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Project: **Dapto Leagues Club**
Proposed Additions & Internal Refurbishment
Station St & Bong Bong Rd
Dapto

Report: **Section J Compliance Report**
NCC 2022-Volume 1
Performance Solution
Section J1V3 Verification using a reference building

Date: Revision 1 – 11/3/2024
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SECTION 1 - BASIS OF ASSESSMENT

1.1 THE PROJECT

The proposed development at Dapto Leagues Club, is a new addition to and refurbishment of the existing building.

- The Climate Zone is Climate Zone 5.
- This assessment is based on drawings as listed in appendix 13
- The Performance Based Design Brief for Section J1V3 verification using a reference building dated 5/3/2023.
- This Report addresses ONLY matters relevant to Section ‘J’ of NCC 2022, Volume 1.
- The project is assessed in accordance with the Performance Based Design Brief, dated 5/3/2024 and Clause A2G2 – NCC 2022 – Volume 1 – J1V3 Verification using a reference building, and using approved energy modeling software namely Design Builder version 7.0.2.004 with Energy Plus version 9.4

1.2 AUTHOR QUALIFICATION

Michael May is a qualified Electrical Engineer (SAIT – 1980), Certified Energy Manager (CEM)(#92319), Sydney University Training in NCC - Section ‘J’ (2007), Member Australian Institute of Energy.

1.3 COMPLIANCE

This assessment demonstrates that the project, as specified in the plans and in the recommendations in Section 2 of this report, complies with the Performance Requirements J1P1 – J1V3 Verification using a reference building method of the NCC 2022 – volume 1.

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SECTION 2 - SUMMARY OF PROVISIONS TO COMPLY

Compliance with Section J of the NCC 2022-volume 1 for new building is achieved using the performance based J1V3 Verification using a reference building method. The annual energy consumption of the proposed building (using the proposed building fabric and proposed services) is less than the annual energy consumption for the reference building (using Deemed to Satisfy (DTS) provision for the building fabric and DTS services) (refer sections 3, 4 and 5 for details).

2.1 PART J4 – BUILDING FABRIC

Compliance can be met by:

New metal roof

- *Installing 110mm R2.5 reflective insulating blanket or equivalent in the ceiling cavity, giving a **total 'R-value' of R3.88(downwards)**, which exceeds the required minimum of R3.70.*
- *Installing a light coloured roof with a solar absorptance of 0.45 or less.*

New skylight

- *Retain the skylight areas as shown on the drawings*
- *Installing the skylight with a maximum U-value of 3.9 and maximum SHGC of 0.36.*

New external brick or block veneer wall

- *Adding R2.50 wall batts in a metal frame to the brick or block veneer wall system, providing an added R-value of R0.65, giving a **total 'R-value' of R1.21.***

New external cladding walls (thermal break strip)

- *adding R2.50 wall batts in a metal frame and R0.20 thermal break to the cladding wall system, giving a **total 'R-value' of R1.10.***

New external cladding walls (reflective airgap)

- *adding R1.5 wall batts in a metal frame and a reflective wall wrap, giving a **total 'R-value' of R1.48.***

New Stud walls (if used)

- *adding R1.5 wall batts in a metal frame, a battens or top-hats to create an air-gap, giving a **total 'R-value' of R1.10.***

New external glazing

- *Installing the new windows and glazed doors with a characteristic equal to or less than a **U-value of 7.0 and a SHGC-value of 0.72,** which can be achieved with neutral or tinted low-e type single glazing.*

New suspended floor

- *No floor insulation required*

2.2 PART J5 - BUILDING SEALING

Compliance can be met by:

- *The new entry doors sports, food & beverage space must be self-closing, or interlocked to ensure the air-conditioning system is inactive when these doors are open.*
- *Ensuring the skylights are sealed, and are fitted with a ceiling diffuser or operable shutter system*
- *Any new exhaust fans to have self-closing dampers, including "miscellaneous exhaust fans".*

2.3 PART J6 - A/C & VENTILATION SYSTEMS

Compliance can be met by:

- *Ensure any new A/C System has the ability to be inactive when the area is not occupied.*
- *Ensure any new A/C System greater than 2kWr has a 7 day time switch installed.*
- *Ensure any new Mechanical Ventilation system has the ability to be inactive when the area is not occupied.*
- *Ensure any new Mechanical Ventilation system greater than 1000L/s is controlled by a time switch.*
- *Any heating or cooling system for the terrace or alfresco areas, must be configured to shut down if there are no occupants in the space or after one hour has elapsed since the last activation of the heater or cooler using a timer*
- *Certification by a mechanical engineer if any new air-conditioner is greater than 65kWr.*

2.4 PART J7 - ARTIFICIAL LIGHTING & POWER

Compliance can be met by:

- *Not exceeding the "Max. Lighting Wattage" for any new lighting in each of the areas in the lighting calculations table in* ***Appendix 2****.*
- *The maximum internal lighting wattage for the additional areas must not exceed* ***16,593 watts.***
- *Time switch(s) or motion detector(s) or security card reader(s) must be installed to control at least* ***95%*** *of the lighting in the building.*
- *Decorative or display lighting must be controlled separately from general lighting manually and by a time switch in accordance with specification* 40 in appendix 7 *if the lighting exceeds 1kW*
- *External perimeter lighting must be controlled by either a daylight sensor or a time switch in accordance with specification* 40 in appendix 7*, and LED lights must be used for 90% of the total lighting load if the lighting exceeds 100 watts.*
- *Ensure the lift lighting and ventilation is turned off when the lift is unused for more than 15 minutes*

2.5 PART J9 - FACILITIES FOR ENERGY MONITORING

Compliance can be met by:

Metering provisions

- *The new addition must have energy meters for recording time-of-use electricity and gas (if applicable) consumption for air-conditioning, lighting, power, lifts, renewable energy, EV charging equipment and battery systems.*

EV Charging Provisions

- *Installing a dedicated electrical distribution board for every 24 electric vehicle carpark spaces.*
- *Installing the switchboards fitted with charging control system to manage and schedule charging*
- *The capacity for each circuit must deliver a minimum 12kWh from 11pm to 7am daily for class 2, 12kWh from 9:00am to 5:00pm daily for class 5 to 9, and 48kWh from 11pm to 7am daily for class 3*

- *Installing the switchboard with capacity*
    - *For a future 7kW (32A) type 2 electric vehicle charge 100% of the spaces in class 2, 10% of the spaces in Class 5 & 6, 20% of the spaces for class 3,7b, 8 or 9.*
    - *For at least 36mm width DIN rail per outgoing circuit for individual sub-circuit electricity metering to record electricity use of electric vehicle charging equipment*
    - *Be labelled to indicate the space is for future use*

Solar PV and Battery provisions

- *If the main switchboard is being upgrades then allow space for*
    - *at least one empty three-phase circuit breaker slots and two DIN rail spaces labelled to indicate the use of each space for a solar photovoltaic system, unless there is already a Solar system designed for at least 20%of the roof area.*
    - *at least one empty three-phase circuit breaker slots and two DIN rail spaces labelled to indicate the use of each space for a battery system, unless there is already a battery system in the design.*
    - *a size to accommodate the installation of solar photovoltaic panels at maximum output on at least 20% of the building roof area.*
- *Leaving at least 20% of the roof area clear for solar photovoltaic panels, unless there is already a solar system designed for at least 20%of the roof area.*

SECTION 3 - PROPOSED BUILDING PERFORMANCE SOLUTION

3.1 INTRODUCTION

The development at Dapto Leagues Club, is a new addition to and refurbishment of the existing building.

This section specifies, in accordance with clause A2G2, clause J1V3, specification 34 and 35, and the Performance Base Design Brief dated 5/3/2024, how the Proposed Building is modelled differently to the Reference Building and supersedes the DTS requirements of clause J4D5 Roof Lights construction, J4D6 glazing construction, and J4D7 Floors construction.

3.2 ACCEPTANCE CRITERIA

Compliance with J1P1 is verified when:

- it is determined that the annual greenhouse gas emissions of the proposed building are not more than the annual greenhouse gas emissions of a reference building when the proposed building is modelled with the proposed service and with the same services as the reference building; and
- The proposed building has a thermal comfort level of between a Predicted Mean Vote of -1 to +1 for at least 95% of the floor area of all occupied zones and at least 98% of the annual hours of operations; and
- The building complies with the additional requirements in Specification 35

Annual greenhouse gas emissions of the proposed building may be offset by renewable energy generated and used on site or another process used on site.

The calculation method used must comply with Specification 36

3.8 PROPOSED BUILDING ASSESSMENT USING JV3 - VERIFICATION METHOD

The annual energy consumption of the proposed buildings, using the proposed building fabric and proposed services is **162.0 MWh** (137.6 tonnes of CO_2-e) The annual energy consumption for the reference buildings, using DTS building fabric and DTS services is **162.5 MWh** (141.4 tonnes of CO_2-e). Refer appendix 8, 9, 10 & 11 for annual energy consumption analysis)

The air conditioning achieves the specified temperature ranges for each transitory and non-transitory occupancy zones for at least 98% of the annual operating hours and the PMV thermal comfort level between -1 and +1 is achieved for each non-transitory zone for 98% of the annual operating hours as shown in appendix 12.

Therefore, the building as proposed is compliant with Section J1V3 as the estimated annual energy consumption of the proposed building is less than that of the reference building. It is assumed that in the proposed building the services will achieve minimum DTS requirements.

The proposed building uses the same services as the reference building.

The proposed building addition has skylight sizes as per the design drawings with no under floor insulation and all new windows and glazed doors (glass and frame) with a thermal performance characteristic of or better than U-value of 7.0 and SHGC value of 0.72.

Compliance for the proposed buildings can be met by:
New skylight

- *Retain the skylight areas as shown on the drawings*
- *Installing the skylight with a maximum U-value of 3.9 and maximum SHGC of 0.36.*

New external glazing

- *Installing the new windows and glazed doors with a characteristic equal to or less than a **U-value of 7.0 and a SHGC-value of 0.72,** which can be achieved with neutral or tinted low-e type single glazing.*

New suspended floor

- *No floor insulation required*

3.9 CONCLUSION

The building as proposed has achieved compliance with Performance Requirement J1P1, as verified against the acceptance criteria.

