Façade Performance Specification - North Tower

Martin Place Metro

Macquarie Bank

Prepared for
Lend Lease

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Contents

1. Technical Specification

1.1 Performance Specification

This Specification is a Performance Specification. The Drawings and this Specification indicate the design intent and establish the required geometry of the visible components, and the minimum acceptable standard to which the facade and glazing installations must be designed, tested, fabricated and installed.

As performance-based documents, the Drawings and Specification do not provide full details of the proposed systems. It is the responsibility of the Contractor to inform itself of the full extent and detailing of the Works and make all necessary monetary and time allowances.

The Specification is divided into sections for convenience. All parts of the Specification are mandatory, including the Appendices. This document is to be read in conjunction with the following documentations:

- Architectural Specification and Finishes Schedule – JPW
- Architectural Drawings – JPW
- Lend Lease requirements including the GMR's, CIDD's, Alerts and ROADS
- SWTC requirements for the relevant façade elements related to the Martin Place Metro Station (nominally station entrance and station louvers)
- Trade specific scope of works and other relevant documents by The Principal and its Consultants
- Other reports identified in Section 2.3

Notwithstanding any checks and/or reviews by the Consultants, the Contractor is fully responsible for the design, procurement, testing, fabrication, installation, and certification of the facade systems, including all interfacing with the structure and other trades' work.

The Head Contract shall take precedence if conflicts or ambiguity occur between this document and the head contract.

1.2 Green Star Strategy

Refer to Appendix I for the Martin Place Metro OSD Green Star Strategy as provided by the ESD engineers for the project (Lend Lease AI).

1.3 Compliance to Human Rights Requirements

The suppliers and factories are to comply with Lendlease requirements including compliance to the 'International Labour Organisations Fundamental Convention' and the 'United Nations Global Compact Principles'.

Human Rights violations (such as Child Labour) is not acceptable for any part of the procurement of these works.

Refer to Lendlease 'Supplier Interview Checklist' for requirements and information required to confirm compliance.

1.4 Description of the Project

The Project includes design and construction of the new Sydney Metro Martin Place Integrated Station Development, integrated with concourse, retail and Martin Place. The two OSD sites, (north 40 storeys and south 29 storeys) are planned for commercial office use which are to be integrated with the ground plane and below ground station to create a single precinct experience.

Project Vision

Macquarie's vision is aligned with the State's objective to create a transportation precinct that offers mixed use space with inter modal travel that seamlessly integrates into the civic centre of Sydney.

The vision will provide the framework for a global leading design for all facets of the built form, one in which high volume transportation systems sit alongside a convergent urban form incorporating commercial office space, modern retail outlets and urban defining civic space. This will reinforce Sydney's credentials as a global city in the 21st century.

A development of this scale, building on a major new transport initiative, comes about only once in a generation. As an integral part of the Martin Place Station precinct, the consolidated Macquarie proposal for the precinct provides a unique opportunity to restructure and revitalise a city block into the vital fabric of Sydney. It is a unique opportunity to create a world class, sustainable, integrated commercial office and retail experience built around the rich heritage of Martin Place and more specifically 50 Martin Place.

The three key components of the precinct include:

North Tower

- Site bound by 50 Martin Place, Castlereagh Street, Elizabeth Street and Hunter Street and incorporate Macquarie owned 50 Martin Place within an integrated precinct
- Property Council of Australia (PCA) 'Premium Grade' commercial tower (refer project brief)
- The tower has a curved form with no set-backs to Elizabeth Street, Castlereagh Street and Hunter Street incorporating approx. 65,000sqm NLA (includes retail)
- The building is a ~40 storey side core reinforced concrete structure with a lift core on Castlereagh Street.
- Targeting 6 Star Green Star Office Design and As Built 2015 V1.1
- Targeting NABERS Energy: 5.5 Star, NABERS Water 3.5 Star:
- Macquarie as anchor tenant for the precinct will consolidate an estimated 8,000+ Sydney staff in a globally significant campus

South Tower

- Situated on the southern side of Martin Place between Castlereagh Street and Elizabeth Street. Site area: ~1,900sqm
- PCA 'Premium' grade commercial tower with 'Premium Grade' services (refer project brief)
- The building is ~29 storey rear core reinforced concrete structure comprising a podium and tower
- The typical podium level floors will offer a ~1,400sqm NLA and the typical tower floors ~1,200sqm NLA. The building is targeted to achieve 35,000sqm of NLA (includes retail)
- Targeting 6 Star Green Star Office Design and As Built 2015 V1.1
- Targeting NABERS Energy: 5.5 Star, NABERS Water: 3.5 Star.

Metro Station and Concourse

A new metro station with 30,000+ passengers at AM peak hour (2026), and station access at Martin Place and Hunter Street (below the South Tower and North Tower respectively), interconnected by public concourses, civic spaces and pedestrian link(s).

The south station entry comprises of a two- level station hall, providing escalator and lift access to the platforms, ticket lines and station amenities. The south shaft incorporates a link to the existing Eastern Suburbs train station (at paid and unpaid locations); a potential future link to the MLC Centre (subject to further stakeholder engagement); retail tenancies and facilities, plant rooms (for Metro and OSD operations) and station offices.

The north station entry comprises of a single-level station hall, providing escalator and lift access to the platforms, ticket lines, station platform rooms, station amenities and an atrium connecting the platform level to the entrance level.

The north shaft incorporates station plant rooms (for Metro and OSD operations), retail tenancies and facilities, and station offices.

A pedestrian tunnel links the north and south station hall at level B3 (unpaid concourse level)

Targeting 6 Star Green Star Design & As Built (Sydney Metro Tool)

1.5 Extent of Work

In general, the scope of works consists of (refer to architectural drawings for all dimensions and finishes):

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 01	**Curtain Wall to Office – Vertical Rectangle** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, roller blinds and pelmet o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Visible seals - black o Spandrel– finish as per JPW finishes schedule o Note requirements at Knowledge Centre (see Appendix A for glass types and detail drawings by JPW and Surface Design for detailing requirements.) o Note openable windows required for smoke relief and make up air at Levels 4 and 5, northern elevation. This includes automatically operated top hung awning sashes. Include all hardware, including actuation of the awning sash (motorisation) control systems (for building management control), sensors and alarms as required for safety and cabling requirements. Awnings opening to be as required by the fire engineer. Include relevant insect and safety screening as required by Lendlease Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Vison head (dummy transom) at 2800mm above sill o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box (note vision and spandrel panel are the same glass panel typically) **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with Section 4 **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 02	**Curtain wall to office – inclined trapezoid** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres, and allow for facet around corners of building o The window sills are to be nominally flush with FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, roller blinds and pelmet o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Vison head at 2800mm above sill (dummy transom) o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box (note vision and spandrel panel are the same glass panel typically) **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 03	**Curtain Wall to Office – Inclined parallelogram** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres but may vary, and allow for facet around the building geometry o The window sills are to be nominally flush with FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, roller blinds, and pelmet o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Note slab edge and blind interface at maximum inclines and angled mullions to be coordinated including increased slab to curtain wall zone o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Vison head at 2800mm above sill (dummy transom) o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box (note vision and spandrel panel are the same glass panel typically) **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 04-A	○ **Curtain Wall to atrium – inclined parallelogram** ○ Facade comprising of flush glazed vision panel supported with aluminium frames. ○ The mullions are nominally 1.5m centres but may vary, and allow for facet around the building geometry, ○ The window sills are to be 350mm from nominal FFL to adjacent floors. Fixed to concrete slab in typical condition. ○ Allow for pelmet, power and control function ○ Integrate airpath between blinds and glass to relief in ceiling void ○ Glass sill to ceiling – double glazed unit ○ Visible seals - black ○ Spandrel– finish as per JPW finishes schedule Key dimensions ○ Floor to floor 3900mm nominal ○ Mullion spacing 1500mm typical ○ Sill at nominal 350mm above SFL, nominally flush with the FFL ○ Frame depth – 170mm ○ Corner panel – interface with facet facade	**Glass:** ○ Vision panel – GN2 **Thermal Performance** ○ Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** ○ Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 ○ Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** ○ Function, refer to Macquarie and Arup requirements ○ Refer to Appendix H – Automatic Blind Requirements **Fixings:** ○ Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** ○ Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** ○ Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 04-B	**Curtain wall to office – inclined trapezoid** Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres but may vary, and allow for facet around the building geometry, refer to geometry study o The window sills are to be 350mm from nominal FFL to adjacent floors. Fixed off concrete slab in typical condition. o Allow for pelmet, power and control function for blinds o Internal metal blind, automatic, roller blinds o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Glass sill to ceiling – double glazed unit o Sunshade and grill elements o Visible seals - black o Spandrel– finish as per JPW finishes schedule o Note openable windows required at level 16 for smoke relief and make up air. This includes automatically operated top hung awning sashes. Include all hardware, including actuation of the awning sash (motorisation) control systems (for building management control), sensors and alarms as required for safety and cabling requirements. Awnings opening to be as required by the fire engineer. Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN2 **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 04-C	**Curtain wall to office – inclined rectangle** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres but may vary, and allow for facet around the building geometry, refer to geometry study o The window sills are to be 350mm from nominal FFL to adjacent floors. Fixed off concrete slab in typical condition. o Allow for pelmet, power and control function for blinds o Glass sill to ceiling – double glazed unit o Sunshade and grill elements o Visible seals - black o Spandrel– finish as per JPW finishes schedule o Note openable windows required for smoke relief and make up air. This includes automatically operated top hung awning sashes. Include all hardware, including actuation of the awning sash (motorisation) control systems (for building management control), sensors and alarms as required for safety and cabling requirements. Awnings opening to be as required by the fire engineer. Include relevant insect and safety screening as required by Lendlease Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN2 **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 06	**Curtain Wall to lifts – vertical rectangle** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The mullions are nominally 1.5m centres o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Bracket design to be coordinated with steel structure including outriggers or edge beams as required. o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN2 o Internal glazing to lift lobby with automated blinds and switch glass to sliding doors as required by Arup (ESD). **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Allow for provision of internal roller blind to high-rise lift lobbies as per JPW Blind Elevations **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 07-A	**Curtain wall to roof – plant louver panels** o Facade comprising of Louvers and BMU doors o The mullions are as per architectural drawings o The sills are to be nominally flush with the FFL o Visible seals - black o Louvers to comply with Mechanical and acoustic engineer's requirements notably 50% open area o To include vermin mesh (stainless steel Grade 316) and where required for exhaust or intake air. To be blanked off and sealed where required. Refer to hydraulic engineer for drainage requirements to the internal space (floor wastes etc). Key dimensions o Floor to floor varies for each plant room level, refer to JPW documentation o Mullion spacing varies, refer to JPW drawings o Frame depth – refer to detail drawings	**Thermal Performance** o NA **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None on the plant room. **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 07-B	**Curtain wall to roof – plant screen panels** o Facade comprising of aluminium grill screen panels o Note all materials and finishes are to have suitable corrosive resistance given the proximity to mechanical equipment including cooling towers. o The support frames are as per JPW drawings o Visible seals - black o Finish as per JPW finishes schedule o Grill to comply with Mechanical and acoustic engineer's requirements notably 80% free area o Coordinate with plant room design (including Architect, mechanical and electrical engineers) for penetrations for flues, antennae, satellite dishes etc. Key dimensions o Refer to JPW documentation	**Thermal Performance** o NA **Aluminium members,:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish suitable for plant room environment including consideration of proximity to cooling towers, these are to be anodised unless agreed otherwise **Blinds** o None on the plant room. **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 07-C	**Curtain wall to roof – plant screen panels with sealed back pan** o Facade as per N-FT-07-B but with sealed back pans. o Note all materials and finishes are to have suitable corrosive resistance given the proximity to mechanical equipment including cooling towers. o The support frames are as per JPW drawings o Visible seals - black o Finish as per JPW finishes schedule o Grill to comply with Mechanical and acoustic engineer's requirements notably 80% free area Key dimensions o Refer to JPW documentation	**Thermal Performance** o NA **Aluminium members:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish suitable for plant room environment including consideration of proximity to cooling towers, these are to be anodised unless agreed otherwise **Blinds** o None on the plant room. **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 07-D	**Curtain wall to roof – plant louver panels** As per N-FT-07A but with sealed and insulated back pan above lift motor room and other areas as shown on JPW drawings. Coordinate and seal to walls under.	**Thermal Performance** o TBC by Arup **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None on the plant room. **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 07E	**Glazed spandrel panels to dome** o Facade comprising of flush glazed panel supported with aluminium frames. Panel shapes vary as required refer to the architectural documentation, these include rectangular, inclined parallelogram, and inclined trapezoidal panels o Note that the panels for the 4m from the slab height will require back pan and insulation for the full panel height o Visible seals - black o Spandrel – colour back glass, colour/finish as per JPW finishes schedule Key dimensions o As per JPW drawings	**Glass:** o Vision panel – GN2S **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 08A and B	**Curtain wall glazed spandrel panels** o Facade comprising of flush glazed vision panel supported with aluminium frames. Panel shapes vary as required refer to the architectural documentation, these include rectangular, inclined parallelogram, and inclined trapezoidal panels o Note that N-FT-8B will include a back pan and insulation for the full panel height o The mullions are nominally 1.5m centres o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Visible seals - black o Spandrel – colour back glass, colour/finish as per JPW finishes schedule Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – 170mm	**Glass:** o Vision panel – GN2S **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N - FT – 09 and 9B	**Curtain wall to mid tower – plant louver panels** o Facade comprising of Louvers, BMU doors, removable panels as required (to be removable internally). Hinged panels required to L28 substation transformer room. o The mullions are nominally 1.5m centres o The sills are to be nominally flush with the FFL o Visible seals - black o Spandrel– finish as per JPW finishes schedule o Louvers to comply with Mechanical and acoustic engineer's requirements, also refer to Section 4.5.4 of this Specification o To include vermin mesh (stainless steel Grade 316) and where not required for exhaust or intake air to be blanked off and sealed, the blanked off and sealed panels are referred to as N-FT-9B o Note generator exhaust and design for the expected heat loads from the generator (nominally noted as up to 400^{0}C by the mechanical engineer). This is to incorporate stainless steel shields, cladding and stainless steel louver blades as required Key dimensions o Floor to floor varies for each plant room level, refer to JPW documentation o Mullion spacing 1500mm typical o Frame depth – 170mm, may require stiffeners for large spans	**Thermal Performance** o NA **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Stainless steel louver blades to generator exhaust** o Typically grades 316 or other suitable grades as per AS4673 o Finish – #4 Linish with surface roughness less than 0.5microns **Blinds** o None on the plant room. **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-10	**Level 10 – terrace glazing** o Facade comprising of flush glazed vision panel supported with aluminium frames. o The terrace facades includes metal cladding to columns, soffits and structural brace elements. o Includes swinging doors and associated hardware (hinges, door stops, door closers, locks and handles etc) o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, either roller, pleated or venetian blinds o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Integrate airpath between blinds and glass to relief in ceiling void o Visible seals - black o Spandrel– finish as per JPW finishes schedule o Structural steel mullion supports required to southern elevation over 2 storey void. Key dimensions o Floor to floor as per JPW drawings o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Vison head (dummy transom) at 2800mm above sill o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN3 o Spandrel Panel – GN3 with shadow box **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-11	**Curtain wall to podium office with fins (depth varies)** o Facade comprising of flush glazed vision panel supported with aluminium frames. o Vertical Aluminium fin of 150mm width, depth varies o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, either roller, pleated or venetian blinds o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor Varies refer to JPW documentation o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – varies depending on spans o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements o **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-11B	**Curtain wall to podium office with screen and fins (depth varies)** o Facade comprising of flush glazed vision panel supported with aluminium frames, aluminium screen and fins. o Vertical Aluminium fin of 150mm width, depth varies o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Visible seals - black o Spandrel– finish as per JPW finishes schedule o The aluminium grill/screen is to be openable for glass cleaning and maintenance o Note openable windows required to L3 and L4 east elevation for smoke relief and make up air. This includes automatically operated top hung awning sashes. Include all hardware, including actuation of the awning sash (motorisation) control systems (for building management control), sensors and alarms as required for safety and cabling requirements. Awnings opening to be as required by the fire engineer. Key dimensions o Floor to floor Varies refer to JPW documentation o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – varies depending on spans	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-11C	**Curtain wall to podium plant glazing** o Facade comprising of flush glazed vision panel supported with aluminium frames. o Vertical Aluminium fin of 150mm width, depth varies o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor Varies refer to JPW documentation o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – varies depending on spans o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN1 o Spandrel Panel – GN1 with shadow box **Thermal Performance** o None to plant room **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o None to plant room **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-15	**Feature Ground Floor to Level 2 Glazed screen north elevation** o Facade comprising of glazed vision panel supported with steel frames. o The mullions are nominally 2.25m centres but vary, refer to JPW drawings o The window sills are to be nominally flush with the FFL o Visible seals - black o Include interfaces with cladding systems at soffit Key dimensions o Floor to floor varies o Mullion spacing varies	**Glass:** o Vision panel – Clear laminated glass o Various thickness depending on structural and acoustic requirements. Generic laminated clear heat strengthened glass. **Thermal Performance** NA **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Back-pans and flashings** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-16 and 16B	**Curtain wall to podium – plant louver with screen and fins (depth varies)** o Facade comprising of aluminium louvers panel supported with aluminium frames. Also refer to Section 4.5.4 of this Specification for louver requirements o 150mm wide aluminium vertical fins, depth varies, refer to architectural drawings o The mullions are nominally 1.5m centres but vary o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor Varies refer to JPW documentation o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Frame depth – varies depending on spans o Corner panel – interface with facet facade	**Glass:** o NA **Thermal Performance** NA **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Blinds** o NA on the louvers **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-17	**Curtain Wall to light well** o Facade comprising of captive glazed vision panel supported with aluminium frames. To match 50 Martin Place o The mullions are nominally 1.5m centres but vary o The window sills are to be nominally flush with the FFL o Glass sill to ceiling – double glazed unit o Internal metal blind, automatic, roller blinds o Integrate airpath between blinds and glass to relief in ceiling void o Integrate vertical blind guide channels on mullions o Coordinate with blind sub-contractor o Visible seals - black o Spandrel– finish as per JPW finishes schedule Key dimensions o Floor to floor 3900mm nominal o Mullion spacing 1500mm typical o Sill at nominal 350mm above SFL, nominally flush with the FFL o Vison head (dummy transom) at 2800mm above sill o Frame depth – 170mm o Corner panel – interface with facet facade	**Glass:** o Vision panel – GN5 o Spandrel Panel – GN5 with shadow box (note vision and spandrel panel are the same glass panel typically) **Thermal Performance** o Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with Section 4 **Blinds** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H – Automatic Blind Requirements **Fixings:** o Within curtain wall panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.
N-FT-24	**Red Granite cladding**	**As per this Façade Specification and refer to Stone Performance Specification**

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-18 (east and west shopfront)	**Feature Ground Floor to Level 2** **East and west shop fronts glazing** o Facade comprising of glazed vision panel supported with steel frames. o The mullions are nominally 2.25m centres but vary, refer to JPW drawings o The window sills are to be nominally flush with the FFL o Visible seals - black o Include interfaces with cladding systems at soffit Key dimensions o Floor to floor varies o Mullion spacing varies	**Glass:** o Vision panel – Clear laminated glass o Various thickness depending on structural and acoustic requirements. Generic laminated clear heat strengthened glass. **Thermal Performance** Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Blinds (if required)** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H The blinds are not part of the base build and are anticipated to be installed by the tenant if required. **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-19 Lobby Glazing	**Lobby glazing** o Facade comprising of glazed vision panel supported with glass fins. Includes relevant doors (revolving, sliding or pivot, refer to JPW drawings) o The mullions are nominally 2.25m centres but vary, refer to JPW drawings o The window sills are to be nominally flush with the FFL o Visible seals - black o Include interfaces with cladding systems at soffit Key dimensions o Floor to floor varies o Mullion spacing varies	**Glass:** o Vision panel – Clear laminated glass o Various thickness depending on structural and acoustic requirements. Generic laminated clear heat strengthened glass. **Thermal Performance** Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Blinds (if required)** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H The blinds are not part of the base build and are anticipated to be installed by the tenant if required. **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
Glazed awnings and canopies	**Clear laminated heat strengthened glass fixed to steel awning and canopy frames with aluminium glazing adaptors** Note there is a portion of the awnings on the eastern elevation that is to be removable in case of plant (transformer) replacement. This is subject to Ausgrid's endorsement.	**Glass:** o Vision panel – Clear laminated glass o Generic laminated clear heat strengthened glass. **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316

Type	General Description	Material Requirements (refer to Section 4 for details)
Glazed bridges at level 5 and level 10	**Glazed bridges to level 5 and 10** o Facade comprising of glazed vision panel and operable shutter glazing supported with steel frames. o The window sills are to be nominally flush with the FFL o Visible seals - black o Include interfaces with cladding systems at soffit o Incorporate façade access systems into the roof glazing system o Electrical Separation between 50Martin Place and the North Tower required as per the electrical engineers requirements Key dimensions o Floor to floor varies o Mullion spacing varies	**Glass:** o Vision panel – Clear laminated glass, refer to Appendix A **Thermal Performance** Refer to Appendix A – Glass Type Schedule **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Blinds (if required)** o Function, refer to Macquarie and Arup requirements o Refer to Appendix H The blinds are not part of the base build and are anticipated to be installed by the tenant if required. **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316 **Insulation:** o Spandrel Panel – (as per acoustic, mechanical and thermal requirements) **Back-pans** o Metal back pan, fully sealed, with appropriate finish and structural capacity.

