# BMU Performance Specification – North Tower

## Martin Place Metro

## Macquarie Bank

**Prepared for**
Lend Lease

Date: 18 February 2020

Reference: 17032Aconex Reference: CSWSMP-MAC-SMN-AT-SPC-99-99-20

Revision: 6

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## Document control

| Revision | Date | Revision details | Author | Signed | Verifier | Signed | Approver | Signed |
|---|---|---|---|---|---|---|---|---|
| 00 | 20/01/19 | Draft issue | RM | | | | | |
| 1 | 18/02/19 | Update to comments | RM | | | | | |
| 2 | 25/03/19 | Updated to comments | RM | | | | | |
| 3 | 15/04/19 | Updated to Lend Lease comments | RM | | | | | |
| 4 | 10/05/19 | Stage 3 | RM | | | | | |
| 5 | 3/02/20 | Stage 4 Design 75% Submission | RM | | | | | |
| 6 | 18/02/20 | Stage 4 Design | RM | | | | | |

## Contents

# 1. Technical Performance Specification

## 1.1 Performance Schedule and Specifications

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 access 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 Sub-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 relevant project documentation. Refer to Section 2.3 of this Specification for a list of project specific documents. As a minimum refer also to the following:

- Trade specific scope of works and other relevant documents by Lend Lease and the project consultants.
- Architectural drawing package
- Architectural facade systems descriptions and materials finishes schedule
- Lend Lease requirements including the GMR's, CIDD's, Alerts and ROADS
- Structural and mechanical engineers' documentation (by Arup)
- Façade Access Strategy Report
- Façade Performance Specification

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

The main contract will take precedence if conflicts or ambiguity occur between this document, the documents listed above and main contract.

## 1.2 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.

## 1.3 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.

Figure 1 - Image of the Macquarie Proposed development issued in Stage 1 of the USP

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)

## 1.4 Extent of works

In general, the facade access systems are to comply with:

- The Occupational Health and Safety Act
- WorkCover NSW requirements
- AS 1418.13: Building Maintenance Units
- AS 2550.13: Cranes Safe Use, Building Maintenance Units

| Refer to the following descriptions of each system | **General Description** | **Materials minimum requirements (summary refer to section 4 for more information)** |
|---|---|---|
| Level Roof BMU | o BMU garaged at level 39 (roof)<br>o Refer to 'Façade Access Strategy' report for extent of the BMU reach and functional requirements.<br>o Refer to Appendix B for further description details<br>The base requirements are as follows:<br>o Any tracks and steel base frames are to be fabricated from hot dip galvanised steel and to be installed by the BMU contractor.<br>o The BMU (including all materials and coatings) is to be suitable for the external exposure in the plant rooms.<br>o Option 1 - Operable garage doors required on the façade at the BMU garage.<br>o Option 2 - Alternative systems of façade fixed to BMU system, and raised and lowered with the BMU<br>o The maximum drop of the BMU cradle is 150m nominal to ground level.<br>o The BMU is also to service the dome above level 38.<br>o Any blind spots beneath the BMU boom or other are to be nominated and a separate façade access strategy required for these elements for both heavy and light maintenance.<br>o Cradle speed 12m/min typical. Pinch zones to reduce to 6m/min, pinch points to be identified by the contractor. Relevant alarms and strobe lighting or similar to be included.<br>o Ropes to be in accordance with AS1418.13,<br>o The jib is to include telescoping and articulating knuckle booms as required.<br>o The jib reach is to be developed with pairing of L28 BMU<br>o Luffing through electro-hydraulic mechanism<br>o Luffing range as per geometry per the tower<br>o Slewing allow for $360^0$ slewing, or as required to reach all of the façade depending on the BMU machine configuration<br>o Cradle dimensions (internal dimensions) to be 3000mm long, 900mm wide and 1000mm high<br>o Cradle self-weight nominally 300kg (to be determined by the BMU subcontractor, this does not include workers or tools or any equipment)<br>o Cradle to include bumpers on all relevant faces<br>o Cradle to include restraint brackets for lanyards for maintenance personnel.<br>o Landing zones for BMU to be coordinated including landing on awnings and canopies.<br>o Independent lifting device for glass to allow for lifting 650kg of glass or plant equipment. This is to be confirmed through coordination with the Mechanical Designers and Contractors to confirm plant equipment lifting weights required.<br>o Soft rope system to be deployed on the sloping facades. Including intermediate lanyard and electronically interlocked pin type connection to the facade<br>o Power supply to be coordinated with the electrical engineer and contractors. Nominal 415V, 3 phase unless agreed otherwise.<br>o Cut off switches to be provided to stop manoeuvring when an obstacle is encountered<br>o All communications requirements for the BMU system | **Steel frame members:**<br>o Typically grades 300plus as per AS 4100 or other suitable grades as per AS4100<br>o Finish – per Section 4 of this Specification, note these are to be reviewed in relation to the environmental conditions appropriate to the space including consideration of the plant and cooling towers in the vicinity<br><br>**Extruded aluminium frame members:**<br>o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664<br>o Finish – to AAMA 2604<br><br>**Stainless steel components**<br>o Typically grades 316, in accordance with AS 4673<br><br>**Fixings:**<br>o External and visible fixings to be grade 316 stainless steel, all others to be grade 304 stainless steel<br><br>**Mechanisms, electronics and hydraulic mechanisms as per AS 1418.13**<br><br>**Garage doors requirements (including power and safety requirements) to be coordinated with façade contractor.** |