SECTION 4 - JV3 - REFERENCE BUILDING REQUIREMENTS

This section specifies the methodology used to model both the reference and proposed buildings.

4.1 PART JV3 VERIFICATION METHOD USING A REFERENCE BUILDING

(a) For a Class 5,6 & 8 building, compliance is verified when it is determined that the annual energy consumption of the proposed building with its services is not more than the annual energy consumption of a reference building when
   a. The proposed building is modelled with the proposed services and
   b. The proposed building is modelled with the same services as the reference building.

(c) The annual energy consumption has been calculated using a method that complies with the ABCB protocol for Building Energy Efficiency, namely Design Builder version 7.0.2.004 with Energy Plus version 9.4

(d) (i) The annual energy consumption for the reference building has been calculated using:
- The Deemed-To-Satisfy (DTS) Provisions as per Part J1 to J7.
- Solar absorptance of 0.6 for the external walls and 0.45 for the roofs,
- The maximum illumination power density without any increase for adjustment factors
- Air-conditioning with the conditioned space temperature, for 98% of the plant operation time, within the range of 18^0 CDB to 25^0 CDB for transitory spaces and 21^0 CDB to 24^0 CDB in all others spaces
- The profiles for occupancy, air-conditioning, lighting, internal heat gains from people, appliances and equipment and hot water systems as per Specification JV,
- Infiltration values of 0.7 air changes per hour when there is no mechanically supplied outside air and 0.35 air changes per hour at all other times.

(ii) The annual energy consumption for the reference building and the proposed building has been calculated using the same:
- Annual energy consumption method,
- Location
- Adjacent structures and features
- Orientation
- Building form
- Testing standards
- Thermal resistance of air films
- Dimensions of all walls
- Quality of insulation
- Assumptions and calculations relating to A/C zone boundaries
- Floor coverings
- Shading devices
- Range and type of services
- Internal artificial lighting
- Internal heat gains
- A/C system configuration
- Daily and annual occupancy and service profiles
- Hot water system
- Infiltration values

SECTION 5 - REFERENCE BUILDING ASSESSMENT

This section specifies how the Reference Building has been modelled using the DTS requirements of Section J and is superseded by Section 3 where ever conflicts arise.

5.1 PART J4 - BUILDING FABRIC

J4D2 Application - All new parts of the new building envelope need to comply.

External envelope means any walls separating internal conditioned space and external ambient conditions. Internal envelope means any walls separating internal conditioned space and internal non-conditioned space.

Building Envelope

The building envelope for the purpose of Section J is bound by the new external walls, floor and roof of the proposed addition and new work on the existing building, as shown in Appendix 5

J4D3 Thermal Construction General - Builder is to ensure compliance, during construction.

- Insulation must comply with AS/NZS 4859.1.
- Insulation must abut or overlap adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels where the insulation must be against the member.
- Insulation must form a continuous barrier with ceilings, walls, bulkheads, floors or the like that contribute to the thermal barrier.
- Insulation must not affect the safe or effective operation of a service or fitting.
- Reflective insulation must be installed with the necessary airspace between the reflective side of the insulation and the lining or cladding.
- Reflective insulation must be installed closely against any penetration, door or window opening.
- Each adjoining sheet of roll membrane being overlapped not less than 50mm or taped together.
- Bulk insulation must be installed so that it maintains its position and thickness, other than when it is compressed between cladding and supporting members, water pipes, electrical cabling or the like.
- When selecting insulation caution should be taken to clearly identify the total R-value of the installed roofing and ceiling system or wall system.

J4D4 Roof & Ceiling Construction

(1) In this Climate Zone, the minimum total R-value is R3.70 (downward direction of heat flow).

The roof & ceiling system is a metal roof with plasterboard ceiling which requires additional insulation to achieve a minimum total R-value of R3.7(downwards).

Roof & Ceiling Element	R- Value Unventilated- Down
Outside air film	0.04
Metal roof	0.00
Additional insulation	2.32 minimum
Reflective Airspace	1.12
Plasterboard	0.06
Internal air film	0.16
Total R-value	**3.70 minimum**

Compliance can be met by:

- *Installing 110mm R2.5 reflective insulating blanket or equivalent in the ceiling cavity, giving a **total 'R-value' of R3.88(downwards)**, which exceeds the required minimum of R3.70.*

(2) In this Climate zone the solar absorptance of the upper surface of a roof must be no more than 0.45 (light coloured roof)

Compliance can be met by:

- *Installing a light coloured roof with a solar absorptance of 0.45 or less.*

The following table is provided by "Colorbond" to describe their range of roof colours according to the Section J requires. It is reproduced here as a guide.

Colour	Solar Absorptance
Classic Cream™	0.32
Surfmist®	0.32
Paperbark®	0.42
Evening Haze®	0.43
Shale Grey™	0.43
Sandbank®	0.46
Dune®	0.47
Windspray®	0.58
Pale Eucalypt®	0.60

J4D5 Roof lights

(a) The total area of roof lights must not exceed 5% of the floor area of the room or space they serve.

(b) The total system U-value must be 3.9 or less, and the SHGC value must comply with Table J4D5

Table J4D5: Roof lights – Total system SHGC

Roof light shaft index Note 1	Total area of *roof lights* up to 3.5% of the *floor area* of the room or space	Total area of *roof lights* more than 3.5% and up to 5% of the *floor area* of the room or space
<1.0	≤ 0.45	≤ 0.29
≥ 1.0 to < 2.5	≤ 0.51	≤ 0.33
≥ 2.5	≤ 0.76	≤ 0.49

Table Notes

(1) The *roof light* shaft index is determined by measuring the distance from the centre of the shaft at the roof to the centre of the shaft at the ceiling level and dividing it by the average internal dimension of the shaft opening at the ceiling level (or the diameter for a circular shaft) in the same units of measurement.

(2) The area of a *roof light* is the area of the roof opening that allows light to enter the building.

(3) The total area of *roof lights* is the combined area for all *roof lights* serving the room or space.

In this project, the main skylight has an area of 53.2m^2 and the smaller skylights have a combined area of 32.4m^2, servicing a floor area of 1113 m^2 on the ground floor, which is more than the maximum allowance of 5%. Therefore, the skylight area has to be reduced by 30m^2 to achieve compliance

Compliance can be met by:

This requirement is superseded by Section 3

- *Reducing the skylight area to a maximum of 55.6m^2*
- *Installing the skylight with a maximum U-value of 3.9 and maximum SHGC of 0.29.*

J4D6 Walls-glazing construction

(1) The total system U-value for the Wall-glazing construction must not be greater than U-value 2.0
(2) The total system U-value for display glazing must not be greater than U-value 5.8.
(3) The total system U-value for wall-glazing construction must be calculated in accordance with Specification 37.
(4) Wall components must achieve a minimum total R-value of R1.0 where the wall area is less than 80% of the total wall-glazing area, and R1.4 where the wall area is 80% or more of the total wall-glazing area.
(5) The solar admittance of externally facing wall-glazing construction must not be greater than that specified in Table J4d6b, namely 0.13 for this climate zone.
(6) The solar admittance of a wall-glazing construction must be calculated in accordance with Specification 37.
(7) The total system SHGC of Display glazing must not be greater than 0.81 divided by the shading multiplier specified in Specification 37C7.

In this project the new walls have to achieve a minimum R-value of R1.0.

Brick or block veneer walls with metal frames and plasterboard

Wall Element	R- Value
Outside air film	0.04
Brick or block	0.17
Air gap	0.17
R2.5 wall batts in metal frame	0.65
Plasterboard	0.06
Internal air film	0.12
Total R-value	**1.21**

Compliance can be met by:

- *Adding R2.50 wall batts in a metal frame to the brick or block veneer wall system, providing an added R-value of R0.65, giving a **total 'R-value' of R1.21.***

Cladding walls with metal frame and internal plasterboard. (thermal strip)

Wall Element	R- Value
Outside air film	0.04
Cladding	0.03
Thermal break	0.20
R2.5 Wall batts with metal frame	0.65
Plasterboard	0.06
Internal air film	0.12
Total R-value	**1.10**

Compliance can be met by:

- *adding R2.50 wall batts in a metal frame and R0.20 thermal break to the cladding wall system, giving a **total 'R-value' of R1.10.***

Cladding walls with metal frames and internal plasterboard. (reflective airgap)

Wall Element	**R- Value**
Outside air film	0.04
Cladding on 15mm top hats	0.03
Reflective air-gap	0.66
R1.5 Wall batts with metal frame	0.57
Plasterboard	0.06
Internal air film	0.12
Total R-value	**1.48**

Compliance can be met by:

- *adding R1.5 wall batts in a metal frame and a reflective wall wrap, giving a **total 'R-value' of R1.48.***

New stud walls with metal frames and internal plasterboard

Wall Element	**R- Value**
Internal air film	0.12
PB of FC sheet on 15mm top hats or battens	0.06
Air-gap	0.17
R1.5 Wall batts with metal frame	0.57
PB or FC sheet	0.06
Internal air film	0.12
Total R-value	**1.10**

Compliance can be met by:

- *adding R1.5 wall batts in a metal frame, a battens or top-hats to create an air-gap, giving a **total 'R-value' of R1.10.***

Glazing – Method 2 – Refer appendix 1.

Compliance can be met by:

This requirement is superseded by Section 3

- *Installing the new windows and glazed doors with a characteristic equal to or less than a **U-value of 4.2 and a SHGC-value of 0.62,** which can be achieved with neutral or tinted low-e type single glazing.*

J4D7 Floors

(a) A floor must achieve a minimum Total R-Value of R2.0
(b) The slab on ground achieves the minimum R-value of R2.0.