Type	General Description	Material Requirements (refer to Section 4 for details)
Glass screens and miscellaneous glazing	**Clear laminated heat strengthened glass fixed to steel and aluminium frames** Includes but not limited to: o Glass screens on east and west elevations at lower levels o Glazing to central lift structure at ground to L4 (MRL lift glass shafts)	**Glass:** o Vision panel – Clear laminated glass o Generic laminated clear heat strengthened glass. o All glass elements to be engineered to the appropriate glazing requirements as set by this Performance Specification. **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316
Glass balustrades to atrium voids	**Clear laminated heat strengthened glass fixed to steel and aluminium frames**	**Glass:** o Vision panel – Clear laminated glass o Generic laminated clear heat strengthened glass. **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316

Type	General Description	Material Requirements (refer to Section 4 for details)
Glazing to Internal lift lobbies Walls and glass ceilings	**Clear laminated heat strengthened glass fixed to stainless steel, steel and aluminium frames, refer to detail drawings by JPW**	**Glass:** o Vision panel – Clear laminated glass o Generic laminated clear heat strengthened glass. o Sliding door glass to be approved switchable glass product, product to be approved by Lendlease **Extruded aluminium frame members, spandrel panels:** o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664 o Finish – standard commercial finish – compliant with AAMA 2604 for external elements **Structural Steel** As per AS 4100 **Stainless steel** As per AS 4673 **Fixings:** o Within panels to be grade 304 stainless steel and visible fixings to be grade 316

1.6 General Scope of Works

The general scope of work for the façade systems described above includes the following:

- Unitised and pressure equalised and drained aluminium curtain wall cladding to include all pre-finished framing, glazing, back panels, spandrels, fixings, brackets, trims, sealants, smoke flashings, thermal & acoustic insulation, frame stiffening and the like.
- The scope is to include all engineering, testing, fire rating, samples and visual mock ups, performance prototype testing, shop drawings and Digital Engineering (BIM) and monitoring (refer below section titled 'Tracking and Statusing of Building elements')
- Other window systems including sub-frame windows (pressure equalised and drained), sliding doors, sliding window, bi-fold doors, fixings, brackets, trims, sealants, thermal & acoustic insulation and the like.
- Refer to the Architectural drawings and design intent details for the extent and components of each facade type.
- Where required the parapets and soffit capping/trims, flashings and terminations to match wall systems in detail and finish.
- Testing of all systems as required (Refer to AS/NZS 4284). Previously tested systems shall only be accepted where the interfaces are the same as the systems previously tested. Refer to Surface Design indicative sketch for minimum extent of performance mock-ups required.
- Site water testing of the façade in accordance with AAMA 501.2 to the satisfaction of the client and the consultant team.
- Trade Cleaning of all façade surfaces internally and externally. For panelised curtain wall panels trade clean to typically be completed prior to installation of the panels and any subsequent cleans during progressive install and/or handover and/or at completion to be confirmed and agreed between subcontractor and Lendlease accordingly. The design of all systems and elements is to be coordinated with cleaning, access and maintenance strategy, this includes

the ability to clean behind all elements such as sunshades and feature grills from the access strategy as documented, this is typically to be from the BMU's.

- Lightning protection – Co-ordination for connection of the facade to the building's primary structure.
- Submissions of samples, mock-ups and the like for this project as per the relevant sections of this Specification.
- Undertake design and development of the facade with the consultants and the principle
- Submission of calculations and material datasheets
- Preparation of a Facade Maintenance Manual in accordance with Section 7.1.5 of this Specification

Specific System Requirements

All facade types shall comply with the following minimum requirements (unless noted otherwise):

- To be fully panelised, factory assembled frames using standard extrusion dies where possible. However, make allowance for new dies to suit architectural intent if standard sections are not acceptable.
- The intent is for integral extrusions to be used for all extrusions forming the air-seal; built-up extrusions will only be acceptable where identified by the contractor and agreed by the façade engineer.
- The system design and installation is to be suitably air sealed so as not to cause any acoustic noise such as whistling or other tonal noise.
- Adherence to this specification
- External and internal finishes to architect and client approved colour samples.
- All facade joints, spandrels and other cavities within the systems are to be ventilated and drained; they are to be pressure equalised.
- All spandrel panels are to be provided with air-sealed back-pans (for thermal & acoustic requirements refer to relevant reports).
- Continuous gutters located to building perimeter at the vision sill transom and drained at every floor/stack joint or as approved by the façade engineer.
- Provide smoke seals and fire rating to all interfaces as required, including to slab edges, core walls, plant rooms interfaces etc.
- Double glazed high performance vision panels and laminated vision panels to approved samples.
- Allowance in the system for application of captive glazing (for possible future application, where applicable).
- All façade interfaces with structure are to incorporate sub-frames to heads, sills and / or jambs, glazing channels and/or glazing adaptors. All such interfaces are to be of drained joint design.
- Restraint pins for rope access to be able to reach the recessed floors for maintenance and cleaning.
- All glass to be designed to allow replacement, replacement strategy to be developed and agreed with all parties.
- Sprinklers and façade drenchers as required for the project.
- Provide all lightening protection as required
- Provide all overflows to terraces and the like as required.
- Refer to Lend Lease CIDD for specific requirements including requirements for aluminium brackets coatings in concrete, balustrades and climbing hazards, external cladding, glass (including monolithic toughened glass requirements, overhead glazing requirements), waterproofing, wind effects on buildings.
- To be demonstrated through calculation, prior to façade procurement, of compliance with the Section J and thermal comfort requirements as identified by ESD consultant.

Tracking and Statusing of Building Elements (provided by Lend Lease)

Lendlease continually looking for ways to improve the delivery of our projects utilising BIM models data and technologies.

The Sydney Martin Place Metro project presents an opportunity for Lendlease to utilise the BIM model for the purpose of tracking, statusing, logistics and progress claims of various building elements (Façade, MEP, etc.).

As such, the subcontractor is required to model elements to allow Lendlease to identify assemblies as one element in the model, geometrically and by a unique code (i.e. Assembly ID), to include status data, either through direct access to an online model (to be provided by Lendlease) and or through Excel spreadsheets.

The Subcontractors needs to be willing to work with Lendlease to develop, test and implement such workflow.

1.7 Secondary Steelwork

Include for all required secondary steelwork, including all sub-framing, stiffening and brackets necessary for the erection of façade and cladding systems.

1.8 Interfaces

The façade design and installation are to be coordinated with the following disciplines. The list of coordination items should be considered indicative and non-exhaustive.

Discipline	Coordination Items
Building Structure	*Coordinate with structural tolerances for reinforced concrete structural elements, and structural steel.* *Coordinate locations of cast in brackets and all other façade fixings to be outside the zone of influence of slab reinforcement.* *Coordinate and agree loads and locations of fixings with the structural engineer for all relevant load cases including but not limited to gravity, wind, seismic and thermal.*
Other Façade Contractors	*Interface with all adjoining façade and cladding designed and installed by other Façade Contractors including:* - *Blind contractor* - *Stone and masonry contractors* - *Awnings* - *Canopies* - *50 Martin Place* - *Etc.*
Mechanical Services	*Interface with services ductwork , plant enclosures, louvers, operable façade elements and unit exhausts etc.* *Coordinate prototype requirements and thermal performance of facades.* *Coordinate access doors/hatches for maintenance removal and materials handling of plant equipment.* *Coordinate flues and exhaust etc associated with the mechanical plant room with the façade elements.*
ESD	*Coordinate materials and thermal performance with requirements set out in ESD report*
Acoustics	*Coordinate whole of system acoustic performance with the requirements set out in the Acoustic Report*
Hydraulics	*Coordinate with hydraulic drawings for locations of any interfaces.* *Including water capture design requirements.*
Internal Finishes	*Interface with ceiling, sill, internal linings, partitions, blinds, and floor finishes.*

Electrical Services	*External lighting (including integrated feature lighting), signage, lightning protection, internal lighting, electrical power and comms to skirting duct and security systems (including interfaces for external door hardware).* *Coordinate with satellite dishes and communications requirements*
Waterproofing Membranes:	*Plinths and perimeter hobs including compatibility of sealants with membranes by others.*
Fire services	*Provision of all requirements set out in fire engineering report, building services report and fire services specification (including façade drenchers as required)*
Building Maintenance	*Building access requirements, co-ordination as required.* *Coordinate all doors and penetrations for monorail/rope access points with Rope access contractor or building maintenance unit contractor. This includes any large scale doors required for BMU at L28 and L38/39/roof* Coordinate all access and maintenance requirements such as anchors, safety lines, BMU restraint pins etc.
Signage	*Coordinate the location of bracketry for any signage.*

Where the contractor is uncertain they are to raise an RFI and seek approval from The Principle

1.9 Contractor's Responsibilities

It is the Contractor's responsibility to provide labour, materials, equipment and related items and to design, engineer, test, fabricate, transport to site, install, commissioning and provide warranty for complete and weather tight systems in accordance with specified parameters, and with the design intent of the contract drawings and this performance Specification.

The Contractor's Works shall include but not necessarily be limited to the following:

- Submission to and compliance with all Authority Requirements.
- Supply of samples and mock-ups. Note that all materials, systems and elements are not to be procured until approval by the client and the consultant team (including façade engineer and architect) is provided
- Prototyping and testing of cladding systems
- Preparation of detailed shop drawings and computations for production of the cladding systems.
- Certification from a suitable qualified engineer (NER registered)
- Submission of documents and samples in accordance with this Specification and the agreed construction programme.
- Design and operation of an agreed quality assurance program and the maintenance of all records.
- Preparation of as-built drawings.
- Preparation of a Facade Maintenance Manual in accordance with this specification.
- Design and installation of glazing assemblies and cladding elements including all required thermal and acoustic insulation, back-pans, weather, air, acoustic and structural silicone seals, smoke flashings, fixings, brackets and accessories, doors and operable façade elements
- Design for building maintenance in accordance with the requirements of the maintenance system and WH&S regulations.
- Provide certification as per this Specification.
- Comply with Lend Lease documentation including GMR's, CIDD's, Alerts and ROADS documentation

1.10 Design and Supply only Items

The following items are to be designed, fabricated and finished by the Contractor and then supplied to the Main Contractor for incorporation into the Works by others.

Cast in fixing elements:

The Contractor is responsible for co-ordinating any cast-in details with the structure, providing detailed set-out drawings (plans), and verifying the position of the fixings once they have been placed them prior to the pouring of concrete.

They are to comply with SA TS 101:2015.

1.11 Warranties

The warranty shall comply with the requirements of that noted in the Head Contract and referred to in the Works Contract and the requirements of this Specification.

In addition to the head contractors warranty requirements the following is to be provided:

- The Contractor shall agree to warrant their works against any defects in the design, workmanship, quality of materials, weather-tightness and performance, and to repair or replace defective design, workmanship or materials of the Contract Works during the warranty period. Defective materials and workmanship includes abnormal deterioration, ageing or weathering of the Works, leakage of water or air ingress exceeding specified limits, structural failure of components resulting from exposure to pressures and forces within reasonably expected limits, failure of parts to function normally, glass breakage and failure of the Works to meet any other specified performance requirements.
- The warranty period is as set out in the Head Contract Works.

2. Standards and Referenced Documents

Standards and Guidelines as a minimum:

2.1 General Notes

All work and labour practices under this Works Contract shall be in strict accordance with all applicable building codes, regulations, bylaws and laws.

- The Standards, Codes and Legislation referenced below and elsewhere in this Specification shall be the current editions.
- No substitutions to these Standards and Codes shall be permitted without the written acceptance of The Consultant. Refer to commentaries for all Standards and Codes where they exist for further information and clarification.
- It is the Contractor's responsibility to ensure that The Principal and its Consultants are satisfied with the Codes adopted by the Contractor for the Works.
- Wherever there are conflicts between different Local Authority Regulations, Codes and/or Standards, the more stringent shall apply and the Contractor shall in such circumstances notify The Principal accordingly.

2.2 Local Legislation

National Construction Code – Building Code of Australia (year per BCA report)

2.3 Project Specific Documentation

Note: Refer to the GMP Documents for a complete list for project specific documentation for current editions and where to acquire them. Including but not limited to the following:

Architectural Specification	JPW
North Tower and North Shaft Structural Report	Arup
Structural Movements and Tolerances Report	Arup
Mechanical Services Specification	Arup
Section J Report	Arup
Acoustic Report	Arup
Reflectivity Report	Arup
Hydraulics Reports	Arup
Wind Pressure Report	CPP
Construction Methodology Report	Lend Lease

2.4 Relevant Standards

2.4.1 General

Unless otherwise specified or is specifically supplied by The Principal, the applicable issue of a standard is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

The following abbreviations are used in this Specification:

AS	Australian Standard
AS/NZS	Australian/New Zealand Standard
BS	British Standard
BS/EN	British/European Standard
ASTM	American Society for Testing and Materials
AAMA	American Architectural Manufacturers Association
CCAA	Cement Concrete Aggregates Australia

2.4.2 Design and Structures

AS/NZS 1170.0	Structural design actions – general principles
AS/NZS 1170.1	Structural design actions – permanent, imposed and other actions
AS/NZS 1170.2	Structural design action – wind actions
AS/NZS 1170.4	Structural design action – earthquake design actions
AS 3600 and Supplement	Concrete structures
AS 4100 and Supplement	Steel structures
AS/NZS 4600 and Supplement	Cold-formed steel structures
AS 3700 and Supplement	Masonry structures
AS/NZS 1664 and Commentaries	Aluminium structures – Part 1: Limit state design Part 2: Allowable stress design
AS/NZS 4673	Cold-formed stainless steel structures
AS 1288	Glass in buildings – selection and installation
AS1428.1	Design for access and mobility – general requirements for access – new building work
AS1657	Fixed platforms, walkways, stairways and ladders – design construction and installation

2.4.3 Aluminium

Materials and Products

AS/NZS 1734	Aluminium and aluminium alloys – flat sheet, coiled sheet and plate
AS/NZS 1865	Aluminium and aluminium alloys – drawn wire, rod, bar and strip
AS/NZS 1866	Aluminium and aluminium alloys – extruded rod, bar, solid and hollow shapes
AS/NZS 1867	Aluminium and aluminium alloys – drawn tubes
AS 1874	Aluminium and aluminium alloys – ingot and castings
AS 2848.1	Aluminium and aluminium alloys – compositions and designations – wrought products

Surface Coatings and Finishes

AS 1231	Aluminium and aluminium alloys – anodic oxidation coatings
AS 3715	Metal finishing- thermoset powder coating for architectural application of aluminium and aluminium alloys
AAMA 2605	Superior performing organic coatings on aluminium extrusions and panels

Welding

AS/NZS 1665	Welding of aluminium structures
AS/NZS ISO 18273	Welding consumables – wire electrodes, wires and rods for welding of aluminium and aluminium alloys – classification

2.4.4 Structural Steels and Components

Materials and Products

AS 1163	Structural steel hollow sections
AS/NZS 3679.1	Structural steel – hot-rolled bars and sections
AS/NZS 3679.2	Structural steel – welded sections
AS/NZS 3678	Structural steel – hot-rolled plates, floorplates and slabs
AS/NZS 1594	Hot-rolled steel flat products
AS/NZS 1595	Cold-rolled, unalloyed, steel sheet and strip
AS 1397	Steel sheet and strip – hot-dipped zinc-coated or aluminium/zinc coated
AS 2551	Steel sheet and strip – cold rolled, electrolytic zinc coated

Welding

AS/NZS 1554.1	Structural steel welding – welding of steel structures
AS/NZS 1554.2	Structural steel welding – stud welding (steel studs to steel)
AS/NZS 1554.5	Structural steel welding – welding of steel structures subject to high levels of fatigue loading
AS/NZS 1554.7	Structural steel welding – welding of sheet steel structures
AS/NZS 4855	Welding consumables – covered electrodes for manual metal arc welding of non-alloy and fine grain steels – classification
AS 1858.1	Electrodes and fluxes for submerged arc welding – carbon steels and carbon-manganese steels
AS/NZS 1167.2	Welding and brazing – filler metals – filler metal for welding
AS/NZS 2717.1	Welding – electrodes – gas metal arc – ferritic steel electrodes
AS 4882	Shielding gases for welding
AS 1796	Certification of welders and welding supervisors
AS/NZS 2980	Qualification of welders for fusion welding of steels

Bolts and Fasteners

AS 1110	ISO metric hexagon bolts and screws – product grade a and B – Part 1 – Bolts; Part 2 – Screws
AS 1111	ISO metric hexagon bolts – Product Grade C – Part 1 – Bolts; Part 2 – Screws
AS/NZS 1559	Hot-dip galvanized steel bolts with associated nuts and washers for tower construction
AS 1112	ISO metric hexagon nuts (4 Parts)
AS 3566	Self-drilling screws for the building and construction industries (2 Parts)

Corrosion Protection and Coatings

AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3750	Paints for steel structures (several parts)
AS 1627	Metal finishing – preparation and pre-treatment of surfaces (several parts)
AS 3894	Site testing of protective coatings (several parts)

2.4.5 Stainless Steels and Components

Materials and Products

BS EN 10088-1	Stainless steels. List of stainless steels
BS EN 10088-2	Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
BS EN 10088-3	Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
BS EN 10088-4 (05/30126202 DC)	Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes
BS EN 10088-5 (05/30126205 DC)	Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels
BS EN ISO 3506	Mechanical properties of corrosion-resistance stainless steel fasteners. Part 1: Bolts, screws and studs; Part 2: Nuts; Part 3: Set screws and similar fasteners not under tensile stress; Part 4: Tapping screws

Welding of Stainless Steels

AS/NZS 1554.6	Structural steel welding – welding stainless steels for structural purposes
AS/NZS ISO 14343	Welding consumables – wire electrodes, wires and rods for arc welding of stainless and heat resisting steels – classification

Passivation

ASTM A380	Standard practice for cleaning, descaling and passivation of stainless steel parts, equipment, and systems
ASTM A967	Standard specification for chemical passivation treatments for stainless steel parts
ASTM B912	Standard specification for passivation of stainless steels using electro-polishing

2.4.6 Corrosion Resistant Castings

ASTM A518	Standard specification for corrosion-resistant high silicon iron castings
ASTM A743	Standard specification for castings, iron-chromium, iron-chromium-nickel, corrosion resistant, for general application
ASTM A744	Standard specification for castings, iron-chromium-nickel, corrosion resistant, for severe services
ASTM A890	Standard specification for castings, iron-chromium-nickel-molybdenum corrosion resistant, duplex (austenitic/ferritic) for general application
AS 2074	Cast steels
BS EN 10283	Corrosion resistant steel castings

2.4.7 Glass and glazing

Glass and glass products

ASTM C1036	Standard specification for flat glass
ASTM C1048	Standard specification for heat treated flat glass – Kind HS, Kind FT coated and uncoated glass
ASTM C1422	Standard specification for chemically strengthened flat glass
ASTM C1172	Standard specification for laminated architectural flat glass
ASTM C1376	Standard specification for pyrolytic and vacuum deposition coatings on flat glass

ASTM E2190	Standard specification for insulating glass unit performance and evaluation
AS/NZS 2208	Safety Glazing Materials in Buildings
AS 2047	Windows in buildings – selection and installation
AS/NZS 4666	Insulating Glass Units
AS/NZS 4667	Quality requirements for cut-to-size and processed glass
ASTM C1369	Standard specification for secondary edge sealants for structurally glazed insulating glass units
ASTM E2354	Standard guide for assessing the durability of absorptive electro-chromic coatings within sealed insulating glass units
BS EN 1279: Part 2	Glass in Buildings: Insulating glass units — Part 2: Long term test method and requirements for moisture penetration
BS EN ISO 12543	Glass in Buildings: Laminated Safety Glass Part 1: Definitions and descriptions of component parts Part 2: Laminated Safety glass Part 3: Laminated glass Part 4: Test methods for durability Part 5: Dimensions and edge finishing

Gaskets, Sealants and Glazing Compounds

ASTM C509	Standard specification for elastomeric cellular preformed gasket and sealing material
ASTM C864	Standard specification for dense elastomeric compression seal gaskets, setting blocks and spacers
ASTM C920	Standard specification for elastomeric joint sealants
ASTM C1087	Standard test method for determining compatibility of liquid applied sealants with accessories used in structural glazing systems
ASTM C1294	Standard test method for compatibility of insulating glass edge sealants with liquid applied glazing materials
ASTM C1281	Standard specification for preformed tape sealants for glazing applications
ASTM C1184	Standard specification for structural silicone sealants
ASTM C1401	Standard guide for structural sealant glazing

Performance Testing

ASTM D2203	Standard test methods for staining from sealants
ASTM C510	Standard test method for staining and colour change of single or multi-component joint sealants
AAMA 501	Methods of test for exterior walls
AAMA 511	Voluntary guideline for forensic water leakage testing of fenestration production
AAMA 502	Voluntary specification for field testing of newly installed fenestration products
AAMA 503	Voluntary specification for field testing of newly installed storefronts, curtain walls and sloped glazing systems
AS/NZS 4284	Testing of building facades
AS/NZS 2047	Windows in buildings – selection and installation

2.4.8 Security

AS 4145.2 – 2008	Locksets and hardware for doors and windows – Mechanical locksets for doors and windows in buildings.
AS 5039 – 2008	Security screen doors and window grilles
AS 5040 – 2003	Installation of security screen doors and window grilles
AS 5041 – 2003	Methods of test – Security screen doors and window grilles

2.5 Fire Protection

AS 1530	Methods for fire tests on building materials

2.6 Quality Management

ISO 9000 – 2000	Quality management systems – fundamentals and vocabulary
ISO 9001 – 2000	Quality management systems – requirements

2.7 Building Maintenance

OHS Regulations	NSW Work Health and Safety Regulation 2011
	NSW Work Health and Safety Act 2011

3. Performance Requirements

Design of the façade systems are to be in accordance with the following performance parameters.

