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SECTION 0171 -- GENERAL REQUIREMENTS

1 FORMAT, DEFINITIONS AND USE OF THE SPECIFICATION

1.1 Specification Format

- A. This section provides general requirements applicable to the work sections in the Specification. The work sections provide specific requirements for individual trades.
- B. This specification is Descriptive: When read with the Design Drawings, the sections indicate the visual intent to which the Head Contractor must comply when undertaking and completing the Detailed Design. The design responsibility rests with the Head Contractor who will be responsible for completing the Detailed Design, meeting any specified performance criteria and executing the work.
- C. No requirement of the Specification work sections shall impose a lesser standard of material or workmanship than defined in Divisions 01 and 08.
- D. This Specification shall be read in conjunction with the Contract, the Preliminaries, the PPR and other contract documentation provided.
 - 1. Also refer to the Service Engineer's documents and specifications.
- E. Performance criteria, where specified, shall be considered as minimum standards with which the Head Contractor shall comply.
- F. Unless stated otherwise, all requirements of this Specification (and any related documents) refer to work to be provided by, and obligations of, the Head Contractor and therefore all clauses are addressed to, and refer to, the Head Contractor.

1.2 Work Section Categories

Division 1 - General

0171 - General Requirements (P)

Division 2 - Site Work

None Included

Division 3 - Structure

0315 - Concrete Finishes (Architectural Requirements) (P)

0316 - Precast Concrete Finishes (Architectural Requirements) (P)

0331 - Masonry Construction (P)

0383 - Timber Flooring (P)

Division 4 - Enclosure

0411 - Waterproof Membranes (P)

0416 - Rainwater Systems (Architectural Requirements) (P)

0431 - Metal Cladding (P)

0433 - Stone Cladding (P)

0438 - Fibre Cement Wall Cladding (P)

0451 - Windows/ Skylights/ Screens/ Louvres/ Glazed Doors (D)

0453 - Doorsets (P)

0454 - Overhead Doors (Roller Shutters) (P)

0455 - Hardware (P)

0458 - Roof Access Safety Systems (P)

Division 5 - Interior

0522 - Partitions And Linings (P)

0531 - Suspended Ceilings (P)

0551 - Joinery (P)

0552 - Architectural Metalwork (P)

0555 - Sanitary/ Kitchen/ Laundry Appliances/ Fittings (P)

- 0556 - Trims/ Sundry Items (P)
- 0572 - Loose Furniture, Fittings And Equipment (P)
- 0581 - Signage (P)

Division 6 - Finish

- 0611 - Rendering (P)
- 0612 - Screeds (P)
- 0631 - Tiling (P)
- 0652 - Carpet (P)
- 0671 - Painting/ Clear Finishing (P)
- 0681 - Fire Stopping (P)
- 0691 - Lift Fit-Out (Architectural Requirements) (P)

Division 7 - External

- 0742 - Barriers (P)

Division 8 - Common Materials

- 0811 - Adhesives, Sealants And Fasteners (P)
- 0812 - Glass And Coatings (P)
- 0813 - Metals And Pre-Finishes (P)
- 0814 - Galvanised Coatings (P)
- 0815 - Timber And Wood Based Products (P)
- 0816 - Anodising (P)
- 0819 - Insulation And Barriers (P)
- 0820 - Gaskets (P)
- 0821 - Mortar (P)

Division 9 - Appendices

None Included

1.3 Additional Information/ Appendices

- A. The Head Contractor's attention is drawn to the requirements of the schedules, drawings, reports and supplemental information, as nominated in the Contract.

1.4 Definitions

- A. Refer to the Contract.
- B. For the purposes of this Specification, the following definitions apply:
 1. "Accepted, Acceptance or Acceptable": Materials, components, equipment and installations accepted by the Superintendent shall be based upon inspections (as defined below).
 2. "As-Constructed Drawings": Drawings produced by the Head Contractor, where required, which show the Works as finally constructed.
 3. "Attendance": "Attendance", "provide attendance" and similar expressions mean give assistance for examination and testing.
 4. "Default": Specified value, product or installation method which is to be provided unless otherwise documented.
 5. "Design": Documents which reflect the visual and design intent, scope, layout, principal dimensions, arrangements of services and structure, technical, function and aesthetic requirements.
 6. "Design Drawings": Drawings issued by the Superintendent, representing the Design.
 7. "Detailed Design": Includes the Shop Drawings and Head Contractor's specifications prepared by the Head Contractor.
 8. "Design life": The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.

9. "Documented": "Documented" and similar terms mean contained in the contract documents.
10. "Economic life": The period of time from the acquisition of an asset to when the asset, while still physically capable of fulfilling its function and with only anticipated maintenance, ceases to be the lowest cost alternative for satisfying that function.
11. "Evaluation": Reviews carried out by the Superintendent and Head Contractor between Tender return and Contract award to agree materials, typical details and critical interfaces.
12. "Fire hazard properties": To NCC A2.4.
13. "Geotechnical site investigation": The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
14. "Give notice": "Give notice", "submit", "advise" "inform" and similar expressions mean give notice (submit, advise, inform) in writing to the Superintendent.
15. "Head Contractor": The person or organisation bound to carry out and complete the work under the Contract.
16. "Head Contractor's Design Obligations": Tasks carried out by the Head Contractor, maintaining the design and visual intent, functional, performance criteria and technical requirements as stated in the documents to complete and deliver the Works.
17. "Hold point": A point on the inspection and test plan beyond which the process may not continue until it has been accepted by the Superintendent.
18. "Indicative to": Where used in relation to a manufacturer and/or product reference this shall demonstrate the level of quality required. Ensure that all products meet the aesthetic and performance requirements specified before commencing on Site.
19. "Inspection": Inspection carried out by the Superintendent, consultants or authorities of any part of the Works.
20. "If required": A conditional Specification term for work which may be shown in the documents or is a legislative requirement.
21. "Local government authority": A body established for the purposes of local government by or under a law applying in a state or territory.
22. "Manufacturer's recommendations": Recommendations, instructions, requirements, specifications (and similar expressions) provided in written or other form by the manufacturer and/or supplier relating to the suitability, use, installation, storage and/or handling of a product.
23. "Obsolescent": Relating to AS (Australian Standards) means this standard has been withdrawn to be superseded in the future. However, a new Australian Standard is not yet available. Comply with the assigned Australian Standard, or propose an alternative Australian Standard for the Superintendent's review.
24. "Obtain": "Obtain", "seek" and similar expressions mean obtain (seek) in writing from the Superintendent.
25. "Practical Completion": The requirements for these stages of completion are defined in the relevant building Contract for the project.
26. "Principal": Principal has the same meaning as "owner", "client" or "proprietor" and is the party to whom the Head Contractor is legally bound to construct the works.
27. "Principal's Project Requirements (PPR)": As defined in the Contract. Refer to the PPR document also.
28. "Proprietary": Proprietary means identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
29. "Provide": Provide and similar expressions mean supply and install and include development of the design beyond that documented.
30. "Registered testing authority":
 - a) An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field; or
 - b) An organisation outside Australia registered by an authority recognised by NATA through a mutual recognition agreement; or
 - c) An organisation recognised as being a Registered Testing Authority under legislation at the time the test was undertaken.

-
31. "Required": Means required by the documents, the local council or statutory authorities.
32. "Shop Drawings": Drawings to be provided by the Head Contractor, where required, which:
- a) Demonstrate compliance with the Design Drawings and Specification.
 - b) Identify construction and assembly methods.
 - c) Demonstrate compliance with performance requirements, if any.
 - d) Indicate methods of Site installation.
 - e) Indicate relationships with other parts of the Works, including but not limited to, engineering services.
33. "Specification" This document comprising the trade sections as listed above.
34. "Statutory Authority": Any person or entity having jurisdiction over the Works or part thereof.
35. "Statutory Requirement": The requirements of a Statutory Authority.
36. "Subcontractor": A person or organisation, other than the Principal, having a Contract with the Head Contractor for the provision of part of the works.
37. "Superintendent": The person appointed by the Principal under the Contract.
38. "Supply": "Supply", "furnish" and similar expressions mean supply only.
39. "Tests":
- a) Pre-completion tests: Tests carried out before completion tests.
 - i. "Type tests": Tests carried out on an item identical with a production item, before delivery to the site.
 - ii. "Production tests": Tests carried out on a purchased item, before delivery to the site.
 - iii. "Progressive tests": Tests carried out during installation to demonstrate performance in accordance with this Specification.
 - iv. "Site tests": Tests carried out on the site.
 - b) "Completion tests": Tests carried out on completed installations or systems and fully resolved before the date for Practical Completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements. The Superintendent may direct that completion tests be carried out after the date for Practical Completion.
40. "Tolerance": The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
41. "Verification": Provision of evidence or proof that a performance requirement has been met or a default exists.
42. "Withdrawn": Relating to AS (Australian Standards) means this standard has been withdrawn with no available or planned replacement. Comply with the assigned Australian Standard, or a proposal of an alternative Australian Standard will be made for the Superintendent's review.
43. "Witness point": A point on the inspection and test plan where the Head Contractor shall give reasonable notice that a particular part of the process has been reached, although the process may continue without acceptance being notified by the Superintendent.
44. "Work": The scope of work covered by the Specification.

1.5 Abbreviations

- A. AFCS: Australian Forest Certification Scheme.
- B. AS: Australian Standard.
- C. ASTM International: Formerly the American Society for Testing Materials.
- D. BS: British Standard.
- E. CSIRO: Commonwealth Scientific and Industrial Research Organisation.
- F. EMC: Electromagnetic compatibility.
- G. FSC: Forest Stewardship Council.

- H. GBCA: Green Building Council of Australia.
- I. GECA: Good Environmental Choice Australia.
- J. MSDS: Material safety data sheets.
- K. NATA: National Association of Testing Authorities.
- L. NCC: National Construction Code. Also referred to as BCA, having the same meaning.
- M. NZS: New Zealand Standard.
- N. PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.
- O. PVC: Polyvinyl chloride.
- P. PVC-U: Unplasticised polyvinyl chloride
- Q. QA: Quality Assurance.
- R. QC: Quality Control.
- S. VOC: Volatile organic compound.
- T. WHS: Work Health and Safety.

1.6 Copyright, Patent Rights, etc.

- A. The copyright in any designs or installation details developed for this project shall be vested in the Principal and may not be reproduced elsewhere without the Superintendent's written permission. This will not apply to standard products and designs already in existence before the date of Tender.

1.7 Disclosure

- A. The nature of the design and construction work performed and any information belonging to the Principal, with which the Head Contractor may become familiar, shall be treated as confidential and may not be disclosed without the written consent of the Superintendent. Do not publish any drawings, sketches or photographs of the project or its construction, without the prior written consent of the Superintendent.

2 DESCRIPTION OF THE PROJECT

2.1 Project Description and General Statement

- A. A new residential tower over 23 levels, with a childcare centre on ground floor and 4 levels of basement parking.
Full fit-out to apartments and cold shell to the childcare centre.
- B. Refer to the PPR document for a further detailed description.

3 DETAILS OF HEAD CONTRACTOR'S RESPONSIBILITIES

3.1 The Works

- A. Take responsibility for the Head Contractor Design part or parts of the Works.
- B. Head Contractor's responsibility:
 1. Develop and complete the Detailed Design maintaining the function, visual requirements, performance and intent of the Design.
 2. Provide detailed proposals, demonstrating compliance with the visual intent and performance and confirm the provision of fully warranted systems in accordance with the Contract conditions.
 3. The Head Contractor's proposals shall include drawings, calculations, methods and technical specifications detailing the proposed materials and systems so that a technical appraisal can be made by the Superintendent.
 4. A Tender based on the Head Contractor's own preferred design solution may be offered for review by the Superintendent provided the performance and visual requirements are fully satisfied. Any alternative solutions shall not alter the performance requirements, appearance or visual intent of the Design Drawings or the Specification.

5. Ecologically Sustainable Design (ESD) is an important component of the design of this building and as such the Head Contractor is required to accept the ESD concepts indicated and make use of the environmentally friendly products, materials and systems either nominated or detailed on the Design Drawings or nominated in this Specification and assist where required to obtain a Green Building Council of Australia (GBCA) 5 Star, Green Star rating and 6 star Green star Communities rating. Assist where required to obtain a Green Building Council of Australia (GBCA) Green Star rating and work with the Green Star accredited professional already appointed by the Principal.
6. The Specification and Design Drawings may be modified and amended before the Contract is awarded to reflect the agreed final scope of works, materials and systems selected to reflect the design intent. The Detailed Design must reflect the Contract Specification and Drawings.
7. The design and visual character of the project is important and shall be maintained. Hence, there shall be no variation in the final surface finish of similar materials, which shall remain visually consistent, including colour and texture, regardless of orientation or natural grain, within agreed tolerances and agreed samples.
8. Provide submittals outlined within each work section.
9. Provide Shop Drawings and technical information to demonstrate compliance with the Design Drawings and Specification and complete the detailing as necessary and comply with the approvals process specified. The Head Contractor's final Detailed Design must be based on the Design Drawings which indicate generic solutions and may not cover all conditions.
10. Where proprietary products are to be installed, provide any modification, additional bracing, reinforcing, suitable fixings, etc. to ensure that the products meet the requirements of the Specification for the circumstances and situation in which they will be expected to perform. Be responsible for conveying any concerns that the manufacturers may have expressed regarding the suitability of products for the purpose intended.
11. Be responsible for ensuring that items specified are installed correctly such that the performance requirements specified are fully satisfied for the service life required. All fixings and other aspects not fully detailed or specified shall be regarded as the Head Contractor's responsibility.
12. Subject to the Superintendent's review, the Head Contractor shall be responsible for the selection of products and associated components, which shall be used solely for the purpose intended by the manufacturer and will satisfy the requirements of the Contract.
13. Be responsible for carrying out all testing as specified.
14. Coordinate with the work of others, including all interfacing, as required.
15. Provide the nominated warranties in addition to any other warranties available from manufacturers, suppliers and Subcontractors. If the manufacturer's standard warranty period is longer than that nominated, then the longer period is to be applied.
16. Obtain and submit all approvals, certificates and any other documents required by the Statutory Authorities to permit use and occupation of the Works.
17. Comply with any approval conditions to which the Works are subject.
18. Set out and accurately coordinate all work.
19. Provide details, calculations and any other relevant information to the Superintendent for review and submittal to and approval by Statutory Authorities. Make any adjustments required by Statutory Authorities, following submittals, to the satisfaction of the Superintendent.
20. In addition to submittals for the Statutory Authorities, be responsible for submitting structural, deflection and other calculations and technical information, where required (as requested in the Specification), for review by the Superintendent. Such submittals shall comply with the Specification.

C. Head Contractor's Proposals:

1. The Head Contractor's Proposals shall be submitted for review by the Superintendent during the Evaluation period. Attend evaluation meetings as required and make adjustments and alterations to the Head Contractor's Proposals to agree the major design principles to the satisfaction of the Superintendent prior to Contract award.

2. Provide the Superintendent with access to the design office and personnel during the Design Evaluation period.
 3. The Head Contractor's Proposals as a minimum shall include:
 - a) Full details of systems, materials and suppliers.
 - b) Pre-Contract proposals.
 - c) Details of any "Specialist" involvement.
 - d) Details of Shop Drawings being submitted.
 - e) Samples of proposed materials as required by the work sections.
 - f) Full details of systems, materials and suppliers where different from those specified.
 - g) Comprehensive technical specifications of the Head Contractor's Proposals.
 - h) Relevant supplementary information.
 - i) Drawings as required by the work sections or as deemed necessary to explain the Head Contractor's Proposals.
 - j) Technical statements confirming performance compliance.
 - k) Where specified warranties cannot be met, provide details of alternative warranty proposals.
 - l) Summary of deviations from the Design Drawings and Specification.
 - m) Commissioning information as relevant.
- D. When preparing the Detailed Design:
1. Comply with all applicable Statutory Authority codes of practice, standards and regulations.
 2. Prepare a programme for the Detailed Design showing all tasks and submittals and submit to the Superintendent for review.
 3. Produce Shop Drawings to represent the Detailed Design, supported by calculations for review by the Superintendent.
 4. Submit to the Superintendent three (3) copies of all design/production information.
 5. The Shop Drawings shall finalise all manufacturing, interface and installation details.
 6. Ensure that any necessary amendments are made in accordance with the Submittals subsection. Unless and until the Superintendent confirms that resubmittal is not required, submit copies of amended drawings, etc, and ensure necessary amendments are incorporated.
 7. The Specification shall not be altered without the Superintendent's prior written consent.
 8. Select suitable materials, sizes, thicknesses, types and locations of fixings and sealants, all in accordance with specified standards and ensure that they are used for the purpose intended by the manufacturer.
 9. Any necessary support structure shall accommodate all movements and tolerances to which it is subjected.
 10. Include descriptions of relevant structural performance principles, including how and where loads are transmitted to the primary structure and the accommodation of tolerances.
 11. Show details of all fixing requirements to interfacing elements for review from the Superintendent before commencing work.
 12. Coordinate all interfaces between trades.
 13. The Superintendent's review of Shop Drawings relates to visual and performance matters only.
 14. Be responsible for compiling the Shop Drawings and technical specifications of any chosen Subcontractors to ensure all obligations are met to the satisfaction of the Superintendent.
- E. Supply of Head Contractor's Supplemental Information:
1. Provide such additional supplemental information in respect of design, materials, systems, methods, installation and procedures as required by the Superintendent.

2. Additional supplemental information shall comply fully with the design intent, functional and performance requirements of the Design.
3. Where alternative subcontractors/suppliers/products are proposed, they shall not be used until they are reviewed by the Superintendent.
4. Submit all relevant information sufficient to demonstrate compliance with the Specification and the requirement of all relevant Statutory Authorities.

F. Material Preferences:

1. Where a particular product or supplier is specified in this Specification, these are an indication of the type of product/system used by the Superintendent in developing the Design. The final selection of products/systems shall be the responsibility of the Head Contractor and shall be those specified unless another is confirmed as acceptable by the Superintendent. The Head Contractor shall remain fully responsible for the Detailed Design.
2. Where the Specification identifies preferred materials, these must be confirmed as being suitable and fit for their specified and intended purpose with the Tender return. If no such specific confirmation is received, the submittal of the Tender return itself will constitute such a confirmation. If the preferred materials are considered unsuitable, advise at the time of Tender.
3. Review of alternative proposals by the Superintendent does not relieve the Head Contractor of the responsibility to provide suitable materials, components and assemblies fit for the purpose intended by the manufacturer and in compliance with the Contract documents.
4. If, with the Tender, the Head Contractor submits no such alternative proposal to any of the preferences indicated in the Tender documents, the solutions proposed in the Specification and on the Design Drawings are deemed to be acceptable and warranted by them.

G. Manufacturing and Installation Tolerances:

1. The Specification together with the corresponding Design Drawings indicate the dimensional tolerances (hereafter referred to as "tolerances") to which the Head Contractor must work, where relevant, for manufacture, sub-assembly, setting-out and installation.
2. The Shop Drawings will clearly demonstrate how manufacturing and construction tolerances shall be accommodated.
3. Take into account building tolerances and their effect. Inform the Superintendent of any apparent tolerance omissions, inconsistencies or incompatibilities.
4. Maintain the tolerances as defined and demonstrate, upon request by the Superintendent, the means by which specified tolerances shall be assured and, where appropriate, which specialist equipment and/or methods will be used.
5. All dimensions shall be checked on Site. Site measurements shall be undertaken in sufficient time to enable corrective action to be taken to ensure an accurate fit within agreed or implied tolerances.
6. Be responsible for obtaining and taking into account the Structural Engineer's Movements and Tolerances information.
7. Confirm common reference points and agree with the Superintendent. Carry out dimensional checks prior to the commencement of manufacture, as necessary.
8. Ensure that any dimensions are compatible and consistent with other relevant design dimensions and accumulated tolerances and movements. State and/or show, on the Shop Drawings, the provisions made to accommodate the accumulated tolerances of adjoining or adjacent trades.
9. Inform the Superintendent of any work that does not meet the specified tolerances.
10. Installations are to be free from deformation outside the specified tolerances and must not be subject to warping, twisting and/or perishing but remain stable, firm, free from vibrations, knocking, rattles and/or whistles, squeaks or other such noises, taking into account known or specified conditions.
11. Details shall be provided for review by the Superintendent of the Head Contractor's proposed methods for achieving and constantly monitoring the fabrication and erection tolerances during all stages of the Works. Detailed records of the constant control and tolerances achieved shall be submitted to the Superintendent.