The new concrete suspended slab requires additional insulation where it is above an enclosed subfloor achieve a minimum total R-value of R2.0. The insulation value of an enclosed subfloor for a floor area to perimeter ration of 6.4 is R0.60 (refer Table S39C2a below)

Floor Element	R- Value
Indoor air film	0.16
150mm Concrete Slab	0.10
Additional insulation	1.14 minimum
Enclosed subfloor insulation	0.60
Total R-value	**2.0 minimum**

Compliance can be met by:

This requirement is superseded by Section 3

- *Adding a 30mm R1.3 PIR board product or equivalent to the concrete slab, giving a **total 'R-value' of R2.16,** which exceeds the required minimum of R2.0.*

Table S39C2a: R-Value of sub-floor spaces

Ratio of *floor area* (m^2) to floor perimeter (m)	Sub-floor space *R-Value*
1.0	0.10
1.5	0.15
2.0	0.20
2.5	0.25
3.0	0.30
3.5	0.35
4.0	0.40
4.5	0.45
5.0	0.50
5.5	0.55
6.0	0.60
6.5	0.65
7.0	0.70

Table Notes

Where the ratio of *floor area* to floor perimeter is between the values stated, interpolation may be used to determine the sub-floor space *R-Values*.

Table S39C2b: R-Value of soil in contact with a floor

Ratio of *floor area* (m^2) to floor perimeter (m)	Wall thickness of 50 mm	Wall thickness of 100 mm	Wall thickness of 150 mm	Wall thickness of 200 mm	Wall thickness of 250 mm	Wall thickness of 300 mm
1.0	0.4	0.5	0.5	0.6	0.7	0.8
1.5	0.6	0.7	0.7	0.8	0.9	1.0
2.0	0.7	0.8	0.9	1.0	1.1	1.3
2.5	0.9	1.0	1.1	1.2	1.3	1.5
3.0	1.0	1.2	1.3	1.4	1.5	1.7
3.5	1.2	1.3	1.5	1.6	1.7	1.9
4.0	1.3	1.5	1.6	1.7	1.9	2.2
4.5	1.5	1.7	1.8	1.9	2.1	2.4
5.0	1.6	1.8	2.0	2.1	2.3	2.6
5.5	1.8	2.0	2.1	2.2	2.4	2.8
6.0	1.9	2.1	2.3	2.4	2.6	2.9
6.5	2.0	2.3	2.4	2.6	2.8	3.1
7.0	2.2	2.4	2.6	2.7	3.0	3.3

Table Notes

(1) Where a wall thickness or ratio of *floor area* to floor perimeter is between the values stated, interpolation may be used to determine the soil *R-Value*.

(2) Wall thickness means the thickness of the *envelope* wall that sits on or around the slab.

3.2 PART J5 - BUILDING SEALING

J5D3 Chimneys and Flues – not applicable

J5D4 Roof Lights

A roof light must be sealed when serving a conditioned space and must be constructed with an imperforate ceiling diffuser or a weatherproof seal if it is a roof window, or a readily operable shutter system (manual, mechanical or electronic).

Compliance can be met by:

- *Ensuring the skylights are sealed, and are fitted with a ceiling diffuser or operable shutter system*

J5D5 Windows and doors

All external doors and windows must either have seals to restrict air infiltration or the windows must comply with AS 2047. (fire and smoke doors, roller shutter door or grills are exempt)

A seal for the bottom edge of a swing door must be a draft protection device and for other edges of an external door and openable windows may be a foam or rubber compression strip fibrous seal or the like.

An entrance to a building must have an airlock, self-closing door, revolving door or the like, where the conditioned space has a floor area greater than 50m^2.

Compliance can be met by:

- *The new entry doors sports, food & beverage space must be self-closing, or interlocked to ensure the air-conditioning system is inactive when these doors are open.*

J5D6 Exhaust fans

All exhaust fans fitted in a conditioned space must have a sealing device such as a self-closing damper or the like.

Compliance can be met by:

- *Any new exhaust fans to have self-closing dampers, including "miscellaneous exhaust fans".*

J5D7 Construction of roofs, walls and floors

Roofs, walls and floors and any opening such as a window or door must be constructed to minimise air leakage by:

- Enclosed or internal lining systems that are close fitting at ceiling, wall and floor *junctions* or
- Sealed by caulking, skirting, architraves, cornices or the like.

3.3 PART J6 - A/C & VENTILATION SYSTEMS

J6D3 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—
      (i) thermostatically control the temperature of each zone of area; and
      (ii) not control the temperature by mixing actively heated air and actively cooled air; and
      (iii) limit reheating to not more than—
         (aa) for a fixed supply air rate, a 7.5 K rise in temperature; and
         (bb) for a variable supply air rate, a 7.5 K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air rate is respectively decreased or increased; and
   iii. which provides the required mechanical ventilation, other than in climate zone 1 or where dehumidification control is needed, must have an outdoor air economy cycle, if the total air flow rate of any airside component of an air-conditioning system capacity is greater than or equal to 3000) l/s; and
   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 1000L/s, must have a variable speed fan when its supply air quantity is capable of being varied; and
   vi. when serving a sole-occupancy unit in a Class 3 building, must not operate when any external door of the sole-occupancy unit that opens to a balcony or the like, is open for more than one minute; and
   vii. must have the ability to use direct signals from the control components responsible for the delivery of comfort conditions in the building to regulate the operation of central plant; and
   viii. must have a control dead band of no less than $2^{o}C$, except where a smaller range is required for specialised applications; and
   ix. must be provided with balancing dampers and balancing values that ensure the maximum design air or fluid flow is achieved but not exceeded by more than 15% above design at each component or group of components
   x. must ensure that each independently operating space of more than $1000m^2$ and every separate floor of the building has provision to terminate airflow independently of the remainder of the system sufficient to allow for different operating times; 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 from operating in opposing heating and cooling modes.

(c) Time switches –
   (a) A time switch must be provided to control –
      (A) an air-conditioning system of more than 2 kWr; and
      (B) a heater of more than 1 $kW_{heating}$ used for air-conditioning.
   (b) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days

(c) The requirements of (a) and (b) do not apply to –
  (A) an air-conditioning system that serves—
    (A) only one sole-occupancy unit in a Class 2, 3 or 9c building; or
    (B) a Class 4 part of a building; or
  (B) a building where air-conditioning is needed for 24 hour occupancy.

Compliance can be met by:

- *Ensure any new A/C System has the ability to be inactive when the area is not occupied.*
- *Ensure any new A/C System greater than 2kWr has a 7 day time switch installed.*

J6D4 Mechanical ventilation systems control

(1) General - A mechanical ventilation system, including one that is part of an air-conditioning system, except where the mechanical system serves only one sole-occupancy unit in a Class 2 building or serves only a Class 4 part of a building, 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
    (A) where in the outdoor air flow is greater than 1000 L/s, have
      (A) an energy reclaiming system that preconditions outdoor air at a minimum sensible heat transfer effectiveness of 60%; or
      (B) demand control ventilation in accordance with AS 1668.2 if appropriate to the application; and
    (B) not exceed the minimum outdoor air quantity required by Part F4 by more than 20%, except where –
      (A) additional unconditioned outdoor air is supplied for free cooling; or
      (B) additional mechanical ventilation is needed to balance the required exhaust; or
      (C) an energy reclaiming system preconditions all the outside air.
  (iii) For an airflow of more than 1000L/s, have a variable speed fan unless the downstream airflow is required by Part F4 to be constant.

(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 sole-occupancy unit in a Class2,3 or 9c building.

(c) Carpark exhaust systems – Carpark exhaust systems must have a control system in accordance with 4.11.2 or 4.11.3 of AS 1668.2

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

Compliance can be met by:

- *Ensure any new Mechanical Ventilation system has the ability to be inactive when the area is not occupied.*
- *Ensure any new Mechanical Ventilation system greater than 1000L/s is controlled by a time switch.*

J6D5 Fan systems

(a) Fans, ductwork and duct components that form part of an air-conditioning system or mechanical ventilation system must separately comply with (2), (3), (4) and (5) or achieve a lower fan motor input power per flowrate than when combining (2), (3), (4) and (5) together.

Clauses J6D5 (2), (3), (4) and (5) are included in appendix 6

J6D6 Ductwork insulation

(i) Ductwork and fitting in an air-conditioning system must be provided with insulation.
   i. Complying with AS/NZS 4859.a, and
   ii. Have an insulation R-value greater than or equal to
      - R1.0 flexible ductwork
      - The same as connecting duct work for cushion boxes
      - R1.20 within a conditioned space
      - R3.0 where exposed to direct sunlight
      - R2.0 all other locations

(ii) Insulation must
   i. Be protected against the effects of weather and sunlight, and
   ii. Be installed so that it abuts joining insulation to form a continuous barrier and maintains it position and thickness
   iii. When conveying cooled air be protected by a vapour barrier on the outside of the insulation.

(iii) These requirements do not apply to:
   - Ductwork or fittings located in the last room served, or
   - Return air ductwork passing in a conditioned space, or
   - Ductwork for outside or exhaust air, or
   - The floor of an in-situ air-handling unit, or
   - Packaged air-conditioning equipment complying with MEPS, or
   - Flexible fan connectors

J6D7 Ductwork sealing

Ductwork in an air-conditioning system with a capacity of 3000 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 of the system

J6D8 Pump systems

Refer appendix 6.

J6D9 Pipework insulation

Refer appendix 6.

J6D10 Space Heating

(1) A Heater used for air-conditioning or as part of an air-conditioning system must be-
   (a) A solar heater; or
   (b) A gas heater; or
   (c) A heat pump heater; or
   (d) A heater using reclaimed heats from another process such as reject heat from a refrigeration plant; or

(e) An electric heater if_
  (i) The heater capacity is not more than-
    A. 10 W/m^2 of the floor area of the conditioned space in climate zone 1; or
    B. 40 W/m2 of the floor area of the conditioned space in climate zone 2; or
    C. In this climate zone <500m2 – 65W/m2 or >500m2 – 55W/m2; or
  (ii) The annual energy consumption of the heating is not more than 15 kWh/m2 of the floor area of the conditioned space in climate zones 1,2,3,4 and 5; or
  (iii) The in-duct heater complies with J5.2(a)(ii)(C); or
(f) Any combination of (i) to (v).