Item	Performance Parameter	Performance Requirement	Notes
1	**Design Life**	All facade elements are to be designed for: 50 years for structural integrity (Framing, brackets and fixings. excl. structural silicone). 20 years serviceable life (life to first major maintenance)	Unless noted otherwise by the clients' documents such as the Base Building Project Brief. If any existing elements are to remain their ongoing design life will need to be assessed (such as the recladding required to the north of 50 Martin Place). SWTC Requirements to be complied with for those relevant façade elements at Station entrance and Station Louver exhaust.
2	**Loads**		
	General Requirements	Design to comply with AS1170	
	Dead Loads	Design to AS1170.1	
	Imposed Loads	Design to AS1170.1 Glass and glazing systems are to withstand barrier loads in accordance with AS1170.1 All horizontal and vertical facade projections are to be able to withstand impact loads without dislodgment. Glass and glazing systems are to withstand maintenance point load perpendicular to the glass surface of 0.5kN. Expressed elements are to withstand maintenance point load of 1.1kN in any direction. Fall arrest fixings, and cladding elements in contact with rope access lines are to withstand fall arrest loads. Glass floor loads are to be determined, to comply with structural Engineers equivalent requirements for adjacent floor slabs with similar use of floor.	
	Wind Loads	Design to AS1170.2 For serviceability design to 25 year return period For ultimate limit state design to 1000 year return period.	Refer to façade cladding pressures report for design pressures (by CPP)

Item	Performance Parameter	Performance Requirement	Notes
	Earthquake Loads	Design to AS1170.4	Refer to Structural Movements and Tolerance report (by Arup) Also note Building Importance Level for the various elements, and note the station elements required Building Importance Level 4
	Balustrades	Unless noted otherwise all Balustrades to be designed for loading criteria given in AS1170.1 (Table 3.3)	The level 10 terrace balustrade is to be designed in accordance with C2 per table 3.3 from AS 1170.1
3	**Thermal Movement**	System to accommodate: Ambient Temperature Range -10°C to 50°C Surface Temperature Range -10°C to 100°C Elements within cavities or behind glazing may experience high temperatures that are to be determined through prototyping and calculations. Aluminium components shall accommodate expansion/contraction; minimum 1mm per metre of component length depending on the predicted temperature range determine through detailed calculations and testing/prototyping to be completed by the sub-contractor.	

Item	Performance Parameter	Performance Requirement	Notes
4	**Light and Heat Transfer**	For indicative Glass Types & performance requirements, refer to Glass Schedule. Refer to Section J report for detailed requirements for compliance. Compliance with this document is required as a minimum. The external visible light reflectance for all materials proposed for the external façade to be in accordance with DA Consent items B11 and B12, as follows: "***Materials and Finishes*** *B11 Prior to the issue of the relevant Construction certificate, details of final materials and finishes must be lodged to eh satisfaction of the Planning Secretary. The details must include:* *a) Specifications and sample boards for all external finishes, colours, and glazing including annotated drawings and computer-generated imagery of their application* *b) confirmation of the process and methods in arriving at the final choice for all materials and finishes* *c) detailed architectural drawings of the facetted glazed façade, including glazing specification, mullion spacing and materials, sun shading and internal sun shading. This must include snapshots at different point in the façade in plan, elevation and section to a scale of 1:20 or 1:50 as necessary.* ***Reflectivity*** *B12. External materials must be pre colour coated or manufactured having a low glare and low reflective finish. The building materials used on the facades of the building shall have a maximum normal specular reflectivity of visible light limited to 20 per cent and shall be designed so as not to result in glare that causes unacceptable discomfort or threatens the safety of pedestrians or drivers. A report/statement demonstrating compliance with these requirements is to be submitted to the satisfaction of the Planning Secretary prior to the issue of the relevant Construction Certificate."*	Refer to reflectivity report

Item	Performance Parameter	Performance Requirement	Notes
5	**Condensation**	Condensation is not to form on internal surfaces of framing members, glazing, solid panels. Any condensation that forms internally within the construction of the panels forming part of the works shall drain to the outside.	
6	**Fixing to Structure**	Design fixings to resist all loads both individually and in combination.	
7	**Displacement of façade elements**	Serviceability deflection limits (unless stated otherwise): Glass – Span/60 Deflection of overhead glass under self-weight to be minimised to reduce visible distortions. Nominally to span/1000 for long term loads (self-weight). Overhead glass to be limited to span/60 for medium and short-term loads.. Aluminium and steel framing – Span/250 Cantilevered frame members – Span/150 Aluminium panels – Span/90 In-plane member deflections (deflection due to self-weight) – Span/500 or 3mm, whichever is less, unless agreed otherwise. Maximum displacement (framing and glass) to be 25mm at any point unless agreed otherwise with the design team. For ultimate limit state loads no non-linear (permanent) distortion is acceptable.	
8	**Tolerances**		
	Building structure tolerances	*Indicative Tolerances:* Refer to Structural Movement and Tolerance report by Arup *Cast In Inserts:* +/- 10mm from slab edge +/- 3mm from concrete surface +/- 25mm off grid position	
	Fabrication tolerances	Glass – to AS4667 (refer to Appendix B) Framing members – cut to +/-1mm The contractor will be required to submit a detailed list of fabrication tolerances from all of their suppliers including the glass supplier/manufacturer.	
	Installation tolerances	Curtain wall panels +/- 3mm (in plan and height) relative to adjacent panel. Overall façade plane +/- 5mm (in/out) from nominal plane position. The contractor will be required to submit a detailed list of installation tolerances from all of their installers.	

Item	Performance Parameter	Performance Requirement	Notes
9	**Building structure movements and deflections**	The design of the glazing systems is to accommodate the structural movements per the Arup structural report. Identify the magnitude and location of all assumed movements, movement joint dimensions, and opening and closing dimensions of stack joints at design development stage and submit for approval by the Client and its consultants.	Refer to structural report by Arup
10	**Fixings to Structure**	Design to resist all loads individually and in most severe load combinations. All fixings are to accommodate the worst combination of structure tolerances, as identified by the builder.	
	Cast-in Inserts	Use only proprietary inserts and design to manufacturer's published data. If non-proprietary inserts are to be used the contractor will be required to provide test data and/or complete adequate site testing on the cast-ins. All inserts are to be compliant to SA TS 101:2015.	If non-proprietary inserts are to be used load testing is required.
	Masonry Anchors	Use only proprietary inserts and design to manufacturer's published data. All anchors are to be compliant to SA TS 101:2015.	If non-proprietary fixings are to be used load testing is required.
11	**Air Infiltration**	As per AS/NZS 4284.	
12	**Weatherproofing**	No water shall appear on any interior surface during testing or on the Site for the design life. The glazing systems (including interfaces) shall be fully pressure-equalised and drained, unless agreed otherwise. Minimum drain hole dimension shall be 12mm (diameter). Ensure all drain holes are adequately positioned and sized when applied pressure is zero or negative, all water in internal cavities of the façade system shall drain to outside without detrimental effect to external surfaces. Facade forming the weatherproof line shall be waterproof when tested to AS/NZS 4284.	
13	**Maintenance & Replacement Capacity**	Identify maintenance requirements in terms of routine (e.g. cleaning) and component repair / replacement. Identify components which must be replaced during the life of the installed systems.	Maintenance and replacement strategy is to be developed

Item	Performance Parameter	Performance Requirement	Notes
	Glass replacement	Each glass panel is to be capable of replacement in isolation without damage to adjacent elements, and without removing adjacent unitised panels. External features such as sunshades, fins and / or cladding that may have to be removed for glass replacement must be confirmed by the contractor.	
14	**Acoustic Performance**	Design of all façade systems is to be in accordance with the performance requirements outlined in the Acoustic Consultants report, and the minimum glass build-up requirements summarised in the glass schedule.	
15	**Lightning Protection**	Electrical continuity is required between individual sections of facade, in accordance with AS/NZS 1768 and AS 1882. Provide test data to verify electrical continuity of the proposed system.	Electrical Engineer to confirm all details. Note requirements of roof dome and connections of façade elements to structural reinforcing.
16	**Structural Silicone**	Structural silicone glazing for glass retention under loading to be as agreed and to comply with AS 1288.	
17	**Regulations**	Comply with all Government and Statutory Authority Regulations.	
18	**Concealed Fixings**	All fixings are to be concealed where possible (i.e. designed such that they are not visible externally).	
19	**Fixing of beads, trims and features**	Ensure that each significant glazing trim or feature is attached to the façade by mechanical means to agreed method and centres, in addition to reliance upon wedge gaskets.	
20	**Isolation of Materials**	Separate different metals with a non-conductive material to eliminate galvanic action. Separation is not required for series 300 stainless steel screws/bolts in aluminium members and zinc (galvanised) and painted aluminium. EPDM (or similar) gaskets.	
21	**Fire / Smoke Separation**	All floors and walls (as per the fire engineering report) shall be separated in accordance with BCA requirements. This is to comprise a continuous and complete smoke flashing at slab level to separate all adjacent floors, provide fire rated insulation as required to relevant slab edges and vertical interfaces.	Refer to fire engineers report and JPW documentation. All materials used are to be deemed non-combustible under the BCA unless agreed otherwise.

Item	Performance Parameter	Performance Requirement	Notes
22	**Operable elements**	The operable elements (for example doors) are to include control systems, security, link with BMS and override control.	
23	**Materials Compatibility**	All materials compatibility testing between adjacent existing and new materials to be completed in accordance with this Specification and the manufacturers requirements.	
24	**Signage**	Details, locations and interfaces are to be coordinated	
25	**Hydraulics and overflows**	Details, locations and interfaces are to be coordinated. Note requirement to prevent run off onto adjacent properties (gutters to be provided as per Hydraulic Engineers requirements).	All drainage requirements are to be confirmed and coordinated with the project hydraulic engineer (Arup)

4. Minimum Requirements

4.1 Materials: General

This section defines the minimum requirements for the project in terms of materials, submissions and workmanship. The Works shall either meet or exceed these requirements.

Where a specific product is nominated, use that product or an approved equivalent. Approval of an equivalent is subject to the discretion of The Client and the consultant team. Provide manufacturer's technical data to verify equivalence.

All materials used shall be new and fit for purpose for which they are to be used.

4.2 Materials: Expected Life

The Subcontractor shall supply documented information outlining the expected service life of all materials used in the Works. This information shall be obtained from product/material manufacturers. This information shall be submitted in accordance with the submission schedule, and be included in the Façade Maintenance Manual.

As a minimum, this information shall include:

- The service life of the product/material on the project (this is not a warranty).
- Requisite maintenance procedures which must be followed in order to achieve the economic life of the product/material.
- An assurance from the manufacturer that the product is suitable and fit for purpose.
- Relevant product data including names of supplier and manufacturer.

4.3 Internal Drainage Systems (Curtain Wall and Windows)

- All cladding elements are intended to be pressure equalised and drained.
- To the maximum extent possible, water leakage control in the curtain wall and other glass systems shall be by internal gutters which are drained to the exterior. Walls and cladding shall have a continuous gutter at each floor level so that any leakage is confined to and drained from the floor level of leakage origin. All exterior wall joints shall be backed up by a gutter and weep system and/or a secondary seal and weep system.
- All facade systems shall be designed, fabricated, assembled and installed so that all leakage, both within and around the perimeter of the system, or condensation shall be drained and discharged to the exterior face of the wall.
- Movement of water within the exterior cladding system must be controlled to ensure that water is not retained, or that elements will not be damaged or corroded by water, or to minimize the potential for algae and fungus growth as a result of standing or trapped water.
- The drainage system will be sealed off per floor height to prevent infiltrated water from leaking to the lower floor.
- Weep holes, vents and drain holes shall be inconspicuously located and in such positions as not to be visible and where possible not to contribute to staining, streaking or marking on the glass spandrels, stainless steel trimming, cladding panels, fascias, soffits, or other exterior cladding components. Weep tubes shall be secured to the gutter system or back pan by positive means and not read through the spandrel glass.
- Coordinate with other sections of work to achieve a continuous gutter and water control and drainage system for the entire exterior wall. Individual drainage systems within adjacent sections of the work shall not be permitted.

4.4 Glass & Glazing

4.4.1 General

- Refer to the glazing schedule for project glass types, descriptions, indicative thicknesses/build-ups and performance requirements. Suppliers shall be approved by the project team prior to approval.
- Glass thicknesses and types are to be determined to AS1288 and are to accommodate other performance requirements including acoustics, thermal performance and security (minimum thickness 6mm for each lite).
- Verification of glass thicknesses by calculation is to be provided for all glass types, and with any proposed alternatives.
- Safety glass is to be provided to locations in accordance with AS1288. All safety glass to comply with AS2208.
- Overhead glass is to be provided to relevant locations in accordance with AS 1288 and this specification.
- Glass dimensional tolerances including flatness and bow to be generally in accordance with AS/NZS4667 unless documented otherwise within this document.
- Glass shall be free from defects or impurities detrimental to its performance. Defects which are not detrimental to the performance such as bubbles, waves, spots, scratches, spalls, discolouration, chipping, or impurities shall only be acceptable if not visible from a distance of 3m, as agreed with The Client and its Consultants.
- A detailed thermal analysis shall be carried out to confirm that the glass is not at risk from thermal breakage. This analysis shall consider shading by facade trims/projections, shading by adjacent structures or building projections, internal blinds and the like. The Subcontractor shall warrant that the glass is not subject to thermal breakage and will replace at its own cost (full replacement cost) all panels which suffer thermal failure.
- Visible glass edges are to be arrissed, fine ground or polished and free from damage.
- Laminated glass is to have any non-encapsulated interlayer protected from elements where shown on the design intent drawings. Edge treatment to be provided. Method to be agreed with The Client, the Architect and Facade Consultant.
- All use of monolithic toughened glass is subject to agreement with the Façade Engineer and Lend Lease. Where agreed, fully toughened glass is to be 100% heat soak tested in accordance with BS EN 14179-1 standard guidelines.
- Heat strengthened glass shall have a residual surface compression in accordance with AS 1288 (nominally within 26 to 52MPa, this is to be demonstrated during production by non-destructive testing. Test records are to be provided to demonstrate this and as required under the relevant quality control procedure).
- The glass shall be installed with any roller wave marks orientated horizontal (parallel to sill). Where panel widths exceed that achievable in the heat treatment process, acceptance by the Client and its consultants will be required for the use of vertical roller wave.
- Glass shall be consistent in colour and equivalent to the control samples agreed with The Client and its consultants.
- All glass shall be delivered to the Site with the manufacturer's label of identification attached.
- All glass is to be inspected by the Subcontractor prior to setting or glazing into cladding. Any panels with imperfections, scratches, pinholes, irregular cut or chipped edges, chipped corners or any cracks, not in accordance with AS/NZS 4667 and Appendix B (equivalent to ASTMC1036 class q3) or not in accordance with manufacturers guidelines shall be rejected. A copy of the glass manufacturer's manufacturing guidelines shall be supplied to The Client at the time of preliminary glass order.
- The Subcontractor shall supply and replace any glass panels that are broken during construction and up to the Date of Practical Completion of the project. Allow for glass replacement, inclusive of material and all installation costs. The Subcontractor shall be entitled to reasonable costs for breakages caused by other trades.
- Horizontal glazing (and glazing greater than 30° from the vertical) shall be designed so that sag from permanent actions shall not allow any pooling of water
- All glass markings to be provided in accordance with the Australian Standards and positioned on the panels in accordance with the Architects and Lendlease requirements (including for AS

4666: Insulating Glass Units and AS 2208: Safety glazing materials in buildings). The subcontractor is to present detailed shop drawings and samples indicating all glass markings type, size, colour, position etc. for review and approval by the Architect and Lendlease prior to manufacture.

4.4.2 Glass – Performance Coatings

- Performance coated glass products are to be examined for defects in accordance with BS EN 1096: Part 1.
- Acceptance criteria for defects (uniformity, stains, spots/pinholes, clusters and scratches) to be in accordance with BS EN 1096: Part 1.
- Provide a QA/QC statement prior to order of the glass product from the glass processor for the glass coating works. To include preparation, handling, protection and transportation of the coated product.
- Visible colour or reflectivity variations in the coating (including colour shift), if evident when viewed internally or externally, will not be acceptable. Glass samples to be provided and approved as a benchmark prior to glass order.

4.4.3 Insulated Glazing Units (IGU)

- IGU to consist of 2 glass panes
- Unless otherwise specified, double glazed units shall be hermetically sealed units complying with AS 4666.
- Visual inspection of the glass edges, edge seals and spacers shall be unhindered, prior to glazing.
- Drainage of water along edge seals shall not be permitted.
- All double glazed units shall be assembled in controlled temperature and humidity conditions. Breather tubes shall be used, if necessary, during manufacture and transportation. These shall be thereafter removed and the units sealed prior to manufacture.
- State the maximum concavity and convexity that will occur under the ambient climatic conditions and barometer pressure differentials anticipated by the requirements of the Specification. Ensure that the double glazed units are flat (with a maximum deviation of 1/ 1000 at the centre of the glass pane when measured diagonally) when finally installed.
- Double glazed units shall carry a test certificate/ report carried out by an independent authority, showing compliance with AS 4666 or BS EN 1279: Part 2.

4.4.4 Laminated glass and Composite laminated products

Note all relevant durability requirements related to laminate glass, testing and the like is applicable to these products including composites with stone and composites with metal mesh interlayers.

