in accordance with A2.2(3) and A2.4(3) as applicable.

J8.1 - Application of part

The DTS provisions of this Part do not apply -

(a) within a SOU of a Class 2 building or a Class 4 part of a building; or
(b) to a Class 8 electricity network substation

J8.2 - N/A

J8.3 - Facilities for energy monitoring

(a) A building or SOU with a floor area of more than 500m^2 must have an energy meter configured to record the time-of-use consumption of gas and electricity.

~~(b) A building with a floor area of more than 2,500m^2 must have energy meters configured to enable individual time of use energy consumption data recording, in accordance with (c), of the energy consumption of -~~
~~(i) air-conditioning plant including, where appropriate, heating plant, cooling plant and AHU fans; and~~
~~(ii) artificial lighting; and~~
~~(iii) appliance power; and~~
~~(iv) central hot water supply; and~~
~~(v) internal transport devices including lifts, escalators and moving walkways where there is more than one serving the building; and~~
~~(vi) other ancillary plant.~~

~~(c) Energy meters required by (b) must be interlinked by a communication system that collates the time-of-use energy consumption data to a single interface monitoring system where it can be stored, analysed and reviewed.~~

~~The provisions of (b) do not apply to a Class 2 building with a floor area of more than 2,500m^2 where the total area of the common areas is less than 500m^2.~~

Appendix A - Façade Calculations

19-23 The Corso, Manly U-value Calculations – Method 1

Ground North	
Façade Area	81.89
Glass to Façade Ratio	13.75%
Wall to Façade Ratio	86.25%
Total External façade area	25.68
Glass to External Aspect Ratio	43.85%
Target U-value	2
Façade U-value	1.647331787
Result	Compliant
Total Aspect Façade Area	81.89
Total External Façade	25.68
Total External Glass to aspect	43.85%

Ground East	
Façade Area	91.46
Glass to Façade Ratio	0.00%
Wall to Façade Ratio	100.00%
Total External façade area	15.79
Glass to External Aspect Ratio	0.00%
Target U-value	2
Façade U-value	0.714285714
Result	Compliant
Total Aspect Façade Area	91.46
Total External Façade	15.79
Total External Glass to aspect	0.00%

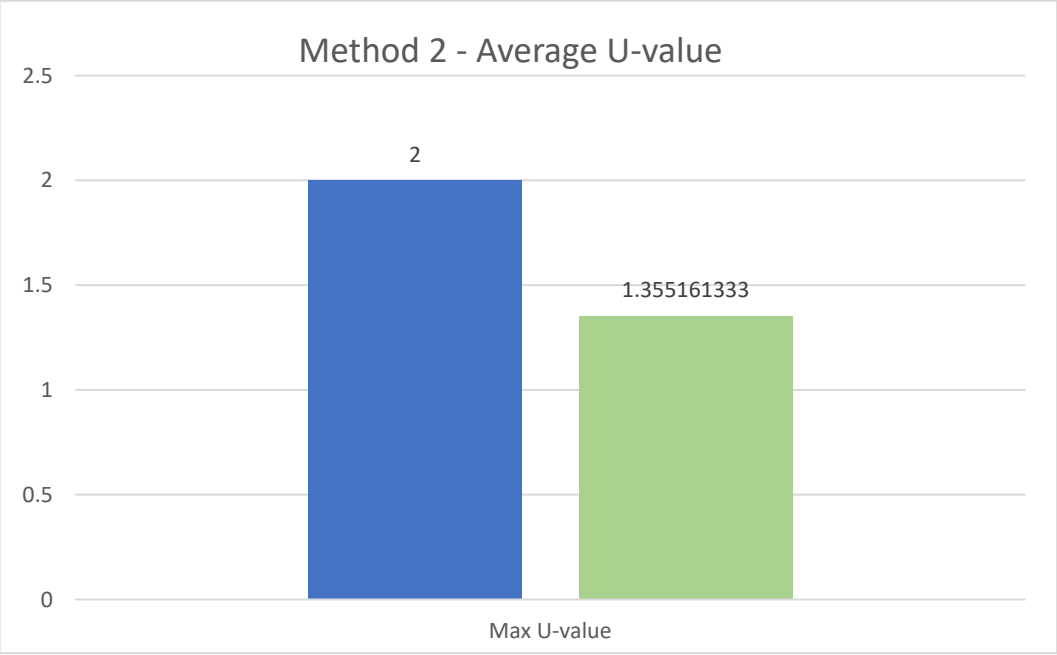
Ground South	
Façade Area	80
Glass to Façade Ratio	45.13%
Wall to Façade Ratio	54.88%
Total External façade area	62.31
Glass to External Aspect Ratio	57.94%
Target U-value	2
Façade U-value	3.009214286
Result	Non Compliant
Total Aspect Façade Area	80
Total External Façade	62.31
Total External Glass to aspect	57.94%