(2) An electric heater may be used for heating a bathroom in a class 2,3,9a or 9c building if the heating capacity is not more than 1.2 kW and the heater has a timer.

(3) A fixed heating or cooling appliance that moderates the temperature of an outdoor space must be configured to automatically shut down when-
  (a) There are no occupants in the space served; or
  (b) A period of one hour has elapsed since the last activation of the heater; or
  (c) The space served has reached a design temperature.

(4) A gas water heater, that is used as part of an air-conditioning system, must-
  (a) If rated to consume 500MJ/hour of gas or less, achieve a minimum gross thermal efficiency of 86%; or
  (b) If rated to consume more than 500MJ/hour of gas or less, achieve a minimum gross thermal efficiency of 90.

Compliance can be met by:

- *Any heating or cooling system for the terrace or alfresco areas, must be configured to shut down if there are no occupants in the space or after one hour has elapsed since the last activation of the heater or cooler using a timer*

J6D11 Refrigerant chillers

Refer appendix 6.

J6D12 Unitary air-conditioning equipment

Any new air-conditioning system 65kWr or less must comply with MEPS, and any new air-conditioning system greater than 65kWr must have a minimum energy efficiency ratio of 4.0 $W_r/W_{input\ power}$ for water cooled and 2.9 $W_r/W_{input\ power}$ for air cooled

Compliance can be met by:

- *Certification by a mechanical engineer if any new air-conditioner is greater than 65kWr.*

J6D13 Heat rejection equipment

Refer appendix 6.

3.4 PART J7 - ARTIFICIAL LIGHTING & POWER

J7D3 Artificial lighting

(2) All artificial lighting for the whole building must not exceed the aggregated maximum Illumination Power Density (IPD) specified in Table J7D3a.(refer Appendix 3).

Compliance can be met by:

- *Not exceeding the "Max. Lighting Wattage" for any new lighting in each of the areas in the lighting calculations table in Appendix 2.*
- *The maximum internal lighting wattage for the additional areas must not exceed* ***16,593 watts.***

(3) The lighting limits do not apply to the following:

- Emergency Lighting
- Signage and display lighting
- A heater where it emits light
- Lighting for a specialised process nature
- Lighting for performances such as theatrical or sporting
- Lighting of permanent displays in museums or galleries
- Lighting installed solely to provide Photosynthetically active radiation for plant growth

J7D4 Interior artificial lighting and power control

(1) Artificial lighting of a room or space must be individually operated by a switch or other control device.

(3) An artificial lighting switch must:

(i) Be located in a visible position in the room being switched or in an adjacent room or space from where 90% of the lighting being switched is visible,

(ii) for other than a single function space such as an auditorium, theatre or sporting stadium, not operate lighting for an area greater than 250m^2 if in a Class 5 or Class 8 building, or.

(ii) not operate lighting for an area greater than 250m^2 for a space up to 2000m^2 or up to 1000m^2 for a space greater than 2000m^2

(4) 95% of artificial lighting in a building or storey of a building, other than a Class 2 or 3 building or a Class 4 part, of more than 250m^2 must be controlled by:

(i) A time switch in accordance with Specification 40 in appendix 7; or

(ii) An occupant sensing device such as a security key card reader or a motion detector in accordance with Specification 40 in appendix 7.

Compliance can be met by:

- *Time switch(s) or motion detector(s) or security card reader(s) must be installed to control at least 95% of the new lighting in the building.*

(9) These lighting requirements do not apply to Emergency lighting requirements or where lighting is required for 24 hours occupancy situations.

(10) The requirements of (4) 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 in a patient care area in a Class 9a building or in a Class 9c aged care building.

(ii) A heater where the heater also emits light, such as in bathrooms.

J7D5 Interior decorative and display lighting

(1) Interior decorative and display lighting, such as for a foyer mural or art display, must be controlled:
   (a) Separately from other artificial lighting; and
   (b) By a manual switch for each area other than when the operating times of the displays are the same in a number of areas such as in a museum, art gallery or the like, in which case they may be combined; and
   (c) By a time switch in accordance with Specification 40 in appendix 7 where display lighting exceeds 1 kW.

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

Compliance can be met by:

- *Decorative or display lighting must be controlled separately from general lighting manually and by a time switch in accordance with specification* 40 in appendix 7 *if the lighting exceeds 1kW*

J7D6 External artificial lighting

(a) External artificial lighting attached to or directed at the façade of a building, must:
   (a) Be controlled by either 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
   (b) When the total perimeter lighting load exceeds 100W, use LED luminaires for 90% of the total lighting load, or be controlled by a motion detector in accordance with Specification 40 in appendix 7, or when used for decorative purposes, such as façade lighting or signage lighting, have a separate time switch in accordance with Specification 40 in appendix 7.

(b) The requirements of (1)(b) do not apply to the following:
   (i) Emergency lighting in accordance with Part E4.
   (ii) Lighting around a detention centre.

Compliance can be met by:

- *External perimeter lighting must be controlled by either a daylight sensor or a time switch in accordance with specification* 40 in appendix 7*, and LED lights must be used for 90% of the total lighting load if the lighting exceeds 100 watts.*

NOTE:

- That for smaller rooms a greater Illumination Power Density can be achieved by using a Motion Detector.
- All areas have had the Room Aspect Ration applied.
- For stairwells and corridors the provisions of Part E4 override this Section.

J7D7 Boiling water & 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 40 in appendix 7.

J7D8 Lifts

Lifts must be configured to ensure the lighting and ventilation in the car are turned off when unused for 15 minutes, and achieve the ideal and standby energy performance level of 2 for rated load less than 800kg, 3 for 801kg to 2000kg, 4 for 2001kg to 4000kg, 5 for greater than 4000kg, and achieve the energy efficiency class C for usage categories 1 to4 and Energy Class D for usage categories greater than 5, or energy class d for dedicated goods lifts.

Compliance can be met by:

- *Ensure the lift lighting and ventilation is turned off when the lift is unused for more than 15 minutes*

J7D9 Escalators and moving walkways – not applicable

3.5 PART J8 – HEATED WATER SUPPLY, SWIMMING POOL, SPA POOL

J8D2 Heated Water Supply

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

3.6 PART J9 - FACILITIES FOR ENERGY MONITORING

J9D3 Facilities for Energy Monitoring

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

(2) A building with a floor area greater than 2500m^2 must have energy meters to record time-of-use energy consumption of air-conditioning plant, artificial lighting, appliance power, central hot water supply, internal transport devices, renewable energy equipment, on-site electric vehicle charging equipment, on-site battery systems, and other ancillary plant.

(3) Energy meters required by (2) 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.

(4) the provision of (2) do not apply to a Class 2 Building with a floor of more than 2500m^2 where the total area of common areas is less the 500m^2

Compliance can be met by:

- *The new addition must have energy meters for recording time-of-use electricity and gas (if applicable) consumption for air-conditioning, lighting, power, lifts, renewable energy, EV charging equipment and battery systems.*

J9D4 Facilities for Electric vehicle charging equipment

(1) A carpark associated with a Class 2, 3, 5, 6, 7b, or 9 building must be provided with electrical distribution boards dedicated to electric vehicle charging –

  (a) In accordance with Table J9D4 in each storey of the carpark, and

  (b) Labelled to indicate use for electric vehicle charging equipment.

Compliance can be met by:

- *Installing a dedicated electrical distribution board for every 24 electric vehicle carpark spaces.*
- *Installing the switchboards fitted with charging control system to manage and schedule charging*
- *The capacity for each circuit must deliver a minimum 12kWh from 11pm to 7am daily for class 2, 12kWh from 9:00am to 5:00pm daily for class 5 to 9, and 48kWh from 11pm to 7am daily for class 3*
- *Installing the switchboard with capacity*
    - *For a future 7kW (32A) type 2 electric vehicle charge 100% of the spaces in class 2, 10% of the spaces in Class 5 & 6, 20% of the spaces for class 3,7b, 8 or 9.*
    - *For at least 36mm width DIN rail per outgoing circuit for individual sub-circuit electricity metering to record electricity use of electric vehicle charging equipment*
    - *Be labelled to indicate the space is for future use*

Table J9D4: Electric vehicle distribution board requirement for each storey of a carpark

Carpark spaces per *storey* for electric vehicles	Electrical distribution boards for electric vehicle charging per *storey*
0 - 9	0
10 - 24	1
25 - 48	2
49 - 72	3
73 - 96	4
97 - 120	5
121 - 144	6
145 - 168	7

Table Notes

Where there are more than 168 *carpark* spaces per *storey*, one additional distribution board must be provided for each additional 24 spaces or part thereof.

J9D5 Facilities for Solar Photovoltaic and Battery Systems

(1) The main electrical switchboard of a building must-

- (a) Contain at least two empty three-phase circuit breaker slots and four DIN rail spaces labelled to indicate the use of each space for-
    - (i) A solar photovoltaic system; and
    - (ii) A battery system; and
- (b) Be sized to accommodate the installation of solar photovoltaic panels producing their maximum electrical output on at least 20% of the building roof area.

(2) At least 20% of the roof area of a building must be left clear for the installation of solar photovoltaic panels, except for buildings-

- (a) With installed solar photovoltaic panels on-
    - (i) At least 20% of the roof area; or
    - (ii) An equivalent generation capacity elsewhere on the site; or
- (b) Where 100% of the roof area is shaded for more than 70% of daylight hours; or
- (c) With a roof area of not more than $55m^2$; or
- (d) Where more than 50% of the roof area is used as a terrace, carpark, roof garden, roof light or the like.