- Durability and longevity of the products to be demonstrated through agreed test schedule including accelerated weathering test (that is to include UV exposure, water and weather exposure and salt spray). This is to include consideration of location of glass in the project and the build-up of the spandrel panels.
- Warranty required for laminated glass per Lend Lease requirements with expected limit of edge delamination to be provided in warranty. This includes warranty for the use of the laminate in spandrels if required.
- Performance coated glass products are to be examined for defects in accordance with BS EN 1096: Part 1.
- Acceptance criteria for defects (uniformity, stains, spots/pinholes, clusters and scratches) to be in accordance with BS EN 1096: Part 1.
- Provide a QA/QC statement prior to order of the glass product from the glass processor for the glass works. To include preparation, handling, protection and transportation of the product.
- Visible colour or reflectivity variations in the product, if evident when viewed, will not be acceptable. Variations of appearance of natural materials such as stone products is to be determined and agreed with all relevant parties.
- Test regime is to be presented for review prior to any testing being completed. The test regime is to be agreed between all parties

4.4.5 Spacer for IGU

- Colour of spacer to be black, be continuous, with bent corners, shall have butyl sealed joints and provide a consistent moisture seal around the entire perimeter of the unit.
- Finish of spacer to be stable with no off-gassing, fuming or colour fading, and no effect on glass surfaces or coatings.
- Spacers shall have adequate rigidity for their purpose, be continuous, with bent corners and the number of spacer joints per panel to be agreed with the Client and design team. Minimum joints to be incorporated with a maximum of 2 per panel unless otherwise agreed with the Client and the design team. The location of spacer joints for all glass types and sizes is to be approved by the architect prior to manufacture, the sub-contractor is to provide drawings indicating the proposed location for review and approval.
- Spacers shall separate glass panes and the units shall have a mechanically applied primary polyisobutylene seal between glass and spacer. This shall provide a continuous vapour-proof barrier to a minimum width of 2mm and a secondary two part silicone seal to the perimeter of the units to carry wind loads.
- Spacers shall accommodate the seal and the entire hollow spacer bar and be filled with desiccant, allowing both to operate at maximum efficiency and to maximise the life of the unit. Perforations in the spacer bar to be of adequate size to allow water vapour from the cavity within the IGU only to pass through, but retain all desiccant within the spacer. Desiccant within the cavity will not be acceptable.

4.4.6 Structural Silicone

- Use a two-part sealant typically and factory glaze.
- Site glazing will only be acceptable where agreed with the Façade Engineer. Use a single part sealant.
- For all members incorporating structural silicone to retain glass edges against wind pressure, design such members to accept glazing beads which may be retro-fixed.
- Obtain and submit a project-specific Print Review from the sealant manufacturer, indicating the actual sealants to be used, requirements for priming, confirmation of compatibility testing with actual project substrates, confirmation of non-staining and a sample warranty.
- Colour: Structural Silicone: Black.
- The facades systems shall be designed such that structural silicone seals are totally isolated from all long-term movements and all building movements.
- Primers, if required, shall be compatible with all project sealants and substrates and shall be of same manufacture as the project sealant(s).
- Install in strict accordance with manufacturer's printed recommendations.
- Obtain manufacturers written endorsement of all proposed details and submit with shop drawings before commencement of fabrication.

4.4.7 Double Sided Tape

- Unisil Series 2000 double sided glazing tape or similar equivalent.
- EVA tape, if used, joints shall not be visible from occupied internal spaces
- Colour to be black

4.4.8 Weatherproofing Sealant

- Colour: Weather seals: Black
  Air seals: Black
- Compatible with all substrates, including PVB interlayer of laminated glass.
- Non-staining.

- Obtain manufacturers written endorsement of all proposed details and submit with shop drawings.

4.4.9 Insulated Spandrel Construction

Thermal Insulation

- Insulation density and type to meet the specified performance of the spandrel. Thermal calculations are to be provided by the Sub-Contractor to verify thickness, type and density of thermal insulation. Thermal performance effects of framing elements to be considered in the calculation of the thermal performance of the facade spandrel panels.

The Sub-Contractor shall confirm the following:

- The proposed insulation material will not emit gases or volatiles when at elevated temperatures (provide technical data sheet which nominates material melting point)
- The proposed insulation material has no detrimental effects when it becomes wet through condensation or humidity;
- The method of securing the insulation will not allow the insulation to sag or slump;
- The Contractor shall guarantee that there will be no reaction between the insulation, adhesives, sealants or other materials inside the spandrel box and the glass, which will cause any form of unacceptable visual irregularity in the spandrel glass.
- All insulation is to be non-combustible in accordance with the fire engineer's requirements.

Shadow box cladding

- Pre-finished aluminium profile (extrusion or approved alternative). Install stiffeners as required. Panel visual flatness to be maintained through all service conditions including under thermal expansion. Design fixing methods to accommodate all thermal expansion, prototyping of the system required to verify the design.
- Minimum thickness 4mm. Thicknesses/design to be verified by calculations and test during AS4284 prototype testing.
- Calculate thickness and fixing detail to sustain full wind load or alternatively design to serviceability wind load and verify back pan design by monitoring a nominated spandrel in the prototype test including glass deflection, deflection, external pressure, cavity pressure and internal pressure.
- Fully seal to glazing system framing.
- The shadow box panels are to be protected from water ingress during fabrication, storage transportation, installation and during construction phase to reduce risk of visible condensation or staining within the shadow box

Spandrel Air seal (Internal lining to spandrel)

- Pre-finished Zincalume or Galvabond sheet, or approved equivalent.
- Minimum thickness 1.2mm. Alternative thicknesses will be considered if verified by test during AS4284 prototype testing.
- Calculate back pan thickness and fixing detail to sustain full wind load or alternatively design to serviceability wind load and verify back pan design by monitoring a nominated spandrel in the prototype test including glass deflection, back pan deflection, external pressure, cavity pressure and internal pressure.
- Fully seal back pan to glazing system framing.

Cavity (spandrel)

- Ventilation/weep holes at top and bottom of spandrel cavity forming pressure equalised chamber with external pressures.
- Foam baffles fixed to ventilation holes.

4.4.10 Gaskets

- Neoprene, Santoprene, EPDM or silicone.
- Shore A hardness: to suit application.

- The subcontractor shall obtain approval in writing from the sealant manufacturer confirming compatibility of all gaskets touching sealant.
- Gaskets and seals used to achieve the required weather and/or air-tightness shall be selected to accommodate the expected cladding movements, the range of dimension tolerances associated with fabrication and installation of the cladding system.
- Gaskets to maintain dimensional stability for the design life of the cladding.

4.4.11 Setting Blocks

- Dense heat cured silicone rubber, 'silicone compatible rubber' or other rubber type approved in writing by the sealant manufacturer.
- Shore A hardness: 80 – 90 durometer.
- Setting block size shall be in accordance with AS1288, shall support the full width of the glass panel or DGU it supports and be a minimum of 3mm thick and 100mm long.
- Setting blocks shall be positioned at transom1/5th points or as advised by the glass panel manufacturer.
- Sloped glazing panels shall have setting blocks supporting glass dead load around the perimeters and setting blocks to resist the glass panels sliding down–slope.
- Setting block locations shall be engineered to transfer glass loads back to the framing system without transferring loads to other panels

4.4.12 Backing Rods

- Closed cell (polyethylene) or open-cell (polyurethane) foam.
- Compatible with sealants and substrate.
- Use only round tools (no sharp edges) to install backing rod. Do not pierce the rod skin of closed-cell rod.

4.5 Aluminium

4.5.1 General

If the Contractor chooses an alloy other than those listed below and not listed in a recognised code (BS8118 or AS1664), then a certificate of properties shall be obtained from the billet maker. The data shall include all mechanical properties required for design, including the yield in compression. This data shall be used in the relevant calculations.

4.5.2 Extruded members

- Alloy 6063-T5 or T6 (typical extrusions) or similar.
- Alloy 6061-T6 (brackets).
- Minimum wall thickness 2.5mm for structural elements.
- Minimum wall thickness 1.2mm for non-structural components, unless agreed otherwise.

4.5.3 Aluminium Finishes:

Refer to Architectural Finishes Schedule for specific finish references.

Typically, the following applies:

- Glazing system framing internal extrusions (mullions and transoms) –coated in accordance with AAMA 2604.

  Colour: Refer Architectural Finishes Schedule and design intent drawings for finishes and locations.
- Glazing system framing external extrusions (captive beads) –in accordance with AAMA 2604.

Colour: Refer Architectural Finishes Schedule and design intent drawings for finishes and locations.

- External aluminium panels, cappings, horizontal sunshades and visible flashings (where not accessible) –in accordance with AAMA 2604

  Colour: Refer Architectural Finishes Schedule.
- External aluminium elements at roof dome plant roof, anodised in accordance with AS 1231 with AA25
- Concealed elements – Powdercoated or anodised any colour.

4.5.4 Aluminium Louvres

- Extruded aluminium independent louvre panel system.
- System is to incorporate 'continuous appearance louvers', with all louver blades notched around vertical support members. Support framing, fixing and brackets to be concealed behind louver blades.
- Louvre system is to incorporate single stage louvres in areas requiring ventilation, and blank off panels where not required.
- The system is to be compliant with AS 4740 for the relevant Water Ingress Efficiency Class B, Wind Load Rating Class 1, louver pressure drop and face velocity as required by the Mechanical Engineer. Refer to the louver Schedule (document number to be confirmed) for the relevant requirements.
- Blank off panels to be a pre-finished metal sheet, in a colour selected by the architect.
- Louvre panels are to be designed with all drainage of water to the exterior.
- Comply with all air flow and minimum free area requirements of the mechanical specification.
- Include all required aluminium support framing and bracketry as required.

  Finish: Louvre blade and supporting frame elements are to be finish to AAMA 2604.

  Finish: Where required, blank-off panels to louvers are to be pre-finished sheet, to an architecturally approved colour.

  Colour: Refer architectural finishes schedule and drawings for finish extent and locations.
- Provide a stainless steel bird/vermin proofing mesh to the rear face of all louvers (colour: Black, similar to 50 Martin Place Sydney).

4.5.5 Composite Aluminium Panels

- Composite Aluminium Panels shall not be used on this project

4.5.6 Flashings, Cappings and Cladding

Visible

- Aluminium sheet: grade 5005 or similar.
- Minimum thickness: 3mm
- Aluminium finish –coat in accordance with AAMA 2604.

Non-visible

- Aluminium (minimum 2mm thick) or zincalume sheet (minimum thickness 1.2mm).

4.6 Secondary Structural Steel

- Minimum requirement, Grade 250 mild steel.
- Paint colour to any exposed structural steelwork to match selected samples, to be approved by the Architect.
- Prepare material and hot dip galvanise in accordance with AS/NZS4680.
- All elements are to be pre-drilled, cut and welded prior to galvanising.

4.6.1 Secondary Structural Steel – Paint Finish; External

- All external visible structural steel is to be hot dip galvanised and painted.
- All external non – visible structural steel is to be hot dip galvanised.
- Surface treatment suitable for high quality architectural paint coating for visible steelwork. Degrease, wash and dry, then sweep blast galvanised surface with a non-metallic abrasive to impart a suitable surface roughness before priming. Prepare surface in accordance with AS/NZS 4680.
- Where steel is to be painted, surface preparation is to be to abrasive blast class 2.5 to AS1627. Pressure wash and leave overnight to ensure no more than 70 mg/m2 of chlorides.
- Where steel is to be visible, suitably prepare members to remove all surface defects and manufacturing markings, to the satisfaction of the architect.
- Painting system for steel to comply with AS/NZS2312:2002, table 5.2 "*Corrosion protection of batch hot-dip galvanized coatings*". Paint system must be capable of being re-coated in-situ to facilitate future maintenance and to allow touching up of construction damage.
- Paint colour: To match selected samples, to be approved by the Architect.
- Acceptable paint products: International Protective Coating Interthane 990 over Interzinc Epoxy Zinc or similar

4.6.2 Secondary Structural Steel – Paint Finish; Internal

- All internal visible steelwork to be coated with suitable metal primer and powder coat finished; colour to Architect's requirements.
- Alternate paint finishes to be agreed
- Where steel is to be visible, suitably prepare members to remove all surface defects and manufacturing markings, to the satisfaction of the architect.
- Grind all welds and finish to a smooth even surface prior to painting.
- Prepare all steel surfaces in accordance with AS2311 prior to painting.

4.7 Stainless steel

4.7.1 General

- Stainless steel shall conform to the requirements published in the American Iron and Steel Institute Steel Products Manual and shall be designed to AS4673.
- All stainless steel sections, sheets, strips and fasteners shall comply with BS1449 Part 2 and AISI 316.

4.7.2 Visible Elements

- Unless otherwise specified series 316L stainless steel shall be used. Prior approval required by Architect and Façade Consultant for use of alternate grades.
- If the stainless steel is contaminated during fabrication by iron and other non-ferrous metals, clean and ensure the surface has adequate passivity. Test the surface passivity to ensure all free iron has been removed.
- During all fabrication procedures, protect the stainless steel finish with a protective film.
- Comply with AWS for recommended practices for welding. Unless otherwise specified, welds to visible areas of stainless steel to be ground smooth to achieve a seamless surface. Heat tints shall be removed using fight abrasives, pickling paste, wire brushing or similar to achieve continuity with the specified finish. Areas difficult to access shall be manually finished if necessary.
- Do not allow the steel surface to be scratched during fabrication. Scratches which cannot be removed will be cause for rejection.
- See Section 5.2.5 for more information

4.8 Internal blinds

Refer to Appendix H. Refer to ESD engineer for thermal and functional requirements.

4.9 Fixings

4.9.1 Cast-In Anchors

- Facade fixings to new structure; use cast-in anchors equal to Halfen or approved fabricated cast-in plate.
- Cast-ins shall be minimum galvanised steel.
- Site welds to facade brackets shall be de-slagged and minimum 2 coat cold galvanised after welding.

4.9.2 Fixings, Screws, Rivets and Washers

- Screws: stainless steel grade 304 or 316 where visible.
- Nuts, bolts & washers: stainless steel grade 304 or 316 where visible.
- Pop rivets (if required): aluminium grade 5052 or stainless steel (300 series) with aluminium or stainless steel mandrels.
- Masonry anchors (expanding or chemical): Stainless steel Grade 316.
- Masonry anchors installed inboard of the airseal may be galvanised or plated steel. Only recognised brands such as Fischer, Hilti, Ramset and Powers may be used.
- Ensure all fixings are concealed. Exposed fixings are unacceptable unless approved in writing by the Architect. Acceptable exposed fixings shall be stainless steel grade 316 pig nose or recessed hex head and finished flush.
- All fixings shall be vibration proof under dead loads, live loads, wind loads and thermal movements.

4.10 Other Materials

4.10.1 Isolation Materials

- Inert material, compatible with materials with which it is in contact
- Non-conductive
- Non-compressible
- Water resistant
- UV resistant
- Compatible with materials with which it is in contact.

4.11 Summary of process for procurement

The following is a summary of the recommended reviews during the procurement stages:

- Review technical data sheets for proposed supplier's product
- Review proposed shop drawings and calculations.
- Review samples
- Prototype testing and Visual Mock ups
- Review of supplier quality management plan
- Factory review/audit
- Quality testing review during production of the materials
- Fabrication review
- Installation reviews

5. Fabrication

5.1 General

Fabricate and assemble the Works in strict accordance with approved Shop Drawings and with the requirements of this section.

Do not modify or adapt the agreed drawings and method statements without written approval. Record all changes on the master set of shop drawings.

5.2 Workmanship

5.2.1 Assembly

- Undertake assembly of components under factory controlled conditions.
- Remove all swarf and burrs from edges of cut and drilled aluminium before assembly of components.
- Where aluminium components are fixed together, ensure meeting aluminium surfaces are fully sealed. Ensure proper cleaning procedures are followed in the preparation of surfaces for sealing.
- Check each glass panel prior to glazing. Ensure glass is free from scratches, shells, edge damage, delamination or other defects, which exceed the specified tolerances, set out in this Specification. Reject any glass panels that do not comply.
- Ensure all drain holes are clear of sealant and laitance and drain freely.
- Adequately reinforce and accurately cut, fit and seal all junctions to leave only sealed hairline joints.
- Form joints accurately without lipping or offsets in visible surfaces unless designed otherwise. Joints shall be rigidly secured to prevent all but designed movement, unless indicated otherwise.
- Use jigs and computer controlled fabrication tools wherever appropriate to achieve accuracy. Carry out grinding, cutting, shaping and finishing operations using tools and techniques which will prevent contamination or damage of adjacent components with particles or substances which could stain or corrode them.
- Test fit all panels interlocking extrusions (such as mullions and stack joints) in factory prior to full production, machining, packaging and shipping

5.2.2 Aluminium Framing

- Machine-cut all aluminium extrusions
- Factory drill or punch all holes, slots, etc in aluminium extrusions
- Pre-fit and test fit all elements and panels in factory prior to shipping

5.2.3 Structural Silicone

- Factory glaze all panels where structural silicone is to be used. Site glazing shall only be used for replacement of glass / spandrel panels into panels that are already installed.
- Keep full and up-to date records of sealant shelf-life; structural silicone sealant shall not be used after expiry of its shelf life.
- Store, clean, prepare substrates, install and cure the structural silicone sealants in strict accordance with manufacturer's project specific printed recommendations.
- For two part structural silicone, ensure each batch is tested for consistency and quality prior to application. Record results of batch testing.
- Install structural silicone joints to design dimensions and ratios as per approved detail drawings
- Gun and fully tool structural silicone into joints. Avoid air pockets between silicone sealant and substrate and within silicone sealant.

- Use purpose made angled nozzle to apply silicone into joints if required to ensure complete fill of the joints.
- Mask all sealant joints with non-staining tape prior to sealant installation to ensure a neat joint and to protect adjacent finishes.
- Provide a smooth, slightly concave surface. Wet tooling techniques are unacceptable.
- Apply a quality control ("QC") sticker to each panel indicating all QC details for the panel.
- Keep full QC record of all site-glazed panels, including their position on the building.

5.2.4 Structural Steel

- Prepare all visible structural steel to receive a high quality architectural paint finish. Ensure all manufacturing marks and the like are ground back to a smooth finish where exposed to view.
- Ensure all structural steel is prefabricated complete with all holes, welds, vents and the like prior to finishing.

5.2.5 Stainless Steel

- Ensure all fabrication in accordance with ASSDA recommendation.
- Stainless steel sheet for external architectural application shall meet the requirements of type 316L (ASTM A167) or stainless steel grade with pitting resistance equivalent number (PRE = %Cr + 3.3 x % Mo + 16 x %N) of not less than 25. Ferritic stainless steel such as 445M2 grade is considered acceptable for external applications. Stainless steel sheets shall meet all the requirements of relevant current standards (ASTM or BS EN) and additional requirements given in this Specification.
- The external surface of stainless steel sheets shall be mechanically polished with non-directional finish to 2P as per EN10088/2 with surface roughness of not more than 0.5 microns".
- Avoid cross contamination with ferrous metals
- Ensure all oils and chemicals used during the manufacturing process are adequately removed and cleaned prior to being installed in factory fabricated panels and arriving on site.

5.2.6 Vibration-proof fixings

- Ensure all fixings are vibration proof under dead loads, live loads, wind loads and thermal movements, either by use of locking nuts, washers or the application of an approved locking fluid.

5.2.7 Tolerances

- Achieve compliance with maximum allowable fabrication tolerances specified in this specification.

5.2.8 Markings

- Clearly mark fabricated assemblies to identify lifting points, panel types, assembly or installation sequence, location and orientation.
- Mark with removable material, which can be completely removed without affecting appearance of the marked area. Alternatively, mark in areas which will be concealed when the installation is complete.

5.2.9 Protection

- Store fabricated assemblies in a manner that will prevent overload, distress or permanent deformation of the overall assembly or individual components.

- Protect the Works to prevent damage and staining during transportation, storage and erection until Practical Completion under the Head Contract is granted. Ensure temporary protective measures will not affect the appearance of the finishes when the protection is removed.
- The Subcontractor is to submit protective measures for approval prior to transportation and installation. Notify the Principal and discuss protective measures with the design team if open top containers are used to transport materials.
- Package fabricated assemblies so as to prevent finish damage, overload, distress or permanent deformation of overall assembly or individual components either during transportation or hoisting/lifting operations.

5.2.10 **Material Deliveries**

Check all materials provided by other suppliers for compliance with the project requirements. In particular, check for:

- Source, type, quality, grade, finishes and colour
- Correct accessories and fixings
- Correct sizes
- Correct quantities (to ensure shortages do not delay the works)
- Correct coating thickness
- Shelf life (i.e. that they are not out of date)
- Record all checks, confirming satisfactory supply or corrective actions.

6. Installation

6.1 General

Carry out installation in accordance with approved Shop Drawings by personnel experienced in the handling and site installation of the Works.

Do not cut, drill, modify or otherwise alter any work or the agreed details without obtaining written approval from the client and their consultants (façade engineer and architect). All such alteration work shall be carried out in accordance with the requirements of the Contract Documents and agreed submissions. All changes must be recorded on master documents held by the Subcontractor for inclusion on the 'as-built' drawings.

Employ only competent and experienced installers to carry out the installation. Provide and maintain records to demonstrate their employees' experience and related training.

6.2 Site Glazing

- Comply with the recommended guidelines set out in AS1288 and AS2047.
- Install glazing units with a minimum 5mm clearance at the vertical and top edges from the framing, and 6mm at the bottom with allowance for water to drain freely.
- Edge clearance and edge cover requirements to comply with Table 8.1 of AS1288 in addition to the requirements stated above.
- Install gaskets without incorrect distortion such as stretching or compression of length, or folding back of wiper seals.
- Do not site cut or nip glazing.
- Provide setting blocks in accordance with AS1288 and the relevant section of this specification.
- Provide test certificates for each sealant type to confirm compatibility with all surrounding substrates, and adhesion to the relevant substrates.