12. In the event of any discrepancy in the values of existing datum reference points, datum levels, buildings, foundations or other features to which the work is related, determine and report such a discrepancy to the Superintendent and obtain written instruction before proceeding.
13. The permissible tolerances stated in the Specification shall be progressively checked up until Practical Completion. Where two or more different tolerances can be derived by calculation and/or from the Design Drawings for the same dimension, the lowest tolerance shall apply, which shall be confirmed by the Head Contractor to the Superintendent. Tolerances shall not be cumulative.

H. Intent:

1. The general intent is to construct a building which is complete, functionally and visually.
2. Specific requirements are to construct a building which:
 - a) Is weatherproof and watertight.
 - b) Is complete in terms of function.
 - c) Is complete in terms of finish and trim.
 - d) Complies with all statutory requirements.
 - e) Complies with applicable standards and statutory regulations.
 - f) Is constructed and finished to the standards implicit in the contract documents, notwithstanding that not all items of work may be drawn, specified or detailed. Materials and finishes shall be consistent with those items which are fully documented.

4 SUBMITTALS

4.1 Procedure

- A. No portion of work shall commence without review of the required submittals by the Superintendent.
- B. A schedule of submittals shall be provided for agreement with the Superintendent. The Schedule shall indicate the dates on which the Superintendent will receive the required submittals. The schedule shall be coordinated/correlated with the Head Contractor's Programme and allow sufficient time for the review, resubmittal and further review, as necessary, for each submittal, so as not to have an adverse effect on the critical path. Critical decision dates shall be indicated for selection of finishes and colours. The schedule of submittals shall be revised and resubmitted as necessary.
- C. Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use within 3 weeks of site possession.
- D. Make allowance for the following, for the Superintendent's review and return of submittals:
 1. Shop Drawings: 10 working days for the initial review and 10 working days for resubmittals.
 2. Samples, calculations, test reports and the like: 10 working days.
 3. Proposals for alternative materials: 10 working days.
- E. Provide submittals in accordance with the following:
 1. Addressing of submittals: Submittals shall be delivered to the premises identified by the Superintendent.
 2. Identification of submittals: Each submittal shall be individually identified with the project name, respective Specification reference, supplier's/manufacturer's name and product reference, as appropriate. Each submittal shall be accompanied by a transmittal form containing similar information, together with the purpose for which the submittal is being made. Space shall be provided on each item submitted, for stamping by the Superintendent.
 3. Numbering of submittals: Submittals shall be numbered consecutively and that numbering system shall be retained throughout all revisions and resubmittals.
 4. Completeness of submittals: All relevant information shall be included within each submittal to define completely and explain each separate system of work. Submittals may be combined from various sections, as necessary, and furnished at one time as a single submittal.

5. Variations and substitutions: Submittals that differ from the requirements of the Design Drawings and Specification shall be so identified.
 6. All submittals provided shall be written in English.
- F. The Head Contractor's submittals will be reviewed by the Superintendent and any alteration and/or agreements reached shall be incorporated into the Design Drawings and Specification.

4.2 Submittals Generally

- A. Provide Shop Drawings, samples, mock-ups, prototypes, quality benchmarks, calculations, test reports and other relevant data as specified in the work sections of the Specification.
- B. Other than those being issued electronically and unless nominated otherwise, provide 2 sets of all submittals for review. Once accepted, one set shall be retained by the Superintendent, the other shall be returned to the Head Contractor and kept on Site.

4.3 Samples Generally

- A. Samples shall include various products, natural materials, fabricated items, equipment, devices, appliances or components thereof, as may be required to satisfy the visual appearance and technical requirements of the Design.
- B. Where moving or operating elements are involved, the Superintendent shall be given the opportunity to review working samples.
- C. Ranges of samples shall be provided where a considerable range of colour, graining, texture, smoothness and other characteristics may be anticipated. The ranges shall indicate the extremes of each nominated characteristic.
- D. Where custom colours are specified, samples shall be submitted illustrating precise colours, textures, patterns and finishes for review by the Superintendent.
- E. Unless specified otherwise, the minimum sizes of samples shall be:
 1. 500mm x 500mm.
 2. 1 tile.
 3. 500mm long.
- F. Each sample or set/range of samples shall be submitted in duplicate. Upon acceptance by the Superintendent, one sample/set/range will be returned to the Head Contractor to keep on Site, and the other will be retained by the Superintendent for QA/ QC purposes.

4.4 Contract Samples

- A. At the appropriate time provide the Superintendent with Contract samples as listed in the Specification. These samples shall be kept as a record of materials incorporated into the Works and used as references for controlling consistency.
- B. Contract samples shall comprise materials in their final form.
- C. Do not procure, order or fabricate such items until the relevant sample has been accepted.

4.5 Mock-Ups

- A. During the Shop Drawings preparation phase, in due time to permit adjustments to the design, and where described in the Specification, provide full-sized mock-ups for inspection by the Superintendent.
- B. Mock-ups shall be erected either on or off Site as agreed, not necessarily using actual materials to be incorporated into the Works but representing the design solutions.
- C. The mock-up shall be constructed to confirm the general visual intent including colour, size and coordination.
- D. Mock-ups shall be kept on Site in a safe and secure location.

4.6 Prototypes

- A. Prior to manufacture of elements of the Works, construct off Site (or on Site if specifically requested by the Superintendent) full scale, three-dimensional sections where described in the Specification and/or shown on the Design Drawings using final specified materials but not necessarily final production techniques.
- B. The prototypes shall be tested fully to ensure the systems meet the performance requirements of the Specification by application of the maximum applied loads, climatic conditions and structural movements, and/or be used as a Quality Assurance/Quality Control "Hold Point". Manufacture of materials/products for inclusion in the Works shall not commence until the Superintendent's written acceptance of the prototypes has been received.

- C. Shop Drawings for the prototypes shall be submitted in accordance with the requirements of the Specification.
- D. Any modifications required of the prototypes shall be recorded to show their final construction.
- E. Program the testing of prototypes to ensure that any modifications required of the prototype can be made without causing delay to the programme.
- F. The cost of constructing prototypes and their subsequent modification and re-submission for review (by the Principal or the Superintendent) are to be included in the Head Contractor's Tender price.

4.7 Quality Benchmarks

- A. Upon commencement of individual trades of the work, erect, for acceptance by the Superintendent, complete sections, products and/or components of the work as described in the Specification. These shall be used to establish the benchmark for quality of finish and workmanship for similar elements, for the remainder of the work, until Practical Completion.
- B. As soon as practicable, and prior to fitting out any other units, establish a quality benchmark of one for each type of apartment for acceptance by the Superintendent. These benchmarks, once accepted, shall establish the acceptable level of workmanship to which all other apartments will be measured.
- C. Upon receipt of the Superintendent's acceptance, fully protect the quality benchmark until Practical Completion. It will be used by the Superintendent as required to check and monitor the quality of materials and workmanship incorporated in the remaining areas of the Works.
- D. Refer to the following Frasers Property projects as benchmarks for the quality to be achieved for the WUC:
 - 1. Central Park, Connor – Internal Finishes
 - 2. Central Park, Mark – External Finishes
 - 3. Putney Hill, Putney - External Finishes
 - 4. Central Park – Exposed Concrete

4.8 Shop Drawings

- A. Shop Drawings shall be submitted to the Superintendent for review. Unless agreed otherwise at the first Site Meeting, Shop Drawings shall be provided in the following numbers:
 - 1. Electronic file in .pdf format.
 - 2. Electronic files in .dwg format where applicable.
- B. For instances where Shop Drawings are required to resolve and/or indicate relationships and interfaces between complex forms and the like, and where 2-dimensional (2D) representations do not show adequate detail, 3-dimensional (3D) Shop Drawings shall be prepared and submitted to the Superintendent for review. This may include, but not be limited to, Shop Drawings for structural steel, electrical services, fire prevention services, mechanical services, and hydraulic services.
- C. Submittal and return of Shop Drawings/Documents:
 - 1. Allow sufficient time (a minimum of 10 working days) between the first submittal of a Drawing/document and receipt of comments. Allow for resubmittals for each item to achieve a "No comments" or "Attention to comments where noted" status in accordance with the schedule of submittals.
 - 2. Provide a list of proposed Shop Drawings within 20 working days of acceptance of Tender.
 - 3. Information specifically requested for each element shall be provided.
 - 4. Additional information may be required by the Superintendent on inspection of the Head Contractor's submittals to allow for accurate comments to be made.
- D. The Superintendent's review of the Shop Drawings does not relieve the Head Contractor of his responsibility for errors, correctness of dimensions, quantities, calculation, construction, fabrication techniques, or for supplying components and materials to the full satisfaction of the Superintendent.
- E. Shop Drawings shall be fully dimensioned in metric, to an agreed scale appropriate to the detail, and include:
 - 1. Full-sized details and graphic-representation describing materials, components and equipment, construction, finishes, provision for movements, fabrication and erection tolerances.

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2. Layouts, locations and assemblies of all types of construction detail and junctions, details of materials, method of jointing, details of all Site connections and fixing and sealing methods, finishes and all pertinent information related to:
 - a) Method of fabrication and construction.
 - b) Proper relation to adjoining work.
 - c) Finishes.
 - d) Amplification of details.
 - e) Minor changes to the Design to suit actual conditions.
 - f) Coordination with services, if required.
- F. Submit Shop Drawings and do not commence fabrication of components until they are formally returned by the Superintendent with either "No comments" or "Attention to comments where noted" stamped on each of the Shop Drawings. Ensure there is space on each of the Shop Drawings for stamping by the Superintendent. The following drawing inspection codes shall be used when returning the Shop Drawings to the Head Contractor:
1. Drawings stamped "No comments": Fabrication, manufacture or construction may proceed in accordance with the drawings submitted.
 2. Drawings stamped "Attention to comments where noted": Fabrication, manufacture or construction may proceed in accordance with the drawings submitted subject to the Head Contractor taking necessary action based on the Superintendent's comments and all annotations on the returned drawings. Unless indicated to the contrary on such drawings, the work shall comply with the Contract documents. To achieve "No Comments" status, the required number of copies of amended drawings shall be sent to the Superintendent.
 3. Drawings stamped "Submission of revised drawings before proceeding": No work shall be fabricated, manufactured or constructed. Submit new drawings to the Superintendent for review until resubmittal is not required.
- G. The Superintendent's final comment on the Shop Drawings ("No comments"): shall be conditional on receipt of all documentation as requested in the Specification.
- H. The receipt of Shop Drawings by the Head Contractor from the Superintendent does not constitute agreement of variation.
- I. When preparing the Shop Drawings, consult the current architectural, structural and services Design Drawings, adjusting the Shop Drawings to allow for any changes to Site tolerances and/or discrepancies where applicable.
- J. If, before commencing or during the preparation of the Shop Drawings, the design intent of the Design Drawings and/or Specification may be affected, or where other elements may be affected, notify the Superintendent immediately.
- K. Where applicable, the Shop Drawings may use the manufacturer's standard details, provided they comply.
- L. The Superintendent has the right at all reasonable times to visit the Head Contractor's (or his specialist Subcontractor's) design office to review progress.
- M. The Shop Drawings shall be annotated in English and titled in the manner determined for the Contract, with the title block fully indicating the part of the work to which it applies.
- N. Information contained in any of the Design Drawings shall be treated as confidential and shall not be used for any purpose other than for the Works. Such information shall not be communicated to third parties for other purposes without the Superintendent's consent.
- O. Maintain on Site a full set of Design Drawings, Shop Drawings and technical specifications.
- P. Shop Drawings will not be accepted if produced to a reduced size.
- Q. The Shop Drawings shall be fully coordinated with interfacing trades.
- 4.9 As-Constructed Drawings and Manuals**
- A. On completion of the Works, and when deemed necessary by the Superintendent, provide As-Constructed Drawings in hardcopy, as well as in an agreed computer format showing the Works as finally fabricated and installed.
 - B. The As-Constructed Drawings shall include any Site variances or installation adjustments or variations and any actual Site or setting-out dimensional modifications as installed.

- C. As-Constructed Drawings shall be produced to a relevant and agreed scale and shall be used to complement the Maintenance Manual for the specific purpose of locating the elements within the overall structure.

4.10 Other Submittals

- A. Product Data: Provide technical information detailing the characteristics of each proprietary item, system component or material incorporated in the Works. This shall include material schedules and manufacturer's literature.
- B. Certifications: Provide independently certified reports verifying the compliance of each element or component with the requirements of the Design Drawings and Specification. These reports shall include the chemical and physical properties of various building materials.
- C. QA/ QC Programme: Provide a programme to satisfy the requirements specified.
- D. Pre-construction Testing Reports:
1. Provide technical reports recording test results systems, components and materials as required by the Design Drawings, the Specification, the Superintendent or a testing laboratory, prior to commencement of installation.
 2. These reports shall state compliance with the technical requirements of the Specification and include, where appropriate, test certificates.
 3. Provision of testing data does not relieve the Head Contractor of his responsibility regarding the performance of the Works.
- E. Building Operation and Maintenance Manuals: Manuals prepared by the Head Contractor for the Principal/building users detailing the maintenance and operational requirements of the various building systems and/or components thereof.
- F. Supplemental product literature: Such literature may include manufacturer's catalogue information, product specifications, standard illustrations, diagrams and standard details. The supplemental product literature shall describe physical characteristics such as size, weight, finish, material analysis, electrical requirements and other information such as load tables, test results, assessments and industry quality standards.
- G. Warranties:
1. Provide to the Superintendent, warranties as nominated in the documents from each Subcontractor and/or supplier of materials. Where the warranty as nominated in the documents is not able to be obtained from the particular Subcontractor and/or supplier, notify the Superintendent in writing prior to commencement of the work of the relevant Subcontractor/supplier and agree alternative warranty terms.
 2. Warranties shall name the Principal as the beneficiary.
 3. Refer to Annexure part K of the contract for required warranty periods.
 4. All warranty periods shall commence from the Date of Practical Completion and remain in force for the periods nominated in the documents.
 5. The written warranties shall state:
 - a) That workmanship, materials and installation are warranted for the period as specified.
 - b) That any defects which may arise during the warranty period shall be made good.
 - c) Any work in other trades resulting from such making good must be undertaken at the expense of the warrantor upon written notice from the Superintendent.
 6. Do anything necessary to facilitate a warranty and do not do anything which may impair or inhibit the provision of a warranty.
 7. The warranty shall be confirmed prior to commencement and issued to the Superintendent prior to Practical Completion.
 8. If the manufacturer's standard warranty period is longer than that nominated in the relevant trade sections, then the longer period is to be applied.

4.11 Review of Submittals

- A. The Superintendent will review submittals for general and practical conformity to the requirements of the Contract. Submittals which meet these requirements shall be stamped or marked in accordance with the procedure described herein. Submittals which are incomplete or erroneous, or which are not required, will be returned and a new submittal made as necessary.

5 PERFORMANCE REQUIREMENTS AND DATA

5.1 Performance Requirements

- A. Comply with the following performance criteria unless there are detailed performance criteria stated in the work sections.
- B. The performance criteria included in the Specification sets the minimum standards with which the Detailed Design solutions shall comply, and the means by which compliance shall be checked and controlled prior to completion.
- C. Although the Design Drawings show considerable detail and dimensions, no warranty or representation is given by the Superintendent as to the accuracy of such dimensions or the adequacy or buildability of such details. Should the Head Contractor adopt the details or arrangements indicated on the Design Drawings, it will be deemed that the Head Contractor has checked: their buildability and performance in terms of the Specification, all relevant statutory requirements, and manufacturer's recommendations for any products referred to.
- D. Minimum Requirements: Where there is in existence a relevant Australian Standard, BS code of practice, draft BS, German DIN Standard, ISO Standard, European Standard applicable to the design, execution or performance of the Works or any part thereof, the recommendations and requirements of such documents shall be considered a minimum standard and must be complied with. Should two standards conflict, draw attention to this and state the option chosen, before implementing any work in connection to this.

5.2 Service Life of Components

- A. Confirm the predicted service life (i.e. the service life predicted from recorded performance or accelerated tests) and maintenance requirements of the components of the building for the review by the Superintendent.
- B. Materials shall be used solely for the purpose intended by the manufacturer and which satisfy the requirements of the Specification.
- C. Materials shall be selected for durability according to the conditions of use.
- D. Premature deterioration will not be acceptable.

5.3 Structural Generally

- A. To AS/NZS 1170.
- B. Refer to the Structural Engineer's Specification.

5.4 Seismic Restraint of Non-Structural Components

- A. Earthquake actions: To AS 1170.4.
- B. Arrange all components, other than service items exempted in AS 1170.4, to resist seismic loads determined in accordance with AS 1170.4. Securely fix all plant and equipment to the building structure. Do not rely on gravity and/or friction to resist seismic forces.
- C. Anti-vibration mounts: Use horizontally restrained type.
- D. Components: Do not use components that will be damaged by earthquake conditions. Protect systems against the adverse effects of components such as mercury switches that, although not damaged by earthquake, may malfunction.

5.5 Movements and Tolerances

- A. The Detailed Design, fabrication and installation shall take into account all tolerances and movements of the building structure in permanent and temporary conditions, under all design loads or combination of loads, and shall resist specific static and dynamic design loads likely to be encountered without causing permanent deformation of components of failure of systems, materials or seals and shall transmit such loads safely to the points of support.
- B. Accommodate the following movements without any permanent deformation or reduction in the specified performance:
 - 1. Deflection under design loads.
 - 2. The effects of any wind or pressure loadings.
 - 3. Changes in dimension and shape of components arising from building movements, including settlement, creep and twisting.
 - 4. Movement of any joint whether designed to permit movement or not.
 - 5. Thermal and moisture related movements.
- C. Torsional stresses shall be accommodated safely.
- D. All fixings shall be capable of providing adequate adjustment to suit building movement and prevent system/installation failure.

- E. Movement joints shall accommodate the maximum movement that can be derived from the specified and determined design loads and movements. Under maximum movements, the joints shall meet all the performance requirements of the Specification.

5.6 Dead Loads

- A. Design to AS/NZS 1170.1.
- B. Accommodate all dead loads without any reduction in performance including:
 - 1. The component and final assembly dead load, which shall be accommodated locally without causing deflections or movements which adversely affect any component.
 - 2. The dead loads derived from any permanent fixtures or attached services.
- C. When calculating loads the worst combination shall be accommodated.

5.7 Live Loads

- A. Accommodate all live loads without any reduction in performance including:
 - 1. All loads resulting from movements of the building structure and support structure.
 - 2. Impact loads, or transferred impact loads, within the performance criteria specified.
 - 3. Loads imposed during replacement of components.
- B. When calculating loads the worst combination shall be accommodated.

5.8 Deflections

- A. The specified deflection limits shall not be exceeded.
- B. The Works shall not deflect under loading in any way that is detrimental to any component or adjacent structural or building elements.
- C. All components, couplings and fixings shall be capable of accommodating deflections without permanent distortion, deformation or failure.
- D. Accommodate differential structural movements arising from any loads imposed by adjacent structures.
- E. The magnitude of the allowable deflections shall be reduced if they are detrimental to any part of the Works, its support structure or internal finishes.

5.9 Impact and Abrasion Resistance

- A. Surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects and maintenance systems without any noticeable change to their appearance.

5.10 Wind Loads

- A. To AS/NZS 1170.2.
- B. The Works shall withstand, without damage or permanent deformation, the effects of wind loads where appropriate (e.g. external conditions or internal areas subject to external wind pressure).

5.11 Preceding Work

- A. At the appropriate time, check all preceding work, including checking line, level and fixing points and report immediately to the Superintendent if any is considered to be unsuitable and propose remedial action if so requested by the Superintendent.
- B. Prior to manufacture of components, where possible, inspect the Site and check measurements of the preceding work while completing the Shop Drawings and coordinate all Site dimensions.
- C. The Shop Drawings shall include full details of all interface conditions, demonstrating full compatibility with adjoining items of work, and the Detailed Design shall take into account all such conditions.

5.12 Vibration

- A. Ensure that the Works are able to withstand all vibration caused by traffic, aircraft, plant and equipment effects or any other shocks, slamming, strains, stresses and movement imposed, thus avoiding deterioration or fracture of any element, both during construction and after installation.