Compliance can be met by:

- *If the main switchboard is being upgrades then allow space for*
    - *at least one empty three-phase circuit breaker slots and two DIN rail spaces labelled to indicate the use of each space for a solar photovoltaic system, unless there is already a Solar system designed for at least 20%of the roof area.*
    - *at least one empty three-phase circuit breaker slots and two DIN rail spaces labelled to indicate the use of each space for a battery system, unless there is already a battery system in the design.*
    - *a size to accommodate the installation of solar photovoltaic panels at maximum output on at least 20% of the building roof area.*
- *Leaving at least 20% of the roof area clear for solar photovoltaic panels, unless there is already a solar system designed for at least 20%of the roof area.*

SECTION 4 - APPENDICES

This requirement is superseded by Section 3

NCC 2019 Facade calculator

Project Name	Dapto Leagues addition					
Building Class	6		Class 2,3,5,6,7,8,9a, 9c, ward			
Climate Zone	5		Storey	ground		
Wall+glazing U-value max limit	2.0					

	N	E	S	W
Solar Admittance max limit	0.13	0.13	0.13	0.13
Proposed wall R-value	1.10	0.00	1.10	1.10

	Method 1				Method 2	
	N	E	S	W	Combined	
Wall+glazing area	180.4	0.0	180.4	444.6	805.4	
Glazing area	72.2	0.0	65.8	129.1	267.0	
wall area percentage	60%	0%	64%	71%	67%	
Proposed Wall U-value	0.91	0.00	0.91	0.91	0.91	
Proposed Wall+Glazing U-value	2.22	0.00	2.11	1.86		2.00
Proposed Wall+Glazing Solar Adn	0.190	0.000	0.129	0.096		
	Reference combined SHGC Energy Value					178.07
	Proposed combined SHGC Energy Value					176.32

Element	Facing	Height	Width	Area	U-value	SHGC	P (device	H
Sports	s	3.00	9.50	28.5	4.20	0.62		
Sports	w	5.40	10.30	55.6	4.20	0.62	device	
Sports door	s	3.00	3.00	9.0	4.20	0.62	device	
sorts window	s	3.00	2.00	6.0	4.20	0.62	device	
Sports device	w	5.40	3.40	18.4	4.20	0.62	device	
sports	w	5.40	3.40	18.4	4.20	0.62		
sports window	n	3.00	1.50	4.5	4.20	0.62		
food device	w	5.40	3.40	18.4	4.20	0.62	device	
food	w	5.40	3.40	18.4	4.20	0.62		
food	n	3.00	1.50	4.5	4.20	0.62		
food doors	n	3.00	6.00	18.0	4.20	0.62		
food window	n	3.00	6.40	19.2	4.20	0.62		
servery	n	3.00	1.90	5.7	4.20	0.62	device	
Stair 9 entry	s	4.50	2.40	10.8	4.20	0.62	device	
Alfresco	n	2.70	7.50	20.3	4.20	0.62	device	
Kids play	s	2.40	4.80	11.5	4.20	0.62	int	

APPENDIX 2 - LIGHTING CALCULATIONS TABLES

AREA DESCRIPTION	FLOOR DIMENSIONS		AREA (m2)	LIGHT ALLOW	MAX. LIGHTING WATTAGE
	L	B		(W/m^2)	(W)
Basement					
Proposed Store	6.1	11.9	72.7	1.5	**146**
Ground					
Sports area	21	19.1	401.6	8	**4178**
Wash	7.1	2.6	18.5	4	**125**
Bar	11	2.8	31.3	4	**196**
Food & Beverage	21	23.1	484.7	14	**8529**
Additional mill area	7.2	13.1	94.2	14	**1795**
Male	3.2	7.9	25.2	3	**118**
Acc WC	2.5	2.6	6.4	3	**33**
Add circulation	3	3.8	11.5	5	**95**
Kitchen	7.4	14.9	110.3	4	**576**
Loading dock	9	9.8	87.9	4	**536**
Bin Store	9	5.6	50.4	1.5	**106**
Servery	7.3	2.7	19.9	5	**160**
Total Sum					**16593**

APPENDIX 3 - TABLE OF MAXIMUM ILLUMINATION POWER DENSITY

Space	Maximum illumination power density ($W/m^{2)}$
Auditorium, church and public hall	8
Board room and conference room	5
Car park - general	2
Car park - entry zone (first 20 m of travel)	11.5
Common rooms spaces and corridors	4.5
Control room, switch room, and the like	3
Corridors	5
Courtroom	4.5
Entry lobby	9
Health-care - Children's ward	4
Health-care - examination room	4.5
Health-care - patient ward	2.5
Health-care - all patient care	2.5
Kitchen and food preparation area	4
Laboratory	6
Library - stack and shelving	2.5
Library - reading room	4.5
Museum and gallery - circulation, cleaning and service lighting	2.5
Office - artificially lit to an ambient level of 200 lux or more	4.5
Office - artificially lit to an ambient level of less than 200 lux	2.5
Plant room	4
Restaurant, café, bar, hotel lounge and a space for the serving and consumption of food or drinks	14
Retail space including a museum and gallery whose purpose is the sale of objects	14
School - general purpose learning area	4.5
Storage with shelving no higher than 75% of the height of the aisle lighting	1.5
Service area, locker room, staff room, cleaner's room, rest room and the like	1.5
Toilet, locker room, staff room, rest room and the like	3
Wholesale storage and display area	4

Notes:

1. In areas not listed above, the maximum *illumination power density* is:
   a) For an illuminance of less than 80 Lux, 2 W/m^2
   b) For an illuminance of less than 80 to 160 Lux, 2.5 W/m^2
   c) For an illuminance of less than 160 to 240 Lux, 3 W/m^2
   d) For an illuminance of less than 240 to 320 Lux, 4.5 W/m^2
   e) For an illuminance of less than 320 to 400 Lux, 6 W/m^2
   f) For an illuminance of less than 400 to 600 Lux, 10 W/m^2
   g) For an illuminance of less than 600 to 800 Lux, 11.5 W/m^2

APPENDIX 4 - EVIDENCE OF COMPLIANCE CHECKLIST

The purpose of this checklist is to itemise the evidence that should be collected during the construction phase of the project that will demonstrate how the final building complies with the Energy Efficiency requirements of Section J of the NCC that were identified during the design phase. This following check list is a generic list and some elements may not be applicable to a particular project. Evidence of construction compliance should be provided by the installer.

PART J4 - BUILDING FABRIC

Element	Applicable (Y or N)	Evidence
Roof & ceiling insulation		Delivery receipts for roof/ceiling insulation type and rating and/or pictures of insulation installation and the R rating of the insulation.
Roof Lights		Delivery receipts for any roof lights nominating the number, size and solar characteristics (U-value and SHGC-value).
Wall insulation		Delivery receipts for wall insulation type and rating and/or pictures of insulation installation and the R rating of the insulation.
Floor		Delivery receipts for floor insulation type and rating and/or pictures of insulation installation and the R rating of the insulation.
Glazing		Delivery receipts for the glazing installed on site including the thermal characteristics of the glazing (U-value and SHGC- value).

Or a signed and dated statement from the builder/contractor that the Building Fabric insulation was installed as per the authorised plans and the Energy Efficiency Report.

PART J5 - BUILDING SEALING

Element	Applicable (Y or N)	Evidence
Infiltration prevention		Delivery receipts for the number of self closing doors installed.
Exhaust fans		Delivery receipts for the self closing dampers on exhaust fans or pictures showing their installation.

Or a signed and dated statement from the builder/contractor that the self closing doors and/or A/C outlet next to the open shop front was installed as per the authorised plans, specifications and the Energy Efficiency Report.

PART J6 - A/C & VENTILATION SYSTEMS

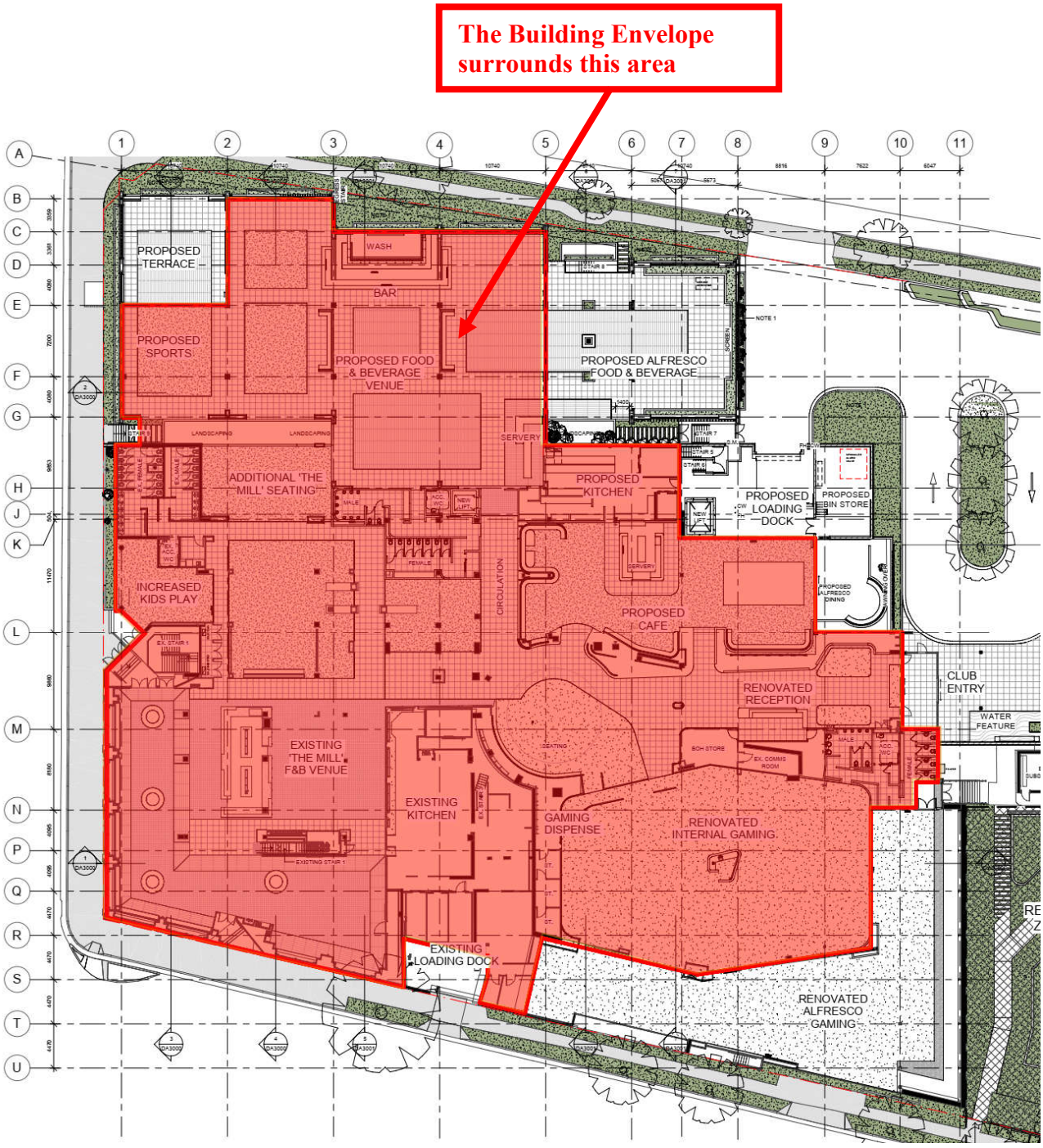
A signed and dated statement from the A/C installer that the A/C system complies with MEPS and complies with all the requirements of Section J of the NCC 2022.