6.3 Weather-seal Application

- Follow the sealant manufacturer's instructions for substrate preparation and sealant installation.
- Minimum sealant joint glue-line, neck and bite shall be 6mm. Minimum glue-line to bite ratio of joints shall be 1:1 to 2:1. Maximum joint glue line shall be 20mm.
- Mask all visible sealant joints with non-staining tape prior to sealant installation to ensure a neat joint and to protect adjacent finishes. Remove the tape immediately after tooling.
- Provide a smooth, slightly concave surface.
- Complete tooling before any signs of skinning. If a seal skins before tooling is complete, remove the seal after curing and re-seal.
- Wet tooling techniques shall not be used.

6.4 Structural Silicone

- Use site applied structural silicone for replacement panels only unless agreed otherwise.
- Ability to achieve an adequate joint under site conditions shall be proven. A method of temporary mechanical restraint ensuring undisturbed curing irrespective of the applied wind load during the curing period shall be documented and used.

6.5 Fixings

- Install fixings in accordance with the manufacturer's recommendations and procedures.
- Do not cut reinforcement to concrete/masonry when installing fixings.
- Make good the integrity of the steel corrosion protection system where post drilled or site fixings are used for connections to the external steel work.

6.6 Site Welding

- For site welding of facade fixing brackets or other structural steel, all welding shall be carried out in full accordance with BS EN ISO 15614. Welding shall be supervised by an appropriately qualified tradesperson.
- Protect all finishes from weld spatter, including glass and paint finish. Replace all glass panels damaged by weld spatter.

6.7 Protection

- Protection of the works will be supplied, installed, maintained and removed by the subcontractor to the requirements of The Client. Protection will remain in place until the commencement of the final clean and will be removed to facilitate trade and final clean.

6.8 Cleaning

- The contractor shall trade clean their works as per The Client scope of work requirements (final clean to be provided).
- Clean all internal and external surfaces of glass, aluminium framing and painted steel etc.
- Undertake a trade clean of the Works, and any surfaces affected by the Works, at a time agreed with The Client. The trade clean shall remove all:
    - Protection tapes, films, covers and the like, together with any residual adhesives left by the protection materials.
    - Incidental construction dust, laitance, rubble and the like, to a level where the performance and appearance of the installation is not compromised, and any residual material will not etch the surface coatings/finishes and can be easily removed during the final clean.
    - Visible installation stickers and temporary product markings and QA markings.
    - Conduct a trial trade clean at the commencement of cleaning operations, and seek approval that the level of cleaning is suitable.

6.9 Rejections and Defect Rectification

- Any work determined by the Client and Consultants as being defective (either during the course of the Works or during the Defects Liability Period) shall be rectified by the Subcontractor to the satisfaction of the Client and Consultants. The cost of such rectification shall be borne by the Subcontractor.
- If directed, open up complete work for inspection. The time and cost of the opening up, inspection and closing up will be borne by the contractor.
- Where the inspection identifies that the works have been undertaken in a manner which is different from the approved method statements, then all costs associated with the inspection and subsequent rectification works will be borne by the Subcontractor.

6.9.1 Agreed Methods

- Rectification methods for finished products will be trialled and submitted for approval prior to the commencement of work. Where rectification methods are rejected, replacement of the component and/or assembly will be required.

6.9.2 Allocation of Costs

- Defects, which are clearly due to the actions of the contractor and/or his agents, shall be rectified at the contractors cost.

- Damage, repair/replacement and clean-up costs due to weatherproofing failure of completed work will be at the Subcontractors cost.

6.10 Delivery, Handling and Storage

Co-ordinate the delivery, handling and storage of panels and components so as to ensure they reach their final position in a clean, undamaged condition.

7. Verifications

7.1 Submissions

7.1.1 Schedule

- Make submissions in accordance with the Submission Schedule.
- Confirm schedule of submissions in accordance with the Submission Schedule within two weeks of Contract award.

7.1.2 Contract Samples

- Submit samples of each significant component complete with the proposed colour, texture and finish for acceptance by the Architect, The Client and the consultant team. Ensure that samples incorporate the full variance expected for the project.
- Glass samples proposed for the project shall be submitted in 300 x 300mm size and in 600 x 600mm size (minimum). Glass shall be submitted in the heat treated state to be used on the project; indicate direction of roller wave on the samples.
- Cladding samples shall be minimum 300 x 300mm (including aluminium panels).
- Finish samples shall be minimum 300 x 300mm for each finish type.
- Samples of continuous elements submit 300mm lengths (e.g. extrusions, gaskets, etc.).
- Samples of bolts, fixings and anchors; submit one unit of each type.
- Samples of hardware and ironmongery; submit one unit of each type.
- Approved samples will form the benchmark for the minimum acceptable quality for the project

7.1.3 Shop Drawings

Provide initial system design drawings for review and agreement prior to preparation of shop drawings. The system drawing should include all typical details including mullions, stack joints, transoms, sunshades, sub-framing (sub-sills, sub-heads and sub-jambs).

For the shop drawing submission as a minimum provide plans, elevations, detail elevations and full size (1:1 or other suitable scale) detail drawings for each component, condition and connection. Include allowance for 3D assembly drawings.

As a minimum provide:

- Set-out plans of cast-in anchors or elements to slab edges/edge beams where required.
- Co-ordinated detail of cast in anchors or elements indicating anchor, concrete, prestressing and rebar locations
- Plans, elevations and relevant section details indicating extent of visual mock-up and performance prototype.
- Plan indicating façade set-out and extent
- Elevations indicating wall panels, material type, facade type, etc. (including cross referencing of details)
- Part elevations for each facade type
- External wall sections (use suitable scales such as 1:1, 1:2 or 1:5 details) for all typical and non-typical details.
- Detailed sections through all typical and non-typical details for each facade type and each detail including but not limited to:
  - i) Mullions/vertical support members – typical, jambs, internal corner, external corner
  - ii) Transoms/horizontal support members
  - iii) Stack/expansion joints
  - iv) Stack-joint / sub-sill / sub-head termination details
  - v) Doors / window sections
  - vi) Brackets (including double bracketing where required)
  - vii) Insulation
  - viii) Fire stops and smoke stops

ix) Cappings
x) Detail of structural silicone joint indicating bite and glueline dimensions
xi) Interface details with building structure and other trades (including integration of any motorised actuator cabling)
xii) Methods and extent of jointing and sealing.
xiii) Plans and details for steel secondary structure members and their fixings, indicating exposed steel and internal stiffeners inside aluminium members and the like.
xiv) Aluminium cladding and soffit details
xv) Sunshade details

- Do not commence fabrication until shop drawings have been reviewed and endorsed by The Client, the Architect and the consultant team.
- Review of shop drawings by The Client and the consultants shall not relieve the Subcontractor of any responsibilities under this Specification.
- Submit print copies of each drawing together with one electronic copy in .pdf format for review in sufficient time to allow for the review / comment / re-submission process to occur prior to fabrication. Allow a minimum of 20 working days for review by all parties from receipt of drawings.
- At the completion of the project, or as directed by The Client, provide the final set of As-Built drawings. These shall be a set of approved details, modified to reflect details changed to suit site conditions, different from those approved originally. These shall include changed details in the event of a failed performance prototype test.

7.1.4 Calculations

- Submit detailed calculations for the facade system.
- Calculations to be prepared by a professional engineer with experience in the design of glass and curtain wall systems. The calculations are to be reviewed, approved and certified by a Professional Engineer (CPEng NER).
- Calculations shall include a summary page indicating key results, assumptions and references.

As a minimum, calculations are to include:

i) Summary including basis of design; Limit State
ii) Table of contents
iii) Determination of Design Wind Pressures including local pressure factors
iv) Mullion design for strength and stiffness (typical, corners, bottom span, parapet span and any large spans) and design of mullion joint for tolerances and movement
v) All stiffening or double bracketing required to mullions
vi) Transom design for strength and stiffness
vii) Stack /expansion joint design for strength and stiffness and design of the joint size for vertical movement (manufacture, installation, thermal, building movement and column shortening) and tolerances
viii) Glass design for strength and deflection. Also include a thermal analysis of the glass
ix) Structural silicone joint bite and glue-line design
x) Thermal movement assessment
xi) Bracket and connection design including cast-in channels and anchors
xii) All secondary structural steel elements including external steel members, internal steel stiffeners inside aluminium members and their fixings.
xiii) Thermal performance calculations of all frame elements and provide calculations for average panel thermal properties (for all types of panels) including total panel U-values, spandrel panel U-values and vision panel U-values (to AFRC requirements). The façade thermal performance must be verified and issued to Principal for review and comment prior to commencement of procurement (this includes calculations with Lawrence Berkeley National Laboratory (LBNL) Window software or approved similar).

- Review by The Client and its consultant team of calculations will in no way relieve the Subcontractor of its responsibilities under this Specification.
- Structural engineering certification shall be provided by the Subcontractor's professional engineer (CPEng) confirming the design complies with the Specification and all relevant Standards and Codes, local by-laws etc.

- Submit calculations in conjunction with shop drawings whenever possible. Allow 10 working days from date of receipt of last element for review of calculations by the Consultants.

7.1.5 Maintenance Manuals

- Upon Practical Completion, provide four copies of facade maintenance manuals for the project.
- Maintenance manuals shall include as a minimum:
  - xiv) Schedule of all materials used including material data, suppliers, and supplier contact details.
  - xv) Cleaning and maintenance requirements (including pre-dated QC sheets to be completed with each maintenance procedure, adequate for 20 years of façade life) for all surfaces / materials.
  - xvi) Method for warranties for materials and workmanship including those for components from other manufacturers. Provide original copies of all warranties for materials and workmanship.
  - xvii) A3 size copies of all as-built drawings for the project
  - xviii) CD-Rom copies in AutoCAD DWG and PDF format of all as-built shop drawings for the project
  - xix) Methods for repair / repainting of all painted elements
  - xx) Suggested inspection regime.

7.2 Visual Prototypes

Mock-Up (Fabrication Stage)

- Visual mock-ups are required for all main facade types, size and extent (Including blinds or other internal fixtures as agreed with Lend Lease) to be agreed by Architect and Client and relevant consultants.
- The mock-up(s) is to be located outside in the contractor's factory or similar prior to placement of the glass order.
- Glass and other material orders to be placed only after Architects written approval of the materials in the visual mock-up.
- The mock-up sample should be constructed using specified glass types, materials, colours and finishes, but is not required to be fabricated using project extrusions.
- The mock-up shall be used as a visual prototype to assist in the final confirmation of jointing, colours, and materials selection.
- The mock up is to be approved by Lend Lease prior to the commencement of fabrication

Control Bays (Installation Stage)

- Control bays are intended to be areas comprising the first panels for each facade type installed on the building. They are intended to become the benchmarks for acceptance of the installation in terms of materials, workmanship and general appearance.
- The location and configuration of the control bays may be modified to suit site programme and access arrangements; staged inspections may be undertaken. These will form part of the Works once accepted by The Principal.
- Control bay locations are to be agreed during shop drawing submission phase.
- A structural bay width x 1 storey height area is envisaged for each of the agreed control bays.

7.3 Testing

7.3.1 Performance Prototype Testing

Conduct full prototype testing of all non-proprietary systems in accordance with AS/NZS 4284 for structural adequacy and weather tightness. All external projections shall be incorporated into the prototype to allow for the dead loads and the maintenance loads to be considered.

The prototype test samples shall be full scale and consist of a minimum of two and a half floors in height by six glazing modules in width (to include all corner types). The test sample is to represent all typical components and features of the systems proposed. The final prototype configuration shall be selected by the Architect/Facade Engineer.

Testing should be carried out using an externally mounted pressure chamber. This is one in which the pressure chamber is fitted to the external face of the prototype sample, with the perimeter sealed against air and water penetration.

All testing facilities to be NATA (or equivalent) accredited.

IMPORTANT NOTE:

Please identify in the tender submission the proposed method of testing, and the face of the sample onto which the pressure chamber will be located for the proposed method. If it is proposed to test with an internally mounted pressure chamber, clearly identify within the tender submission an extra-over cost for testing with an external chamber as specified above.

The tested prototype is to be carefully dismantled and inspected. Dismantling is to be witnessed and recorded by the NATA representative. A dismantling report is to be completed by the NATA accredited testing facility indicating that the prototype has been constructed as per the drawings and installers instructions. Any ambiguities are to be recorded.

Submit proposed testing requirements with tender.

Should a test be unsuccessful, the Subcontractor shall determine the cause of failure, rectify the cause and re-test. All costs of testing and re-testing where required, including attendance by representatives from The Client and its consultant team shall be borne by the Subcontractor. Any modifications made to the test sample as a result of failure shall be fully documented in the final test report.

Previously Tested Systems

Where systems have been previously tested, submit test reports to confirm performance. Only reports prepared by NATA approved test authorities will be acceptable.

Reports should include a full description of the tested sample, including overall dimensions, module dimensions, perimeter detailing, glazing details, system drainage principles, etc.

Where the tested sample outlined in the previous testing report significantly differs in size or detail from the project requirements, acceptability of the report will be at the sole discretion of the Façade Consultant.

7.3.2 Performance prototype testing for thermal performance.

Complete all relevant testing (including validation of glass properties on the International Glass Data Base as required to comply to NCC/BCA and AFRC and NFRC requirements) of all façade types to confirm thermal performance in accordance with NFRC requirements.

Also coordinate façade and mechanical performance testing prototype in accordance with Arup mechanical and ESD engineering requirements.

7.3.3 Site Water Testing

- Conduct hose testing on random areas of each facade type, as nominated by The Client, the Architect and the Facade consultant, to demonstrate weather tightness of the installations. Tests shall be conducted, witnessed and reported by an Independent Testing Authority. Allow to conduct a minimum of 10 such tests.
- Water test to AAMA 501.2 field hose test standard.
- Submit test report for each field hose test conducted for the approval of The Client.
- The testing is to be allowed for by the sub-contractor (that is, paid for by the sub-contractor). This includes as a minimum access, water testing equipment (nozzle and hose), testing personnel and test witness to complete the Independent Testing Authority report
- If a test is unsuccessful, the Subcontractor shall allow to investigate the cause(s) of failure, rectify the problem and re-test the failed panel and additional panels until such time as The Client and its consultants are satisfied with the weatherproofing performance of the glazing system. If the

cause is found to be a design defect or a defect of installation procedure, all panels with the same defect shall be identified and rectified by the Subcontractor at its cost.

7.3.4 Acoustic performance testing

Acoustic Testing to be as per Arup Acoustic requirements, and as a minimum in compliance with ISO 10140-1 (including the current version and Amendments).

The testing is to confirm acoustic performance of the facade. The size and layout of each test is to be as per Arup Acoustic Engineers requirements.

The testing is to occur at an accredited and approved test facility.

The Contractor is to propose the test facility as part of tender submission.

7.3.5 Wind performance and Structural Bourne noise tests

Complete testing of all vertical sunshade elements (nominally in podium levels) and operable awning windows (smoke relief windows) in full scale prototypes within wind tunnel to determine performance under all wind conditions for dynamic response and for structure bourn noise effects.

Test regime to be provided by the contractor for review prior to any testing being completed.

7.3.6 Structural Silicone

- Obtain written confirmation from the structural silicone manufacturer as part of the silicone sealant manufacture's print review, that:
- Joint design is acceptable and within warranty parameters
- Silicone is compatible with proposed glass, *painted/anodised* aluminium, gasket rubber, setting blocks, and other substrates and all adjacent materials. Provide reports of compatibility testing for this project; and
- Silicone will not contaminate laminated glass interlayer or cause de-lamination.
- Conduct design tests to confirm the structural adequacy of the design.
- Conduct 'butterfly', snap-time and peel tests on 2-part sealant in the factory to confirm silicone consistency and adhesion. Record the results of all such tests in the factory QA system.
- Conduct regular skin-over time tests on one part structural silicone sealant where used in the factory and on site.
- Carry out de-glazes as instructed by Consultants and sealant manufacturer; minimum deglazes shall be 1% of all frames glazed in the factory and 1% of all panels glazed on the Site. Ensure that sealant manufacturer's representative is present at all de-glazes. Obtain the sealant manufacturer's representative's report for every de-glaze.
- Confirm by the signoff of site QA documentation that all structural silicone joints have been installed in full accordance with the manufacturer's requirements.
- Mark on plans or elevations details of all panels structurally glazed on the Site.
- Provide copies of quality documentation to The Client for review. Include a full copy of Quality Assurance documentation in the maintenance manual.

7.3.7 Weather seals; Site Installed

- Prior to commencement of regular installation of weather seals on the Site conduct at least three (3) on-site hand-peel tests for each type of seal. Ensure that the sealant manufacturer's representative attends the test and provides a written report of the test and is satisfied with all aspects of the sealant installation and curing.
- Keep QC records of weather seal silicone used on the Site. Ensure that it is stored in accordance with the sealant manufacturer's instructions and that its use-by date is not exceeded.
- Test weather seal sealants regularly on site; skin-over time test.

- Regularly test by hand-pull, cured silicone weather seal joints on the Site. The Subcontractor shall ensure that hand-pull tests shall be carried out with the sealant manufacturer's representative present and obtain the sealant manufacturer's representative's report for all hand-pull tests.
- Make all test reports and QC records available to the Consultants on request. Include a full copy of all QC records in the maintenance manual.

7.3.8 Masonry Anchors

- Verification methods in accordance with SA TS 101:2015.
- Tests of masonry anchors shall be carried out by a tester approved The Client and its Consultants. A representative of the manufacturer of the masonry anchors may carry out the tests, if they regularly carry out this work.
- Nominally load test 1 in every 100 typical masonry anchor. Test at least 1 of each type of non-typical anchor to a minimum of 1% of the type. Provide a graph of load versus deflection for all tests.
- Ensure that the method of load application is representative of the loading in service. The test procedure, including a diagram of the test equipment layout shall be submitted to The Client for approval prior to testing.
- At a test loading value of 1.2 times the design load for the anchor, deflection shall not exceed 1mm, or lesser value agreed with the masonry anchor manufacturer.
- Failures of any of these tests shall be reported immediately to The Client. The Client shall then determine the extent of re-testing required by the Subcontractor, which the Subcontractor shall carry out and bear all associated costs.
- Make all test reports available to The Client and its consultants on request. Include a full copy of all QC records in the maintenance manual.

7.3.9 Finishes

Powdercoat and PVF2 Paint Finishes and Anodising of Aluminium

- Test powdercoating quality and thickness to the requirements of AS 3715.
- Test PVF2 quality and thickness to the requirements of AAMA 2605.
- Test anodised coating and thickness to AS 1231.
- Make all test reports available to The Client and its consultants for review. Include a full copy of all QC records in the maintenance manual.

7.3.10 Weld Testing / Inspection

- Inspect and test welding of site and factory fabricated structural steel, including site welding of curtain wall brackets in accordance with BS EN ISO 15614.
- Make all test reports available to The Client and its consultants on request. Include a full copy of all QC records in the maintenance manual.

7.4 Quality Assurance

- Implement a quality assurance system in compliance with AS/NZS ISO 9001.
- Provide a professionally prepared project specific quality plan divided into separate sections for factory and site works. Present quality plan to The Client for review and comment prior to commencement of the Works.
- Implement a site inspection / verification procedure which ensures that all elements of the installation are installed in full accordance with the design.
- As a minimum, the QA manual shall include the following:
  - xxi) A method statement for each procedure involved in the implementation of the Works, including responsibilities for each procedure.
  - xxii) A pro-forma for each procedure.
  - xxiii) Hold points in each procedure when QC checks/tests are carried out.

xxiv) Pass/fail requirements for each check/test cross-referenced to a Specified, Code, Standard or local government requirement.

xxv) Non-conformance procedures for each test/check including quarantine and rectification procedures.

Appendix A

Appendix A – Glass Type Schedule

Where:

VLT – Visual light transmission

R_e – External reflectivity

R_i – Internal reflectivity

U – U value (thermal conductivity) to NFRC calculations in W/m^2K

SC – Shading coefficient

A – Annealed glass

HS – Heat strengthened glass

T – Toughened glass

Lam – Laminated glass

DGU – Double glazed unit

Thicknesses provided are indicative only and does not relieve the sub-contractor of their requirements to comply with strength, acoustic or manufacturing limits. Grade A safety glass to be provided in locations as per AS 1288.

Note that interlayer thickness is indicated based on previous experience and require the glass manufacturer to determine and to propose relevant glass build ups for compliance with the performance requirements of this Specification.