5.13 Living Housing Design Guidelines

- A. Comply with the Living Housing Design Guidelines for all Silver Level Apartments.

5.14 Environmental Conditions

- A. Take into account all local environmental conditions prevailing at Site.

- B. Allow for the fact that work will proceed in extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions will be the Head Contractor's responsibility.
- C. All material grades, manufacturing methods and standards, corrosion protection, etc, are to be selected so they are fully suited to the internal and external environmental conditions as set out below (to meet the relevant Australian Standards and all other relevant standards) and as contained in the relevant parts of the mechanical and electrical engineer's specification sections and drawings.

5.15 Air Permeability

- A. Minimise airflow from the outside to the inside of the building through joints/junctions to control concentrated airflow.
- B. Any air leakage shall be distributed and not concentrated at a single location.

5.16 Acoustic Performance

- A. Provide the degree of acoustic insulation as defined in the Acoustic Specification and/ or the Acoustic Report.
- B. Provide evidence that the acoustic performance requirements herein are adhered to.
- C. Also refer to the Design Drawings (Wall Types Schedule).

5.17 Acoustic Sound Absorption

- A. Allow no "buzzing", "ringing" or other extraneous noise arising from vibration or other movements of fittings. Extraneous noise arising from local response, loose fit resonant elements and scope for friction and noise shall be avoided by means of careful quality control in assembly and installation.
- B. Form complete, acoustically sealed joints at junctions with interfacing elements.
- C. Provide seals at all edge conditions to minimise transmittance of sound to adjoining areas.

5.18 Psychrometric Data

- A. Refer to the Mechanical Engineer's Specification for internal and external temperature design criteria.

5.19 Fire and Smoke Stops

- A. Detail and coordinate all necessary fire/smoke stops required by Statutory Authorities.
- B. Where the Statutory Authorities require a specific fire resistance to elements of structure which form a junction with adjacent components, ensure that the junction is fire stopped to the same degree as the elements.

5.20 Fire Protection

- A. Fire performance in terms of fire resistance and fire hazard properties, of materials, composite systems and structure shall meet the requirements of the NCC.
- B. All components incorporated in external walls, common walls, internal non-load bearing fire-resisting walls and shaft walls are to comply with Deemed-To-Satisfy provisions of Clause C1.9 of the NCC, with a spread of flame index of 0 and is to be non-combustible in accordance with AS 1530.1.
- C. Materials used for floor finishes shall be tested for critical radiant flux in accordance with AS ISO 9239.1.
- D. Materials used for wall and ceiling linings shall be tested to determine the group number in accordance with AS ISO 9705 or AS/NZS 3837.
- E. All other materials, as described in the NCC, shall meet the requirements for spread of flame index and smoke developed index when tested in accordance with AS/NZS 1530.3.
- F. Fire resistance levels, where nominated, shall be determined in accordance with AS 1530.4.

5.21 Earth Bonding and Electrolytic Protection

- A. At all locations where different metals are assembled together, ensure that electrolytic corrosion does not occur and that the necessary protection is provided where needed, in both temporary and permanent conditions.
- B. All extraneous conductive parts shall be effectively bonded to earth. An extraneous conductive part is defined as being that part which is liable to transmit a potential, including earth potential, and not forming part of the electrical installation. Each component shall constitute an extraneous conductive part.

- C. The Works shall be electrically continuous as required by the latest edition of the Institution of Engineering and Technology (IET) Regulations.
- D. Equipotential bonding shall be provided to ensure the various exposed conductive parts and extraneous conductive parts as defined in the IET Regulations are at a substantially equal potential.
- E. Earthing connecting shall comply with AS/NZS 1768 and AS 1882. Copies of the final testing certificates shall be incorporated in the Health and Safety File.

6 QUALITY CONTROL

6.1 General Quality Assurance, Quality Control, Testing

- A. Within 30 days of taking possession of the Site, submit a comprehensive Quality Control Manual to the Superintendent for review, amendment (where appropriate) and acceptance.
- B. Provide facilities in the event that the Superintendent wishes to examine these proposals at the Site.
- C. Include details of any formal approvals held for the Head Contractor's or any Subcontractor's quality systems or any evaluations or assessments carried out by independent third parties.
- D. As a minimum, the Quality Control Manual shall include information and procedures for the following:
 1. Organisation and Management.
 2. Facilities, Measuring and Test Equipment.
 3. Personnel Training and Certification.
 4. Environmental Management.
 5. Waste Management.
 6. Receipts, Storage, Handling and Transportation.
 7. Welding.
 8. Fabrication and Erection.
 9. Prototypes.
 10. Tolerance Control.
 11. Painting and Coating.
 12. Inspection and Testing of Materials and Workmanship.
 13. Non-conforming Items.
 14. Detailed Design.
 15. Control of Purchased Materials and Services.
 16. Completed Item, Inspection and Test Results.
 17. Record Keeping.
 18. Review of the Quality System.
- E. If the Head Contractor is certified to AS/NZS ISO 9001, the Works shall be monitored accordingly.
- F. A tolerance control manual shall be included to cover all aspects of tolerance compliance. This shall describe, in detail, the various types of quality control checks that shall be carried out, what means and methods shall be used, which personnel shall be employed, together with their qualifications, and how each type of tolerance check is to be recorded and kept for reference.
- G. Include, with the Quality Control Manual, an inspection and test plan for each major item of work or type of fabrication which details, in sequential order:
 1. The principal activities to be carried out.
 2. The type, method and frequency of inspections and tests to be carried out.
 3. The Statutory Authority.
 4. The acceptance criteria.
 5. The records to be kept.
- H. The inspection and test plan shall contain sufficient space for the Superintendent to indicate on it the activities he/she wishes to inspect as either "hold" or "witness" points.

1. A "hold point" is defined as a point on the inspection and test plan beyond which the process may not continue until it has been accepted by the Superintendent.
 2. A "witness point" is defined as a point on the inspection and test plan where the Head Contractor shall give reasonable notice that a particular part of the process has been reached, although the process may continue without acceptance being notified by the Superintendent.
- I. The inspection and test plan shall provide the basis of inspection for the item of work and shall be accepted prior to commencement of the work.
 - J. At all times during the Contract period, make available at the Site all necessary resources and facilities and implement any reviews and amendments of the Quality Control Manual deemed necessary or desirable by the Superintendent.

6.2 Means of Auditing

- A. The Superintendent will review the Head Contractor's proposals and carry out such tasks as are necessary to ensure that:
 1. The Head Contractor's methods of working are likely to produce acceptable work.
 2. Finished items and assemblies conform to the Specification.
- B. Nominate a senior member of the technical organisation as Quality Manager who is to be independent of the other functions and be held responsible for all matters relating to the production and implementation of the Quality Control Manual.
- C. At any stage during the Contract period, including those times prior to fabrication, make all facilities available to the Superintendent so that quality audits, according to AS/NZS ISO 9001 or any other established system, may be carried out.
- D. Keep and maintain, at an agreed location, a copy of all relevant check certificates and forward to the Superintendent when requested.
- E. If the Superintendent detects any deficiencies, either in the work or the Head Contractor's QA/ QC system, these matters shall be reported. All items affected by such deficiencies shall be considered as being of suspect quality and shall be physically quarantined in a separate holding area. No work may be carried out on these items until the Superintendent instructs to either rework or repair the affected item, or declares it not to be in accordance with the Contract and is therefore rejected.

6.3 Quality Control Methods

- A. The appointment of any Subcontractors, or the carrying out of any work at any place other than the Head Contractor's nominated principal workplace, shall only occur with the Superintendent's acceptance. The work shall be carried out only under equivalent conditions of QA/ QC to those at the nominated principal workplace. Demonstrate to the satisfaction of the Superintendent the methods used to select, control, inspect and verify that the work carried out conforms to the requirements of the Contract.
- B. Make available to the Superintendent copies of each purchase order for any item or service to be included within the Works, if requested. Each purchase order shall fully detail the item or service in terms of quality, grade, type, appropriate Australian Standard or other standard, inspection, test and documentation requirements.
- C. The organisation and management of the Head Contractor's QA/ QC programme must be confirmed to be comprehensive and effective for the provision of work to the Contract requirements. All such details shall be fully described in a document, referred to as the Quality Control Manual, as accepted for use by the Superintendent.
- D. All facilities, measuring and test equipment shall be recalibrated and checked against standards at whatever frequency is determined appropriate by the equipment manufacturer. Items not considered by the Superintendent to give sufficiently accurate readings or results, or are not able to produce consistent results, shall not be used.
- E. Personnel training and certification shall be subject to the Superintendent's acceptance.
- F. Documentation of materials and processes shall only be considered adequate when they have been checked by the Superintendent and are deemed by the Superintendent to satisfy the Contract requirements in all respects.
- G. Receipt and storage of incoming materials shall be suitably controlled such that, in the opinion of the Superintendent, it can be readily confirmed that the correct materials have been employed at the correct locations in the work, as described in the Specification.

- H. All materials, including part and fully finished components, welding consumables and paints, etc, are to be identified and documented such that the Superintendent can confirm that all materials used comply with the Contractual requirements. Digital progress photographs shall be provided on USB on a monthly basis. The minimum number of photographs shall be agreed with the Superintendent.
- I. All fabrication operations shall use processes, consumables and testing procedures, confirmed by suitable tests, that enable the Superintendent to confirm that the connections placed during fabrication and, if appropriate, during erection, have mechanical properties and freedom from unacceptable defects sufficient to ensure that the Specification requirements are satisfied.
- J. Make available to the Superintendent a detailed programme of work to permit the witnessing of significant stages in the fabrication process.
- K. Painting and coating materials and process checks shall be as stated above and will be monitored by the Superintendent at such intervals necessary to confirm that the fabricator is carrying out this work properly and to the required levels of quality.

6.4 Summary

- A. All items referred to above shall be primarily controlled and implemented by the Head Contractor according to his own devised methods and procedures.
- B. Undertake whatever steps are necessary to confirm to the Superintendent that Contractual responsibility is being discharged in this respect.
- C. On dispatch of each finished item from the point of manufacture, confirm in writing that such items have been fabricated according to the requirements of the Quality Control Manual and satisfy the requirement of the Contract.

6.5 Design Drawings and Specification

- A. The documents which constitute the Contract are mutually explanatory and anything contained in one but not in the other shall be equally binding as if contained in all.
- B. Any ambiguity, discrepancy or inconsistency found in the documents shall be notified to the Superintendent.
- C. If the Head Contractor fails to notify the Superintendent of any ambiguity, discrepancy or inconsistency, it shall be deemed that the Head Contractor has allowed in their Tender for the work constituting the greater expense.
- D. Where repetitive features are not fully drawn, they shall be similar to those which are fully drawn.
- E. The actual position and layout of existing services in relation to each other and to the surrounding work shall be verified on Site (VOS).
- F. All measurements necessary to achieve a neat functional layout shall be taken on the Site by the Head Contractor who shall ensure that clearances for operation and maintenance are adequate and not in any case less than those indicated on the Design Drawings.
- G. Any doubt regarding the clear intention of the Design Drawings shall be brought to the attention of the Superintendent before proceeding with that specific portion of the work involved.
- H. If either the Design Drawings or Specification omit particulars of minor work which nevertheless is clearly to be inferred or is necessary for the proper execution and completion of the Works then such minor work shall be executed by the Head Contractor as part of the execution of the Works and at no extra cost or charge to the Principal.

6.6 Testing and Inspection

- A. Where required, engage an accredited independent testing specialist, as agreed with the Superintendent, to verify that the requirements of the Contract have been satisfied.
- B. Provide testing on samples and materials as necessary.
- C. Include and supply detailed proposals of tests that demonstrate compliance with the requirements of the Specification and the Design Drawings.
- D. The following minimum provisions shall be made available to the Superintendent at all times:
 - 1. Suitably qualified personnel using appropriate validated equipment.
 - 2. All necessary access and facilities for inspection and testing in laboratories, fabrication shops and on Site.
 - 3. Regularly calibrated equipment for the purposes of load measuring.
- E. Maintain the following:

1. Tests and inspection results during all stages of manufacture, assembly and installation of components.
 2. Certificates relating to the materials used in the work, as confirmation of tests carried out in accordance with the relevant standards and codes.
 3. Records of all inspections and tests performed to substantiate conformity with the Contract, including those carried out by Subcontractors and suppliers.
- F. Should any test reveal defective material and/or workmanship, immediately carry out any remedial work and/or retesting, including that of a special nature, under instruction from the Superintendent.
- G. Indicate on the Construction Programme the exact timing of all testing, procedural trials and trial assemblies so that the Superintendent has the opportunity to attend.
- H. If the Superintendent is of the opinion that any item of work does not conform to the requirements of the Contract, undertake appropriate testing as directed by the Superintendent, to establish whether or not this is the case.
- I. Inspection Witness points: If notice of inspection is required with regards to any item of work, advise when these parts are ready for inspection prior to being concealed.
- J. Testing Witness points: If notice of testing is required with regards to any parts of the Works, advise when these parts are to be tested so that the Superintendent can be present to witness the testing.
- K. Minimum notice for inspections to be made: Five (5) working days and to tie in with Superintendent's site visits.
- L. Testing authorities:
1. Except for Site tests, have tests carried out by authorities accredited by the National Association of Testing Authorities (NATA) to test in the relevant field, or an organisation outside Australia recognised by NATA through a mutual recognition agreement. Cooperate as required with testing authorities.
 2. Reports: Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and conformity or non-conformity with requirements.
 3. Site tests: Use instruments calibrated by authorities accredited by NATA.

6.7 Standards

- A. Australian Standards shall be the governing standards, unless otherwise specified.
- B. Only where expressly stated in the Specification should other standards be applied.
- C. All reference to standards, regulations and requirements of statutory bodies shall mean the latest published editions at the time of Contract award. Where such standards, regulations and requirements are amended after Contract award and affect the Head Contractor's responsibilities, immediately inform the Superintendent in writing.
- D. If unable to comply with the governing standards or regulations and proposing to substitute other standards, inform the Superintendent within the summary of deviations from the Specification. Provide fully detailed reasons for being unable to comply, together with any design and/or technical implications. Failure to provide such notification prior to Contract award is deemed to be acceptance of the governing standards or regulations and later notification will be invalid.

6.8 Building Codes and Regulations

- A. All materials, components, equipment and workmanship shall comply with all Statutory Authority codes and regulations, the current Australian Standards and any other regulations, rules or by-laws applicable to both design and execution. The National Construction Code (NCC) is to be the relevant version.
- B. Ensure that the Shop Drawings comply with all Statutory Requirements and relevant codes and that they receive the necessary approvals in good time to ensure that there is no programme delay caused by delay of such approvals.

6.9 Food Preparation Areas

- A. Comply with all requirements in regard to the construction, sealing of all floors walls ceilings, concealment of services, use of impervious materials drained coved surfaces and in general accordance with Food Act 2003, AS 4674, AS 1668.1 and AS 1668.2.
- B. Provide all construction requirements as set out in the DA conditions including compliance.
- C. Provide Compliance certification that the installation complies with required codes.

6.10 Submittals to Authorities

- A. Obtain any approvals required from the Statutory Authorities.
- B. When required by the Statutory Authorities, submit to them any component part of the Works for appraisal, testing, stamping or certifying.
- C. After such a component part has been satisfactorily approved, tested, stamped or certified, return the marked component or documentary evidence of its approval, as appropriate, to the Superintendent for reference purposes.
- D. If the Statutory Authority rejects components, replace the component part or parts with those that are acceptable.

6.11 Damage Anticipation

- A. Other than damage through terrorist attack or similar activity, anticipate the possible sources of damage to the Works and take active and positive protective measures to maintain it in pristine condition until Practical Completion. The acceptance of responsibility for making good in the event of damage shall not be considered adequate.

6.12 Protection Generally

- A. Provide necessary protective devices to protect all goods and materials, at all stages through to Practical Completion, against damage arising from but not limited to weather conditions, moisture, heat, humidity, direct sunlight, construction activities, other contractors, warping, distortion, abrasion and other conditions which could have an adverse effect on any goods and/or materials.
- B. Provide full details of the protective measures proposed for implementation at each of the following five stages:
 - 1. Manufacture and packaging of goods and materials at off-Site locations.
 - 2. Shipment to Site and unloading.
 - 3. Storage on Site and movement to point of installation or construction.
 - 4. During installation/construction.
 - 5. Completion of installation/construction.
- C. Where components are delivered to the Site in packages or crates, each package or crate shall be labelled on the outside giving the reference and quantity of the contents so that deliveries can be accepted at the Site without packages needing to be opened.
- D. Carefully remove all temporary protective elements immediately before Practical Completion or at an appropriate time to the acceptance of the Superintendent and leave the Works perfectly clean and fit for immediate use.

6.13 Vermin

- A. The manufacture and installation of the Works shall protect against and not contain or provide harbourage for infestation by vermin. It shall protect against any vermin including, but not limited to, mice, rats, birds, rabbits, foxes, possums and insects.

6.14 Maintenance and Replacement Materials

- A. Replaceable materials/components shall be maximised.
- B. Materials shall be capable of simple maintenance/repair and integration with other maintenance systems.

6.15 Building Operation and Maintenance Manuals

- A. At least 12 weeks prior to the programmed date for Practical Completion, prepare and submit to the Superintendent one draft copy of all building operation and maintenance manuals required to operate and maintain all components and systems.
- B. The draft Building Operation and Maintenance Manuals will be reviewed by the Superintendent and returned to the Head Contractor within 10 working days. Any issues raised as part of the Superintendent's review shall be addressed by the Head Contractor who shall then resubmit the manuals for further review within 10 working days.
- C. When the draft Building Operation and Maintenance Manuals are returned to the Head Contractor as accepted, prepare an electronic copy of the manuals and issue to the Superintendent. The issue of the Building Operation and Maintenance Manuals is a requirement of Practical Completion. All submissions to be submitted as high resolution files.

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- D. To ensure that the Building Operation and Maintenance Manuals are accepted prior to Practical Completion, provide a schedule within 20 days of starting work on Site, indicating when the Building Operation and Maintenance Manuals will be submitted for review by the Superintendent.
- E. Allow sufficient time for the review, resubmittal and further review, as necessary, for the Building Operation and Maintenance Manuals, so as not to delay Practical Completion.
- F. Content:
1. The Building Operation and Maintenance Manuals shall incorporate all maintenance systems and give details of the operation and required maintenance of all items, components and systems. Refer to specifics detailed in the work sections of this Specification as well as individual services specification sections.
 2. This information shall be supplied for the Superintendent's review in the following format:
 - a) Unless agreed otherwise with the Superintendent, print the manuals on heavy A4-sized paper with standard three or four hole punching, bind into a three or four-ringed binder (not a two-ringed binder) and label the spine and cover of the binder with the title of the manual.
 - b) Specially written information shall be on A4-sized pages with typed text using double spacing and in a format agreed prior to submittal. Drawings shall be folded so they can be kept within a ring binder.
 - c) Drawn information shall generally be on A1-sized sheets. As-Constructed Drawings shall include all drawings and diagrams updated to "as built" state, free of any superfluous markings.
 - d) Standard published information shall be carefully selected and edited to include only those items installed. Where editing is not appropriate, the relevant items shall be typed out and included.
 - e) Each set of the manuals shall contain one electronic version on USB. This shall be in the most recent version of AutoCAD, Revit or other program as instructed by the Superintendent.
 3. The completion and submittal of all Building Operation and Maintenance Manuals and As-Constructed Drawings shall be a precondition for the issuing of the Certificate of Practical Completion when considering progress payments and release of security.
- G. The Building Operation and Maintenance Manuals shall contain the following as applicable:
1. Emergency telephone numbers. After hours numbers must relate to personnel with project knowledge.
 2. Description of work and design parameters.
 3. Operating instructions.
 4. Maintenance instructions/schedule.
 5. Energy efficient features and strategies of the system.
 6. An overview of potential energy savings resulting in economic savings and reduced environmental impact.
 7. Energy targets and benchmarks against which actual readings can be measured.
 8. Trouble shooting.
 9. List of equipment and suppliers: This section shall be in a table format for easy reference and must include all service equipment installed by the Head Contractor whether supplied by the Head Contractor or the Superintendent.
 10. Manufacturer's literature.
 11. Equipment technical data/equipment schedule.
 12. Equipment wiring diagrams.
 13. As-Constructed Drawings.
 14. Commissioning results.
 15. Test results of assistance to future maintenance.
 16. Certification reports/warranties (if applicable).
 17. Logbooks (if applicable).
 18. EWIS/ Fire/ Emergency Lighting/ Generators.