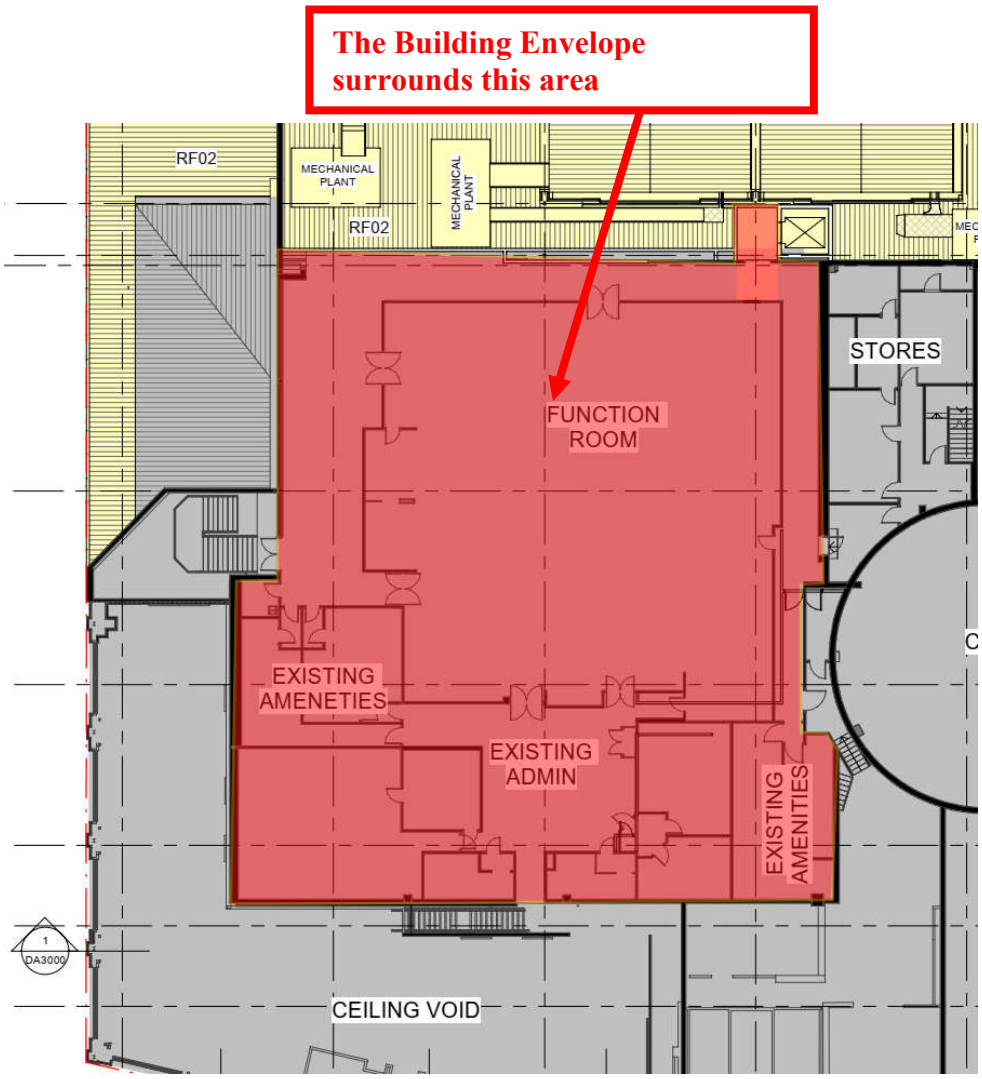
PART J7 - ARTIFICIAL LIGHTING AND POWER

Element	Applicable (Y or N)	Evidence
Internal Lighting		Delivery receipts for the number and wattage of all the internal lights installed.
External lighting		Delivery receipts for the number and wattage of all the external lights installed.

Or a signed and dated statement from the lighting installer that the lighting was installed as per the authorised plans, specifications and the Energy Efficiency Report.

APPENDIX 5 – BUILDING ENVELOPE




The Building Envelope surrounds this area
RF02
MECHANICAL PLANT
RF02
MECHANICAL PLANT
STORES
FUNCTION ROOM
EXISTING AMENETIES
EXISTING ADMIN
EXISTING AMENITIES
1
DA3000
CEILING VOID

APPENDIX 6 – NCC 2022 ADDITIONAL CLAUSES

J6D5 Fans and duct systems

[2019: J5.4]

(1) Fans, ductwork and duct components that form part of an *air-conditioning* system or mechanical ventilation system must—

(a) separately comply with (2), (3), (4) and (5); or

(b) achieve a fan motor input power per unit of flowrate lower than the fan motor input power per unit of flowrate achieved when applying (2), (3), (4) and (5) together.

(2) Fans:

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

$$\eta_{min} = 0.13 \times \ln(p) - 0.3$$

(a) In the formula at (a)—

(i) η_{min} = the minimum *required* system static efficiency for installation type A or C or the minimum *required* system total efficiency installation type B or D; and

(ii) p = the static pressure of the system (Pa); and

(iii) $\ln$ = natural logarithm.

(b) 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:

$$\eta_{min} = 0.85 \times (a \times \ln(P) - b + N)/100$$

(c) In the formula at (c)—

(i) η_{min} = the minimum *required* system static efficiency for installation type A or C or the minimum *required* system total efficiency installation type B or D; and

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

(iii) N = the minimum performance grade obtained from Table J6D5a; and

(iv) a = regression coefficient a, obtained from Table J6D5b; and

(v) b = regression coefficient b, obtained from Table J6D5c; and

(vi) ln = natural logarithm.

(d) The requirements of (a), (b), (c) and (d) do not apply to fans that need to be explosion proof.

(3) Ductwork:

(a) 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.

(b) Flexible ductwork must not account for more than 6 m in length in any duct run.

(c) The upstream connection to ductwork bends, elbows and tees in the index run must have an equivalent diameter to the connected duct.

(d) Turning vanes must be included in all rigid ductwork elbows of 90° or more acute than 90° in the index run except where—

(i) the inclusion of turning vanes presents a fouling risk; or

(ii) a long radius bend in accordance with AS 4254.2 is used.

(4) Ductwork components in the index run:

(a) The pressure drop across a coil must not exceed the value specified in Table J6D5d.

(b) A high efficiency particulate arrestance (HEPA) air filter must not exceed the higher of—

(i) a pressure drop of 200 Pa when clean; or

(ii) the filter design pressure drop when clean at an air velocity of 1.5 m/s.

(c) Any other air filter must not exceed—

(i) the pressure drop specified in Table J6D5e when clean; or

(ii) the filter design pressure drop when clean at an air velocity of 2.5 m/s.

(d) The pressure drop across intake louvres must not exceed the higher of—

(i) for single stage louvres, 30 Pa; and

(ii) for two stage louvres, 60 Pa; and

(iii) for acoustic louvres, 50 Pa; and

(iv) for other non-weatherproof louvres, 30 Pa.

(e) The pressure drop across a variable air volume box, with the damper in the fully open position, must not exceed—

(i) for units with electric reheat, 100 Pa; and

(ii) for other units, 25 Pa not including coil pressure losses.

(f) Rooftop cowls must not exceed a pressure drop of 30 Pa.

(g) Attenuators must not exceed a pressure drop of 40 Pa.

(h) Fire dampers must not exceed a pressure drop of 15 Pa when open.

(i) Balancing and control dampers in the index run must not exceed a pressure drop of 25 Pa when in the fully open position.

(j) Supply air diffusers and grilles must not exceed a pressure drop of 40 Pa.

(k) Exhaust grilles must not exceed a pressure drop of 30 Pa.

(l) Transfer ducts must not exceed a pressure drop of 12 Pa.

(m) Door grilles must not exceed a pressure drop of 12 Pa.

(n) Active chilled beams must not exceed a pressure drop of 150 Pa.

(5) The requirements of (1), (2), (3) and (4) do not apply to—

(a) fans in unducted *air-conditioning* systems with a supply air capacity of less than 1000 L/s; and

(b) smoke spill fans, except where also used for *air-conditioning* or ventilation; and

(c) the power for process-related components; and

(d) kitchen exhaust systems.

Table J6D5a: Minimum fan performance grade

Fan type	Installation type A or C	Installation type B or D
Axial — as a component of an air handling unit or fan coil unit	46.0	51.5
Axial — other	42.0	61.0
Mixed flow — as a component of an air handling unit or fan coil unit	46.0	51.5
Mixed flow — other	52.5	65.0
Centrifugal forward — curved	46.0	51.5
Centrifugal radial bladed	46.0	51.5
Centrifugal backward-curved	64.0	64.0

Table Notes

(1) Installation type A means an arrangement where the fan is installed with free inlet and outlet conditions.