Clear and Low Iron Glass is to be benchmarked and the clarity is to be as per approved benchmark samples.

*Availability of the glass panel sizes to be determined by the contractor. Where the benchmark products are not available the contractor is to propose equivalent products for review by the design team.

Glass Type Matrix

Glass Requirements

Facade type	Façade nominal description	Glass	Glass Description	Colour	Target VLT (%)	Target R_e (%)	Target R_i (%)	Target U Glass only	Target U Total system	Target SHGC Glass only	Target SHGC total system	Acoustic requirements (Per CSWSMP-MAC-SMN-NA-REP-999901 Rev D dated 22 May 2019 and aconex OveArup-GCOR-004455 on 9 October 2019)		Nominal Glass Build Up Recommendation considering architectural, thermal, structural and Safety requirements.	Benchmark products
N - FT – 01	**Curtain Wall to Office – Vertical Rectangle**	GN1	Curtain Wall vision glass to north tower office IGU with low e coating For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral / silver .	>40%	<20	<15	<1.7	<2.6	<0.22	<0.11 For blinds see note ^	L3-4	Knowledge Centre Options including 31.5mm laminate/24 air gap/21.5mm laminate	31.52mm HS laminate/24 air gap/21.52mm HS laminate	Refer to glass product options document provided separately.
												L5-27	6 mm float / 12mm cavity /8.8 mm laminate	8mm HS + low e coating / 12 air gap / 10mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
N - FT – 02	**Curtain wall to office – inclined trapezoid**											L29-35	6 mm float / 12mm cavity /6 mm		
												L36-37	6mm / 12mm cavity /10 mm	8mm HS + low e coating / 12 air gap / 10mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
N - FT – 03	**Curtain Wall to Office – Inclined parallelogram**	GN1	Curtain Wall vision glass to north tower office IGU with low e coating For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288. .	Neutral / silver .	>40%	<20	<15	<1.7	<2.6	<0.22	<0.11 For blinds see note ^	L29-35	6 mm float / 12mm cavity /6 mm	8mm HS + low e coating / 12 air gap / 10mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
												L36-37	6mm / 12mm cavity /10 mm	8mm HS + low e coating / 12 air gap / 10mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	

N - FT – 04 – A, B and C	**Curtain Wall to atrium – inclined parallelogram and Curtain wall to office – inclined trapezoid and Curtain wall to office – inclined rectangle**	GN2	Curtain Wall vision glass to north tower atrium spaces IGU, clear Grade A safety glass (laminated HS glass) required for overhead glass, and as required per AS 1288 For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral	>60%	<10	<15	<1.7	<2.6	<0.3	Refer to Arup	L14-27	6 mm float / 12mm cavity /8.8 mm laminate	8mm HS + low e coating / 12 air gap / 10mm HS * *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
												L29-35	6 mm float / 12mm cavity /6 mm		
												L36 to 37	6mm / 12mm cavity /10 mm	8mm HS + low e coating / 12 air gap / 10mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
N - FT – 06	**Curtain Wall to lifts – vertical rectangle**	GN2	Curtain Wall vision glass to north tower atrium spaces IGU, clear Grade A safety glass (laminated HS glass) required for overhead glass, and as required per AS 1288 For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral	>60%	<10	<15	<1.7	<2.6	<0.3	NA (internal blind to internal lift lobby glass)	L3-L4	10 mm float / 12mm cavity /8.8 mm laminate	10mm HS + low e coating / 12 air gap / 9.52mm HS laminate	Refer to glass product options document provided separately.
												L5-27,	6 mm float / 12mm cavity /8.8 mm laminate	8mm HS + low e coating / 12 air gap / 10mm HS	
												L29-35	6 mm float / 12mm cavity /6 mm		
												L36-37	6mm / 12mm cavity /10 mm	8mm HS + low e coating / 12 air gap / 10mm HS	
N-FT-08A And N-FT-07E	**Curtain wall glazed spandrel panels**	GN2S	Curtain Wall glass to north tower office IGU with low e coating and colourback to surface 4 For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral / silver	NA	<20	NA	<1.7	NA	<0.22	NA	L2-L4	10 mm float / 12mm cavity /8.8 mm laminate	10mm HS + low e coating / 12 air gap / 9.52mm HS laminate	Refer to glass product options document provided separately.
												L5-27	6 mm float / 12mm cavity /8.8 mm laminate	8mm HS + low e coating / 12 air gap / 9.52mm HS *Due to geometry, some glass slopes overhead to inside. This is required to be deemed overhead glass in accordance with AS 1288 and required laminated grade A safety glass.	
												L29-35	6 mm float / 12mm cavity /6 mm		
												L36 to 37 and roof dome	6mm / 12mm cavity /10 mm	17.52mm HS laminate + low e coating / 12 air gap / 13.52mm HS laminate	

N-FT-10	**Level 10 – terrace glazing**	GN3	Curtain Wall vision glass to north tower office IGU with low e coating For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral / silver	>40%	<20	<15	<1.7	<2.6	<0.22	<0.11 For blinds see note ^	L10	6 mm float / 12mm cavity /8.8 mm float	13.52mm HS laminate + low e coating / 12 air gap / 13.52mm HS laminate Note glass on the terrace will need to be Grade A safety glass, so allow to laminate both lites.	To appear as per GN1
N-FT-11A, B and C	**Curtain wall to podium office with fins (depth varies) and Curtain wall to podium plant glazing**	GN1	Curtain Wall vision glass to north tower office IGU with low e coating For overhead areas – provide laminate in accordance with AS 1288. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral / silver .	>40%	<20	<15	<1.7	<2.6	<0.22	<0.11 For blinds see note ^	L3-L4 Knowledge Centre	Knowledge Centre Options including 31.5mm laminate/24 air gap/21.5mm laminate	31.52mm HS laminate/24 air gap/21.52mm HS laminate	Refer to glass product options document provided separately. Note acoustic options provided by acoustic engineers per their acoustic report.
												L5 – L9	6 mm float / 12mm cavity /8.8 mm laminate	8mm HS + low e coating / 12 air gap / 9.52mm HS	
N-FT-17	**Curtain wall to light well**	GN5	Curtain Wall vision glass to lightwell to match 50 Martin Place glazing to the northern lightwell. IGU with low e coating Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral / silver	>60%	<15%	<15	<1.7	<2.6	<0.4	NA (TBC)	L3-9	Arup to confirm acoustic performance.	8mm HS + low e coating / 12 air gap / 10mm HS	50 Martin Place product is 6mm low e clear SDF-174#2 + 12 air + 6mm clear Arup and LLAI to confirm and approve the thermal performance.

	Feature Ground Floor to Level 2 Glazing	GN4 and GN4B (fritted)	Single glazing, laminates. GN4B also includes frits per architectural design. Where Grade A safety glass required provide laminated lites in accordance with AS 1288.	Neutral	>70%	<20	<15	<6.0	<6.0	<0.7	<0.7	Lower Ground Level Retail and EOTF lobby	17.5mm laminated glass		Generic clear laminated glass
												Ground Level Retail east	21.5mm laminated glass	21.5mm HS laminated glass	
												Ground level retail north	10.38mm laminated glass	11.52mm HS laminated glass	
												Level 1 café	17.5mm laminated glass	17.5mm HS laminated glass	
												Level 1 office lobby	10.38mm laminated glass	11.52mm HS laminated glass	
												Level 1 lift lobbies	17.5mm laminated glass	17.5mm HS laminated glass	
												Level 2 Lobby – north (to station entrance void)	10.38mm laminated glass	11.52mm HS laminated glass	
												Level 2 lobby – north east (to Elizabeth Street)	17.5mm laminated glass	17.5mm HS laminated glass	
												Level 2 Lobby – southeast (to Elizabeth St)	17.5mm laminated glass	17.5mm HS laminated glass	
												Level 2 Lobby – southwest (to Castlereagh St)	12.38mm laminated glass	13.52mm HS laminated glass	
												Level 2 Lobby – south (to void over site link)	10.38mm laminated glass	11.52mm HS laminated glass	
	Glazed awnings and canopies		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	NA	NA	Nominal 21.52mm laminated HS glass	Generic clear laminated glass
	Glazed bridges at level 5 and level 10		Clear laminated heat strengthened glass		>80%	NA	NA	<6.0	NA	<0.9	NA	NA	NA	Nominal 17.52mm laminated HS glass	Generic clear laminated glass
	Glass screens		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	NA	NA	Nominal 17.52mm laminated HS glass	Generic clear laminated glass
	Glass balustrades to atrium voids		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	NA	NA	Nominal 17.52mm laminated HS glass	Generic clear laminated glass
	Fixed glass between office and lift shaft and lift lobby		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	See aconex OveArup-GCOR-004455 on 9 October 2019	6mm glass	Nominal 17.52mm laminated HS glass	Generic clear laminated glass.
	Sliding door glass between office and lift lobby		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	See aconex OveArup-GCOR-004455 on 9 October 2019	6mm glass	Nominal 17.52mm laminated HS glass	Generic clear laminated glass. Switch glass as required for sliding doors to floors as allocated by Lendlease.
	Fixed glass between lift lobby and lift shaft		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	See aconex OveArup-GCOR-004455	10.38mm glass	Nominal 17.52mm laminated HS glass	Generic clear laminated glass.

												on 9 October 2019		(note current design with transom could be reduced to 13.52mm laminated HS glass)	
	Lift lobby glass ceilings		Clear laminated heat strengthened glass		NA	NA	NA	NA	NA	NA	NA	NA	NA	To be determined by subcontractor	Clear laminated glass, SGP interlayers may be required.

Where:
VLT – Visual light transmission
R_e – External reflectivity
R_i – Internal reflectivity
U – U value (thermal conductivity) to NFRC calculations in W/m^2K
SC – Shading coefficient
A – Annealed glass
HS – Heat strengthened glass
T – Toughened glass
Lam – Laminated glass
DGU – Double glazed unit

Thicknesses provided are indicative only and does not relieve the sub-contractor of their requirements to comply with strength, acoustic or manufacturing limits. Grade A safety glass to be provided in locations as per AS 1288.
Note that interlayer thickness is indicated based on previous experience and require the glass manufacturer to determine and to propose relevant glass build ups for compliance with the performance requirements of this Specification.
The U-values calculations of all panels is to include the inclination and panel shape. Relevant calculations for all typical panel are to be provided by the sub-contractor.
Glass samples in both clear and low iron glass options are to be sought and reviewed by the project team.
*Availability of the glass panel sizes to be determined by the contractor. Where the benchmark products are not available the contractor is to propose equivalent products for review by the design team.
^ ESD Engineers confirm that a minimum blind solar reflectance of 50% subject to design development to achieve SHGC requirement (ie the overall system SHGC requirements)

Appendix B

Appendix B – Glass Tolerance and Deflection Limits

Glass Dimension Tolerance		
Item	**Description**	**Requirement**
1.0	**Monolithic Glass**	
1.1	Overall thickness	
1.1.1.a	Less or equal to 6.0mm	+/-0.2
1.1.1.b	Greater than 6.0mm	+/-0.3
1.2	Overall Bow & Warp	
1.2.1.a	Nominal 6.0mm	1 in 350 < 1500mm 1 in 250 > 1500mm
1.2.1.b	Greater than 6.0mm	1 in 400 < 1500mm 1 in 300 > 1500mm
1.3	Cut Dimensions	
1.3.1.a	Nominal 6.0mm	+/-1.6mm
1.3.1.b	Greater than 6.0mm	+/-2.0mm
1.3.2	Diagonal/Squareness	+/-5.0mm
1.4	Defects	AS/NZS4667
1.4.1	Viewing Area	
1.4.1.a	Bubbles, gaseous inclusions, dots, residues, knots,dirt and stones	As per AS/NZS 4667
1.4.1.b	Scratches, rubs	As per AS/NZS 4667
1.4.1.c	Surface scars	As per AS/NZS 4667
1.4.1.d	Digs, strings	As per ASTM C1036, q3
1.4.1.e	Reams, lines and other linear distortions	As per AS/NZS 4667
1.4.1.f	Wave, distortions, process surface imperfections	As per AS/NZS 4667
1.4.2	Edge Zones	
1.4.2.a	Bubbles, gaseous inclusions,	As per AS/NZS 4667
1.4.2.b	Dots, residues, knots, dirt and stones	As per ASTM C1036, q3
1.4.2.c	Scratches, rubs	As per AS/NZS 4667
1.4.2.d	Surfaces scars	As per AS/NZS 4667
1.4.2.e	Digs	As per ASTM C1036, q3
1.4.2.f	Ream, lines and other linear distortions	As per AS/NZS 4667
1.4.2.g	Strings	As per ASTM C1036, q3
1.4.2.h	Wave, distortions, process surface blemishes	As per AS/NZS 4667
1.5	Confirmation	
1.5.1.a	Sub-Contractor and supplier to agree to regular factory audits and review of QA records and stock control records.	
2.0	**Heat Treated Glass (Heat Strengthened and Toughened)**	
2.1	Overall thickness	As per section 1.1
2.2	Surface Flatness (variation in surface)	
2.2.1	Leading/trailing edge (Edge Dip)	0.25mm in 300mm
2.2.2	Main Body	

2.2.2.a	All Thicknesses	0.15mm in 300mm
2.3	Overall Bow & Warp	As per section 1.2
2.4	Defects	As per section 1.4
2.5	Confirmation	
2.5.1.a	Roller wave to be parallel and horizontal in orientation when installed on building.	
2.5.1.b	Heat strengthening is to be undertaken such that no localised deformations will result from the heat strengthening process. No tong marks or localised kinks will be accepted.	
2.5.1.c	Permanent Identification marking shall be in the bottom right hand corner or as otherwise agreed with Lend Lease and the Architect.	
2.5.1.d	Glass supplier is requested to provide record of surface stress.	
3.0	**Laminated Glass**	
3.1	Overall thickness of laminate	
3.1.1	Nominal thickness	AS/NZS4667
3.1.2	Variation in thickness, locally	+/-0.15mm in 300mm length
3.1.2.a	Every effort is to be made to align crests and troughs when laminating individual glass lights.	
3.1.2.b	Obvious visual deformations in glass are to be measured as rate of change, as per section 3.1.2, and to be no longer than 100mm.	
3.2	Surface Flatness	As per section 2.2
3.3	Overall Bow & Warp	As per section 2.3
3.4	Step in laminates	<2.0mm for all thicknesses
3.4.1.a	Bottom edge of laminate to have 0.0mm slip/step	
3.5	Dimensions	As per section 1
3.6	Defects Inclusions and bubbles	As per AS/NZS 4667
4.0	**Glass coatings**	
4.1	Horizontality of coated bands	
4.2	Alignment with adjacent panel	+/- 2.0mm
5.0	**Double Glazed Units**	
5.1	Overall thickness of DGU	+/-2.0mm
5.2	Surface Flatness	As per section 2.2
5.3	Overall Bow & Warp	0.1%
5.4	Dimensions	
5.4.1	Height and breadth	As per section 1
5.4.2	Diagonal	As per section 1
5.4.3	Mismatch/Step	2.0mm

Appendix C

Appendix C – Deliverables and Samples Schedule

General Note: The following timings are maximum timeframes. The over-riding control in terms of submissions shall be The Principals approved construction programme.

Sub-Contractor deliverable	Expected delivery
Programme for design, prototyping & procurement	Within 2 weeks of Contract award
Programme for site works	Within 4 weeks of Contract award
Work Method Statements	Within 4 weeks of Contract award
Performance Prototype test programme, including nomination of test laboratory for approval	Within 4 weeks of Contract award Indicative programme for prototype test. Within 10 weeks of visual prototype approval.
Performance Prototype design drawings including detailed test schedule	4 weeks prior to procurement of prototype materials
Contractor's drawing schedule	Within 2 weeks of Contract award
Contractor's drawings; Typical Details	Within 2 weeks of Contract award
Contractor's drawings; Concrete Inserts	4 weeks from Contract award date, or as advised by the Head Contractor
Contractor's drawings; full set	Progressively, in sufficient time to allow review / resubmission process
Calculations	Submit with shop drawings
Performance Prototype test report	Within 2 weeks of successful test completion
Materials certification	Ongoing; 3 weeks prior to use of the material in Production and/or on the Site.
Structural Silicone Glazing print review from Sealant Manufacturer	3 weeks prior to commencement of installation of structural silicone in the factory
Sealant compatibility test results	6 weeks prior to installation on the Site
Draft Quality Assurance Manual	Within 4 weeks of Contract award
ITP for manufacturing	Within 4 weeks of Contract award
ITP for installation	6 weeks prior to commencement of installation of the Works
As Built drawings	4 weeks prior to completion of installation of the Works
Maintenance Manual	4 weeks prior to completion of installation of the Works
Deeds of Warranty	4 weeks prior to completion of installation of the Works
Engineering Certification	4 weeks prior to completion of installation of the Works

Samples	Expected delivery
Glass	300 x 300mm samples prior to award of contract.
Aluminium extrusions; 300mm lengths with applied finish	6 weeks prior to commencement of fabrication
Cladding	6 weeks prior to commencement of fabrication
Material data sheets	8 weeks prior to ordering
Solid aluminium sheet product	8 weeks prior to placement of material order
Material samples (cast ins, fixings, gaskets, sealants, etc)	8 weeks prior to commencement of production
Visual prototypes	Allow sufficient time for inspection and rectification of visual prototype to an agreed standard prior to full scale manufacture and installation.

Appendix D

Appendix D – Performance Prototype Test Requirements

Install the prototype externally on the test chamber so that the outside face of the prototype is facing into the test chamber. Water sprays shall be set up inside the test chamber.

Install Perspex windows to view into the aluminium sections; positions to be nominated by The Principal and its Consultants on The Head Contractor's prototype layout and detail drawings.

The following table provides a recommended methodology and outline procedure for performance testing of the fixed façade prototypes.

Where specified below, refer to the relevant code for test procedures, methods and acceptance criteria.

Prototype testing requirements for operable elements such as doors, access windows etc. is to be completed to the relevant operation procedures and forces nominated by AS2047 and AS4420.3.

For the fixed Glazing Elements including (single skin curtain wall façade prototype) the following test procedure shall be undertaken with all joints of the sample un-taped. All testing to AS/NZS: 4284 unless noted otherwise. A dismantling report is to be completed by the NATA accredited testing facility (or equivalent) indicating that the prototype has been constructed as per the drawings and installers instructions. Any ambiguities are to be recorded.

Test	**Requirement**
Preliminary Loading	Subject sample to a static pressure of 65% of the positive and negative structural (ultimate) test pressures, for a duration of 10 secs (positive) and 10 secs (negative).
Preliminary Water Penetration (static pressure)	▪ Apply water spray of 0.05 L/m^2.s (min) at 0Pa for 5 mins. ▪ 0.3W_S for 15 mins. ▪ Observe sample with no spray at 0Pa for a further 5 mins. ▪
Preliminary Water Penetration (cyclic pressure)	▪ Apply water spray of 0.05 L/m^2.s (min) at 0Pa for 5 mins. ▪ 0.15 x Ws to 0.3 x Ws (3 – 5 secs cycle) for 5 mins. ▪ Water spray at 0Pa for 2 mins. ▪ 0.2 x Ws to 0.4 x Ws (3 – 5 secs cycle) for 5 mins. ▪ Water spray at 0Pa for 2 mins. ▪ 0.3 x Ws to 0.6 x Ws (3 – 5 secs cycle) for 5 mins. ▪ No water spray at 0Pa for 5 mins. ▪
Structural Performance	▪ Serviceability limit state Design Wind Pressure ▪ Transducer positions to be proposed by Contractor and agreed with The Principal and its Consultants. *Deflection/Span Ratio Limits:* ▪ Mullions – Span / 250 ▪ Transoms (out of plane) – Span / 250 ▪ Transoms (in-plane – vertical) – Span/500 or 3mm, whichever is smaller, unless agreed otherwise. ▪ Glass – Span / 60 ▪ Aluminium panels – Span/90 unless agreed otherwise ▪ Successive member / displacement – 3mm ▪ Maximum displacement limit (framing) – 20mm
Air Infiltration (static pressure)	▪ As per AS4284 or as agreed with Mechanical Engineer and ESD Engineer ▪ Test at positive and negative 150Pa, maximum air infiltration and exfiltration is 1.6L/m^{2}s
Water Penetration (static pressure)	▪ Apply water spray of 0.05 L/m^2.s (min) at 0Pa for 5 mins. Water sprays to be left on for start of static test. ▪ 0.3W_S for 15 mins. ▪ Water sprays left on for at least 2 minutes before start of cyclic tests.
Water Penetration (cyclic pressure)	▪ Apply water spray of 0.05 L/m^2.s (min) at 0Pa for 5 mins. ▪ 0.15 x Ws to 0.3 x Ws (3 – 5 secs cycle) for 5 mins. ▪ Water spray at 0Pa for 2 mins. ▪ 0.2 x Ws to 0.4 x Ws (3 – 5 secs cycle) for 5 mins. ▪ Water spray at 0Pa for 2 mins. ▪ 0.3 x Ws to 0.6 x Ws (3 – 5 secs cycle) for 5 mins.