Ground West	
Façade Area	94.218
Glass to Façade Ratio	1.14%
Wall to Façade Ratio	98.86%
Total External façade area	18.168
Glass to External Aspect Ratio	5.89%
Target U-value	2
Façade U-value	0.791348635
Result	Compliant
Total Aspect Façade Area	94.218
Total External Façade	18.168
Total External Glass to aspect	5.89%

19-23 The Corso, Manly U-value Calculations – Method 2

Locations = 4	Façade Area	% of facade	Façade U-value	
Total Area	347.568	100.00%		
Ground North	81.89	23.56%	1.647331787	Compliant
Ground East	91.46	26.31%	0.714285714	Compliant
Ground South	80	23.02%	3.009214286	Non Compliant
Ground West	94.218	27.11%	0.791348635	Compliant

Max U-value	2	
Average Total U-value	1.48	Compliant



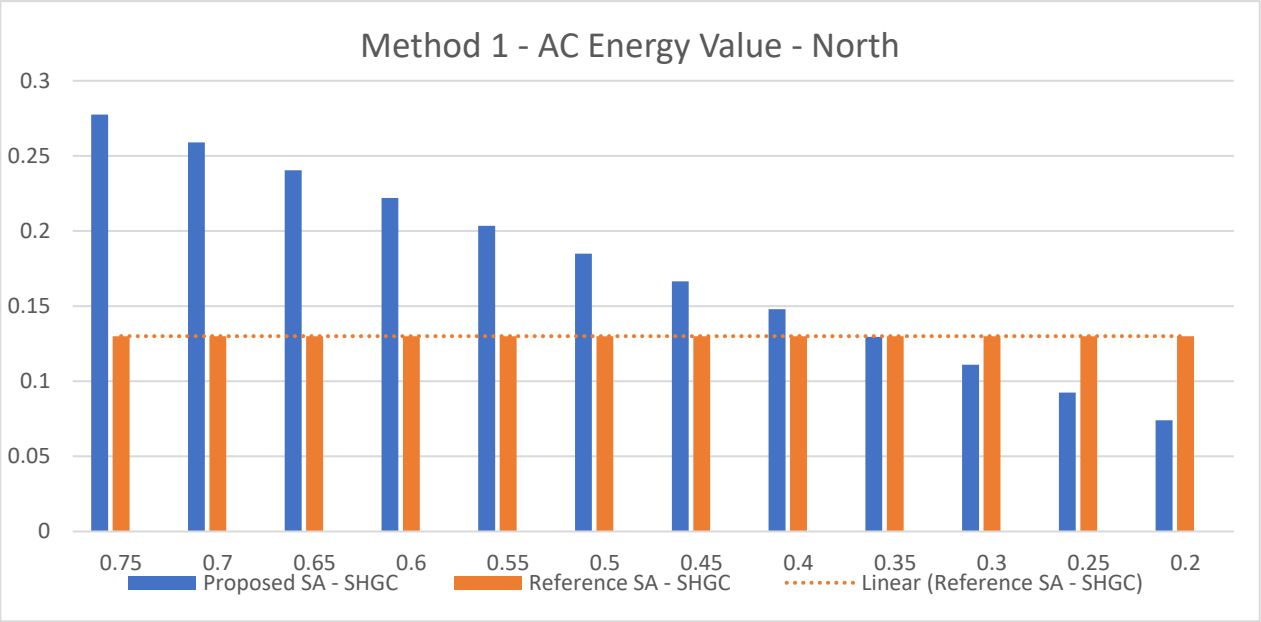
Method 1 & Method 2 assumes the min R-value of R1.40 is required to comply.

Any wall installed will be required to reach this value.