19. Component information: The following information shall be supplied for every item, component and/or system:
 - a) Certified manufacturing certificate.
 - b) Full description giving any special features. A full breakdown of the parts and catalogue numbers of the constituent parts.
 - c) Warranty information including warranty periods.
 - d) The warranty period of any element or material where in excess of the warranty required by the Specification.
- H. Maintenance procedures: The Maintenance Manual shall include fully comprehensive details in respect of:
 1. Cleaning procedures for all elements.
 2. Replacement procedures.
 3. Regular cyclical preventative maintenance procedures (avoiding damage).
 4. Inspection and lubrication requirements.
 5. Repair procedures in the event of damage.
 6. Washing methods, including the frequency and method of washing required to maintain performance and appearance. Details shall be provided in respect of the maximum time during which performance of components can be maintained, together with the frequency and method of washing required to achieve this.
- I. Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or sub system failure, chemical release or spill, include the following:
 1. Emergency instructions.
 2. Emergency procedures including:
 - a) Instructions for stopping or isolating.
 - b) Shutdown procedures and sequences.
 - c) Instructions for actions outside the property.
 - d) Special operating instructions relevant to the emergency.
 - e) Contact details relevant to the emergency.

6.16 Emergency Information Manual

- A. Form of emergency information: Provide one of the following:
 1. An index and coloured tabs identifying emergency information for each type of emergency within the Operation and maintenance manual.
 2. A separate Emergency manual containing copies of emergency information from the main Operation and maintenance manual.

6.17 Apartment Owner's Manual

- A. Further to the requirements specified above for the provision of Building Operation and Maintenance Manuals, provide an Apartment Owner's Manual for each and every apartment. The manual shall include, but not be limited to:
 1. A full list of Subcontractor and their contact details.
 2. Schedules of all colours, finishes, fixtures, fittings, equipment and appliances that have been incorporated into the apartment, including manufacturer and/or supplier details.
 3. Operation and maintenance instructions for all appliances and equipment within and serving the apartment.
 4. All applicable warranties.
 5. All relevant keys, swipe cards, car park access devices, and the like, neatly bundled on their own key tag.
- B. Provide in both electronic format and in a neatly presented hard cover manual, specific for each apartment and area.
 1. One hard copy and one electronic copy per apartment for Owner.
 2. One electronic copy of each type of apartment for the Principal.

- C. Refer to the PPR document for further requirements.

6.18 Building Services and Systems Training

- A. Prior to Practical Completion, provide skilled operatives to instruct on the correct and efficient operation and maintenance of all systems, components, plant, equipment and controls, as detailed in the Operation and Maintenance Manuals.
- B. The building owner, building manager and/or building operating personnel shall be made fully conversant with the function and operation of all the building services and the energy saving features.
- C. Provide a programme and schedule of training requirements, prior to Practical Completion, stating the minimum amount of time needed for the skilled staff to train the user's staff.
- D. Throughout the training period, remain responsible for the operation and maintenance of all components and systems.
- E. Where such training cannot be carried out prior to Practical Completion because of the nature of the equipment, return to the Site at a later, mutually agreed date to complete the training period.

6.19 Spares

- A. Where required by the Contract, provide replacement materials and spares as specified in each work section before Practical Completion.
- B. All replacement materials/spares shall be of identical quality to those installed.
- C. Supply a list of recommended replacement materials and unit prices for specialist elements required for maintenance of the installation.
- D. All spares shall be handed over in crates, boxes or cabinets designed to protect the contents and prevent deterioration during storage. Each shall be individually marked with the words "Spares for..." and the component or equipment name and reference number stencilled on.
- E. Replacement: Replace spare parts used during the maintenance period.

7 GENERAL MATERIALS AND WORKMANSHIP REQUIREMENTS

7.1 General

- A. Except where otherwise specified, ensure that all materials are new and that materials and workmanship comply with the requirements of the Statutory Authorities and are of the best merchantable quality.
- B. All materials or equipment shall be used with all cognisance of, and according to, directions of the respective manufacturers. Supply to Site, materials and products in the manufacturer's original, unbroken containers or packages. If the Head Contractor fails to comply with this requirement, such materials and products may be rejected by the Superintendent.

7.2 Alternative Materials

- A. Where a preference for a particular material, type of construction, dimension, size or thickness is indicated in the Specification or shown on the Design Drawings, or a particular method of construction is implied, warrant that the preference indicated will satisfy the specified requirements. If considered to be inadequate or inappropriate, make alternative proposals at the time of Tender.
- B. In making its submittal to the Superintendent, the Head Contractor shall demonstrate that any alternative material proposed by the Head Contractor is equal in quality, efficiency and performance to that specified. The Superintendent's acceptance or non-acceptance of the proposed alternative is final and binding on the Head Contractor.
- C. Where the Head Contractor proposes to use alternative products, materials or systems to those nominated in either the Specification, any of the schedules or the Design Drawings, the substitution may only occur upon prior written acceptance from the Superintendent.
- D. Procedure to offer Alternatives: If alternatives to the documented products, methods or systems are proposed, submit sufficient information to permit evaluation of the proposed alternatives, including the following:
1. Evidence that the performance is equal to, or greater than, that specified.
 2. Evidence of conformity to a cited standard.
 3. Samples.
 4. Essential technical information, in English.
 5. Reasons for the proposed substitutions.

6. List of tests that will be undertaken and/or test reports that will be provided.
 7. Statement of the extent of revisions to the contract documents.
 8. Statement of the extent of revisions to the construction program.
 9. Statement of the cost implications including costs outside the Contract.
 10. Statement of the consequent alterations to other parts of the works.
- E. Timing: Refer to the contract.
- F. Availability: If the documented products or systems are unavailable within the time constraints of the construction program, submit evidence.
- G. Criteria: If the substitution is for any reason other than unavailability, submit evidence that the substitution:
1. Is of net enhanced value to the Principal.
 2. Is consistent with the contract documents and is as effective as the identified item, detail or method.
- H. Alternatives will not be considered unless there is a cost saving.
- I. Acceptance of alternative proposals by the Superintendent does not relieve the Head Contractor of the responsibility to provide suitable materials, components and assemblies fit for the purpose intended by the manufacturer and in compliance with the Contract documents.
- J. If no such alternative proposal to any of the preferences indicated in the Contract, Design Drawings and Specification is submitted, the solutions proposed in the Specification and on the Design Drawings will be deemed to be acceptable.
- K. Any costs incurred by the Superintendent or other consultants, relating to the evaluation of alternative materials proposed by the Head Contractor, shall be the responsibility of the Head Contractor.

7.3 Health Hazards

- A. All proposed materials shall not, in any way, be potential health hazards. Maintain a full, up-to-date knowledge of all current published research and legislation in this respect.
- B. The Head Contractor shall be familiar with the National Model Regulations for the Control of Workplace Hazardous Substances [NOHSC: 1005 (1994)] and comply with the National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC: 2007 (1994)].
- C. The Head Contractor shall also accept the exclusions contained in the Contract documents.

7.4 Deleterious Materials

- A. The following materials shall not be used:
 1. Asbestos or asbestos-containing products, as defined in the:
 - a) National Occupational Health and Safety Commission (NOHSC) publications: Code of Practice for the Safe Removal of Asbestos 2nd Edition [NOHSC: 2002 (2005)], and Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC: 2018 (2005)], or any statutory modification or re-enactment thereof.
 - b) Regulation 1.1.4 (I) (Schedule I) of the Occupational Health and Safety Regulations 2007, or any later statutory modification or re-enactment thereof.
 - c) National Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].
 2. Lead, where the metal or its corrosive products may be directly ingested, inhaled or absorbed. Applications of lead such as roofing, flashings, rainwater goods and copper alloy fittings containing lead which are specifically required, are acceptable until equal or better alternatives are available.
 3. Lead-based paints and primers.
 4. Urea formaldehyde foam or materials which may release formaldehyde beyond Australian Standard limits.

5. Materials which generally comprise mineral fibres, either manmade or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less, or which contain any fibres not sealed, encapsulated, or otherwise stabilised to ensure that fibre migration is prevented. Products that may contain these fibres include insulation, fire protection and air filters. For all mineral wool insulation products, test evidence must be available and produced confirming that the materials fulfil the requirements of current Safe Work Australia regulations and consequently are not classified as a possible human carcinogen.
 6. Chlorofluorocarbons or hydrochlorofluorocarbons or any goods and/or materials containing the same (e.g. materials in which HFC's, CFC's or HCFC's have been used as blowing agents). All foamed insulation shall be manufactured using HFC, CFC and HCFC-free processes, i.e. zero ozone depleting potential (ODP) and low global warming potential (GWP). Suitable blowing agents include pentane and CO₂.
 7. High alumina cement in structural elements.
 8. Calcium chloride in admixtures for use in reinforced concrete.
 9. Polychlorinated biphenyls (PCB's), polychlorinated terphenyls (PCT's) or any goods and/or materials containing the same.
 10. Calcium silicate bricks or tiles.
 11. Sea-dredged aggregates.
 12. Toxic wood preservatives including but not limited to lindane, pentachlorophenol (PCP), tributyltin (TBT) and chromated copper arsenate (CCA).
- B. Hazardous Materials Survey:
1. Carry out a Hazardous Materials Survey in all areas being refurbished.
 2. Where hazardous materials are found, a follow-up survey shall be undertaken at the completion of demolition works to confirm that the hazardous materials have been removed and disposed of in accordance with the following. Provide evidence by means of disposal receipts.
 - a) Asbestos: Occupational Health and Safety (OH&S) legislation and relevant environmental legislation.
 - b) Lead: to AS 4361.1 or AS 4361.2, as applicable.
 - c) Polychlorinated Biphenyls (PCB's): ANZECC Polychlorinated Biphenyls Management Plan.

7.5 Corrosion Protection

- A. Consideration shall be given to the corrosivity of the local environment when selecting an appropriate coating thickness for steel. The atmospheric corrosivity categories are defined in AS/NZS 2312, Table 2.1.
- B. The corrosive environment of the Site shall be regarded as the following Categories as defined in AS 4312 and AS/NZS 2312:
 1. Externally and internal naturally ventilated spaces: Category C3.
 2. Internal heated and air-conditioned spaces: Category C1.
- C. If the Site is thought to be in more than one category, the selected coating shall be capable of resisting the most severe category.
- D. Metallic coatings for corrosion protection (including metal spray coatings, hot dip galvanising, and electroplating) shall comply with AS/NZS 2312, Section 5.
- E. Paint coating systems for corrosion protection shall comply with AS/NZS 2312, Sections 6 and 8.
- F. Particular care shall be taken with delivery and storage on Site, particularly if storage is prolonged. On no account should materials or components be stored or used beyond the manufacturer's expiry date.
- G. Ensure that protective measures are taken to avoid any corrosion or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of materials.
- H. Ensure full resistance to any corrosion for components that are secured or bolted to each other, paying particular attention to the surface damage caused by such bolting or securing.
- I. Ensure full resistance in repair of corrosion protection to cope with the Site cutting of components, especially at boundary and external conditions.

7.6 Skilled Personnel

- A. Execute all parts of the Works using persons skilled in the processes to be adopted. Where requested, provide documentation that demonstrates an individual's ability and qualifications to carry out the work to which he has been assigned.

7.7 Suitability of Structure

- A. Before commencing any part or element of the Works, survey the structure, checking line, level and fixing points and report immediately to the Superintendent if the structure is considered to be unsuitable and/or will affect the proposed warranty. If the structure is unsuitable, propose remedial action.

7.8 Setting Out

- A. Suitably qualified personnel shall carry out all primary setting out. It shall be done using instruments and methods appropriate for achieving the necessary precision and accuracy.
- B. Prior to commencing the installation, submit to the Superintendent the proposed method of setting out, how grid lines will be marked on Site and how their positions will be checked and maintained.
- C. The plan position of any designated mark (measured to its centre) defining a Primary Positional Grid Line shall be located to within $\pm 2\text{mm}$ of its design dimension from the Base Reference Datum.

7.9 Project Tolerances Definitions

- A. Tolerance: The defined maximum allowable dimensional deviation from a prescribed or agreed value or position.
- B. Base Reference Datum: The physical marker established on Site to define the base reference plan and level position to which all other Site setting out is referenced.
- C. Dimension: Any prescribed dimension, or any dimension which can be determined from a set of prescribed dimensions, for any element or part thereof.
- D. Primary Positional Grid Line: Any setting out grid line used to define the spatial layout of the project and to which the local setting out of elements may be referenced.
- E. Location Reference Point: A specified point that is used to define the position of certain other points and/or elements.
- F. Location Reference Plane: A specified plane that is used to define the position of certain other planes and/or elements. The reference plane is typically defined by a specified set of reference points.
- G. Location Reference Surface: A specified surface that is used to define the position of another surface and/or surfaces. The reference surface may be defined mathematically (e.g. as part of a cylinder or as part of a sphere) where it is spatially fixed in relation to specified reference points.
- H. Reference Element: A specified element that is used to define the position of other elements.
- I. Typically a specific point on the reference element shall be defined to any other element to which it refers.

7.10 Compatibility

- A. Ensure that all materials and processes employed are compatible with each other.

7.11 Manufacturer's Instructions

- A. Where proprietary products, systems or items are specified and/or included, ensure that the method of building, installing, handling, storage, protection, finishing, adjusting and preparation of substrates, etc, is strictly in accordance with the manufacturer's printed instructions and recommendations and that copies of all such documentation are supplied to the Superintendent prior to commencement. All such manufacturer's instructions and recommendations are deemed to be included in the Contract.
- B. All materials and associated components shall be stored in a clean, dry area, in accordance with the manufacturer's written recommendations.

7.12 Suppliers

- A. Be responsible for all materials, components and equipment supplied or manufactured by Subcontractors or suppliers, until the end of the warranty period, defined by when they exceed the Defects Liability Period.

7.13 Site Cutting of Materials

- A. All methods, principles, details, etc, for Site cutting of components shall be submitted as part of the Head Contractor's method statement to the Superintendent for review. No manufacture shall commence until it can be demonstrated that all proposed techniques have been reviewed by the Superintendent.
- B. Cutting of metal products shall be straight and free from burrs and all joints shall be flush, without gaps or imperfections. If base metal is exposed, the surface shall be protected to the same level of protection as stated in the Specification.

7.14 Deterioration

- A. All materials shall be treated/selected to prevent any damage/corrosion from all possible combinations of exposure to seawater, non-saline water, wet rot, dry rot, fungi, mould, soil, high humidity, low or high temperatures, chemical acids and alkalis, abrasion and impact, bacteria and all other deleterious effects including atmospheric pollution and pH factor of the adjacent elements.
- B. Ensure that no chemical or electrolytic action takes place where dissimilar metals and/or materials are used together.
- C. No materials shall discolour, crack or otherwise be damaged by the worst possible combination of environmental conditions.
- D. With materials subject to surface treatment, special attention shall be given to the substrate to ensure that the preparation is compatible with the surface treatment.
- E. Ensure that all superficial dust and friable materials are removed and that adequate protection is provided during the process of the surface treatment and finishes to prevent contamination by dust and other debris.
- F. Materials must not be liable to infestation attack by micro-organisms.

7.15 Line and Level

- A. All components shall be installed such that they are plumb or horizontal and shall line up with adjacent components, in all directions, taking into account the allowable tolerances as defined in the relevant section of the Specification.

7.16 Method Statements

- A. Provide a detailed method statement describing the sequence and methods to be employed in carrying out this work identifying proposed solutions regarding workmanship which affects the fabrication, holding, storing and handling, setting out, Site assembly, bolting, joining and welding of components and the protection of the metalwork against corrosion. Such notes shall be clearly written on the Shop Drawings to be used for Site fixing.

7.17 ESD Requirements

- A. Generally:
 1. The Ivanhoe project is currently targeting a 5 Star Green Star rating under the Design and As Built v1.2 Green Star tool.
 2. Refer to the ESD specification for required credit points and further details.
- B. 10.1 Acoustic Comfort – Internal Noise Levels
 1. Control of internal ambient noise levels, and provisions to be included in commissioning report for verification through measurement of selected representative spaces with all relevant building systems in operation; and
 2. Control of maximum reverberation times and acoustic insulation requirements and provisions to be included in commissioning report for verification through measurement of selected representative spaces with all relevant building systems in operation.
- C. 10.3 Acoustic Separation
 1. Control of internal ambient noise levels, and provisions to be included in commissioning report for verification through measurement of selected representative spaces with all relevant building systems in operation; and
 2. Control of maximum reverberation times and acoustic insulation requirements and provisions to be included in commissioning report for verification through measurement of selected representative spaces with all relevant building systems in operation.
 3. Control of noise transmission in enclosed spaces, and provisions to be included in commissioning report for verification through measurement of selected representative spaces with all relevant building systems in operation
- D. 11.1 General Illuminance and Glare Reduction

1. Achieve the preferred design response for general illuminance and glare. Refer to the Electrical Engineer's documents for further details.
- E. 11.3 Localised Lighting Control
 1. Achieve the preferred design response for localised lighting control. Refer to the Electrical Engineer's documents for further details.
- F. 12.0 Visual Comfort – Glare Reduction
 1. Achieve the preferred design response for glare reduction. Refer to the ESD specification and Section 0572 for further information.
- G. 12.1 Daylight
 1. Undertake compliance option and calculations to comply with the Green Star requirements.
- H. 12.2 Views
 1. Achieve the preferred design response for views.
- I. 13.1 Indoor Pollutants – Paints, Adhesives, Sealants and Carpets
 1. Paints: Refer to Section 0671.
 2. Adhesives and sealants: Refer to Section 0811.
 3. Carpets: Refer to Section 0652.
- J. 13.2 Engineered Wood Products
 1. Engineered wood products: Refer to Section 0815.
- K. 15.E Greenhouse Gas Emissions
 1. To comply with ESD target requirements.
- L. 17B.3 Low Emission Vehicle Infrastructure
 1. To comply with ESD target requirements.
- M. 17B.4 Active Transport Facilities
 1. To comply with ESD target requirements.
- N. 19A.1 Life Cycle Assessment Performance Pathway - Comparative Lifecycle Assessment
 1. To comply with ESD target requirements.
- O. 20.1 Responsible Building Materials - Structural and Reinforcing Steel
 1. To comply with ESD target requirements.
- P. 20.2 Timber Products
 1. Refer to Section 0815.
- Q. 20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables
 1. To comply with ESD target requirements.
- R. 25 Heat Island Effect
 1. Meet the required SRIs in the Green Star requirements.

8 COMPLETION

8.1 Maintenance

- A. Prior to commencement of the Defects Liability Period, the Head Contractor shall submit a maintenance schedule for the Superintendent's appraisal, setting out maintenance procedures and frequencies to ensure trouble free operation and maintain plant operating efficiency. The maintenance schedule shall be included in the Building Operation and Maintenance Manuals.
- B. Routine maintenance of services is required in accordance with Australian Standards and the NCC.
- C. Maintenance of essential services shall be included in the maintenance schedule and is typically referred to in the 'Certificate of Occupancy' and/or the 'Certificate of Final Inspection'.
- D. Perform maintenance in accordance with statutory regulations and in accordance with the schedule. Maintenance shall be conducted in accordance with AS 1851 (all levels).
- E. Perform maintenance at times and in a manner which will cause the least inconvenience to the normal operation and occupants of the building.

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- F. Coordinate the maintenance to ensure all necessary Subcontractors are present when required for coordinated essential services tests.
 - G. Notify the Principal of intent to perform a service at least three days prior to each visit. Obtain the representative's signature on a service report at the end of each visit and leave a copy on Site. The service report shall detail the work carried out and shall list any adjustments and/or rectification work found to be necessary.
 - H. Unsigned reports will not be recognised and the Principal, at the end of the maintenance period, may elect to:
 - 1. Have additional services carried out to make up the number of signed reports at the Head Contractor's expense; or
 - 2. Deduct the cost of disputed visits at the pro rata rate for each maintenance visit disputed.
 - I. At least 14 days before carrying out the final service, request that an inspection be arranged to coincide with this service.