| Refer to the following descriptions of each system | **General Description** | **Materials minimum requirements (summary refer to section 4 for more information)** |
|---|---|---|
| Level 28 BMU | o BMU garaged at level 28<br>o Refer to 'Façade Access Strategy' report for extent of the BMU reach requirements.<br>o Refer to Appendix B for further description and details<br>o The base requirements are as follows:<br>o Any tracks or base support frames are to be fabricated from hot dip galvanised steel and to be installed by the BMU contractor.<br>o The BMU (including all materials and coatings) is to be suitable for the external exposure in the plant rooms.<br>o Operable garage doors required on the façade at the BMU garage.<br>o The maximum drop of the BMU cradle is 110m nominal to ground level.<br>o Cradle speed 12m/min typical. Pinch zones to reduce to 6m/min, pinch points to be identified by the contractor. Relevant alarms and strobe lighting or similar to be included.<br>o Ropes to be in accordance with AS 1418.13.<br>o The jib is to include telescoping knuckle booms or as required depending on the final solution<br>o The jib reach is to be coordinated with the roof BMU<br>o Luffing through electro-hydraulic mechanism<br>o Luffing range as per geometry per the tower<br>o Slewing allow for nominally $270^0$ slewing or as required, to be determined by the subcontractor<br>o Cradle dimension to be 3000mm long, 900mm wide and 1000mm high<br>o Cradle self-weight nominally 300kg (to be determined by the BMU subcontractor, this does not include workers or tools or any equipment)<br>o Cradle to include bumpers on all relevant faces<br>o Cradle to include restraint brackets for lanyards for maintenance personnel.<br>o Independent lifting device for glass to allow for lifting 650kg of glass or plant equipment. This is to be confirmed through coordination with the Mechanical Designers and Contractors to confirm plant equipment lifting weights required.<br>o Soft rope system to be deployed on the sloping facades. Including intermediate lanyard and electronically interlocked pin type connection to the facade<br>o Power supply to be coordinated with the electrical engineer and contractors. Nominal 415V, 3 phase unless agreed otherwise.<br>o Cut off switches to be provided to stop manoeuvring when an obstacle is encountered | **Steel frame members:**<br>o Typically grades 300plus as per AS 4100 or other suitable grades as per AS4100<br>o Finish – per Section 4 of this Specification<br><br>**Extruded aluminium frame members:**<br>o Typically grades 6063-T5 or T6 or other suitable grades as per AS1664<br>o Finish – to AAMA 2605<br><br>**Stainless steel components**<br>o Typically grades 316, in accordance with AS 4673<br><br>**Fixings:**<br>o External and visible fixings to be grade 316 stainless steel, all others to be grade 304 stainless steel<br><br>**Mechanisms, electronics and hydraulic mechanisms as per AS 1418.13**<br><br>**Garage doors requirements (including power and safety requirements) to be coordinated with façade contractor.** |
| Internal face of Southern atrium south facade access | Refer to Façade Access Equipment (Excluding BMU) Performance Specification | |
| Awnings | Refer to Façade Access Equipment (Excluding BMU) Performance Specification | |
| Glass Bridge | Refer to Façade Access Equipment (Excluding BMU) Performance Specification | |
| Light well | Refer to Façade Access Equipment (Excluding BMU) Performance Specification | |
| Ground floor | Refer to Façade Access Equipment (Excluding BMU) Performance Specification | |
| **Note** | 50 Martin Place façade access is to be as per existing methods, refer to 50 Martin Place building managers for details (including the 50MP north wall). | |