(2) Installation type B means an arrangement where the fan is installed with a free inlet and a duct at its outlet.

(3) Installation type C means an arrangement where the fan is installed with a duct fitted to its inlet and with free outlet conditions.

(4) Installation type D means an arrangement where the fan is installed with a duct fitted to its inlet and outlet.

Table J6D5b: Fan regression coefficient a

Fan type	Fan motor input power < 10 kW	Fan motor input ≥ 10 kW
Axial	2.74	0.78
Mixed flow	4.56	1.1
Centrifugal forward-curved	2.74	0.78
Centrifugal radial bladed	2.74	0.78
Centrifugal backward-curved	4.56	1.1

Table J6D5c: Fan regression coefficient b

Fan type	Fan motor input power < 10 kW	Fan motor input ≥ 10 kW
Axial	6.33	1.88
Mixed flow	10.5	2.6
Centrifugal forward-curved	6.33	1.88
Centrifugal radial bladed	6.33	1.88
Centrifugal backward-curved	10.5	2.6

Table J6D5d: Maximum coil pressure drop

Number of rows	Maximum pressure drop (Pa)
1	30
2	50
4	90
6	130
8	175
10	220

Table J6D5e: Maximum clean filter pressure drop

Filter minimum efficiency reporting value	Maximum pressure drop (Pa)
9	55
11	65
13	95
14	110

J6D8 Pump systems

[2019: J5.7]

(1) General — Pumps and pipework that form part of an *air-conditioning* system must either—

(a) separately comply with (2), (3) and (4); or

(b) achieve a pump motor power per unit of flowrate lower than the pump motor power per unit of flowrate achieved when applying (2), (3) and (4) together.

(2) Circulator pumps — A glandless impeller pump, with a rated hydraulic power output of less than 2.5 kW 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.

(3) 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.

(4) Pipework — Straight segments of pipework along the index run, forming part of an *air-conditioning* system—

(a) 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—

(i) for constant speed systems, the values nominated in Table J6D8a; or

(ii) for variable speed systems, the values nominated in Table J6D8b; or

(b) in any other pipework system, must achieve an average pressure drop of not more than—

(i) for constant speed systems, the values nominated in Table J6D8c; or

(ii) for variable speed systems, the values nominated in Table J6D8d.

(5) The requirements of (4) do not apply—

(a) to valves and fittings; or

(b) where the smallest pipe size compliant with (4) results in a velocity of 0.7 m/s or less at design flow.

Table J6D8a: Maximum pipework pressure drop – Non-distributive constant speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	400
25	400	400
32	400	400
40	400	400
50	400	350
65	400	350
80	400	350
100	400	200
125	400	200
150 or more	400	200

Table J6D8b: Maximum pipework pressure drop – Non-distributive variable speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	400
25	400	400
32	400	400
40	400	400
50	400	400
65	400	400
80	400	400
100	400	300
125	400	300
150 or more	400	300

Table J6D8c: Maximum pipework pressure drop – Distributive constant speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 2000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating between 2000 hours/annum and 5000 hrs/yr (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	300	150
25	400	220	100
32	400	220	100
40	400	220	100
50	400	220	100
65	400	400	170
80	400	400	170
100	400	400	170
125	400	400	170
150 or more	400	400	170

Table J6D8d: Maximum pipework pressure drop – Distributive variable speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	250
25	400	180
32	400	180
40	400	180
50	400	180
65	400	300
80	400	300
100	400	300
125	400	300
150 or more	400	300

J6D9 Pipework insulation

[2019: J5.8]

(1) *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 *air-conditioning* system, other than in appliances covered by MEPS, must be provided with insulation—

(a) complying with AS/NZS 4859.1; and

(b) for *piping* of heating and cooling fluids, having an insulation *R-Value* in accordance with Table J6D9a; and

(c) for vessels, heat exchangers or tanks, having an insulation *R-Value* in accordance with Table J6D9b; and

(d) 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 500 mm of the connection.

(2) Insulation must—

(a) be protected against the effects of weather and sunlight; and

(b) be able to withstand the temperatures within the *piping*, vessel, heat exchanger or tank.

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

(4) The requirements of (1) and (2) do not apply to *piping*, vessels or heat exchangers—

(a) 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

(b) encased within a concrete slab or panel which is part of a heating or cooling system; or

(c) supplied as an integral part of a chiller, *boiler* or unitary air-conditioner complying with the requirements of J6D10, J6D11 and J6D12; or

(d) inside an air-handling unit, fan-coil unit, or the like.

(5) For the purposes of (1), (2), (3) and (4)—

(a) heating fluids include refrigerant, heated water, steam and condensate; and

(b) cooling fluids include refrigerant, chilled water, brines and glycol mixtures, but do not include condenser cooling water.

Table J6D9a: Piping — Minimum insulation R-Value

Fluid temperature	Minimum insulation *R-Value* nominal pipe diameter ≤ 40 mm	Minimum insulation *R-Value* — nominal pipe diameter > 40 mm and ≤ 80 mm	Minimum insulation *R-Value* — nominal pipe diameter between > 80 mm and ≤ 150 mm	Minimum insulation *R-Value* — nominal pipe diameter > 150 mm
Low temperature chilled — ≤ 2°C	1.3	1.7	2.0	2.7
Chilled — > 2°C but ≤ 20°C	1.0	1.5	2.0	2.0
Heated — > 30°C but ≤ 85°C	1.7	1.7	1.7	1.7
High Temperature heated — > 85°C	2.7	2.7	2.7	2.7

Table Notes

The minimum *required R-Value* may be halved for *piping* penetrating a structural member.

Table J6D9b: Vessels, heat exchangers and tanks — Minimum insulation R-Value

Fluid temperature range	Minimum insulation *R-Value*
Low temperature chilled — ≤ 2°C	2.7
Chilled — > 2°C but ≤ 20°C	1.8
Heated — > 30°C but ≤ 85°C	3.0
High temperature heated — > 85°C	3.0

J6D11 Refrigerant chillers

[2019: J5.10]

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 Table J6D11a or Table J6D11b when determined in accordance with AHRI 551/591.

Table J6D11a: Minimum energy efficiency ratio for refrigerant chillers – Option 1

Chiller type	Full load operation ($W_r/W_{input\ power}$)	Integrated part load ($W_r/W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kWr	2.985	4.048
Air-cooled chiller with a capacity > 528 kWr	2.985	4.137
Water-cooled positive displacement chiller with a capacity ≤ 264 kWr	4.694	5.867
Water-cooled positive displacement chiller with a capacity > 264 kWr but ≤ 528 kWr	4.889	6.286
Water-cooled positive displacement chiller with a capacity > 528 kWr but ≤ 1055 kWr	5.334	6.519
Water-cooled positive displacement chiller with a capacity > 1055 kWr but ≤ 2110 kWr	5.800	6.770
Water-cooled positive displacement chiller with a capacity > 2110 kWr	6.286	7.041
Water-cooled centrifugal chiller with a capacity ≤ 528 kWr	5.771	6.401
Water-cooled centrifugal chiller with a capacity > 528 kWr but ≤ 1055 kWr	5.771	6.519
Water-cooled centrifugal chiller with a capacity > 1055 kWr but ≤ 1407 kWr	6.286	6.770
Water-cooled centrifugal chiller with a capacity > 1407 kWr	6.286	7.041

Table J6D11b: Minimum energy efficiency ratio for refrigerant chillers – Option 2

Chiller type	Full load operation ($W_r/W_{input\ power}$)	Integrated part load ($W_r/W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kWr	2.866	4.669
Air-cooled chiller with a capacity > 528 kWr	2.866	4.758
Water-cooled positive displacement chiller with a capacity ≤ 264 kWr	4.513	7.041
Water-cooled positive displacement chiller with a capacity > 264 kWr but ≤ 528 kWr	4.694	7.184
Water-cooled positive displacement chiller with a capacity > 528 kWr but ≤ 1055 kWr	5.177	8.001
Water-cooled positive displacement chiller with a capacity > 1055 kWr but ≤ 2110 kWr	5.633	8.586
Water-cooled positive displacement chiller with a capacity > 2110 kWr	6.018	9.264
Water-cooled centrifugal chiller with a capacity ≤ 528 kWr	5.065	8.001
Water-cooled centrifugal chiller with a capacity > 528 kWr but ≤ 1055 kWr	5.544	8.001
Water-cooled centrifugal chiller with a capacity > 1055 kWr but ≤ 1407 kWr	5.917	9.027
Water-cooled centrifugal chiller with a capacity > 1407 kWr	6.018	9.264

J6D13 Heat rejection equipment

[2019: J5.12]

(1) The motor rated power of a fan in a cooling tower, closed circuit cooler or evaporative condenser must not exceed the allowances in Table J6D13.

(2) The fan in an air-cooled condenser must have a motor rated power of not more than 42 W for each kW of heat rejected from the refrigerant, when determined in accordance with AHRI 460 except for—

(a) a refrigerant chiller in an *air-conditioning* system that complies with the energy efficiency ratios in J6D11; or

(b) packaged air-conditioners, split systems, and variable refrigerant flow *air-conditioning* equipment that complies with the energy efficiency ratios in J6D12.

Table J6D13: Maximum fan motor power – Cooling towers, closed circuit coolers and evaporative condensers

Type	Cooling tower maximum fan motor input power (W/kW_{rej})	Closed circuit cooler maximum fan motor input power (W/kW_{rej})	Evaporative condenser maximum fan motor input power (W/kW_{rej})
Induced draft	10.4	16.9	11.0
Forced draft	19.5	Note	11.0

Table Notes

A closed circuit, forced draft cooling tower must not be used.

Appendix 7

This appendix contains the requirements for lighting and power control devices including timers, time switches, motion detectors and daylight control devices, consistent with Specification 40 in the NCC.