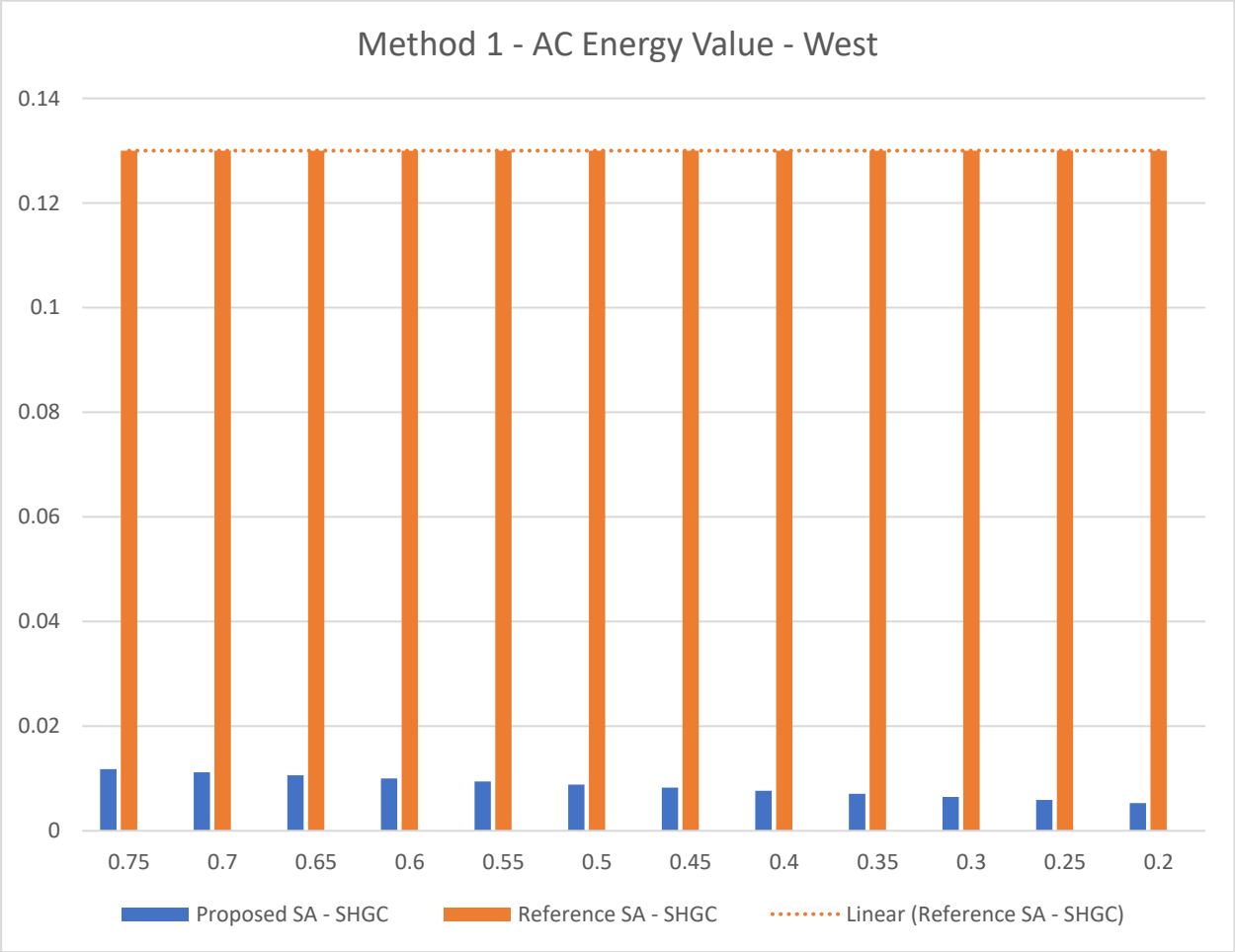
Wall thermal bridging calculations

Solar Admittance Calculation - Method 1

SHGC	AC Energy Value	Result
0.75	0.2774533	Non-Compliant
0.70	0.2589564	Non-Compliant
0.65	0.2404595	Non-Compliant
0.60	0.2219626	Non-Compliant
0.55	0.2034657	Non-Compliant
0.50	0.1849688	Non-Compliant
0.45	0.1664720	Non-Compliant
0.40	0.1479751	Non-Compliant
0.35	0.1294782	Compliant
0.30	0.1109813	Compliant
0.25	0.0924844	Compliant
0.20	0.0739875	Compliant



SHGC	AC Energy Value	Result
0.75	0.0154599	Compliant
0.70	0.0144292	Compliant
0.65	0.0133986	Compliant
0.60	0.0123679	Compliant
0.55	0.0113372	Compliant
0.50	0.0103066	Compliant
0.45	0.0088637	Compliant
0.40	0.0086575	Compliant
0.35	0.0072146	Compliant
0.30	0.0061839	Compliant
0.25	0.0051533	Compliant
0.20	0.0041226	Compliant



Example of wall thermal bridging calculation - External wall on thermal envelope

Wall Systems

Ventilation		Slightly Ventilated	A slightly ventilated air space is derated by 45% for each layer between the cavity and layer 1 to account for lower thermal resistance				
Material	Clay brick - 3.25kg	Airspace - non-reflective	R2.5	Gypsum plasterboard			
Thickness (mm)	110	20	90	10			
Conductivity (W/mK)	0.650		0.036	0.170			
Framing Material			Steel				
Metal Frame, Web Thickness (mm)			0.55				
Metal Frame, Flange Width (mm)			39				
Framing Area %			11.0%				
Thermal Break Material							
Thermal Break Thickness (mm)							
Thermal Break Overlap Area %							
Resistance (m².K/W)	0.08	0.00	1.21	0.06	0	0	0
Wall Construction	Brick Veneer		**External Surface Resistance (moving air, more than 3m/s and not more than 7/ms wind speed)**				0.03
						Internal Surface Resistance (still air, on a wall)	0.12
						System R-Value (m².K/W)	1.50
						System U-Value (W/m².K)	0.67
							Add to User Library

Appendix B - Building Envelope

Red outline notates building envelope

Total R-value = R1.40