### 1.4.1 General Scope of Work

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

- Providing access to all areas of façade for both light and heavy maintenance (such as cleaning and seals replacement, glass replacement and cladding replacement)
- Allow for use of the BMU for plant replacement, refer to Plant Replacement Strategy by Arup
- Refer to the Architectural drawings and design intent details for the extent and components of each facade type.
- Coordination with all façade detailing
- Submissions of samples, mock-ups and the like for this project as per the relevant sections of this Specification.
- Provision 'Building Information Models' (BIM) as per agreed scope with Lend Lease.
- Servicing and spare parts as required by the client. Requirement for a full maintenance warranty is set up with 24 hour call out access and spare parts as required.
- Safety in Design assessment and reporting
- Testing, commissioning and certification of all access systems and methods.
- Construction methodology per Lend Lease documentation

### 1.4.2 Secondary Steelwork

Include for all required secondary steelwork, including all sub-framing, stiffening and brackets (including cast in elements) necessary for the erection of façade access systems. All secondary steelwork is to be fixed and coordinated with the primary structural elements.

It is the sub-contractors responsibility to design, supply and install all necessary secondary steelwork to support the façade access systems. The proposed designs are to be approved by the design team.

### 1.4.3 Interfaces

Co-ordinate the design and installation with:

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|---|---|
| Building Structure | *Co-ordinate with structural tolerances for reinforced concrete structural elements, and structural steel as per the Structural Movement and Tolerance report by Arup.*<br>*Coordinate reaction loads to structure*<br>*Coordinate fixing details and design to accommodate and minimise and structural borne noise, vibrations and the like from the BMU operations.* |
| Façade Contractors | *Interfaces with all adjoining façade and claddings designed and installed by other Facade Contractors.* |
| Mechanical Services | *Interface with services ductwork , plant room layouts and enclosures, louvers, etc.* |
| Water supply and outlet locations | *Coordinate with hydraulic engineers and designers for requirements* |
| ESD | *Co-ordinate materials with ESD requirements* |
| Internal Fitout | *Interface with ceiling, sill, internal linings, partitions and floor finishes (as required).* |
| Electrical Services | *The electrical systems for the BMU is to be included as an Essential Service.*<br>*Coordinate electrical requirements for BMU including:*<br>o Power supply<br>o Communications within cradle and at BMU garage and at power outlet (ie phone line or other such as UHF or CB radio, as approved by the client and building |

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| | managers)<br>o Lighting to garage<br>o Earthing and lightning protection<br>o Emergency power requirements<br>o Temporary power requirements (such as back up power for emergency events) |
| Waterproofing Membranes: | *Plinths and perimeter hobs including compatibility of sealants with membranes by others.* |
| Fire services | *Interface with wall drenchers include coordination with commissioning and testing of fire sprinklers and pipes.* |

### 1.4.4 Contractor's Responsibilities

It is the Sub-Contractor's responsibility to provide labour, materials, equipment and related items and to design, engineer, test, fabricate, transport to site, install, and provide warranty for complete façade access systems in accordance with specified parameters, and with the design intent of the contract drawings, this performance Specification and Scope of Works (to be issued by Lend Lease).

The Sub-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.
- Prototyping and testing of access systems.
- Preparation of detailed shop drawings and computations for production of the access systems.
- Submission of documents and samples in accordance with this Specification and construction programs.
- 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 for building maintenance in accordance with the requirements of the maintenance system and OH&S regulations.
- Provide training to all relevant users of the BMU and access equipment
- Provide certification as per this Specification.

### 1.4.5 Design and Supply only Items

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

**Cast in fixing elements:**

The Sub-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 the main contractor has placed them prior to the pouring of concrete.

These are to comply with SA TS101:2015.

### 1.4.6 Warranties

The warranty shall comply with the requirements of that noted in the Contract.

# 2. Standards, Codes and Referenced documents

Design, fabrication and installation of the façade access systems shall comply with the following Codes, 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, by laws and laws, Lend Lease ROAD, CiDD and GMR documentation.
- 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 Sub-Contractor's responsibility to ensure that the Project Manager and its consultants are satisfied with the Codes adopted by the Sub-Contractor for the Works.
- Wherever there are conflicts between different Local Authority Regulations, Codes and/or Standards, the more stringent shall apply and the Sub-Contractor shall in such circumstances notify the client accordingly.