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SECTION 0315 -- CONCRETE FINISHES (ARCHITECTURAL REQUIREMENTS)**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification, the Structural Engineer's documents and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Concrete floor finishes.
 2. Fair faced concrete walls, columns, beams and/ or soffits.
 3. Movement/ expansion joints.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. Prior to submitting the following Contract samples for acceptance, provide details on the concrete mix from the concrete supplier for all concrete types.
- B. In accordance with Section 0171, provide Contract samples of the following:
1. Sample discs from the concrete supplier of the range of concrete mixes/ colours available from which the Superintendent may select the desired mix/ colour for the project. Minimum of six (6) discs.
 2. A 600mm x 600mm sample of each type of off-form and worked concrete finish using proposed formwork, concrete mix, oxide admix and surface treatments as specified and as applicable.
 3. A 300mm minimum length of each type of movement/ expansion joint.

1.4 Sample Panels

- A. Provide the following sample panels in accordance with Section 0171:
1. A sample panel of Class 2 off-form concrete finish, nominally 1800mm long x 1800mm high, including a minimum of 4 (2 up x 2 across) regularly spaced form ties. The sample panel edges shall include arris treatments and the form ties shall be filled to the proposed level of finish. The sample panel shall demonstrate the quality of finish and colour consistency to be achieved in the finished work.
- B. Obtain acceptance from the Superintendent prior to commencing any subsequent work. If a panel is rejected, construct further sample panels, as necessary, until acceptance is obtained by the Superintendent.

1.5 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. A 2000mm x 2000mm section of floor representing each type of concrete floor finish with the applicable floor sealer applied.
 2. A 1000mm x 1000mm section for each type of off-form concrete finish representing the quality of finish as accepted by the Superintendent.
- B. The accepted sample panel shall represent the quality benchmark for that particular concrete finish.

1.6 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Evaluation of the off-form finishes.
 2. Evaluation of surface finish.

1.7 Shop Drawings

- A. Provide Shop Drawings in accordance with the requirements of Section 0171 of the following:

1. All formwork and temporary work details. Include details of all fittings, features, associated formwork and temporary work for installation. Typical details shall not be accepted.
2. All interfaces, particularly in respect to corner junctions, services penetrations and interfaces with other trades.
3. Show all dimension as applicable, all panel sizes, panel joints, formwork layout, connection details, form tie spacings, edge details, slab setdowns, any features, bolt spacing, nail spacing and the like as well as all cast-in elements, attachments and penetrations.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Testing and Compliance Assessment

- A. Test authority: Concrete supplier or NATA registered laboratory.
- B. Product conformity: Submit current assessments of conformity, as appropriate and as follows:
 1. Certificate of conformity by a JAS-ANZ accredited third party.
 2. Report by a NATA accredited laboratory describing tests and giving results which demonstrate that the product conforms.
- C. Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.
- D. Assessment process of test results
 1. Standard: To AS 1379.
 2. Method of assessment: Project assessment.
- E. Test methods:
 1. To the relevant parts of the AS 1012 series.
- F. Embedded pressure pipes: Complete leak tests before embedding pipes.
- G. Liquid retaining structures:
 1. Testing for liquid tightness: AS 3735.
- H. Refer to the Structural Engineer's documentation.

1.10 Slip Resistance and Slip Resistance Testing

- A. Pedestrian areas shall be stable, safe and minimise the risk of slipping or tripping due to slippery surfaces or misaligned joints. Slip resistances shall comply with the requirements of HB 197, HB 198 and NCC Table D2.14.
- B. Provide slip resistance test certificates to confirm that slip resistance values are in accordance with AS 4663.
- C. Where additional topical surface treatment is applied to concrete floor surfaces, provide slip resistance test certificates to confirm that slip resistance values for surface treatment are in accordance with AS 4586. Test the surfaces once the sealer has been applied to concrete in accordance with AS 4663.
- D. Arrange and pay for on-site slip resistance testing of all types of concrete floor surfaces that are left exposed in the finished work and in sufficient number to cater for all areas and conditions including ramps, steps entrances etc. Testing shall be undertaken by a registered testing laboratory. Tests shall include wet pendulum and dry floor friction testing in accordance with AS 4663.

2 PRODUCTS

2.1 General

- A. The quality of concrete finish shall comply with AS 3610, AS 3600 and AS 1379.
- B. Concrete shall be a mixture of cement, aggregates and water with or without the addition of chemical admixtures or other materials as specified, with finishes as defined by the following clauses.
- C. Provide finishes to formed and unformed concrete surfaces which are:
 1. Appropriate to the importance (visual or physical) of the concrete elements.
 2. Compatible with subsequent trades and finishes.

3. Compatible with the uses and functions.
 - D. Ensure that all top surfaces of walls externally are positively drained with no pooling or ponding.
 - E. Aggregates: AS 2758.1.
 - F. Cement: To AS 3972.
 1. Age: Less than 6 months old.
 2. Storage: Store cement bags under cover and above ground.
 - G. Water: To AS 1379 clause 2.4.
 1. Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.
 - H. Chemical admixtures: To AS 1478.1, used to the manufacturer's recommendations.
 - I. Refer to the Master Schedule and the Design Drawings for product selection and details.
- 2.2 Off Form Concrete Finish - Class 2**
- A. Class 2 (Normal class) concrete: Concrete with finish of uniform quality and texture, in accordance with AS 3610, and include the following requirements:
 1. Surface finish class 2 formwork.
 2. Colour control: Class 2C grey scale concrete with a tonal range in accordance with AS 3610 and to the acceptance of the Superintendent.
 3. Surface face: Smooth.
 4. Surface pattern: As indicated on the Design Drawings.
 - B. Applied Surface Finish: Refer to the Master Schedule.
- 2.3 Worked Concrete Finish - Tamped**
- A. Tamp the surface of the poured concrete with the edge of a board or beam to give an even texture of parallel ribs.
- 2.4 Worked Concrete Finish - Power**
- A. Power float concrete finish.
 1. Indicative location(s) suitable for vinyl and carpet finishes by other trade.
- 2.5 Concrete Stair Finish**
- A. Concrete stair soffits and stringers shall be formed to an Off Form Finish - Class 2 as specified. Stairs are to meet the requirements of AS 1428.1 as a minimum.
 - B. Treads in fine granolithic finish as specified in Section 0612. Refer to the Design Drawings for details of set-out and set down requirements.
 - C. Tread nosing: Refer to the Design Drawings.
 - D. Stair nosing:
 1. Stair nosing to comply with accessibility standards AS/NZS 1428.4.1.
 2. Stair nosing shall comply with the luminous contrast requirements stated in AS 1428.1 Appendix B. Slip rating shall conform to the NCC Table D2.14 as a minimum.
- 2.6 Concrete Waterproofing Admixture**
- A. Where waterproofing of concrete is required the following shall be added to the concrete mix at the time of batching:
 1. Manufacturer/ reference: Xypex Admix C-1000 NF crystalline dry powder compound.
 2. Quantities shall be determined by the admix manufacturer and accepted by the Structural Engineer prior to concrete manufacture.
- 2.7 Concrete Finish - Class 2 Generally**
- A. Produce a smooth, even finish with an impervious sheet material (eg high quality resin film faced plywood) arranged in an accepted regular pattern as a feature of the surface. This will coincide with the architectural features as indicated on the Design Drawings. Do not replace parts of the formwork panels where this may cause a change in colour in the concrete.
 - B. Abrupt irregularities and surface qualities shall be not greater than the stated criteria set out in AS 3610 table 3.4.2 and clause 5.6.

- C. The surface shall be free from discoloration caused by contamination from a release agent, grout leakage or other source.
- D. Cover spacers: No spacers shall be visible or rust marks evident.
- E. Generally, surfaces shall be free from voids, honeycombing, segregation and other defects. Voids shall be kept to an absolute minimum while ensuring compliance with other requirements of the Specification. The following criteria shall be observed:
 - 1. Blowhole evaluation shall be conducted in accordance with photo examples and evaluation criteria as defined in AS 3610 Appendix B.
 - 2. The concrete shall have a consistent, uniform, matt, light coloured face.
 - 3. The concrete shall be free from surface blemishes visible to the eye at 3m.
 - 4. No repairs are permitted to the formwork, unless acceptance has been given by the Superintendent. Damaged panels shall be replaced with material of the same performance and shall be grout washed to blend in with the existing panels.
 - 5. No water or grout loss shall be permitted. Marks no larger than 50mm in any dimension shall be acceptable.
 - 6. Making good: Apart from the making good allowed for in the Structural Engineer's Specification, making good shall be minimal and consistent to an accepted sample. As far as possible, the finished surface shall be achieved without making good. The improvement of the surface finish by the Head Contractor (eg filling noticeable surface blemishes) shall be agreed with the Superintendent prior to any work being carried out. Continuity of personnel for making good, where required, shall be provided by the Head Contractor, to the satisfaction of the Superintendent.
- F. Formwork tie-rod holes shall be at uniform centres and in-line, horizontally and vertically, and in-filled with matching prepared cement/ fine aggregate paste, to an accepted sample as specified.
- G. Where rebates or features are shown, these will also be the panel joints. No other joints are permitted. The design of panel joints, rebates, striking pieces and other elements are the responsibility of the Head Contractor but shall be subject to acceptance by the Superintendent. Features shall be bedded on mastic, but no mastic shall be permitted on the finished facework.
- H. All concrete, that is visible in the finished work, is to achieve this level of finish, unless nominated otherwise in the Design Drawings or Schedules.
- I. For applied finishes refer to Section 0671.

2.8 Machine Float Finish Generally

- A. Power float the concrete to an even surface with no ridges or steps, then immediately commence curing as specified in the Structural Engineer's specification. When the concrete is suitably stiff, power trowel to give a uniform, smooth surface, free from trowel marks and other blemishes. Resume specified curing without delay.
- B. Hand float in locations inaccessible to the machine float.

2.9 Steel Trowel Finish Generally

- A. After machine floating finish, work the concrete surface as follows:
 - 1. Use power or hand steel trowels to produce a smooth surface relatively free from defects.
 - 2. When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

2.10 Formwork

- A. To AS 3610 and the Structural Engineer's details.
- B. Formwork shall be timber or other impervious material of suitable quality to produce the specified finish. Materials used as formers for profiled formwork, chamfers, splays, rebates and other features shall be such that they produce the same finish as the main formwork. Steel shutters shall not be used without prior acceptance by the Superintendent.
- C. Plywood for formwork shall have a close, uniform grain with consistent direction and the edges shall be sealed with barrier paint, polyurethane varnish or other impermeable material. There shall be no more than one knot replacement in any 300mm x 300mm area. The plywood or other substrate shall be subject to acceptance by the Superintendent and be from one source.
- D. The faces of formwork for all finish types shall have a uniform texture and a matt (not a shiny or polished) surface. The edges of the formwork shall be straight and square and be sealed.

- E. Formwork is to be coated with a form release agent to aid in the removal of the formwork and thus minimise possible damage to the concrete face from the stripping operation.
- F. Release agents are to be applied uniformly and evenly over the form surface at the minimum rate, consistent with full coverage, to ensure that the entire form surface has the same even characteristics.
- G. Formwork is not to bow, bulge, sag or otherwise distort/deflect to an extent that the specified shape, tolerances or appearance of the off-form surface can not be achieved.

2.11 Timber Generally

- A. Refer to Section 0815.

2.12 Colour Consistency

- A. The consistency of the concrete colour is of great importance. Select all suppliers, materials and all methods to ensure the specified finish and consistency, including but not limited to the following:
 1. The main plant shall have a consistent supply to achieve the specified finish.
 2. The back-up plant shall be selected to achieve an equivalent supply.
 3. Cement, fines and other aggregates shall be from one region/ source in order to achieve consistent concrete colour.
- B. Colour shall be within the relevant tonal scale range as defined in AS 3610 for the specific class of finish or as agreed with the Superintendent based on the benchmarks or samples which shall then become the colour standard for the project.
- C. Concrete colour and consistency must be uniform in colour and texture with no discolouration.
- D. Coloured concrete must be cured in accordance with the Structural Engineer's details, including where curing compounds are used.
- E. Colour consistency problems, for example inherent colour variation, aggregate transparency or loss or movement of water, shall be avoided and appropriate measures taken. These include but are not limited to:
 1. Ensuring the continuity of supply from one source for the duration of the work under the Contract. Any back-up plant shall have an equivalent supply.
 2. Batching the concrete precisely and mixing thoroughly.
 3. Bracing or stiffening the formwork to reduce flexibility.
 4. Ensuring that the formwork face material has a uniform absorbency.
- F. Prevent surface blemishing and do not cure with plastic sheeting, intermittent wetting and drying, membranes, paper, sodium or fluoro-silicate hardeners and other compounds which can cause discolouration.

2.13 Builder's Film

- A. To the underside of slabs on ground, including integral ground beams and footings, provide a polythene builder's film with a minimum thickness of 300 microns or, in areas prone to rising damp or salt attack, a damp-proofing membrane.
- B. Standard: To AS 2870.
- C. Lay underlay over the base as follows:
 1. Lap joints at least 200mm and seal the laps and penetrations with waterproof adhesive tape.
 2. Face the laps away from the direction of concrete pour.
 3. Continue up vertical faces past the damp-proof course where applicable, and tape fix at the top.
 4. Patch or seal punctures or tears before placing concrete.
 5. Cut back as required after concrete has gained strength and formwork has been removed.

2.14 Movement Joints

- A. Manufacturer/ reference: Latham, Construction Specialties or acceptable equivalent expansion/ movement joints with duty and movement capabilities suitable for the particular application and as recommended by the manufacturer.

- B. Movement joints shall be set to the required height using plastic packers at the mechanical fixing position and then fixed into place. High strength, non-shrink grout shall be applied under the joint to set it firmly in place. Finish off the concrete to either side of the joint for a seamless, flush and uniform finish
- C. All movement joints shall be proprietary types as recommended by the manufacturer for the particular situation and able to cater for building movements as specified by the Structural Engineer.
- D. Unless otherwise accepted by the Superintendent, all movement joints shall be stainless steel and set flush with the adjacent floor finish.

3 EXECUTION

3.1 Generally

- A. Refer to the Structural Engineer's Specifications.

3.2 Batching, Mixing and Transport

- A. Ensure that accurate and consistent batching and mixing is carried out to achieve the specified quality of finish. For example, added water shall allow for the moisture content of the aggregate to achieve a similar slump for each mix.
- B. Consideration shall be given to the use of a dedicated main mixing and batching plant to avoid contamination of the mix. A standby back-up plant capable of providing equivalent mix and batching facilities shall also be available.

3.3 Storage

- A. Suitably store all materials on Site, clear of the ground with protection from inclement weather and contamination by other materials, and keep dry.

3.4 Day Joints

- A. Submit Shop Drawings showing proposed day joint locations, together with details of proposed methods of construction for acceptance by the Superintendent.

3.5 Construction of Formwork Generally

- A. Formwork design and construction for formed surface finishes to be in accordance with AS 3610.
- B. Formwork components to be designed to carry the loads imposed on the formwork.
- C. Formwork shall not have any splits, cracks or other defects. The faces and edges of formwork shall be clean and the formwork face free from projecting nails.
- D. Formwork that has been previously used shall be repaired and the edge resealed before it is erected. Formwork, which in the opinion of the Head Contractor has deteriorated to an extent such that it will not produce the specified finish, shall not be used for that class or a higher class of finish.
- E. Formwork shall be firmly supported and individual panels shall be rigid. Joints between formwork panels, stop ends and adjoining concrete shall be tight and not permit grout loss.
- F. Formwork shall be cut in such a manner that reinforcement and built-in components passing through the formwork are maintained in position. The joint shall be tight and not permit grout loss. Installation of built-in components shall be accurate, at least within the tolerances for that element.
- G. Formers for profiled formwork, chamfers, splays, rebates, curved troughs and other features shall be rigidly and evenly fixed to the formwork along the complete length, shall not permit grout loss and shall provide a finish indistinguishable from the main formwork.
- H. Formwork ties and components shall be fixed in such a manner that they do not touch reinforcement or built-in components. Formwork ties and components shall fit tightly against formwork faces and not permit grout loss.
- I. Formwork panels for all finishes shall be the same size unless otherwise specified and shall form a regular pattern for acceptance by the Superintendent. The special finish size and layout shall be as indicated in the Design Drawings. The lines of joints between panels shall form smooth lines consistent with the surface geometry and as indicated on the Design Drawings, and are subject to the acceptance of the Superintendent. The number of make-up pieces shall be kept to a minimum.
- J. Unless otherwise permitted by the Superintendent, provide chamfers for all external angles of 90° or less in concrete surfaces with plain or fine finishes as indicated on the Design Drawings.
- K. Formwork for curved concrete surfaces shall not be made from a series of facets, unless indicated on the Design Drawings.

3.6 Construction of Formwork for Class 2 Concrete Finishes

- A. Obtain formwork from one source. Different types of formwork shall not be mixed unless permitted by the Superintendent. Damaged formwork and steel framework shall not be used unless permitted by the Superintendent.
- B. Joints between formwork panels and between the formwork and stop ends, adjoining concrete and built-in components shall be sealed with gaskets with rubber, flexible foamed polyurethane or other material permitted by the Superintendent. The gaskets shall be fixed firmly and evenly to the formwork. The joints shall not be sealed by tape fixed to the formwork faces, by putty or by other sealants.
- C. Formwork shall be protected from spillages, rust marks, stains and any other debris or harm whatsoever.
- D. All formwork shall have corner protection during construction cycles.

3.7 Tolerances

- A. As a minimum, concrete shall meet the tolerances nominated in AS 3600, AS 3610, and as noted below:
 - 1. Slabs:
 - a) The maximum deviation from any nominated height, plan or cross-sectional dimension shall be the greater of 1/200 times the nominated dimension or 5mm.
 - b) The maximum deviation from the nominated surface level shall be ± 10 mm.
 - 2. Columns and walls:
 - a) The maximum deviation from the nominated plan or elevation position shall be ± 15 mm.
 - b) The maximum deviation in plumbness of any vertical element shall be ± 10 mm.
 - 3. The location of built-in items or embedments in any concrete element shall not exceed ± 10 mm from the stated location.
 - 4. Anchor bolt groups for structural steel: To AS/NZS 5131.
 - 5. Other fixing bolts: 3mm.

Table 1 - UNFORMED SURFACE FINISHES TOLERANCE CLASSES

Class	Measurement	Maximum deviation (mm)
A	3000mm straight edge	3
B	3000mm straight edge	6
C	600mm straight edge	6

- 6. The flatness of horizontal (as laid) concrete generally shall be determined using a straight edge placed anywhere on the surface in any direction and not exceed the following and shall be in accordance with the Flatness tolerance class table and associated Australian Standards and publications:
 - a) Floors specified or scheduled to receive carpet (broadloom or tiles) (Class A): The maximum deviation under a 3000mm straight edge shall be 3mm, when laid in any direction or as recommended and stated in AS 2455.1, which ever is the more onerous.
 - b) Floors specified or scheduled to receive sheet or tile finishes such as vinyl, linoleum, rubber, seamless liquid applied finish and the like (Class A): The maximum deviation under a 3000mm straight edge shall be 3mm, when laid in any direction or as recommended and stated in AS 1884, whichever is more onerous.
 - c) Floors specified or scheduled to receive tile finishes such as ceramic, porcelain, stone and the like (Class B): The maximum deviation under a 3000mm straight edge shall be 6mm, when laid in any direction or as recommended and stated in AS 3958.1, which ever is the more onerous. Where thick adhesive or mortar bedding is specified for tile bedding, deviation may vary in accordance with AS 3958.1.

- d) Floors specified or scheduled to receive under sheet or liquid applied waterproofing membrane (Class A): The maximum deviation under a 3000mm straight edge shall be 3mm.
- e) Floors requiring a topping slab or bonded bedding (Class C): The maximum deviation under a 600mm straight edge shall be 6mm.
- f) Exposed concrete flooring (Class A): The maximum deviation under a 3000mm straight edge shall be 3mm.
- g) Footpaths specified or scheduled: The maximum vertical deviation when measured under a 4000mm straight edge shall be ± 10 mm.
- h) All other as-laid floors: The maximum deviation under a 3000mm straight edge laid in any direction shall be 12mm. In accordance with the CCA publication 'Tolerances for Concrete Surfaces'.
- i) Concrete retaining walls specified or scheduled (Class C): The maximum deviation under a 600mm straight edge shall be 6mm.
- j) Rectify non-conforming 'as laid' concrete by suitable procedures, such as levelling compounds or grinding.