S40C2 Lighting timers

A lighting timer must-

(a) Be located within 2m of every entry door to the space; and
(b) Have an indicator light that is illuminated when the artificial lighting is off; and
(c) not control more than 100m^2 with a single push button and 97% of the lights in spaces more than 25m^2; and
(d) be capable of maintaining the artificial lighting for no less than 5 minutes and no more than 12 hours.

S40C3 Time switch

(a) A time switch must be capable of switching on and off electric power at variable pre-programmed times and on variable pre-programmed days, and configured to turn off the lights any time the space is designated to be unoccupied.

(b) A time switch for internal lighting must be capable of being overridden by
- a means of turning the lights on
  - by a manual switch or occupant sensing device for a period of 2 hours after which the time switch must resume control or
  - an occupant sensing device that overrides the time switch upon a person's entry and returns control to the time switch on the person's exit (eg security card reader), and
- a manual "off" switch

(c) A time switch for external lighting must be capable of
- Limiting the period the system is switched on to between 30 minutes before sunset and 30 minutes after sunrise is determined or detected including any pre-programming period between these times, and
- Being overridden by a manual switch, remote control or a security access system for a period of up to 8 hours, after which the time switch must resume control.

(d) A time switch for boiling water and chilled water storage units must be capable of being overridden by a manual switch or a security access system that senses a person's presence, overrides for a period of up to 2 hours, after which if there is no further presence detected, the time switch must resume control.

S40C4 Motion Detectors

(2) In a Class 5, 6, 7, 8, 9a or 9b building, a motion detector must:
- (a) Be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means; and
- (b) Be capable of detecting a person before they have entered 1 m into the space; and
- (c) Not control more than an area of 100m^2 and 95% of the lights in spaces more than 25m^2; and
- (d) Be configured so that the lights are turned off when the space is unoccupied for more than 15 minutes; and
- (e) Be capable of being overridden by a manual switch only enabling the lights to be turned off.

(3) When outside a building, a motion detector must:

(a) Be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means; and

(b) Be capable of detecting a person within a distance of twice the mounting height or 80% of the ground area covered by the lights beam, and

(c) Not control more than 5 lights and

(d) Be operated in series with a photoelectric cell or astronomical time switch so that the lights will not operate in daylight hours, and

(e) Be configured so that the lights are turned off when the space is unoccupied for more than 15 minutes, and

(f) Have a manual override switch which is reset after a maximum period of 4 hours.

(4) When in a fire-isolated stairway, fire-isolated passageway or fire-isolated ramp, a motion detector must:

(a) Be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means; and

(b) Be capable of detecting movement of 500mm within the useable part of the space and a person before they have entered 1m unto the space; and

(c) Be configured so that the lights dim to a 30% peak power or less when the space is unoccupied for more than 15 minutes.

Spec J6.5 Daylight sensor and dynamic lighting control device

(1) A daylight sensor and dynamic lighting control device for artificial lighting must:

(a) For switching on and off, be capable of having the switching level set point adjusted between 50 and 10000 lux; and have a delay of more than 2 minutes or a differential of more than 100 lux for high pressure discharge lighting and 50 lux for everything else; and

(b) For dimming or stepped switching, be capable of reducing the power consumed by the controlled lighting in proportion to the incident daylight on the working plane either continuously down or in no less than 4 steps down to a power consumption that is less than 50% of full power.

(2) Where a daylight sensor and dynamic control device has a manual override switch, the manual override switch must not be able to switch the lights permanently on or bypass the lighting controls.

APPENDIX 8 - REFERENCE BUILDING - TOTAL ANNUAL ENERGY CONSUMPTION

Fuel Totals - Reference, Building

EnergyPlus Output | 1 Jan - 31 Dec, Run period | Licensed

	Year
Room Electricity (MWh)	41.78
Lighting (MWh)	60.11
System Fans (MWh)	1.71
Electricity (MWh)	162.46
Heating (Electricity) (MWh)	8.14
Cooling (Electricity) (MWh)	50.71

APPENDIX 9 - REFERENCE BUILDING - MONTHLY ENERGY CONSUMPTION

Fuel Totals - Reference, Building

EnergyPlus Output | 1 Jan - 31 Dec, Monthly | Licensed

Month												
Room Electricity (kWh)	3478.11	3203.86	3598.89	3467.21	3478.11	3467.21	3598.89	3478.11	3467.21	3479.02	3467.21	3598.89
Lighting (kWh)	5004.66	4609.63	5177.66	4988.32	5004.66	4988.32	5177.66	5004.66	4988.32	5004.66	4988.32	5177.66
System Fans (kWh)	237.14	220.07	203.47	139.15	82.85	61.69	84.09	92.90	92.74	128.69	162.29	201.32
Electricity (kWh)	16781.29	15583.31	15949.16	13336.37	11486.11	10822.05	11979.39	11873.04	11743.04	12960.58	14048.10	15893.51
Heating (Electricity) (kWh)	39.33	8.50	43.22	273.83	788.89	1564.34	2342.86	1607.27	872.89	355.03	177.74	70.05
Cooling (Electricity) (kWh)	8022.05	7541.26	6925.91	4467.86	2131.60	740.49	775.89	1690.10	2321.90	3993.17	5252.54	6845.59

APPENDIX 10 - PROPOSED BUILDING - TOTAL ANNUAL ENERGY CONSUMPTION

Fuel Breakdown - Proposed, Building

EnergyPlus Output | 1 Jan - 31 Dec, Run period | Licensed

	Year
Room Electricity (MWh)	41.78
Lighting (MWh)	60.11
System Fans (MWh)	1.65
Electricity (MWh)	161.97
Heating (Electricity) (MWh)	13.94
Cooling (Electricity) (MWh)	44.48

APPENDIX 11 - PROPOSED BUILDING - MONTHLY ENERGY CONSUMPTION

Fuel Breakdown - Proposed, Building

EnergyPlus Output | 1 Jan - 31 Dec, Monthly | Licensed

Month												
Room Electricity (kWh)	3478.11	3203.86	3598.89	3467.21	3478.11	3467.21	3598.89	3478.11	3467.21	3479.02	3467.21	3598.89
Lighting (kWh)	5004.66	4609.63	5177.66	4988.32	5004.66	4988.32	5177.66	5004.66	4988.32	5004.66	4988.32	5177.66
System Fans (kWh)	237.24	218.31	190.75	121.32	71.24	71.58	107.03	95.87	81.56	117.46	148.51	193.75
Electricity (kWh)	16800.47	15530.92	15530.33	12763.85	11207.71	11384.33	13070.95	12193.18	11518.01	12677.88	13623.36	15671.85
Heating (Electricity) (kWh)	89.18	17.91	99.17	425.20	1338.35	2683.62	3958.06	2652.14	1503.78	679.08	309.08	184.38
Cooling (Electricity) (kWh)	7991.28	7481.21	6463.87	3761.81	1315.35	173.60	229.31	962.41	1477.14	3397.65	4710.24	6517.17

APPENDIX 12 - Proposed Building - temperature and PMV range excursions

Section J Temperature Range Check. Target temperature range: 21 - 24 degrees.
All zones pass temperature check - **Building : PASS**

Block	Zone	Floor Area (m²)	Fraction Total Floor Area	Building Class	Operation Hours	Operation Hours T below target	Operation Hours T in target range	Operation Hours T above target	Fraction Operation Hours T in target range	Zone temperature meets Section J target (T in target range ≥ 98 % Operation Hours)
Ground	Cafe	321.9	0.19	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground	Mill	290.8	0.17	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground	Kitchen	102.1	0.06	Class 6 cafe/restaurant (TO)	4069	0	4069	0	1.000	PASS
Ground	Sports & Food	1101.4	0.64	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS

Section J PMV Thermal Comfort Check. Target PMV range: -1.0 to +1.0
More than 95% (99.1%) of floor area passes PMV check - **Building : PASS**

Ground	Cafe	321.9	0.19	Class 6 cafe/restaurant	4069	75	3994	0	0.982	PASS
Ground	Mill	290.8	0.17	Class 6 cafe/restaurant	4069	72	3997	0	0.982	PASS
Ground	Kitchen	102.1	N/A	Class 6 cafe/restaurant (TO)	4069	N/A	N/A	N/A	N/A	N/A
Ground	Sports & Food	1101.4	0.64	Class 6 cafe/restaurant	4069	55	3998	16	0.983	PASS

Appendix 13 – Drawing List

DA DRAWING LIST		
Sheet Number	Sheet Name	Current Revision
DA0000	COVER PAGE	C
DA0001	SITE PLAN	C
DA0002	SITE ANALYSIS	C
DA0003	SHADOW DIAGRAM - SUMMER SOLSTICE	A
DA0004	SHADOW DIAGRAM - WINTER SOLSTICE	A
DA1000	EXISTING DEMOLITION BASEMENT PLAN - ZONE A	C
DA1001	EXISTING DEMOLITION GROUND FLOOR PLAN - ZONE A	D
DA1002	EXISTING DEMOLITION GROUND FLOOR PLAN - ZONE B	D
DA1003	EXISTING DEMOLITION LEVEL 1 PLAN - ZONE A	C
DA1004	EXISTING DEMOLITION LEVEL 2 PLAN (PLANT ROOM) - ZONE A	C
DA1005	EXISTING DEMOLITION ROOF PLAN - ZONE A	C
DA1100	BASEMENT PLAN - ZONE A	C
DA1101	GROUND FLOOR PLAN - ZONE A	F
DA1102	GROUND FLOOR PLAN - ZONE B	D
DA1103	LEVEL 1 PLAN - ZONE A	C
DA1104	LEVEL 1 PLAN - ZONE B	C
DA1105	LEVEL 2 PLAN (PLANT ROOM) - ZONE A	C
DA1106	ROOF PLAN - ZONE A	C
DA2100	PROPOSED ELEVATIONS - ZONE A	C
DA2101	PROPOSED ELEVATIONS - ZONE A	D
DA2102	PROPOSED ELEVATIONS - ZONE B	D
DA3000	PROPOSED SECTIONS - ZONE A	C
DA3001	PROPOSED SECTIONS - ZONE A	C
DA3002	PROPOSED SECTIONS - ZONE B	C