## 2.2 Local Legislation

Building Code of Australia

## 2.3 Project Specific Documentation

*Structural Design report – by Arup*
*Structural Movement and Tolerances Report – by Arup*
*Materials and finishes schedule – by JPW*
*Wind Tunnel Test report – CPP*
*Façade Access Strategy Report – by Surface Design*
*Façade Performance Specification – by Surface Design*

## 2.4 Relevant Standards

### 2.4.1 General

Unless otherwise specified or is specifically supplied by the client, 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:

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|---|---|
| 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 |

### 2.4.2 Access systems

Workcover - Guidelines For Building Façade Access Systems (or equivalent)

Access from fixed or portable structures:
AS 1657 Fixed platforms, walkways, stairways and ladders - Design, construction and installation.
AS/NZS 4576 Guidelines for scaffolding.
AS/NZS 1892 Portable ladders.

Personnel Lifting Equipment
AS 2550.10 Cranes-safe use, Part 10: Evaluating work platforms.

Industrial Rope Access
AS/NZS 4488.1 Industrial rope access system, Part 1: Specifications.
AS/NZS 4488.2 Industrial rope access systems, Part 2: Selection, use and maintenance.

Industrial Rope Access Association IRAA - Industry Code on Industrial rope access technique - September 2000.

Fall Arrest System
AS/NZS 1891.1 Industrial fall-arrest systems and devices, Part 1: Safety belts and harnesses.
AS/NZS 1891.2 Industrial fall-arrest systems and devices, Part 2: Horizontal lifeline and rail systems.
AS.NZS 1891.3 Industrial fall-arrest systems and devices, Part 3 Fall-arrest devices.
AS/NZS 1891.4 Industrial fall-arrest systems and devices, Part 4: Selection, use and maintenance.

Safe Work Australia – Code of practice: Managing the risk of falls at workplace

Building Maintenance Units
AS 1418.13: Building Maintenance Units
AS 2550.13: Cranes Safe Use, Building Maintenance Units

### 2.4.3 **Design and structures**

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|---|---|
| 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 | Earthquake loads and commentary |
| 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 –<br>Part 1: Limit State Design<br>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 |
| BS EN 14024 | Metal profiles with thermal barrier – Mechanical Performance – Requirements, proof and tests for assessment |
| SA TS101:2015 | Design of post installed and cast-in fastenings for use in concrete |

2.4.4 **Aluminium**

Materials and products

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|---|---|
| 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

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|---|---|
| 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

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|---|---|
| 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 |

2.4.5 **Structural steels and components**

Materials and products

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|---|---|
| AS 1163 | Structural steel hollow sections |
| AS/NZS 3679.1 | Structural steel – Hot-rolled bars and sections |
| AS/NZS 3679.2 | Structural steel – Welded I 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

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|---|---|
| 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

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|---|---|
| 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

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|---|---|
| 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) |

2.4.6 **Stainless steels and components**

Materials and products

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|---|---|
| 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

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|---|---|
| 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

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| 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 electropolishing |

### 2.4.7 Corrosion resistant castings

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| 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 |

## 2.5 Fire Protection

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| AS 1530 | Methods for fire tests on building materials |

## 2.6 Lightning Protection

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|---|---|
| AS/NZS 1768 – 2007 | Lightning Protection |

## 2.7 Quality Management

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

## 2.8 Building Maintenance

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

## 3. Performance requirements

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

| Item | Performance requirement | Performance requirement | Notes |
|---|---|---|---|
| 1 | **Design life** | All elements are to be designed for:<br>50 years for structural integrity (Framing, brackets and fixings).<br>20 years for systems, seals and finishes (life to first major maintenance) | Note that the BMU is parked in the plant room and exposed to the environment. The systems durability is to be designed, installed and maintained to achieve the design life within this environment.<br><br>All elements to be designed to environmental conditions of C5 unless agreed otherwise. |
| 2 | **Loads** | | |
| | General requirements | Design to comply with AS1170 | |
| | Dead Loads | Design to AS1170.1 | |
| | Imposed loads (including fall arrest loads) | Design to AS1170.1<br>All horizontal and vertical facade projections are to be able to withstand impact loads without dislodgment.<br>Expressed elements are to withstand maintenance point load of 1.1kN in any direction.<br>Fall arrest fixings, and cladding elements in contact with rope access lines are to withstand fall arrest loads if required | |
| | Wind Loads | Design to AS1170.2<br><br>Per CPP wind engineers. | Contractor to nominate safety procedure and operating conditions for the BMU system |
| | Earthquake loads | Design to AS1170.4 | |
| | BMU Restrain Pins | BMUS Restraint pins to the façade are to be provided and designed by the BMU contractor.<br>The reaction loads to the façade are to be provided by the BMU contractor to the Façade Contractor for coordination of locations and design loads/fixing points. | |