	▪ No water spray at 0Pa for 5 mins.
Maintenance load	Apply ultimate maintenance load (1.5 x 0.5kN for vertical and 1.5 x 1.1kN for horizontal elements) to center of exposed elements and at maximum cantilever for maximum reaction bending moment to fixing brackets for 10sec.
Structural Proof Test	▪ Positive and Negative test pressures equal to the Ultimate limit state design pressures. ▪ Load period from zero to ultimate limit state pressure to be 1 min. Hold test pressures for duration 10 secs.
Seal degradation test	▪ As per AS 4284

Appendix E

Appendix E – Structural Silicone Quality Control Programme

Minimum Performance Requirements

The Subcontractor's structural silicone Quality Management Programme shall include (but not be limited to) the following:

a) Documentation of the sealant manufacturer's requirements for the particular substrates of the project, regarding joint size, limitations, backer rod, mixing, cleaning, surface preparation, priming & primer application, temperature and humidity of glazing conditions and any other criteria which may affect sealant performance.

b) Provision of certification from the sealant manufacturer that the sealant manufacturer has reviewed all sealant details and tested all contact surfaces and finds same suitable for use with the proposed sealant, suitable for the purpose intended and compatible with and will not stain the surfaces with which the sealant my come into contact. Sealant manufacturer's certification as to compatibility, adhesion sufficiency and non-staining shall be accompanied by actual test results on production substrates performed in accordance with applicable ASTM procedures.

c) The bite size shall be determined from adhesion testing and the sealant manufacturer's recommended procedure. Bite size shall meet the performance requirements of wind and dead load etc., and be adequate for the panel size. Structural silicone joint size and geometry must be in accordance with the sealant manufacturer's recommendations for glue-line and bite to glue-line ratio.

d) Care must be exercised to prevent "three sided adhesion". Bond breakers shall be provided where necessary.

e) Tensile (tensometer) testing shall be carried out to confirm adequacy of adhesion of the silicone to the substrate surface, the paint to metal and etc. A minimum of twelve (12) samples shall be tested to destruction. The samples shall be at least 150.mm long and be made of actual production components. The samples shall be assembled under actual production conditions. The test results shall be analysed using recognised small-sample statistical methods to determine the design stress. The chosen design stress shall be approved by the sealant manufacturer.

f) Glazing procedures including frame assembly, cleaning, priming, gunning, tooling and frame handling after curing. A primer shall be used, unless instructions to the contrary are issued by the sealant manufacturer. In such a case, the sealant manufacturer shall certify that the use of primer will reduce the silicone joint performance.

g) Units shall not be moved until the structural silicone has achieved full cure to the satisfaction of the sealant manufacturer.

h) Silicone batch procedures shall record all batches used, including silicone batch manufacture date and arrival date of each batch to the glazing factory. Ensure stock rotation and that silicone sealant shelf life is not exceeded.

i) Silicone testing shall be continued on a weekly and/or silicone batch basis, for the full glazing production period.

j) Substrate testing shall be completed to ensure continued high quality and consistency of silicone adhesion to the substrates for the glazing production period.

k) Frames shall be logged at time of assembly and will identify every panel by a unique number, readable from inside the building, for the life of the building. Glazing records will then provide information on each panel by its number, including silicone type and batch, date of silicone installation, glazier's name, temperature and humidity measured inside the factory at a nominated time each day.

l) De-glazing shall be carried out in the factory periodically to ensure continued high quality of sealant joints through the glazing production period. Frames shall be chosen at random and the minimum number of factory de-glazes shall be as follows:

- 1 out of the first 10 panels (panel numbers 1 to 10)
- 1 out of the next 40 panels (panel numbers 11 to 50)
- 1 out of the next 50 panels (panel numbers 51 to 100)
- 1 out of each 100 panels for the remainder of the project.

m) De-glazes shall be done to adequately represent all types of frames, ie visions, spandrels, corners etc.

n) Acceptance criteria for de-glazes, including adhesion, cohesion, voids and inclusions shall be agreed with The Architect prior to the commencement of silicone glazing.

o) A procedure shall be determined in case a panel is rejected due to inadequate silicone joints. This shall include de-glazes of panels glazed on the same day with the same silicone batch as the rejected panel. The procedure shall determine the extent of the problem, how many panels are involved, the return of the rejected panels to the factory and re-glazing or disposal and replacement.

p) Site glazing procedures must be determined and include all of the above points, a. to o. If site installed silicone procedures vary in any way from the established factory method, then the adequacy of the seals shall be established as indicated in points a., e. & l. above. The ability to install an adequate structural silicone seal on site must be established. A method of ensuring undisturbed curing irrespective of applied wind loads during the curing period shall be established and documented.

q) The Subcontractor shall provide elevations and/or plans of the building indicating the position of all structurally silicone-glazed panels, giving their unique frame numbers. All site-glazed panels shall be highlighted. These marked-up plans shall be updated weekly.

r) All management records shall be provided to The Principal, starting from the date of commencement of glazing and updated on a monthly basis. These will include records of all relevant points above. At completion of the Works, the Subcontractor shall include all structural silicone QC records in the Façade Maintenance Manual.

Appendix F

Appendix F – Not used

Appendix G

Appendix G – Façade Types, Finishes (JPW and Grimshaw) and Design intent details

Appendix H

This is an update to the Façade Performance Specification Appendix H
"Automated blind requirements for coordination and provisions"

This document is to be read in conjunction with the Façade Performance Specification and all referenced and related documentation for the project including the drawings and finishes schedules by JPW (the architects) and the façade detail drawings by Surface Design.

This update is provided on the 15 Septeber 2019, and should supersede the previously provided Appendix H from the Façade Performance Specification.

Appendix H – Automated blind requirements for coordination and provisions

The minimum performance requirements of the blind are to be in accordance with this Appendix/Specification and with the British Blind and Shutter Association (http://www.bbsa.org.uk/). This includes compliance with the standards (note some sections of the standards are for manually operated blinds and therefore may not be relevant to automated blinds):

- BS EN 13659 – Shutters – Performance requirements including safety
- BS EN 13120 – Internal Blinds – Performance requirements including safety

Scope of Works (Summary):

The blind contractor is fully responsible for the design, design development, samples, testing, procurement, fabrication, installation, commissioning, certification and tuning the blind system including all interfaces with façade systems, structure, ceilings, BMCS, ICN, Electrical systems and other trades' work.

Included in the above the blind contractor will include but not limited to:

- Wiring of blinds to a motor control unit, suitable for connection to a field power outlet supplied by the Electrical Contractor.
- Coordination with the Electrical Contractor to determine power requirements, location of outlets, quantities etc.
- Design, supply and installation of network cabling and associated infrastructure between the blind system and the ICN interface point on each floor (currently located at the North West core)
- Supply and installation of all control panels, sensors etc. including associated cables, containment etc.
- Contractor should allow for 3D modelling in Revit for coordinating with all services including control units, blinds etc.
- Interfacing with the BMCS and Integrated Services Platform (ISP)

ESD fabric requirements:

The minimum fabric requirements required for the ESD.

Solar reflectivity: >= 70%

Visible light transmission: <= 5%

Openness: <= 5%

The material will either, not contain any PVC, or is certified to meet the *Best Practice Guidelines for PVC in the Built Environment*, as defined by the GBCA. Refer to Appendix I Green Star Strategy, Clause 20.3.

Blind Performance Testing required for ESD compliance

Optical testing comprising of spectral measurements of hemispherical

transmission (total and diffuse) and reflection (total and diffuse) over wavelength ranges of 300-2500nm and including longwave emissivity measurements are to be facilitated by the sub-contractor. Applicable standards required to be followed include ISO 9050:2003 and EN 14500:2008.

From the above spectral measurements, a bidirectional scattering distribution function (BSDF) is to be created for use within the Shading Layer library of WINDOW 7. This is to enable the glass and blind system thermal performance to be confirmed. This process is to be facilitated by the sub-contractor using a suitably qualified consultant.

Motorised blinds assembly

Internal window dimensions:
Refer to architectural drawings for set out

Height of drop: Refer to architectural drawings (from top of aluminium sill to u/s of ceiling. Blind to stack above ceiling when raised)

Benchmark product is to be provided and reviewed by design team.

Blind Materials:

Approved grades and finishes. To comply with the Facade Performance Specification minimum requirements. Where alternative materials are offered, technical information is to be provided to the satisfaction of the design team.

Colour: To be as per architectural finishes schedule. Colour selection to consider facade performance and reflectivity.

Geometry and detailing of blinds to be provided for review and through visual mock up and sampling process.

Headbox/pelmet (to be provided by the façade contractor unless noted otherwise):
Aluminium extrusion section sized to contain the entire control mechanism, with powdercoat finish – colour per architects' requirements. Colour to be reviewed and approved by design team through visual prototyping process.

Provide custom installation brackets suitable for purpose and finished to match headbox. Brackets are to be fixed to the Facade frame elements with approval from the façade contractor and are to allow blind box to be positioned relative to the slab edge as indicated on architectural drawings.

Power operation requirements:

Details of operable elements including motors, gear boxes, to be provided.

The system shall contain 10-year power failure memory of shade positions and programmed stops and schedules. Should power be interrupted and subsequently restored, the system shall resume normal behaviour without any actions on the part of a user.

Variations in speed, accuracy of the position of limit stops to be as per BS EN 13120

There is to be no visible traces of grease or oil.

All system components shall provide power spike and brownout protection at ±10% of live voltage (note that this generally provided by base building power supply however must be coordinated and approved by electrical engineer).

All system components shall be UL Listed or approved equivalent certification.

Subcontractor to confirm power requirements within 2 weeks of award of contract.

Blind control methodology and capabilities:
The blinds shall be automated to minimise cooling loads, reduce discomfort associated with direct solar glare, whilst maximising access to views and daylight.

The following outlines the nominal operational capabilities of the blind control system.

The blind and blind control system is to be provided as part of the Window Coverings Package including but not limited to the design, fabrication, installation and maintenance of the blind, the motors, control systems and wiring as required.

The operation of the blinds is to be in accordance with the Project Brief requirements for thermal performance and glare control, override, and overcast conditions assessment (nominal weather station required to tower to inform conditions of sky for blind control strategy).

The minimum operation capability requirements are as follows:

- Provide sun tracking programme/software to determine position of sun throughout the year
- Provide intelligent controls algorithm to avoid excessive blind movements upon change in light intensity, allow for tuning of the system during commissioning
- Include facility to modify controls strategy for each blind control zone using weather readings and time clock settings.
- Provide capability to inhibit user override during 'high energy' periods (via operator management system)
- Ability to program the blinds to raise and lower to a range of different positions, i.e. 20% lowered, 40% lowered, 60% lowered, 80% lowered, 100% lowered.
- Schedule and/or control blind position of each control zone throughout the year. Blind scheduling/control parameters are to be reviewed by and agreed with design team prior to implementation and tuned through the commissioning process accordingly.
- The programming is to consider adjacent buildings in blind control/schedule to minimise blind use where overshadowing occurs.
- Allow occupants to override the blind position and raise or lower each blind and bank of blinds as required.
- Ability to implement an occupant override lockout function, based on sun position and/or signal from BMCS.
- Overcast sky override, based on roof top sensor. Provide a weather station with four lux sensors located at roof level to facilitate an overcast sky override for raising blinds and enabling occupant control during relevant periods.
- Unless agreed otherwise, there are to be one blind per window with user override capabilities. The override system is to allow a maximum of 10 individually controlled zones of blinds per floor level. The zones are to be agreed with the design team
- The system is to include a standalone control by the BMS (changes to the control strategy shall only be permitted by BMS). System to be coordinated with BMS requirements for the project.
- Allow for full commissioning of system including tuning period for up to 12 months after Practical Completion (see below)

Commissioning and tuning

Blind control parameters are to be agreed with the design team and implemented by the sub-contractor prior to practical completion. The sub-contractor is to allow for a 12-month building tuning period during which adjustments will be made as required to optimise the blind operation. During this period adjustments will be made, based on occupant feedback and measured conditions, to maximise the thermal performance of the façade whilst maximising views for the occupants.

Occupant Control:

There will be an occupant control panel adjacent to the blind being controlled, labelled to clearly illustrate which blind will be controlled and how to utilise the full extent of functionality available. The control panel will enable the occupant to control both the individual blind adjacent to the control, and the bank of blinds (per façade) that the individual blind is adjoined to, as follows:

- Incrementally raise or lower blind/s (20% increments).
- Fully lower blind/s

- Fully raise blind/s

The occupant control panel will indicate (via. status indicators or the like) when the blinds are 'locked down' for mechanical reasons, the control panel should be accompanied with documentation/diagrams explaining why tenant control is disabled during these periods.

Central control:

Operation of blind to be as per the Blind Functionality Brief by the ESD engineers.

All blinds to be connected to central façade control system located in the north west core or as otherwise agreed with Lendlease. The system shall be capable of tracking the position of the sun and adjusting the position of the blinds to suit, via connection to local control boxes. The automated control is to operate each blinds individually unless agreed otherwise.

The system shall allow the user to set the parameters for sun tracking including:

- the distance sunlight should be allowed to penetrate through the window to the floor
- the fraction of the window that is to remain covered. This fraction will be varied throughout each day and daily schedules will be required to be varied throughout the year.
- the fraction of the window that is to remain uncovered. This fraction will be varied throughout each day and daily schedules will be required to be varied throughout the year.
- what actions to take at times near sunset and sunrise

The system shall have PC graphical user interface, which provides the minimum information:

- a floor plan of the building with location of all blinds
- the current position for any blind

The graphical user interface shall operate on a PC running any of the following operating systems: Windows Vista/7/8, Linux, Solaris, BSD and Mac OSX.

The Control System shall operate as a stand-alone system, but also be capable of connection to an overall Building Management System.

Control boxes:

Typically provide one control box per number of motors as agreed with design team. Final confirmation of control box numbers is the subcontractor's responsibility.

Local control:

Blinds to have a manual override to allow local dropping (but not raising).

Manual override to be controlled via web-based software controls.

Override system to have capability for override to time out. The 'time out' period shall be adjustable and capable of being changed at the central control position.

Allow retraction of blinds within that grid bay for maintenance and cleaning of windows.

Motors:

All blinds to be fully motorised, with 240v AC tubular electric motor, drive shaft and electrical connections fully concealed within the head box.

The noise of the blind motors and blinds system are to be as per the requirements set by the Acoustic Engineer (Arup). Refer to Section 13 of CSWSMP-MAC-SMN-NA-REP-999901 Revision D dated 9 May 2019.

Accelerated weathering testing requirements for blind assembly:

Verification of the performance of the blind assembly through approved test regime is required. All testing is to be completed by an independent authority. Calibration of test lab equipment to be provided.

Previously completed tests may be provided to demonstrate compliance of the components and the assembly. This is to be presented to Lendlease and the Façade Consultant for review/approval.

If no suitable previously tested systems are available, the following testing is required:

All configurations and geometries are to be tested.

Durability (accelerated weathering) testing is to include cyclic testing (raising, lowering of blind, estimated up to 20,000 cycles of retraction and lowering) of assembly under environmental conditions including UV exposure and heat exposure (temperatures as predicted through calculations, cycle temperatures within the test chamber required).

Monitoring of the samples at agreed stages during the test is to be completed by the test lab and progress reports are to be issued outlining any weathering (colour change, dimensional change or other) that occurs during the test. The report is to contain photographic evidence and comparison to control samples.

The accelerated weathering testing of the blind assembly is to represent the worst case condition predicted over a 10 year period (longer testing may be completed as agreed with the design team for observation) for:

- maximum UV and
- maximum and minimum temperature exposure
- worse case cyclic temperature exposure and
- Maximum predicted operating cycles (raising, lowering, 20,000/20,000).

Number of cycles for the above conditions to be agreed with design team. Monitoring of condition of the assembly (through visual inspection and photographic record) during accelerated weathering test is required at agreed stages/hold points during test.

A minimum of 20 full size individual blind assemblies is to be tested.

Samples are required to be retained from the blind accelerated ageing testing for review.

Fire resistance requirements for blind assembly:

Fire resistance properties of assembly to be determined and comply with the Fire Consultants requirements.

Appendix I

Appendix I – Green Star Strategy

MARTIN PLACE METRO OVER STATION DEVELOPMENT

GREEN STAR STRATEGY

Document History

Prepared by	Peter Zacharia
Approved by	Daniel Grunbaum
Project Manager	Peter Kazaglis
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01		Draft for review	15.01.2019
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Table of Contents

1.0 Introduction

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

This document is intended to:

- Communicate the Green Star risk position to the project teams
- Provide examples of general specification clauses to be included in the contract documentation and the relevant trades.

This document does not:

- Present specific design responses to achieve the targeted credits and rating.
- Contain an exhaustive list of specification clauses specific to each discipline.
- Serve as a contract document to be included in Subcontractor tender packages

While the sustainability consultant is available to provide guidance to the design team, it is the responsible consultants role to ensure design documentation is consistent with the targeted credit requirements. This includes both design intent and contractual requirements to be undertaken by sub-contractors.

2.0 Green Star Strategy

2.1 Rating tool

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

Design & As-Built was released in 2015 and is a single rating tool for all building typologies, replacing building specific legacy tools such as Office, Retail Centre, Multi Unit Residential etc. In general, this tool is less prescriptive than previous tools, putting more onus on the project team to demonstrate how the design delivers the targeted outcome in operation.

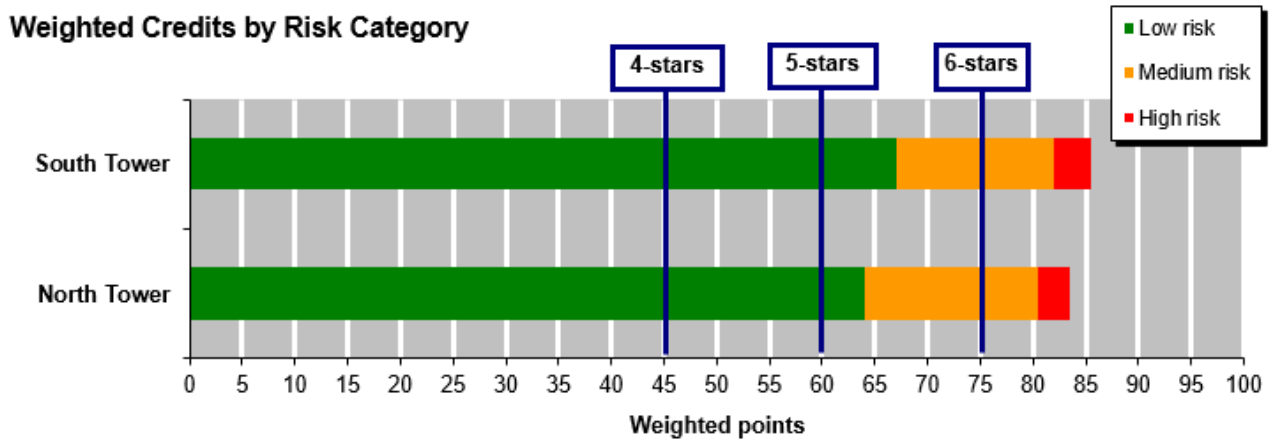
2.2 Risk Assessment

2.2.1 Risk category credit summary

Separate Green Star pathway documents identify targeted Green Star credits for each building. Credits are classified into risk categories as follows:

- **Low Risk:** credits are likely to be achieved as standard practice, or easily incorporated
- **Medium risk:** Credit likely to be achieved, however subject to design development, delivery risk or agreement with Green Building Council
- **High Risk:** Significant delivery risk or may require changes to design intent or delivery methodology

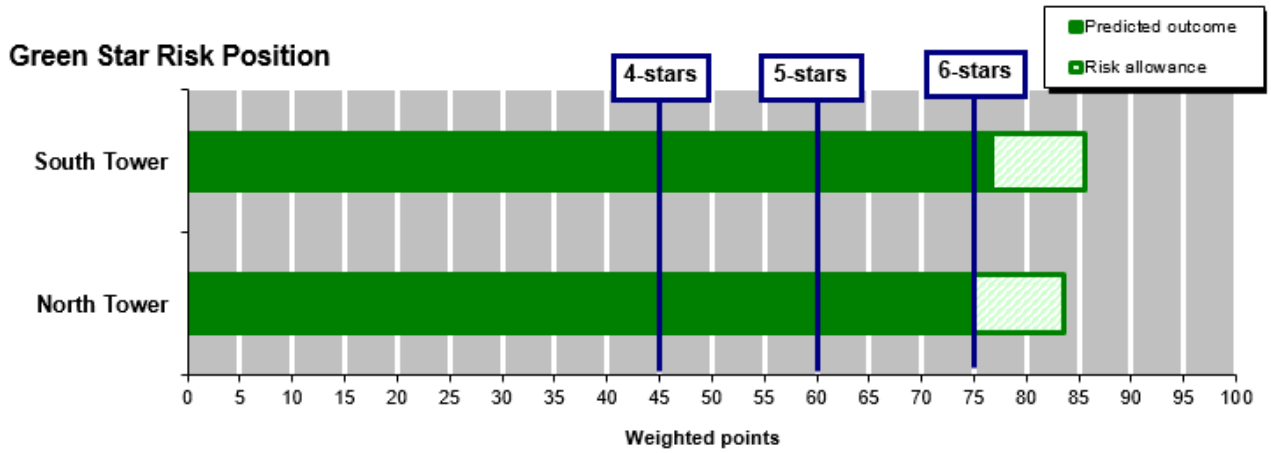
The chart below indicates the total targeted points and the credits by risk category for each building. Risks associated with each credit will change as the project develops so the latest Green Star pathway document should be referred to for each building.