B. Tolerances shall not be cumulative.

3.8 Concrete Chamfers/ Edge Dimensions

- A. Unless indicated otherwise on the Design Drawings chamfer dimensions shall be as follows:
 - 1. In situ concrete generally: 15mm x 15mm.
 - 2. Concrete columns: 15mm x 15mm.
- B. Unless detailed otherwise, provide chamfers to all external corners/ edges to concrete slabs, beams, columns and soffits. Provide fillets to internal corners as for chamfers.
- C. Chamfer edges shall be straight and sharp.
- D. Edge straightness shall not vary more than ± 3 mm over a 3000mm length and not more than ± 5 mm over the total length of the chamfer.

3.9 Joints in Formwork

- A. Joints in formwork, including joints between forms and completed work shall prevent grout loss.
- B. Where formwork joints are featured on the Design Drawings, ensure that all joints are left clean and true to the pattern shown.
- C. The overall jointing patterns shall be maintained and be regular throughout the project.
- D. Alignment of rebates and mould levelling, especially to the side of the moulds, shall be levelled to give a finished surface of ± 1 mm from the adjacent panel or joint.
- E. Construct formwork, including joints in form linings and between forms and completed work to prevent loss of grout, using seals when necessary. Secure formwork tightly against adjacent concrete to prevent formation of steps.

3.10 Cleaning Formwork

- A. Remove all rubbish, chippings, shavings, sawdust or dirt from formwork before concreting in.
- B. Treat all formwork with release agent in accordance with the manufacturer's recommendations in order to achieve the required finish.
- C. Ensure that reinforcement of concrete at construction joints is not contaminated with release oil, to the satisfaction of the Superintendent.
- D. Use retarding agent only when accepted by the Superintendent.

3.11 Final Fixings

- A. Obtain acceptance from the Superintendent for the appearance of each elevation before tightening fixings, filling bed joints and dowel pockets or sealing joints.
- B. Obtain acceptance from the Superintendent for each bay of soffit panels before casting in situ topping.
- C. Where appropriate, tighten threaded fastenings to torque figures recommended by the manufacturer. Do not overtighten restraint fixings intended to permit lateral movement.
- D. Fill dowel bars and recessed lifting devices with a polyester mix, well tamped in and not in the visible faces of the unit without prior acceptance by the Superintendent.

3.12 Curing

A. Refer to the Structural Engineer's details.

3.13 Protection

A. Protection of work:

1. Provide full and adequate protection against the effect of weather for the in situ concrete works until the building is watertight.
2. Provide full and adequate protection for the concrete, against damage, until Practical Completion.
3. The protective measures used shall not in any way permanently mark or damage the concrete finishes.

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SECTION 0316 -- PRECAST CONCRETE FINISHES (ARCHITECTURAL REQUIREMENTS)

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Finish to precast concrete panels
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. A 600mm x 600mm samples of each type of precast concrete finish using proposed formwork, concrete mix, oxide admix and surface treatments as applicable.

1.4 Sample Panels

- A. Construct sample panels of the following:
1. Provide a Sample Panel of Class 2 precast concrete finish, nominally 1800mm long x 1800mm high, including arris treatment at edges, applied finish as specified and demonstrating the proposed finish and colour control to both sides.

1.5 Prototypes

- A. Provide the following prototype in accordance with Section 0171 as follows:
1. A 2000mm wide x 2000mm high sample panel incorporating vertical and horizontal precast panel joints including chamfers and any panel grooves.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first precast unit of each type of finish installed on Site and accepted by the Superintendent, representing the acceptable level of finish.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Moulds for precast concrete, at the factory, prior to placing reinforcement and pouring concrete.
 2. Formwork dimensions and stability.
 3. Panel edge details and penetrations.
 4. Precast panels, at the factory, ready for delivery to the Site.
 5. Precast panels, delivered to the site, before installation.
 6. Completion of precast panel installation.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings of precast concrete elements showing the proposed details for their design, manufacture, assembly, transport and installation, including the following:
1. Marking plans and elevations referenced to the building grids and floors to locate each precast element.
 2. Shape or profile drawings (submit before fabrication of moulds and tooling).
 3. Concrete mix and type of cement.
 4. Locations, sizes, details, materials, corrosion protection and grades of cast-in ferrules, locating plates and angles, cut outs and openings, bolts, anchors and lifting devices.

5. Cast-in services.
 6. Site fitments.
 7. Details of all joints, caulking, baffles and waterproofing.
 8. Surface finish class and surface treatment, if applicable.
 9. Curing and protection methods.
 10. Weight of precast elements.
 11. Calculated maximum loading on lifting and bracing inserts and attachments.
 12. Equipment and methods for handling, transport and installation, including lifting inserts and pick-up points.
 13. Specification of plugs for sealing recesses for cast-in fixings.
- B. All interfaces shall be shown on the Shop Drawings particularly in respect to corner junctions, connections and interfaces with other trades.

1.10 Testing Requirements

- A. Refer to the Structural Engineer's Specification.

2 PRODUCTS

2.1 General

- A. The quality of concrete finish shall comply with AS 3610.1, AS 3600 and AS 1379 and Conform to NP PCH (Precast concrete handbook).
1. Formed surfaces finish quality to comply with AS 3610.1 Table 3.3.3.1.
- B. Concrete shall be a mixture of cement, aggregates and water with or without the addition of chemical admixtures or other materials as specified, with finishes as defined by the following clauses.
- C. Aggregates: AS 2758.1.
- D. Cement: To AS 3972.
1. Age: Less than 6 months old.
 2. Storage: Store cement bags under cover and above ground.
- E. Water: To AS 1379 clause 2.4.
1. Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.
- F. Chemical admixtures: To AS 1478.1, used to the manufacturer's recommendations.
- G. Provide finishes to formed and unformed concrete surfaces which are:
1. Appropriate to the importance (visual or physical) of the concrete elements.
 2. Compatible with subsequent trades and finishes.
 3. Compatible with the uses and functions.
- H. Ensure that all top surfaces of walls externally are positively drained with no pooling or ponding.
- I. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Precast Concrete Finish - Class 2

- A. Class 2 (Normal class) precast concrete: Concrete with finish of uniform quality and texture, in accordance with AS 3610, and include the following requirements:
1. Surface finish class 2 formwork.
 2. Colour control: Class 2C grey scale concrete with a tonal range in accordance with AS 3610 and to the acceptance of the Superintendent.
 3. Surface face: Refer to the Master Schedule.
 4. Surface pattern: As indicated on the Design Drawings.
- B. Applied Surface Finish: Refer to the Master Schedule.

2.3 Other Finishes

- A. Take responsibility for the finishes of normally concealed or buried concrete not identified on the Design Drawings taking into account the finish, treatment, application of further materials, coatings or beddings.

2.4 Sizes Generally

- A. The precast concrete units shall be worked to sizes defined by the Design Drawings and be within the specified tolerances. They shall be reasonably square at the back and without broken corners that may impair the strength of the fixings system.
- B. Broken corners shall not be permitted to any visible elements.

2.5 Moulds Generally

- A. Moulds shall be constructed so that casting deviations can be readily controlled to give compliance with the Specification.
- B. Moulds shall be maintained in clean, sound condition and inspected carefully for defects before each reuse. Damaged moulds shall not be repaired and reused if this would impair the surface appearance of the units.
- C. Moulds shall be designed to permit demoulding without damage to the units.
- D. Where applicable, moulds shall be coated evenly with a suitable release agent, which shall not be allowed to touch the reinforcement. Application shall be in such a way so that puddling and concentrations in corners, etc, are prevented.
- E. Moulds shall be constructed of mould lining that is an impervious material suitable to provide the consistency of finish required and selected to provide crisp edge details as indicated on the Design Drawings. The mould linings shall not be of steel unless agreed with the Superintendent. Materials for fillets, etc, required to achieve features shall be chosen to provide a finish identical to the finish of the body of the unit.
- F. Any joints and fixings in mould linings shall be sealed to prevent grout loss defects and shall be such as to result in no visible change in plane of the concrete and no change in the finish whatsoever.
- G. The mould linings shall have no variations in stiffness that may produce differences in vibration across the mould surface.
- H. The mould linings shall be replaced after the agreed maximum number of casts, or when damage or defects are discovered, whichever is the sooner.
- I. Before casting, ensure that moulds have been checked to be free from dust, reinforcement clippings and other debris.
- J. Inform the Superintendent when each mould is complete and not less than 10 working days before commencing manufacture of units.
- K. Moulds for features, etc, shall not have any splits, cracks or other defects.
- L. Moulds that have been previously used shall be repaired and the edges resealed before they are assembled. Moulds, which have deteriorated to such an extent that they shall not produce the specified finish, shall not be used for that class or a higher class of finish.
- M. Moulds shall be cut in such a manner that reinforcement and built-in components passing through the moulds are maintained in position; the joint shall be tight and shall not permit grout loss.
- N. Formers for profiled work, chamfers, splays, rebates, curved troughs and other features shall be rigidly and evenly fixed to the formwork along the complete length and shall not permit grout loss.
- O. Moulds shall be designed to be consistent with the geometry and as indicated on the Design Drawings, for acceptance by the Superintendent. The lines of joints between units shall form smooth curved lines consistent with the geometry and as indicated on the Design Drawings, for acceptance by the Superintendent. The number of make-up pieces shall be kept to a minimum.
- P. Holes left by ties and components in concrete surfaces shall be in line horizontally and vertically and shall form a regular pattern for acceptance by the Superintendent.
- Q. Unless otherwise indicated on the Design Drawings, chamfers shall be provided for all external angles of 90° or less in concrete surfaces with plain or fine finishes.
- R. Moulds for curved concrete surfaces shall not be made up from a series of facets, unless indicated on the Design Drawings.
- S. Materials for moulds shall be obtained from one source. Damaged moulds shall not be used unless permitted by the Superintendent. Propose materials for use in moulds, for acceptance by the Superintendent.
- T. Moulds shall be protected from damage, including cracking, dents, spillages, rust marks, stains or any other debris or harm whatsoever.

2.6 Built-In Components

- A. Built-in components, cast-in items, void formers and box-outs shall be fixed in position before concreting. Unless permitted by the Superintendent, void formers and box-outs shall not be used instead of built-in components. Polystyrene shall not be used for void formers and box-outs unless permitted by the Superintendent.
- B. Do not cut hardened concrete to provide holes or chases.
- C. Correctly locate and secure pipe sleeves, inserts and ducts in place. Formwork for all openings, chases and holes in columns and units shall be constructed in such a way that it does not interfere with the reinforcement.
- D. Formwork moulds shall be rigid and free from movement that shall affect their performance with regard to tolerances or colour of concrete. Allow for all necessary mid-rib reinforcement of the moulds.

2.7 Colour Consistency

- A. The consistency of the concrete colour is of great importance. Select all suppliers, materials and all methods to ensure the specified finish and consistency, including but not limited to the following:
 - 1. The main plant shall have a consistent supply to achieve the specified finish.
 - 2. The back-up plant shall be selected to achieve an equivalent supply.
 - 3. Cement, fines and other aggregates shall be from one region/ source in order to achieve consistent concrete colour.
- B. Colour shall be within the relevant tonal scale range as defined in AS 3610 for the specific class of finish or as agreed with the Superintendent based on the benchmarks or samples which shall then become the colour standard for the project.
- C. Concrete colour and consistency must be uniform in colour and texture with no discolouration.
- D. Coloured concrete must be cured in accordance with where curing compounds are used.
- E. Colour consistency problems, for example inherent colour variation, aggregate transparency or loss or movement of water, shall be avoided and appropriate measures taken. These include but are not limited to:
 - 1. Ensuring the continuity of supply from one source for the duration of the work under the Contract. Any back-up plant shall have an equivalent supply.
 - 2. Batching the concrete precisely and mixing thoroughly.
 - 3. Bracing or stiffening the formwork to reduce flexibility.
 - 4. Ensuring that the formwork face material has a uniform absorbency.
- F. Prevent surface blemishing and do not cure with plastic sheeting, intermittent wetting and drying, membranes, paper, sodium or fluoro-silicate hardeners and other compounds which can cause discolouration.

2.8 Aggregates

- A. Aggregates shall be selected in accordance with the recommendations of AS 2758.1, of consistent colour, free from absorbent particles that may cause pop-outs and other particles such as coal and iron sulphide that may be unsightly or cause unacceptable staining. Obtain aggregates from one source, and ensure that adequate supplies can be maintained throughout the Contract. Submit evidence to demonstrate compliance in respect of compressive strength and free water/ cement ratio.

2.9 Materials Generally

- A. Materials shall be consistent and from the same source. It is essential to bulk purchase and premix a material where inconsistency is a risk (e.g. the aggregate). The cement shall be grey ordinary Portland cement unless otherwise stated or agreed with the Superintendent.

2.10 Dowels/ Fixings

- A. All dowels and fixings shall be concealed when fixed in position.
- B. Dowels/ fixings shall be stainless steel grade 316.

2.11 Quality Control General

- A. Conform to the procedures of the Australian Pre-Mixed Concrete Association and AS 1379.
- B. Quality control/ monitoring requirements:
 - 1. Proposals shall be submitted for ongoing monitoring and quality control of the concrete.

2. Set up a system of "Hold" and "Monitor" points to ensure that the quality achieved is accepted by the Superintendent prior to further pours proceeding.
3. As soon as possible after any concrete has been deemed as unacceptable within the requirements of the Specification, submit proposals to the Superintendent for the removal and reconstruction of that section of concrete.

2.12 Batching, Mixing and Transport

- A. Extreme care shall be taken to ensure that accurate and consistent batching and mixing are carried out to achieve the specified quality of finish. For example, added water shall allow for the moisture content of the aggregate to achieve a similar slump for each mix.
- B. Proposals shall be submitted demonstrating the proposed methods of practice.
- C. Consideration shall be given to the use of a dedicated main mixing and batching plant to avoid contamination of the mix. A standby back-up plant shall also be available capable of providing equivalent mix and batching facilities.

2.13 Construction

- A. Precast concrete units forming permanent shuttering for concrete slabs and walls shall incorporate joints that are fully watertight to prevent any water or grout seepage/ loss through joints during concrete curing which may lead to staining of visible faces of precast concrete. Such joints shall provide continuous impervious water retention with no weak points or areas of local leakage. Provide details of methods and sealant material for achieving this for acceptance by the Superintendent.

2.14 Inserts, Holes and Chases

- A. Confirm all positions and details to ensure that alterations to and decisions about the size and location of inserts, holes and chases are not made without acceptance by the Superintendent.
- B. Fix inserts or box-outs in the correct positions before placing concrete. Form all holes and chases. Do not cut hardened concrete without acceptance from the Superintendent.
 1. For tolerances to fixings and embedded items in precast elements refer To AS 3850.2 Table 3.11(B) and AS 3610.1 Table 3.4.3.
- C. Ensure that all fixings and holding-down bolts, etc, are not disturbed or damaged during construction.

2.15 Production Control Unit(s)

- A. The first unit produced of each type shall be inspected by the Superintendent. If its appearance is accepted it shall be clearly marked and kept safely at the factory as a control standard for appearance of subsequently produced units.
- B. Allow for inspection of all units and provide adequate space and facilities for full inspection of all surfaces.

2.16 Inspection

- A. Carefully inspect and check that all completed match accepted sample(s) or control unit(s) and comply with the Specification before dispatch to Site. Make arrangements for the Superintendent to inspect the completed units in the factory.

2.17 Records

- A. Keep complete records for each unit including the following information:
 1. Unique identification number.
 2. Correlation with records of mixes, including batch numbers.
 3. Date of each stage of manufacture.
 4. Dates and results of all tests, checks and inspections.
 5. Dimensions related to specified levels of accuracy.
 6. Specific location in the finished work.
 7. Details of any damage.
 8. Any other pertinent data. For example, if the unit is an accepted production control unit.
- B. Records shall be available for inspection on request.

2.18 Tolerances for Manufacture

- A. Finished dimensions of completed units shall be such that the sizes fall within the nominated deviations in AS 3610.1 Table 3.3.6.2 and AS 3850.2 Clause 2.11.

1. Tolerance of curved panels are to be established through the sample panel process.
- B. Check the overall dimensions, straightness, squareness, twist and flatness of the mould(s) immediately before each reuse and of each unit as soon as possible after demoulding. Make adjustments to moulds as necessary.

2.19 Mix Proportions and Aggregate

- A. Select mix proportions and aggregate to achieve the specified colour to match the sample held at the Superintendent's office.

2.20 Damaged Units

- A. Making good shall be minimal and consistent to an accepted sample. As far as possible the finished surface shall be achieved without making good. The improvement of the surface finish by the Head Contractor (e.g. filling noticeable surface blemishes) shall be agreed with the Superintendent prior to any work being carried out. Blowholes shall be filled and all irregularities stoned off. Provide continuity of personnel for making good, where required, to the satisfaction of the Superintendent.
- B. Components having arrises or faces that are broken, chipped, cracked, crazed, honeycombed, irregular, inconsistent, stained or otherwise marred such that their appearance or performance is impaired are not acceptable.
- C. Submit finished samples to the Superintendent for acceptance prior to commencement. Finished samples of precast concrete units which have been submitted and accepted by the Superintendent shall be used as reference samples for all precast units prior to being passed for inclusion. Precast units may be rejected for the following reasons:
 1. Exceeding specified construction tolerances for units.
 2. Chipped, spalled or cracked units or other damage incurred during transport or construction operations.
 3. Exposed-to-view surfaces that develop surface finish deficiencies.
 4. Other defects as listed including:
 - a) Ragged or irregular edges.
 - b) Finish quality below standard set by samples.
 - c) Excessive air voids/ blowholes on exposed surfaces.
 - d) Casting lines evident from different placements.
 - e) Visible form joints or irregular surfaces.
 - f) Stains on unit surfaces.
 - g) Non-uniformity of colour and texture.
 - h) Effects of grout seepage.
 - i) Areas of any back-up concrete bleeding through facing concrete.
 - j) Foreign material embedded in face.
 - k) Visible repairs.
 - l) Reinforcement shadow lines.
 - m) Visible cracks.
 - n) Any damage due to erection methods, propping panels, etc.

3 EXECUTION

3.1 Storage

- A. All materials shall be suitably stored on Site, clear of the ground with protection from inclement weather, contamination by other materials and kept dry. Precast concrete units shall be stored so as to prevent soiling, chipping, warping, twisting, crushing, cracking, staining, discolouration and any mechanical damage, contamination by salts and other deleterious substances.

3.2 Marking

- A. Include the following for precast element identification:
 1. Plank thickness (mm).
 2. Number of strands.
 3. Strand diameter (mm).

4. Concrete cover (mm).
5. Remain legible until after the element has been fixed in place.
6. Not visible in the completed structure.
7. Date of casting.
8. Orientation of the element.
9. On precast elements, other than those manufactured as a standard product, indicate their location within the structure, in conformance with the marking plan.
10. Weight of the element.

3.3 Setting Out

- A. Be responsible for providing full setting-out drawings of all precast units, for acceptance by the Superintendent.

3.4 Installation and Propping

- A. Transport, erection and installation shall be in accordance with AS 3850.2.
- B. Design and develop methods of propping and alignment of precast units to achieve accurate positioning without any damage or effects on the finishes of the units.
- C. Consider locating self-aligning/ locating heads, etc, within recesses for light fittings, etc.

3.5 Final Fixings

- A. Ensure that the appearance of each elevation is acceptable before tightening the fixings, filling the bed joints and dowel pockets or sealing the joints.
- B. Where appropriate, tighten the threaded fastenings to the torque figures recommended by the manufacturer. Do not over tighten restraint fixings intended to permit lateral movement.
- C. Dowel bars and recessed lifting devices shall be filled with a polyester mix, be well tamped in and shall not be in the visible faces of the unit without prior agreement.

3.6 Damaged Units

- A. Do not repair damaged units without acceptance from the Superintendent. Such acceptance shall not be given where the proposed repair will result in reduced appearance or performance.

3.7 Cleaning

- A. Clean dirt or blemishes from exposed surfaces.
- B. Wash and rinse in accordance with the precast concrete manufacturer's recommendations.
- C. Protect adjacent surfaces from damage caused by cleaning operations.
- D. Do not use cleaning materials or processes that could alter the character of exposed finishes.