| Item | Performance requirement | Performance requirement | Notes |
|---|---|---|---|
| 3 | **Thermal Movement** | System to accommodate:<br>Ambient Temperature Range -10°C to 50°C<br>Surface Temperature Range -10°C to 110°C | |
| 4 | **Light and Heat Transfer** | NA | |
| 5 | **Condensation** | NA | |
| 6 | **Fixing to Structure** | Design fixings to resist all loads both individually and in combination. | |
| 7 | **Displacement Limits** | Serviceability deflection limits (unless stated otherwise):<br>Aluminium Framing - Span/250<br>Aluminium Panels - Span/90<br>In-plane Member Deflections – Span/1000, or 2mm, whichever is less, unless agreed otherwise.<br>Maximum Displacement (Framing) – 25mm at any point.<br>For ultimate limit state loads no non-linear (permanent) distortion is acceptable. | |
| 8 | **Tolerances** | | |
| | Building structure tolerances | *Indicative Tolerances:*<br>Concrete slab edge (on plan) +/- 25mm<br>Concrete slab Level - +/- 10mm<br>Steel edge beam (on plan) +/- 10mm<br>Steel edge beam Level +/- 10mm<br>*Cast In Inserts:*<br>+/- 10mm from slab edge<br>+/- 3mm from concrete surface<br>+/- 25mm off grid position | Existing slab and structure to be surveyed and measured on site before any work is commenced. |
| | Fabrication tolerances | Framing members – cut to +/-1mm<br>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 | Rails and fixing points +/- 3mm (in plan and height) relative to adjacent panel.<br>The contractor will be required to submit a detailed list of installation tolerances from all of their installers. | |

| Item | Performance requirement | Performance requirement | Notes |
|---|---|---|---|
| 9 | **Building structure movements and deflections** | The design of the BMU is to accommodate structural movements in accordance with the Arup Movement and Tolerances Report. | |
| 10 | **Fixings to Structure** | Design to resist all loads individually and in most severe load combinations.<br>All fixings are to accommodate the worst combination of structure tolerances, as identified by the builder. | All to be coordinated with Arup Structural engineers. |
| | 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.<br>Design and install in accordance with SA TS101:2015. | Attachment to base building structure to be assessed.<br>Design, fabricate, install and test in accordance with AEFAC and ETAG requirements. |
| | Masonry Anchors | Use only proprietary inserts and design to manufacturer's published data.<br>Design and install in accordance with SA TS101:2015. | If non-proprietary fixings are to be used load testing is required. |
| 11 | **Air Infiltration** | NA | |
| 12 | **Weatherproofing** | All access system fixings to structure are to be sealed in order to prevent water penetration to the building.<br>Garage doors to be designed and installed by façade contractor, BMU contractor to coordinate requirements. | |
| 13 | **Maintenance & Replacement Capacity** | Identify maintenance requirements in terms of routine (e.g. cleaning) and component repair / replacement.<br>Identify components which must be replaced during the life of the installed systems. | Maintenance and replacement strategy is to be provided by the specialist contractor in the Operations Manual.<br>This is to include maintenance cycles for all elements, the BMU design is to accommodate a minimum of 4 cycles per year for cleaning all relevant façade elements. |
| | Glass replacement | The BMU is to incorporate independent lifting devices for the glass panels.<br>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 specified. | |