To ensure that an adequate contingency is allowed to enable the rating to be achieved at completion of the project, each of the risk categories presented above carries a risk weighting as follows:

- 95% of Low Risk credits are assumed to be achieved
- 75% of Medium Risk credits are assumed to be achieved
- 50% of High Risk credits are assumed to be achieved

The risk weighted position (i.e. the target points minus the risk allowance) needs to be in excess of the required credits in order to provide confidence that the rating will be achieved. As seen in the following chart, both buildings are in a solid position to commit to a 6 Star rating.



For more information on the points targeted including responsibilities and latest risk please refer to the respective tower's Green Star pathway document.

3.0 Specification Clauses

The section following includes suggested clauses to be incorporated in specifications as per the responsibilities noted in the credit titles. These clauses are for general requirements and do not cover design responses to the Green Star strategy which are discipline specific.

For example; there are no sample clauses relating to lighting design levels or mechanical supply air rates as these are to be determined by the relevant design team and incorporated into the design and contract documentation as appropriate.

Text in red provides comments/advice only and is not to be directly copied into specifications. Where text appears under the green headings in black text it can be copied into an appropriate section of the specification. Please note that while text can be copied in some instances, responsibility of ensuring design compliance remains with the relevant consultant. For example, the architect selecting material and finishes selections needs to ensure that compliance documentation is available for the scheduled products in accordance with the specification requirements.

3.1 General (All Trades)

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

The Subcontractor will be an active contributor to the project team's commitment to achieve this rating. In addition to the specific design and delivery requirements noted elsewhere within this document, the Subcontractor is required to:

- Adhere to the requirements of the project Environmental Management Plan Health and Safety plan and ISO14001.
- Adhere to the requirements of the Waste Management Plan, including the re-use and/or recycling of a minimum of 90% of all construction and demolition waste generated on site and thus achieving a minimum 90% reduction of waste to landfill.
- Gain approval from the design team where the Subcontractor alters the design and/or equipment specified. These changes may require additional works by the design team, the cost of which will be incurred by the Subcontractor. Any changes cannot affect the ESD performance criteria for the project and must meet all ESD requirements.
- Submit all documentation, information, data and drawings necessary to support the Green Star submission.

3.2 Commissioning & Tuning

2.1 Services and Maintainability Review (Mech, BMCS, Elec, Hydr, Fire, VT)

The project team must demonstrate that a comprehensive services and maintainability review has been conducted with the results summarised in a 'Service and Maintainability Report'. While this is led by the Independent Commissioning Agent (ICA) with support and input from the design team, subcontractors will be required to review and provide input as necessary and requested by the ICA. The scope of the review must address the following aspects of the building systems:

- Commissionability
- Controllability
- Maintainability
- Operability
- Safety

The 'Service and Maintainability Report' must be agreed and signed off by all involved parties including sub-contractors.

2.2 Building Commissioning (Mech, BMCS, Elec, Hydr, Fire, VT)

The specification must list the commissioning requirements for each system. It is not sufficient to state that the systems must be commissioned to the relevant standard; instead the documentation must:

- List the design parameters for each system;
- List the required commissioning activities;
- Define how each system is intended to operate; and
- List the acceptable tolerances during commissioning

The specification must clearly indicate divisions of responsibilities, pre-commissioning procedures, commissioning requirements, witnessing requirements, phased completion requirements (if needed), post occupancy checks, and any training requirements for the operator. Where these are documented within a separate project commissioning plan, the specification should detail how the Subcontractor must comply with the plan.

2.3 Building Systems Tuning (Mech, BMCS, Elec, Hydr)

The subcontractor is required to participate in building tuning, which includes quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties.

The building tuning process will require the analysis of data from the monitoring systems and assessment of feedback from occupants on building conditions.

Building tuning generally involves:

- Verification that nominated systems are performing to their design potential at full and part load conditions;
- Reviews of environmental performance against the targets;
- Collection of user feedback to match the system performance with the occupant's needs;
- Adjustments of all the systems to account for all deficiencies discovered; and
- Management, communication, and assignment of responsibilities for the tuning process within the team

3.3 Building Information

4.1 Building Operations and Maintenance Information (Mech, BMCS, Elec, Hydr, Fire, VT~~**All Services**~~**, Facade)**

The project team must demonstrate that comprehensive building operation and maintenance information is available to the facilities management team in accordance with the following requirements.

Operations and Maintenance manuals are provided for all nominated building systems and include the following sections:

- A summary sheet of relevant building service contacts;
- System-level information for nominated building systems;
- Introduction and scope, including physical and functional descriptions;

- Operating parameters and procedures;
- Preventive maintenance requirements, including procedures and schedules;
- Corrective maintenance requirements, including repair requirements;
- Service contacts, and any warranties and certificates;
- As-built drawings for all nominated services ~~(Mech~~ incorporating at least:
    - Mechanical, electrical and hydraulic drawings and schematics covering all associated nominated building systems;
    - Architectural, façade/building envelope drawings; and
    - Architectural layout of base building.

All Operations and Maintenance manuals will be structured at a minimum to include the sections outlined above, and delivered as a single document including bookmarks and/or hyperlinks to allow for easy navigation of the manual, or should the manual and associated drawings be excessive large, be delivered within a succinct folder structure, bookmarked and hyperlinked to allow of easy navigation.

3.4 Indoor Pollutants

13.1.1 Paints, Adhesives & Sealants (Arch, Mech, Elec, Hydr, Fire, VT, Façade, Struct)

Total Volatile Organic Compounds (TVOCs) are to be in conformance with the limits set out in the table below. TVOC values must reflect the final ready to use product (in the case of paints, inclusive of tints) and made in grams of VOC per litre (g/L) of ready to use product.

Product Category	Max TVOC content in grams per litre (g/L) of ready to use product
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

The following test methods are relevant to paints:

- ISO Method 17895 (2005), for a material with a presumed VOC content <1%
- ISO Method 11890-2 (2006), for a material with a presumed VOC content <15%
- ISO Method 11890-1 (2007), for a material with a presumed VOC content >15%
- ASTM D3960, which is comprised of four individual testing procedures that measures TVOC (D2369) as well as density (D1475) and water content (D4017). Exempt compounds (D4457) must not be subtracted in the calculation of VOC contents.

The testing method for adhesives and sealants is the ASTM D3960 as detailed for paints.

The Subcontractor is required to provide a TVOC datasheet for all paints, adhesives and sealants to be applied internally on site for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports confirming the quantities and volume of each product used.

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities of each product type used.

13.1.2 Carpets (Arch)

There are two methods for demonstrating that a carpet complies. A combination of methods can be used to demonstrate compliance.

A. Product certification

The product is certified under a recognized Product Certification Scheme (listed on the GBCA website) or other recognised standards.

The certificate must be current at the time of product registration or submission and list the relevant product name and model.

Please refer to http://www.gbca.org.au/green-star/technical-support/materials-category/product-certification-schemes/2933.htm for a list of recognised schemes.

B. Laboratory Testing

The product complies with the TVOC limits specified in the table below.

Test Protocol	Limit
ASTM D5116 – Total VOC limit	0.5 mg/m^2 per hour
ASTM D5116 – 4-PC (4-Phenylcyclohexene)	0.05 mg/m^2 per hour
ISO 16000 / EN 13419 – TVOC at three days	0.5 mg/m^2 per hour
ISO 10580 / ISO/TC 219 (Document N238) – TVOC at 24 hours	0.5 mg/m^2 per hour

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities of each product type used and providing evidence of compliance.

13.2 Engineered Wood Products (Arch, Mech, Elec, Hydr, VT)

Engineered wood products include particleboard, plywood, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels. Timber veneers are excluded. The following applications of engineered wood products are excluded from this credit:

- Temporary uses of composite timbers (i.e. formwork)
- Composite timbers not used in indoor applications (i.e. car parks)
- Non-engineered wood products such as milled timber

All engineered wood products used in the building must meet the relevant limits specified in the table below, as per the specified test protocol, or have product specific evidence that it contains no formaldehyde.

Test Protocol	Emission limit
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤ 1 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	≤ 1 mg/L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) – LVL	≤ 1 mg/L
JIS A 5908:2003 – Particle Board and Plywood, with use of testing procedure JIS A 1460	≤ 1 mg/L
JIS A 5905:2003 – MDF, with use of testing procedure JIS A 1460	≤ 1 mg/L
JIS A 1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminated)	≤ 0.1 mg/m^{2}hr
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤ 0.1 mg/m^{2}hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤ 0.1 mg/m^{2}hr (at 3 days)
ASTM D6007 *	≤ 0.12 mg/m^3
ASTM E1333 **	≤ 0.12 mg/m^3
EN 717-1 (also known as DIN EN 717-1)	≤ 0.12 mg/m^3
EN 717-2 (also known as DIN EN 717-2)	≤ 3.5 mg/m^{2}hr
* The test report must confirm that the conditions of Table 3 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98. ** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.	

The Subcontractor is required to provide an emissions limit datasheet for engineered timber products to be applied internally on site for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports confirming the quantities and volume of each product used.

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and compliant products have been used, and generate a report summarising the quantities of each product type used.

3.5 Water

18A Potable Water (Hydr, Arch)

Martin Place Metro OSD has committed to the potable water consumption reduction performance pathway. The Compliance Requirements and guidance for the Performance Pathway are detailed in the Green Star Potable Water Calculator Guide. Required points are achieved through specified fixture and fitting efficiencies, as detailed below:

- Hand Basin Taps – 6 Star WELS
- Toilet – Dual Flush 4 Star WELS
- Urinals – Waterless or 6 Star WELS
- Showers – 3 Star WELS (6 L/min)

Other initiatives that are to contribute to low potable water consumption includes:

- Fire system test water is to be captured and re-used on site
- Rainwater capture and re-use on site
- Condensate capture and reuse on site
- No water or non-potable water used for irrigation
- Native plants used for any landscaping

3.6 Responsible Building Materials

20.1 Structural and Reinforcing Steel (Struct)

All structural and reinforcing steel used in the buildings structure must be sourced from a responsible steel maker. The steel manufacturer or maker must demonstrate compliance with the following initiatives:

- The steel making facilities where the steel for the project is being sourced must have a currently valid ISO 14001 Environmental Management System (EMS) in place. The Subcontractor is to provide valid ISO 14001 EMS certificates from the steel making facilities where the structural and/or reinforcing steels in the project were produced.
- The steel maker supplying the steel is a member of the World Steel Association's (WSA) Climate Action Program (CAP). A current CAP certificate from the WSA confirming membership must be provided. Certificates are valid for a period of 2 years and must be current at the time that the Green Star documentation is submitted.

At least 60% (by mass) of all reinforcing bar and mesh shall be produced using energy-reducing processes in its manufacture (measured by average mass by steel maker annually). Energy reduction arising from energy-reducing processes must equate to at least 40 MJ/tonne, measured as a percentage of annual mass of reinforcing steel produced by the steel maker. Reinforcing steel products sourced from a steel maker using Polymer Injection Technology (PIT) in manufacturing their reinforcing products is an acceptable method of compliance.

The Subcontractor is required to provide the following documentation prior to commencement of works:

1. Steel manufacturer ISO 14001 certificate.
2. Evidence of membership to WSA's Climate Action Programme from the Steel Making facilities where the structural or reinforcing steel was produced.
3. Confirmation from the Supplier stating, where relevant based on the credit criteria claimed:
    a. That they are a responsible steel maker, and listing their compliance documentation.

b. The total quantities (by mass) of reinforcing steel supplied to the building.
c. That the steel meets or exceeds 500MPa strength grade.

4. Energy-Reducing Processes report from every reinforcing steel maker, explaining the energy reducing processes used in their steel making process and confirming that it is used in the production of at least 60% of the reinforcement products they produce on an annual basis. The report must contain a summary of the life cycle assessment result for this technology in accordance with the Protocol for Demonstrating Equivalency in Energy Reduction
5. Confirmation and evidence of the chain of custody (location of supply, transport route and transport mode) associated with the sourcing, manufacture and fabrication of structural and reinforcing steel.

20.2 Timber Products (Mech, Elec, Hyd, VT, Arch, Façade, Struct)

Timber requirements apply to all applications within the project including, but not limited to:

- Formwork and other temporary installations (i.e. hoardings)
- Structural and non-structural timber including internal walls, floors and roof structures
- External and internal cladding
- Flooring, wall and ceiling finishes
- Internal and external joinery, windows, doors and other specialist uses of timber, such as installed furnishings or balustrades
- Furniture items made from timber or including timber components
- Engineered timber and composite wood products

All timber used on the project is to be sourced from a combination of the following:

- Sourced from forests that have been certified by forest certification schemes that meet the GBCA's 'Essential' criteria for forest certification. Currently this includes the FSC International and PEFC schemes. Please see http://www.gbca.org.au/green-star/revised-timber-credit/2693.htm for further information.
- Re-used timber

Where certified timber is used, it must be supplied in accordance with the Chain of Custody (CoC) rules of the respective certification scheme. Relevant CoC certificates and invoices including a relevant CoC code and/or serial number must be provided.

Where re-used timber is used a description must be provided demonstrating how this requirement is met and providing calculations (i.e. a breakdown of all components by area, length and mass). Where the actual cost of the item is known then the cost must be reported. Where the actual cost of reused items is not known, then the cost may be estimated on the basis of replacement cost (i.e. the cost of an equivalent new item).

If timber products are produced from 100% post-consumer recycled timber without any virgin timber content, then this can be deemed 're-used' timber. Third party verification, in the form of a signed statement, is required to confirm the percentage of post-consumer recycled content in such product(s) in order for them to be recognised as 'reused timber'. The third-party verification statement must be provided by an auditor registered by the Registrar Accreditation Board Quality Society of Australasia (RABQSA), or other equivalent national or international auditor accreditation system.

The subcontractor is required to provide evidence of compliance for all timber products used on the project for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports on all timber products used with the following details:

- Description of timber use/product

- Whether it is re-used, certified or uncertified timber
  - Where certified, provide name of certification scheme and CoC code or serial number
- Quantity of timber by area (m^2), lineal metre (m), or number of items (no.)
- Cost of each timber item

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables (Arch, Mech, Elec, Hydr, BMCS, Fire, VT, Landscape)

All permanent formwork, pipes, flooring, blinds and cables must either:

- Contain no PVC and have an Environmental Product Disclosure (EPD), or
- Meet Best Practice Guidelines for PVC

Where a product contains no PVC, the subcontractor is to provide a product datasheet or equivalent that describes the composition of the product and an EPD for the product.

Where a product contains PVC, the subcontractor is to provide evidence that the manufacturer has been independently verified to meet the *Best Practice Guidelines for PVC in the Built Environment*.

The subcontractor is required to provide evidence of compliance for all permanent formwork, pipes, flooring, blinds and cables used on the project for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports on all of the above products used with the following details:

- Product name and use
- Whether it is Best Practice PVC or non-PVC
- Cost of each item

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

3.7 Sustainable Products (Refer to - Appendix A – Sustainable Products Strategy)

21 Product Transparency and Sustainability

The following specification clause should only be inserted into specifications which include products or materials highlighted within Appendix A – Sustainable Products Strategy on page 1615. The blue text within the following clause needs to be amended to be made product specific, therefore referencing the product or material in question.

This project is targeting an overall proportion of materials (measured by cost) which meet the transparency and sustainability requirements demonstrated by the following recognised initiatives. Subcontractors are required to limit product selections for **Insert applicable Product e.g. Plasterboard** to those with certification in line with the table below, with preference given to those with certification aligned with the items highlighted Pink, subcontractors are required to submit compliant certification to justify a selection prior to procurement.

At completion of works, the Subcontractor shall undertake a final audit to ensure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

Transparency and Sustainability initiative	Sustainability Factor (SF)
Reused Product	1.00
Recycled Content Product	1.00*
Environmental Product Declarations - product-specific	0.75
Environmental Product Declarations – industry-wide	0.50
Product has Level A Third Party Certification	1.00
Product has Level B Third Party Certification	0.75
Product has Level C Third Party Certification	0.50
Stewardship Program	0.50

** Only the percentage cost of the recycled content in a product cost is considered*

The different initiatives are summarised below along with compliance documentation required:

- **Reused Products**
  - Reused products are items that have bene previously used and are incorporated in the project without significant changes to the structure or function of the item. Cleaning, making good, repairs, recovering and resurfacing are allowed.
  - A statement from the manufacturer confirming that the products are recycled, the recycled content and the cost is required to demonstrate compliance.
- **Recycled Content products**
  - Recycled content items are items produced with recovered materials. The percentage of recycled content is counted towards the compliant product cost.
  - A statement from the manufacturer confirming that the products are recycled, the recycled content and the cost is required to demonstrate compliance.

- **Environmental Product Declarations (EPDs)**
  - There are a number of EPD schemes available globally, however only those with a minimum cradle-to-gate scope which are independently verified are recognised by Green Star. The two EPD formats recognised include:
    - Products with a product-specific third party verified EPD which are issued in conformance with ISO 14025 or EN15804, independently audited and based on cradle-to-gate scope as a minimum
    - Products with an industry-wide, third party verified EPD which are issued in conformance with ISO 14025 or EN15804, independently audited and based on cradle-to-gate scope as a minimum and where the product manufacturer is a recognised participant in the EPD
- **Third Party Certification**
  - Third Party Certification levels are defined in the GBCA's Framework for Product Certification Scheme. Further details are available on the GBCA's website http://www.gbca.org.au/green-star/technical-support/materials-category/product-certification-schemes/2933.htm
- **Stewardship Programs**
  - Product stewardship programs encourage projects and suppliers to share responsibility for the effective reduction, reuse, recycling or recovery of products. Product stewardship is demonstrated via product stewardship contracts for both leased and purchased items, provided:
    - The contract is between a supplier and the building owner or tenant
    - The supplier agrees to collect the item at lease end for re-lease, re-use or recycling without any exemptions for timing, quality or quantity that is accepted for collection

4.0 Appendix A – Sustainable Products Strategy

The following products / materials have been nominated for inclusion within the Sustainable Products Strategy due to the extent of compliant products available on the market. In order to achieve the targeted points within the Green Star pathway, the following products need to be specified as having compliant certification, with preference given to product specific Environmental Product Declarations (EPD) or a Level A Third party certification.

Specifications with products / materials highlighted below shall include the specification clause detailed within section 3.7 – Sustainable Products on page 14~~on page 13~~.

Product / Material	Compliant Manufacturer Example*
Lifts	Schindler
Concrete	Boral
Reinforcement	OneSteel
Access Flooring	ASP
Carpet	Interface
Plasterboard (Wall)	Knauf
Cladding	Alucobond
Tiles	IKF
Reinforcing Steel - Reo	OneSteel
Plasterboard (Ceiling)	Knauf
Metal ceiling tiles	Armstrong
Insulation	Knauf
Structural Steel - Columns	OneSteel
Structural Steel - Suspended Slabs	OneSteel
Structural Steel - Columns	OneSteel
Structural Steel - Roof Structure	OneSteel

*Example suppliers / manufacturers for reference only, other suppliers / manufacturers can be specified once they demonstrate compliance with the relevant certification.