3.8 Accuracy of Erection

- A. The structure, including any fixing inserts, shall be surveyed fully before commencing erection.
- B. Each precast concrete unit shall be clearly marked with its identification symbol relative to its position. Production and storage of units shall be arranged so that delivery in accurate sequence for Site fixing is possible.
- C. Within the length of any joint (including in-line continuations across transverse joints) the greatest width shall not vary by more than $\pm 2\text{mm}$. Any variation shall be evenly distributed with no sudden changes.
- D. The average width of an individual joint between units, compared with the nominal design width of the joint as specified, shall not vary by more than $\pm 2\text{mm}$.
- E. Unit edges at a joint out of parallel shall not taper by more than 3mm, in overall height of joint between units.
- F. A jog in alignment of a unit edge from one unit to another shall not exceed 2mm.
- G. The offset in planes between the vertical faces of adjacent units across any joint shall not exceed 2mm.
- H. Aligning heads shall be incorporated into the units so as to be concealed in the final installation.

3.9 Protection

- A. Protection of the Works:

-
1. Provide full and adequate protection for the Works against the effects of weather, until the building is watertight, during storage, handling, and transport and during and after installation.
 2. Provide full and adequate protection for the Works until Practical Completion of the project, against damage or accidental spillage of liquids that may discolour the concrete finishes.
 3. The protective measures used shall not in any way permanently mark or damage the concrete finishes.

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SECTION 0331 -- MASONRY CONSTRUCTION**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Concrete blockwork.
 2. Autoclaved Aerated Concrete (AAC).
 3. Accessories:
 - a) Restraints, ties and support systems.
 - b) Joints.
 - c) Damp-proofing.
 - d) Miscellaneous items.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Face units: Submit one face units of each type illustrating the range of variation available, including colour, texture, surface irregularities, defective arrises, and shape.
 2. Sand: Submit a 2kg sample of each type of sand required to be of a particular colour, grade or source.
 3. Three of each accessory.

1.4 Sample Panels

- A. Prior to commencement, construct Sample Panels of each type of face quality walling, nominally 1800mm x 1800mm on Site, but away from the work under the Contract. The sample panels shall include a column and works interface (with anchor bolt and tie, movement joint, control joint, fire stopping with filler and mastic as applicable). Obtain acceptance from the Superintendent prior to commencement of construction for each type. If a panel is rejected construct other sample panels of each type until acceptance is obtained from the Superintendent.

1.5 Mock-ups

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First 10m² of each type, in locations to be agreed with the Superintendent, incorporating accessories as specified.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Items to be built in (located in their correct positions), including damp-proof courses, lintels, flashings and the like.
 2. Bottoms of cavities after cleaning out.
 3. Control joints ready for insertion of joint filler.
 4. Reinforcement in place in core holes before grouting.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings of masonry construction showing the following:

1. Control joints location and details.

1.10 Testing Materials

- A. Include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

1.11 Tests

- A. Type tests: Submit results, as follows:
 1. Characteristic unconfined compressive strength of masonry unit: To AS/NZS 4456.4.
 2. Determining resistance to salt attack: AS/NZS 4456.10.
- B. Test materials for durability in accordance with AS 3700 Appendix E.
 1. Acceptance criteria:
 - a) Class M2: 0.5mm.
 - b) Class M3: 0.3mm.
 - c) Class M4: 0.1mm.
- C. Test to verify conformity, as follows:
 1. Compressive strength shall comply with AS 3700 Appendix C.
 2. Flexural strength shall comply with AS 3700 Appendix D.
- D. Carry out additional testing if materials fail original test.
- E. Submit, for each type, test reports to verify the conformity of the following:
 1. Additives.
 2. Damp-proof courses.
 3. Flashings.
 4. Proprietary cold formed lintels.
 5. Wall ties.

1.12 Testing Accessories

- A. Provide independently certified test literature for each type of accessory. The test result data shall meet the requirements of the Specification.

2 PRODUCTS

2.1 General

- A. Control of the manufacture of materials and construction shall comply with AS 3700, AS/NZS 4456.4, AS/NZS 4455 and AS/NZS 4456.
- B. Masonry units shall comply with AS/NZS 4455.1.
- C. Durability of masonry below a damp-proof course shall comply with the "Exposure" category of AS 3700 Table 5.1 (salt attack resistance categories).
- D. Exposure locations: To AS 3700.
- E. Masonry walls including all connectors, fixings, and supports must be capable of maintaining the following (including but not limited to):
 1. structural integrity for the whole assembly under design loads applicable to each application;
 2. required fire resistance properties and fire ratings for the whole assembly.
- F. Provide stiffeners and additional support as nominated and as detailed by the Structural Engineer.
- G. All components incorporated in external walls, common walls, internal non-load bearing fire-resisting walls and shaft walls are to comply with Deemed-To-Satisfy provisions of Clause C1.9 of the NCC, with a spread of flame index of 0 and are to be non-combustible in accordance with AS 1530.1.
- H. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Thermal Performance of External Walls

- A. External masonry walls shall comply with Section J of the NCC as a minimum, unless nominated to higher levels in the Energy Rating Report.

2.3 Masonry Generally

- A. Special shapes: Provide special shapes where required for bond beams, lintels, corners, jambs, sash, control joints, pilasters, headers, and other special conditions as shown on the Design Drawings.
- B. Wall thickness: As indicated on the Design Drawings, to achieve the nominated performance requirements as a minimum.
- C. Nominal face size: 390mm x 190mm, unless nominated otherwise.

2.4 Concrete Blockwork Generally

- A. Proprietary concrete blockwork.
 - 1. Nominal block face size: 390mm x 190mm, unless nominated otherwise.
 - 2. Thickness, as indicated on the Design Drawings, from the following range:
 - a) Series 100: 90mm thick block units.
 - b) Series 150: 140mm thick block units.
 - c) Series 200: 190mm thick block units.
 - 3. Hollow block units reinforced and core filled where nominated by the Structural Engineer.
 - 4. Finish: Smooth, unless otherwise detailed in the Design Drawings or Schedules.
- B. Additional Information:
 - 1. Face finish: As Scheduled and indicated on the Design Drawings.
 - 2. Bond: Stretcher, unless nominated otherwise.
 - 3. Joints: Ironed, unless otherwise indicated.
 - 4. Mortar:
 - a) Type: Cement, lime and sand mortar mix.
 - b) Colour: Standard grey, unless indicated otherwise.
 - 5. Special shapes: Provide special shapes where required for bond beams, lintels, corners, jambs, sash, control joints, pilasters, headers, and other special conditions as shown on the Design Drawings.
- C. Performance requirements:
 - 1. Fire Rating: Refer to the BCA requirements.

2.5 Lightweight Masonry Walls

- A. Proprietary AAC panels to AS 5146.1.
- B. Manufacturer/ reference: CSR Hebel Powerpanel or acceptable equivalent. Steel reinforced autoclaved aerated concrete (AAC) panels.
 - 1. Panel unit: As scheduled.
 - 2. Thickness: As indicated on the Design Drawings and Schedule.

2.6 Wall Systems

- A. The proposed wall systems are indicative and shall be reviewed and assessed by the Head Contractor as acceptable to achieve the specified performance requirements. Where the Head Contractor believes a more suitable system can be achieved, they shall propose details following Contract award for the Superintendent's acceptance.

2.7 Masonry Units

- A. Standard: To AS/NZS 4455.1 and AS/NZS 4455.3.
- B. Salt attack resistance grade: To AS 3700 Table 5.1.

2.8 Mortar Materials

- A. Refer to Section 0821.

2.9 Grout

- A. Standard: To AS 3700 clause 11.7.
- B. Minimum characteristic compressive strength: 12 MPa.

2.10 Built-In Components

- A. Durability class of built-in components: To AS 3700 Table 5.1.

- B. Corrosion protection of built-in steel products shall comply with the coating thickness requirements specified in AS/ NZS 2312 as outlined in Section 0171

2.11 Lintels

- A. Concrete block lintels:
1. Provide concrete block lintels consisting of U-section blocks to match walling. Reinforce and grout in accordance with the structural engineering documents.
- B. Fabricated steel lintels:
1. Angles and flats: To AS/NZS 3679.1.
 2. Cold formed proprietary lintels: Designed to AS/NZS 4600.
 3. Corrosion protection: To AS/NZS 2699.3.
 4. Galvanising: Do not cut after galvanising.
- C. Durability of lintels and shelf angles shall be in accordance with AS/NZS 2699.3.

2.12 Reinforcement

- A. Standard: To AS/NZS 4671.
- B. Corrosion protection: To AS 3700 clause 5.9.
- C. Minimum cover: To AS 3700 Table 5.1.

2.13 Accessories Generally

- A. Accessories shall be in accordance with AS/ NZS 2699.1 and AS/ NZS 2699.2, as applicable.
- B. Materials selection for masonry accessories shall be determined in accordance with AS 3700 Table 5.1 and based on the corrosivity category of the Site as nominated in Section 0171.
- C. Refer to the Structural Engineer's Specifications.

2.14 Flashings and Damp-Proof Courses

- A. Standard: To AS/NZS 2904.
- B. Type: Bitumen-coated aluminium.
1. Thickness: In accordance with AS/NZS 2904, Table 2.

2.15 Weepholes

- A. Provide the following:
1. Plastic inserts with corrosion-resistant insect screens.
 2. Proprietary product: Weepa or acceptable equivalent.

2.16 Sills

- A. Provide sills from the manufacturer's standard range and as detailed on the Drawings.
- B. Finish: To match the wall finish.

2.17 Slip joints

- A. Standard: To AS 3700 clause 4.14.

2.18 Air Vents

- A. Air vents to blockwork:
1. Concrete framed: Bronze wire mesh in concrete frame, 390mm x 190mm.
 2. Vent blocks: Purpose-made vent blocks.

2.19 Fire Prevention Joints

- A. Provide fire prevention joint sealant as specified. Refer to Section 0681.
- B. Construction joint fire protection to comply with NCC C3.16 and AS 1530.4.
- C. Fire stopping: To AS 4072.1 and NCC Clause C3.15.

2.20 Movement Joint Sealants

- A. Filler: Submit samples for acceptance by the Superintendent.
- B. Sealant: Manufactured by Dow Corning, Sika, Radcrete Pacific, Rhone-Poulenc or acceptable equivalent. Submit silicone type for acceptance by the Superintendent.
- C. Colour: To match mortar/ wall colour and to the acceptance of the Superintendent.

3 EXECUTION

3.1 Workmanship Generally

- A. Refer to the Structural Engineer's Specifications.
- B. Workmanship shall comply with the requirements of AS 3700 and the relevant technical manuals as published by the Concrete Masonry Association of Australia (CMAA).
- C. The top course of hollow blockwork walling shall be finished using a solid block as necessary and where required to meet the fire resistance level of the wall.
- D. Installation shall be in strict accordance with the manufacturer's written instructions.

3.2 Mortar Mixing

- A. Refer to Section 0821.

3.3 Protection from Contamination

- A. General: Protect masonry materials and components from ground moisture and contamination.

3.4 Mortar Joints

- A. Solid and cored units: Lay on a full bed of mortar. Fill perpends solid. Cut mortar flush.
- B. Face-shell bedded hollow units: Fill perpends solid. Cut mortar flush.
- C. Finish: Conform to the following:
 - 1. Externally: Tool to give a dense water-shedding finish.
 - 2. Internally: If wall is to be plastered, do not rake more than 10mm to give a key.
 - 3. Thickness: 10mm.
- D. Cutting: Set out masonry with joints of uniform width and minimum cutting of masonry units.

3.5 Rate of Construction

- A. General: Regulate the rate of construction to eliminate joint deformation, slumping or instability.

3.6 Rods

- A. Set out: Construct masonry to the following rods:
 - 1. 90mm high units: 6 courses to 600mm.
 - 2. 190mm high units: 3 courses to 600mm.

3.7 Builders Work in Connection

- A. Generally:
 - 1. Holes, recesses and chases shall be in locations which shall least affect the strength, stability and sound resistance of the construction, and shall be of the smallest practicable size.
 - 2. Holes which exceed 300mm in width shall have pre-cast concrete lintels inserted to achieve structural integrity of the construction with a minimum 150mm end bearing.
 - 3. No chases shall be cut in walls of hollow cellular blocks without acceptance by the Superintendent.
 - 4. In walls of other materials:
 - a) Vertical chases shall not be deeper than one third of the single leaf thickness.
 - b) Horizontal or raking chases shall not be longer than 1000mm and not deeper than one sixth of the single leaf thickness.
 - c) No chases or recesses shall be set back to back. They shall be offset by a clear distance not less than the wall thickness. Where sockets, etc., are shown on Design Drawings as nominally back to back, obtain instructions from the Superintendent.
- B. There shall be no cutting until the mortar is fully set. Cutting shall be carefully and neatly carried out, avoiding spilling, cracking or other damage to surrounding structure.
- C. Ensure the compatibility of systems, components, materials, assemblies and work sequencing so that performance requirements continue at interfaces with adjacent work and construction.
- D. The Head Contractor shall return to complete the builders work in connection holes after the mechanical and electrical works have been installed.

3.8 Protection

- A. General: Cover the top surface of masonry to prevent the entry of rainwater and contaminants.
- B. Single leaf and solid walls: Moisture protection to AS 3700 clause 4.7.4.

3.9 Temporary Support

- A. General: If the final stability of the masonry is dependent on construction of (structural) elements after the masonry work is completed, provide proposals for temporary support or bracing.

3.10 Cleaning Facework

- A. Appropriate detailing, protection, careful finishing and progressive cleaning reduces the need for subsequent cleaning. AS 4773.2 Appendix B, provides extensive guidance on this topic. Choice of correct cleaning method is the Head Contractor's responsibility.
- B. General: Clean progressively as the work proceeds to remove mortar smears, stains and discolouration. Do not erode joints if using pressure spraying.
- C. Acid solution: Do not use.

3.11 Colour Mixing

- A. Distribution: In facework, distribute the colour range of units evenly to prevent colour concentrations and banding.

3.12 Cavity Work

- A. Cavity clearance
 - 1. General: Keep cavities clear at all times.
- B. Cavity fill
 - 1. General: Fill the cavity with mortar to 1 course above adjacent finished (ground) level. Fall the top surface towards the outer leaf.
- C. Cavity width
 - 1. General: Provide minimum cavity widths in conformance with the following:
 - a) Masonry walls: 50mm.
 - b) Masonry veneer walls: 40mm between the masonry leaf and the load bearing frame and 25mm minimum between the masonry leaf and sheet bracing.
- D. Openings
 - 1. Care: Do not close the cavity at the jambs of external openings.
- E. Wall ties connectors and accessories
 - 1. Protection: Install to prevent water passing across the cavity.

3.13 Location of Damp-Proof Courses

- A. General: Provide damp-proof courses as follows:
 - 1. Timber floors: In the first course below the level of the underside of ground floor timbers in internal walls and inner leaves of cavity walls.
 - 2. Cavity walls built off slabs on ground: In the bottom course of the outer leaf, continuous horizontally across the cavity and up the inner face bedded in mortar, turned 30mm into the inner leaf 1 course above.
 - 3. Masonry veneer construction: In the bottom course of the outer leaf, continuous horizontally across the cavity. Fasten to the inner frame 75mm above floor level.
 - 4. Walls adjoining infill floor slabs on membranes: In the course above the underside of the slab in internal walls and inner leaves of cavity walls. Project 40mm and dress down over the membrane turned up against the wall.
- B. Height: Not less than:
 - 1. 150mm above the adjacent finished ground level.
 - 2. 75mm above the finished paved or concrete area.
 - 3. 50mm above the finished paved or concreted area and protected from the direct effect of the weather.

3.14 Installation of Damp-Proof Courses

- A. General: Lay in long lengths. Lap full width at angles and intersections and at least 150mm at joints. Sandwich damp-proof courses between mortar. Step as necessary, but not exceeding:

1. 1 course per step for blockwork
- B. Bed damp-proof courses on an even bed of fresh mortar. On no account bed them dry.
- C. Seal all laps with damp-proof courses using bituminous adhesive and sealing compound in accordance with the manufacturer's written recommendations.
- D. Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses and waterproof membranes.
- E. Lap sealing: Seal with a bituminous adhesive and sealing compound.

3.15 Location of Flashings

- A. General: Provide flashings as follows:
 1. Floors: Full width of outer leaf immediately above slab or shelf angle, continuous across cavity and up the inner face bedded in mortar, turned 30mm into the inner leaf:
 - a) 1 course above for block.
 2. Under sills: 30mm into the outer leaf bed joint 1 course below the sill, extending up across the cavity and under the sill in the inner leaf or the frame. Extend at least 150mm beyond the reveals or each side of the opening.
 3. Over lintels to openings: Full width of outer leaf immediately above the lintel, continuous across cavity, turned up against the inner frame and fasten to it or turned 30mm into the inner leaf:
 - a) 1 course above for block
 - b) Extend at least 150mm beyond the lintels.
 4. At abutments with structural frames or supports: Vertical flash in the cavity using 150mm wide material, wedged and grouted into a groove in the frame opposite the cavity.
 5. At jambs: Vertically flash jamb, extending 75mm into the cavity, interleaved with the sill and head flashing at each end. Fix to jambs.
 6. At roof abutments with cavity walls: Cavity flash immediately above the roof and over-flash the roof apron flashing.

3.16 Installation of Flashings

- A. General: Sandwich flashings between mortar except where on lintels or shelf angles. Bed flashings, sills and copings in one operation to maximise adhesion.
- B. Laps: If required, lap full width at angles and intersections and at least 150mm at joints. Step as necessary, but not exceeding:
 1. 1 course per step for blockwork
- C. Lap sealing: Seal with a bituminous adhesive and sealing compound.
- D. Pointing: Point up joints around flashings, filling voids.

3.17 Ventilation Ducts

- A. Ventilation ducts shall be installed across the cavity, sloping away from the inner leaf, bedding fully in the mortar to seal cavity.
- B. Form stepped damp-proof course cavity tray above the duct, extending 150mm on each side and with stop ends.

3.18 Weepholes

- A. Location: Provide weepholes to external leaves of cavity walls in the course immediately above flashings, and cavity fill, and at the bottoms of unfilled cavities.
- B. Form: Open perpend.
- C. Maximum spacing: 1200mm.

3.19 Wall Ties

- A. General: Space wall ties in conformance with AS 3700 clause 4.10 or AS 4773.2, as appropriate, and at the following locations:
 1. Not more than 600mm in each direction.
 2. Adjacent to vertical lateral supports.
 3. Adjacent to control joints.
 4. Around openings.

- B. Fixing of masonry veneer ties:
 1. To timber frames: Screw fix to outer face of timber frames with AS 3566 fixings.
 2. To concrete: Masonry anchors.
 3. To steel frames: Screw fix to outer face of steel studs with AS 3566 fixings.

3.20 Control Joints

- A. Location and spacing: Provide contraction joints, expansion joints or articulation joints to AS 3700 clause 4.8.
- B. Control joint filling
 1. Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining. Do not use bituminous materials with absorbent masonry units.
 - a) Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
 - b) Foamed materials: Closed-cell or impregnated, not water-absorbing.
 2. Installation: Clean the joints thoroughly and insert an easily compressible backing material before sealing.
 3. Sealant depth: Fill the joints with a gun-applied flexible sealant for a depth of at least two-thirds the joint width.
- C. Fire rated control joints
 1. General: If a control joint occurs in an element of construction required to have a fire resistance rating, construct the control joint with fire stopping materials which maintain the fire resistance rating of the element.
 2. Fire stopping: To AS 4072.1. Refer Section 0681.

3.21 Lintels

- A. General: Do not cut on site. Keep lintels 10mm clear of heads of frames.
- B. Steel lintels: Pack mortar between any vertical component and supported masonry units. For angles, install the long leg vertical.
- C. Minimum bearing each end:
 1. Span 1000mm: 100mm.
 2. Span > 1000mm 3000mm: 150mm.
 3. Span > 3000mm: To structural drawings.
- D. Propping: Provide temporary props to lintels to prevent deflection or rotation.
- E. Minimum propping period: 7 days.

3.22 Slip Joints

- A. General: Provide slip joints to top of all unreinforced masonry walls supporting concrete slabs and other concrete elements.
- B. Protection: Keep the slip joints in place and protect from displacement.

3.23 Flexible Masonry Ties

- A. Provide stabilising ties at control joints and abutting structural elements, including columns, beams and slab soffits.
- B. Locations and details: To Structural Engineer's Drawings.