| Item | Performance requirement | Performance requirement | Notes |
|---|---|---|---|
| | Plant Replacement | The BMU is to incorporate independent lifting devices for the plant replacement elements (this may be the same device as for the glass lifting). | |
| 14 | **Acoustic Performance** | Design of all façade access systems so as to minimise any risk of structural born noise.<br>The following criteria has been provided by the Acoustic Engineer (Arup):<br>The Building Maintenance Unit (BMU) shall be provided with acoustic treatment to meet the acoustic criteria for the project as specified in the Acoustic Report.<br>The provisional acoustic treatments are recommended below:<br>To reduce structure-borne noise, the BMU shall be isolated from the slab by neoprene rubber anti vibration pads. Suitable pads are about 25 mm thick with a minimum static deflection of 3 mm under BMU load.<br>• Details of the anti-vibration pad and the isolated fixings shall be submitted to Arup for review. Suitable pads shall be Gantrex or equivalent, 25 mm minimum thickness and with a minimum static deflection of 3 mm under BMU load.<br>• The fixing bolt shall be isolated from the structure so that it is not bridging.<br>• The noise level within a 1 meter perimeter of the BMU power unit shall be less than 65 dB(A).<br>• The BMU shall have a slow start and slow operating, to keep the noise and vibration level low. | |
| 15 | **Lightning Protection** | Electrical continuity is required between individual sections of facade, in accordance with AS/NZS 1768 and AS 1882.<br>Provide test data to verify electrical continuity of the proposed system. | Refer to Electrical Engineering Consultant for specific requirements<br>The electrical services requirements of the BMU are to be provided as Essential Services. |

| Item | Performance requirement | Performance requirement | Notes |
|---|---|---|---|
| 16 | **Structural Silicone** | NA | |
| 17 | **Regulations** | Comply with all Government and Statutory Authority Regulations. | |
| 18 | **Concealed Fixings** | NA | |
| 19 | **Fixing of beads, trims and features** | Ensure that each significant elements on access equipment (trim or feature) is attached to the structure by mechanical means to agreed method and centres. | |
| 20 | **Isolation of Materials** | Separate different metals with a non-conductive material to eliminate galvanic action.<br>Separation is not required for series 300 stainless steel screws/bolts in aluminium members and zinc (galvanised) and painted aluminium.<br>EPDM (or similar) gaskets. | |
| 21 | **Fire / Smoke Separation** | NA | |
| 22 | **Exterior lighting** | The facade access system is to be coordinated with the exterior lighting requirements | |
| 23 | **Safety in Design** | The Façade Access Systems are to be coordinated with any safety in design items required.<br>This includes compliance to all relevant standards as listed in this Specification and the BCA.<br>This includes:<br>- Cradle restrain to the façade through stainless steel 316 grade lanyard pins compliant to the standards, load transfer to be tested, designed and certified by the façade contractor and the façade access system contractor<br>- Landing surfaces for rescue or emergency situations to be designed and coordinated with the project design team. | |

# 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 Head Contractor 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:

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

## 4.3 Aluminium

### 4.3.1 General

If the Sub-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.

### 4.3.2 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.

### 4.3.3 Aluminium Finishes:

Refer to Architectural Finishes Schedule for specific finish references. Typically, the following applies:

- Glazing system framing internal extrusions (mullions and transoms) –in accordance with AAMA 2605
- *Colour:* Refer Architectural Finishes Schedule and design intent drawings for finishes and locations.
- Glazing system framing external extrusions (captive beads) –in accordance with AAMA 2605
  *Colour:* Subject to confirmation. 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 2605
- *Colour:* Refer Architectural Finishes Schedule.

- Concealed elements – Powdercoated or anodised any colour.

## 4.4 Structural Steel (general)

- Minimum requirement, to be designed and supplied in accordance with AS 4100, typical beam sections to be Grade 300 Plus, plates and the like to minimum Grade 250 mild steel.
- Finish being a compatible, durable paint finish to minimum 15 year warranty paint system.
- Paint colour to any exposed structural steelwork to match selected samples, to be approved by the Architect.
- All elements are to be pre-drilled, cut and welded prior to coating.

### 4.4.1 Structural Steel – Paint Finish; External (open sections only)

- Surface preparation Sa $2^1/_2$ (AS/NZS 1627.9)
- 2-pack epoxy zinc primer (AS/NZS 3750.9) – DFT 75µm
- High build epoxy – high solid 2-pack epoxy (AS/NZS 3750.14) - DFT 200 µm
- High build modified 2-component polyurethane (AS/NZS 3750.6) – DTF 80 µm

### 4.4.2 Structural Steel – Paint Finish; External (open and/or hollow sections)

- All external visible structural steel hollow sections to be hot dip galvanised and painted.
- 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/m$^2$ 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/NZS 2312:1994, table 7.6 "*Painting systems for galvanised coatings – long term protection*". 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: As per architectural finishes schedule (including metallic finishes if required). To match selected samples, to be approved by the Architect.

### 4.4.3 Structural Steel – Paint Finish; Internal (including concealed steel stiffeners in frames)

- All internal visible steelwork to be coated with suitable metal primer and powder coat finished; colour to Architect's requirements.
- 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 AS 2311 prior to painting.

## 4.5 Secondary Cold Formed Structural Steel

- Minimum requirement, Grade 250 mild steel.
- Finish being a compatible, durable finish to minimum 10 year warranty system.
- Minimum coating to be equivalent to Z275

## 4.6 Stainless steel

### 4.6.1 General

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

#### 4.6.2 Stainless Steel 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

### 4.7 Fixings

#### 4.7.1 Cast-In Anchors

- To comply with SA TS 101:2015
- 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.

#### 4.7.2 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.

### 4.8 Other Materials

#### 4.8.1 Isolation Materials

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

# 5. Fabrication and transportation

## 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 metal before assembly of components.
- Where metal components are fixed together, Ensure proper cleaning procedures are followed in the preparation of surfaces for sealing.
- 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.

### 5.2.2 Aluminium Framing

- Machine-cut all aluminium extrusions
- Factory drill or punch all holes, slots, etc in aluminium extrusions

### 5.2.3 Structural Steel

- Prepare all visible structural steel within facade package 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.

### 5.2.4 Stainless Steel

- Ensure all fabrication in accordance with ASDA 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 EN 10088/2 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.

5.2.5 **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.

5.2.6 **Tolerances**

Achieve compliance with maximum allowable fabrication tolerances nominated in this specification.

5.2.7 **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.

5.2.8 **Protection**

- Store fabricated assemblies in a manner that will prevent overload, distress or permanent deformation of the overall assembly or individual components.
- Store and transport fabricated assemblies in a manner that will prevent ingress of moisture into the panel cavities.
- Protect the Works to prevent damage and staining during transportation, storage and erection until Final Completion under the Head Construction Contract is granted. Ensure temporary protective measures will not affect the appearance of the finishes when the protection is removed.
- The Sub-Contractor is to submit protective measures for approval prior to transportation and installation.
- Notify Client 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.
- All materials that are transported from overseas are to be inspected and approved at off-site location (in Sydney) prior to delivery to site.
- Acceptable standard of panel fabrication and transportation is to be agreed between all parties through testing and benchmark process.

5.2.9 **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. 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 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.

## 6.3 Site Welding

- For site welding of fixing brackets or other structural steel, all welding shall be carried out in full accordance with BS EN 288. 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.

## 6.4 Protection

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

## 6.5 Cleaning

The subcontractor shall trade clean their works as per the clients scope of work requirements. This may include progressive clean and handover as agreed between the client and sub-contractor.

Clean all internal and external surfaces of 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 Head Contractor. 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.

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## 6.6 Rejections and Defect Rectification

Any work determined by the Head Contractor 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 Head Contractor 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 born 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 born by the Subcontractor.

#### 6.6.1 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.

#### 6.6.2 Allocation of Costs

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

Defects, which are clearly due to other trades, shall be rectified at the agreed variation rates.

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

## 6.7 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.

All procedures to be in accordance with Lend Lease Construction Methodology and Lend Lease requirements.

# 7. Verifications

## 7.1 Submissions

### 7.1.1 Schedule

- Make submissions in accordance with the Submission Schedule in Appendix.
- 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 Head Contractor and the consultant team.
- Cladding samples shall be minimum 300 x 300mm
- Finish samples shall be minimum 300 x 300mm for each finish type.
- Samples of bolts, fixings and anchors; submit one unit of each type.
- Samples of hardware and ironmongery; submit one unit of each type.
- Samples of restraint pin; submit one unit of each type.

### 7.1.3 Shop Drawings and system design drawings

Provide initial system design drawings for review and agreement prior to preparation of shop drawings. The system drawing should include all typical details.

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

- Do not commence fabrication until shop drawings have been reviewed and endorsed by The Head Contractor, the Architect and the consultant team.
- Review of shop drawings by The Head Contractor and the consultants shall not relieve the Subcontractor of any responsibilities under this Specification.
- Provide 3D models and images as required by Lend Lease.
- 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 10 working days for review by all parties from receipt of drawings.
- At the completion of the project, or as directed by The Head Contractor, 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 access system and coordinate all reaction loads with the façade contractor and structural engineers as required.
- Provide detailed calculations for cleaning cycle times (the project requires a minimum of 4 cleaning cycles per year).
- Calculations to be prepared by a certified practising engineer with experience in the design of glass and curtain wall access systems.
- Submit calculations concurrently with shop drawings and as agreed between sub-contractor, and design team.
- Calculations shall include a summary page indicating key results, assumptions and references.
- Review by The Head Contractor 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 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 for review of calculations by the Consultants.

#### 7.1.5 Maintenance Manuals

- Prior to Technical Completion, provide four copies of facade maintenance manuals for the project, or as required by Lend Lease.
- Training of operator to be coordinated and provided by sub-contractor for all relevant elements/systems, allow for the provision of five separate training sessions
- Maintenance manuals shall include as a minimum:
  - Schedule of all materials used to include material data, suppliers, and supplier contact details.
  - Cleaning and maintenance requirements (including pre-dated QC sheets to be completed with each maintenance procedure, adequate for 25 years of façade life) for all surfaces / materials.
  - Glass replacement strategy for all glass
  - Method for warranties for materials and workmanship including those for components from other manufacturers. Provide original copies of all warranties for materials and workmanship.
  - A3 size copies of all as-built drawings for the project
  - CD-Rom copies in PDF format of all as-built shop drawings for the project
  - Methods for repair / repainting of all painted elements
  - Suggested inspection regime.

## 7.2 Visual Prototypes

TBC

## 7.3 Testing

#### 7.3.1 Access Systems

- Proof load tests of all connections as required by Australian Standards

#### 7.3.2 Masonry Anchors

- Tests of masonry anchors shall be carried out by a tester approved The Head Contractor and its Consultants. A representative of the manufacturer of the masonry anchors may carry out the tests, if they regularly carry out this work.
- Load test 1 in every 100-typical masonry anchor to 1.2 times the design load. 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 Head Contractor 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 Head Contractor. The Head Contractor 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 Head Contractor and its consultants on request. Include a full copy of all QC records in the maintenance manual.

7.3.3 **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 Head Contractor and its consultants for review. Include a full copy of all QC records in the maintenance manual.

7.3.4 **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 288.
- Make all test reports available to The Head Contractor 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 Head Contractor 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:
  - A method statement for each procedure involved in the implementation of the Works, including responsibilities for each procedure.
  - A pro-forma for each procedure.
  - Hold points in each procedure when QC checks/tests are carried out.
  - Pass/fail requirements for each check/test cross-referenced to a Specified, Code, Standard or local government requirement.
  - Non-conformance procedures for each test/check including quarantine and rectification procedures.

# Appendix A

# Deliverables & Samples Schedule

## Appendix A – Deliverables and sample schedule

General Note: The following timings are maximum timeframes. The over-riding control in terms of submissions shall be the Head Contractor construction programme. The below expected delivery durations are to be coordinated and agreed with Lend Lease.

| **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 |
| Test programme, including nomination of test laboratory for approval | Within 4 weeks of Contract award<br>Indicative programme for prototype test. Within 10 weeks of visual prototype approval. |
| Design drawings including detailed test schedule | 4 weeks prior to procurement of prototype materials |
| Position and magnitude of reaction loads to primary structure | Within 2 weeks of Contract award |
| 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,<br>in sufficient time to allow review / resubmission process |
| Calculations | Submit with shop drawings |
| Materials certification | Ongoing;<br>3 weeks prior to use of the material in Production and/or 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 |
| Operations and Maintenance Manual | 4 weeks prior to completion of installation of the Works |
| Training Sessions | 4 weeks prior to completion of installation of the Works and throughout commissioning |
| 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** |
|---|---|
| Aluminium extrusions;<br>300mm lengths with applied finish | 6 weeks prior to commencement of fabrication |
| Material data sheets (for all materials and finishes) | 8 weeks prior to ordering |
| Material samples (for all materials and finishes) | 8 weeks prior to commencement of production |

# Appendix B

# Design intent details

## Appendix B – Design intent details

Refer to relevant project design documentation including:

- JPW and Grimshaw architectural documentation (drawings and finishes schedule)
- Surface Design Façade Performance Specifications and Design Intent drawings
- Surface Design North Tower Façade Access Strategy Report
- Wind Tunnel test report by CPP
- Structural Engineering documentation (Arup) including drawings and specifications and Structural Movements and Tolerances Report
- Arup Acoustic Report
- Arup Mechanical services Documentation