3.24 Tolerances

- A. To AS 3700 Table 12.1.

3.25 Adverse Weather

- A. Protect newly erected walling against rain and sun. Cover when precipitation occurs and at the completion of each day's work.

3.26 Final Clean

- A. Clean down all work immediately prior to completion or prior to the handing over of any part of the work and leave clean, to the satisfaction of the Superintendent.
- B. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh constituents.

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SECTION 0383 -- TIMBER FLOORING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Engineered timber flooring.
 2. Acoustic underlay.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 1000mm x 1000mm sample of each type of the finished timber flooring as specified demonstrating quality of finish, range of colour and variation, applied sealer, treatment of joints and fixings.
 2. Insulation material.
 3. Samples shall include subframing or structural substrate as applicable.

1.4 Mock-Ups

- A. Provide a mock-up in accordance with Section 0171 as follows:
1. Typical mock-up highlighting floor build-up and interface with expansion joints and edge details.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first 9m² of finished timber flooring installed in an area as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Substrate prior to fixing battens or laying flooring, where applicable.
 2. Moisture barrier, acoustic underlay, joists/ battens, as applicable, in place prior to fixing flooring.
 3. Flooring in place prior to sanding, application of sealer coats or and any other floor finish.
 4. Subfloor and any subfloor space before the floor laying.
 5. Trial set out: Before execution.
 6. Control joints: Before fitting skirting.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.10 Identification

- A. General: Identify timber using branding or certification.
1. Branding: Brand timber under the authority of a recognised product certification or accreditation program applicable to the product. Locate the brand mark on faces which will be concealed in the works.

2. Provide certification from the recognised product certification or accreditation programs as appropriate:
 - a) Flooring: The Australasian Timber Flooring Association's (ATFA) Accredited Timber Flooring Manufacturers Program.
 - b) Plywood and particleboard: Engineered Wood Products Association of Australia (EWPAA) Quality Control and Product Certification Schemes.

1.11 Testing Requirements

- A. Include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

1.12 Certification

- A. Certificate: Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying conformance to grading, species and board size and noting the moisture content.
- B. Inspection: If neither branding nor certification is adopted, submit a report by an independent inspecting authority verifying conformance.

1.13 Product Moisture Content

- A. Confirm that the moisture content of the timber products as delivered matches the ambient moisture content of the relevant area of the Site and where the material will be laid. If there is a mismatch allow for acclimatisation.

1.14 Slip Resistance and Slip Resistance Testing of Flooring

- A. Flooring shall be stable, safe and minimise the risk of slipping or tripping due to slippery surfaces or misaligned boards/ joints. Slip resistances shall comply with the requirements of HB 197 and HB 198.
- B. Provide slip resistance test certificates to confirm that slip resistance values are in accordance with AS 4663.
- C. Arrange and pay for on-site slip resistance testing of finished timber flooring and in sufficient number to cater for all areas and conditions including ramps, steps etc. Testing shall be undertaken by a registered testing laboratory. Tests shall include wet pendulum and dry floor friction testing in accordance with AS 4663.

2 PRODUCTS

2.1 General

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Engineered Timber Flooring

- A. Proprietary pre-finished engineered timber floor boards.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Species/ range/ grade: As scheduled.
 2. Size/ thickness: As scheduled.
 3. Finish: As scheduled.
- C. Installation: Direct stick, dual bond adhesive.
- D. Battens: Kiln dried regularised softwood free from decay and active insect attack and with no knots wider than half the width of the section.
- E. Moisture content at time of fixing: 12-14%.
- F. Spacing of battens: Laid at appropriate centres with joints staggered. Battens laid end to end.
- G. Boards: Free from decay and insect attack (including pinholes) and free from knots or splits on face to be exposed. Planed, tongued and grooved and end matched.
- H. Selected timber shall have a critical radiant flux (kw/m²) to comply with NCC specification C1.10a when tested in accordance with AS ISO 9239.1.
- I. Acoustic underlay: Glued to floor.

2.3 Acoustic Underlay Generally

- A. Provide a proprietary underlay under timber flooring where nominated on the Design Drawings.
- B. All acoustic underlay shall comply with the relevant NCC requirements.

- C. Thickness shall accommodate the required acoustic performance and shall be tested in accordance with AS/NZS ISO 140.7.
- D. Installation: Acoustic underlay shall be installed in accordance with the manufacturer's written instructions.
- E. Where adhesives are used as a means of fixing, ensure compatibility between adhesive and moisture barrier to avoid any secondary effects to the underlay.

2.4 Moisture Protection Underlay

- A. Floating floor vapour barrier: Minimum 200 micron thick high-impact resistant polyethylene film.

2.5 Timber Generally

- A. Refer to Section 0815.

2.6 Fabrication

- A. Form sections out of the solid when not specified otherwise. Carefully machine timber to accurate lengths and profiles, free from twist and bowing. After machining, surfaces shall be smooth and free from tearing, woolliness, chip bruising and other machining defects.
- B. Assemble tight and close fitting to produce rigid components free from distortion.
- C. Screw heads shall be countersunk not less than 2mm below timber surfaces that will be visible in completed work. All screws shall have appropriately sized clearance holes.
- D. Cross-sectional dimensions of timber are nominal, unless stated otherwise. Deviation from the stated sizes shall not be permitted unless prior acceptance is given by the Superintendent.
- E. Preservative treated timber: Carry out as much cutting and machining as possible before treatment. Retreat all timber that is sawn along the length, ploughed, thickened, planed or otherwise extensively processed. Treat surfaces exposed by minor cutting and drilling with two flood coats of an organic solvent compatible with wood treatment.

3 EXECUTION

3.1 Workmanship Generally

- A. Keep strips/ boards dry and do not fix to timber supports that have a moisture content greater than 18%.
- B. Methods of fixing and fastenings shall be in accordance with Section 0811 unless specified otherwise.
- C. Protect from dirt, stains and damage until Practical Completion. Lay protective coverings and boards as the work proceeds.

3.2 The Site and Environment

- A. Surface moisture barriers shall be in accordance with the timber flooring manufacturer's recommendations, lapped and taped at joints and turned up at walls.
- B. Do not start work specified in this section before building is weathertight, wet trades have finished their work and the building is well dried out, unless otherwise agreed with the Superintendent.
- C. Before, during and after laying, temperature and humidity shall be maintained at levels approximating to those that will prevail after the building is occupied.

3.3 Expansion

- A. Provide a gap at flooring edges as indicated on the Design Drawings running parallel to the lie of the strips/ boards, and a gap at least 10mm wide at each end of flooring. Remove any spacer blocks and debris before fixing skirting/ cover fillets.
- B. All requirements for expansion shall be to the manufacturer's recommendations.
- C. Form intermediate expansion and movement joints as recommended by the flooring manufacturer/ supplier.

3.4 Heating/ Air Conditioning

- A. Agree arrangements for operating the heating/ air conditioning installation up to the date of Practical Completion to ensure that excessive moisture movement of flooring/ linings does not take place.
- B. Refer to the Service Engineer's specification for temperature ranges within the building.

3.5 Fixtures

- A. Do not start work specified in this section until fixtures around which strip flooring is to be fixed have been installed.

3.6 Moisture Content of Base

- A. Concrete subfloor: Do not start installation of the flooring until the moisture content of the concrete subfloor conforms to AS 1884 clause 3.1.
- B. Timber, plywood or particleboard flooring subfloors: Do not start installation of the flooring until the moisture content of the subfloor conforms to AS 1884 clause 3.2.
- C. Where flooring is to be laid on a new concrete or screed base:
1. Ensure that drying aids have been turned off for not less than four days.
- D. Testing requirements before commencing installation:
1. Concrete subfloor: The moisture content of the concrete has been tested to AS 2455.1 Appendix B and values in clause 2.4.2 (c) have been obtained.
- E. Conformance: Confirm that the moisture content of the timber flooring products, as delivered, matches the moisture content of the subfloor as measured on site. If not allow for acclimatisation.

3.7 Acclimatisation

- A. Acclimatise the flooring by stacking it in the in-service conditions for a minimum period of two weeks with air circulation to all surfaces, after the following construction operations are complete:
1. Air conditioning operational.
 2. Lighting operational.
 3. Site drainage and stormwater works are complete.
 4. Space fully enclosed and secure.
 5. Wet work complete and dry.

3.8 Fixing Battens

- A. Space evenly and securely fix, packing or adjusting as necessary to give a true level and accurately finished surface.
- B. Batten Spacing Table:

Table 1 - Batten Spacing Table				
Strip flooring timber (average species density)	Standard	Flooring thickness (mm)	Batten spacing for flooring type	
			Butt jointed	End matched
Hardwood density 560 kg/m ³ or more	AS 2796.1	19	600	450
		25	600	450
		30	600	600
Hardwood density less than 560 kg/m ³	AS 2796.1	19	450	390
		25	600	450
		30	600	600

- C. For hardwood density calculations of timber species, refer to AS 1720.2.

3.9 Fixing

- A. Adhesive: If required, use a urethane elastomer adhesive in addition to nails as follows:
1. Continuously supported flooring: 4mm beads at 300mm spacing at right angles to run of flooring.
 2. Intermittently supported flooring: 6mm bead along each joist or batten.
- B. Movement control joints: Provide 12mm wide joints:
1. Against vertical building elements.
 2. To divide floors where required.
- C. Nailing:

1. Skew nail in a uniform pattern. Pre-drill all nails located less than 10mm from ends of sheets or boards. Undersize drill hole by 1mm.
2. Top nailing: For boards greater than 65mm cover width, use two nails per board at each joist location skewed 10° in opposite directions. Do not cramp more than 800mm width of boards at one time.
3. Secret nailing: Only where boards are less than 85mm cover width. Skew nail or staple through tongue at 45°. Only cramp one board at a time.
4. Punch nails 3mm below the finished surface and fill with a material tinted to match and compatible with the floor finish.

3.10 Tolerances

- A. Maximum deviation from a 3000mm straightedge laid in any direction on the floor surface: 3mm.

3.11 Strips and Boards

- A. Fix each strip/ board securely to give flat, true surfaces free from undulations, splits, hammer marks, scratches and protruding fastenings.
- B. Allow for movement of timber when positioning boards and fastenings to prevent cupping, springing, warping, opening of joints or other defects.
- C. Lay in straight and parallel lines with each board firmly butted to the next and firmly bedded on the subfloor.
- D. Strips and boards laid on subframing:
 1. Heading joints, where permitted, shall be end matched, tightly butted and positioned centrally over supports, not less than two board widths apart on any one support.
 2. Minimum of two spans across supports.
 3. Locate joints in boards so that they are evenly and symmetrically distributed and as follows for intermittently supported floors:
 - a) Butt joints: Centrally on supports.
 - b) End-matched joints: Not in adjacent boards.
 4. Vapour barrier under battens: 200 µm high-impact resistant polyethylene film to concrete substrate and under battened flooring. Lap 300mm, seal the laps with pressure-sensitive tape and return up the vertical surfaces and trim at the level of the flooring.
- E. Where timber flooring is laid on a concrete ground slab, apply Bostik Moisture Seal to concrete slab, and adhesive fix flooring with Bostik Ultraset Overlay, as per the manufacturer's written instructions.
- F. Where timber flooring is laid on suspended concrete slabs, a polythene sheet moisture barrier over the slab with an acoustic underlay, as specified, and plywood sheeting over.
- G. Storage:
 1. Deliver timber flooring to site in unbroken wrapping or containers and store so that its moisture content is not adversely affected. Do not store on the substrate until the moisture content of the substrate is suitable for the installation of the floor. Do not store in areas of wet plaster.

3.12 Protection

- A. General: Provide protection as follows:
 1. Floors: With hardboard taped at all butt joints. Do not cover with sheet plastic.

3.13 Spares

- A. Supply an extra 2-5% of flooring products, to be stored on site as spares.

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SECTION 0411 -- WATERPROOF MEMBRANES

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings and other related documents, provides particular requirements with respect to:
1. Sheet membranes.
 2. Liquid-applied membranes.
 3. Spray-on membranes.
 4. Inverted roof system.
 5. Drainage cells, protection boards and any other accessories required to complete the installations.
- B. Ensure that all interfaces with other trades are fully coordinated prior to commencement.

1.3 Definitions

- A. For the purposes of this worksection the definitions given in AS 4654.1 and AS 4654.2 and the following apply:
1. Where "manufacturer" is referred to, it is deemed to include the supplier.
 2. Where "supplier" is referred to, it is deemed to include the manufacturer.

1.4 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Each type of membrane, on a representative substrate where necessary.
 2. Drainage cell and geotextile fabric.
 3. Miscellaneous accessories such as reinforcing fabric, sealant, fixings, primers, adhesives, caulking and protective sheeting.
 4. Inverted roof components, including: roof insulation board; geotextile fabric; gravel ballast: 2kg minimum, demonstrating size range; three pavers.
- B. Membrane samples shall be stepped to indicate the different layers.

1.5 Mock-Ups

- A. Not required.

1.6 Prototypes

- A. Provide a prototype in accordance with Section 0171 as follows:
1. Membrane build-up demonstrating watertightness and no leakages, including build-up around typical opening and surrounding interfaces.

1.7 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. A minimum area of 9m² of each type specified in a location as agreed with the Superintendent.

1.8 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Prepared substrate prior to commencing membrane installation.
 2. Incidentals such as sealants, fillets, underflashings in place.
 3. Each completed and certified membrane installation.
 4. Drainage cell and protection board in position before backfilling.
 5. After flood testing.

1.9 Subcontractor's

- A. Each type of membrane shall be installed by the respective manufacturer's approved installer.
- B. Submit names and contact details of proposed suppliers and installers to the Superintendent.
- C. The installer of each membrane system shall be accredited under AS/NZS ISO 9001. Provide evidence of accreditation to the Superintendent.
- D. All personnel employed in the preparation and installation process shall be trained and experienced operatives.

1.10 Subcontractor's

- A. Submit names and contact details of proposed suppliers and Subcontractor.

1.11 Shop Drawings

- A. Submit Shop Drawings, calculations and specifications conveying the following information:
 - 1. Junction and capping details with parapets.
 - 2. Sump and outlet details, falls and substrate details.
 - 3. Details of interfaces and intersection with other materials.
 - 4. Membrane and associated details.
 - 5. Waterproof jointing.
 - 6. Flashings, cappings, upturns, pressure seals.
 - 7. All relevant junction details to the building fabric.
 - 8. Penetrations.
 - 9. Terminations and connections.
 - 10. All relevant accessories.
 - 11. Manufacturers' details specific to the project.
- B. Provide Shop Drawings to complete the design of the waterproofing. Detail all elements of the system at a scale of 1:5 and will coordinate with other trades and design disciplines.

1.12 Warranties

- A. Prior to Practical Completion a written warranty against defects in labour and/ or materials shall be submitted to the Superintendent for the following:
 - 1. It shall be issued jointly by the membrane supplier and the applicator and include unqualified responsibility for the correctness and sufficiency of the materials, detail design, and installation workmanship. Overall warranty to be from the supplier.
 - 2. Refer to Annexure part K of the contract for required warranty periods.
- B. The warranty for each membrane system shall consist of back-to-back warranties for installation and materials.
- C. The warranties shall cover:
 - 1. Materials and labour generally.
 - 2. Required incidentals such as sealants, flashings, drainage cell and reinforcing.
 - 3. The identification and location of defects.
 - 4. Rectification of damage resulting from membrane deficiencies.

1.13 Marking

- A. Identification: Marked to show the following:
 - 1. Manufacturer's identification.
 - 2. Product brand name.
 - 3. Product type.
 - 4. Quantity.
 - 5. Product reference code and batch number.
 - 6. Date of manufacture.
 - 7. Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern.

1.14 Certification

- A. Before starting each membrane installation on Site, provide a certificate for each stating that the respective substrates are satisfactory in all respects to receive the membranes. Each certificate shall be signed by both the installer and the Head Contractor.
- B. On completion of each membrane type, area or zone, provide a certificate for each stating that work under the Contract has been carried out and tested in accordance with the requirements of the Specification. Each certificate shall be signed by the installer and the Head Contractor. The certificates shall be provided before any backfilling, covering over, decoration or other concealment.
- C. Each type of certificate referred to in this clause shall be provided to the Superintendent in duplicate.

1.15 Test Requirements

- A. Provide each manufacturer's materials type test data if requested by the Superintendent.
- B. Carry out the specified tests and provide copies of test reports to the Superintendent.
- C. Invite the Superintendent to be present at all quality control testing.

1.16 Waterproofing and Watertightness Testing

- A. Undertake all required tests, confirming water tightness and performance requirements of the installation. All test locations and results to be documented for future reference and will become part of the warranty documentation.
- B. Sequence the testing to precede any concealment of the tested area. The Head Contractor is to obtain manufacturer's sign off for the test results and compliance with the project specific Specification.
- C. Irrespective of the above, as a minimum, all installations must be tested for the following unless alternative test methods are approved by the Superintendent and recommended by the manufacturer in writing.
- D. Conduct test preparations in conjunction with the manufacturer and the Superintendent prior to concluding the tests. Provide Shop Drawings of test locations.
- E. Promptly investigate leakage, identified by testing or other inspections, report on the cause of the defect with rectification proposal for the Superintendent's approval. Document rectification methods and include in warranty documentation.
- F. Rectify the defective area in a method agreed with the manufacturer and the Superintendent. Repeat the tests until compliant performance is achieved and confirmed. Verify and confirm that the cause of the identified defect is unlikely to reoccur at other treated areas.
- G. Failure to acquire the Superintendent's approval of the test results for each area will automatically render the treatment defective. The Head Contractor will be required to carry out the omitted tests in compliance with the criteria noted herein and reimburse all costs including consequential damages like making good by other trades to the Principal.

1.17 Dry Film Thickness Test

- A. Confirm minimum thickness specified (minimum of 1 test per 25m². area with Elcometer or equivalent).

1.18 Pin Hole Detection Test

- A. Test the entire area with a holiday tester.

1.19 Elongation Tests

- A. For two part elastomeric spray-on waterproofing membranes provide elongation test results from samples taken on site.

1.20 Moisture Content Test

- A. Substrate is to be tested to have a relative humidity of 75% before applying waterproof membranes, test to be carried out in accordance with ASTM F2170.

1.21 Adhesion Testing

- A. Adhesion to substrate to ASTM D7105.
- B. Undertake a minimum of one test per 25m² of membrane area using an elcometer adhesion tester or equivalent. Adhesion results shall not be less than 1MPa unless otherwise agreed in advance with the Superintendent.

1.22 Substrate Preparation Testing

- A. Inspect and test all substrates to ascertain whether the concrete has been treated in any way which may affect the membrane and if any of the following additives have been included in or on the substrates:
 1. Silicone based waterproofing treatments.
 2. Hydrophobic waterproofing treatments.
 3. Concrete curing agents.
 4. Heavy duty sealers.
 5. Other additives and applications.
 6. Burnished concrete.
 7. Grease, paint, oil or other similar substances.
 - a) Any of the above or other which may interfere with the adhesion of waterproofing systems to the substrates.
- B. Concrete substrates to be tested according to ASTM D4263 to ensure they are properly cured.
- C. Before commencement of work, obtain from the materials manufacturers, certification of acceptance of the substrates for approval.
- D. Notify the Superintendent in writing of any serious defect or condition of surfaces or supports that will interfere with or prevent the achievement of a first class standard of workmanship.
- E. Do not proceed with any work until such defect or conditions have been corrected. However, before commencement of the waterproofing membrane system application, obtain certification from the materials manufacturer that the substrate is acceptable for application of the waterproofing membrane system.

1.23 Slip Resistance and Slip Resistance Testing

- A. Test Certificates:
 1. Installed surfaces shall be stable, safe and minimise risk of slipping or tripping due to slippery surfaces. Slip resistance shall comply with AS 4586.
 2. Slip resistance test certificates shall be provided in accordance with the relevant codes (AS 4586, AS 4663, HB 197 and HB 198) to confirm slip resistance ratings are as per that specified for each relevant membrane. Batch testing to be carried out in accordance with the requirements of AS 4586 and provision of certification that the batches provided to the project have been tested not more than 12 months prior to their installation into the project.
 3. Where no slip resistance criteria is specified materials complying with HB 197 and HB 198 recommendations for specific usages will be submitted for approval prior to ordering. Provide test certification in the same manner as those covered by the specified slip resistance rating.
 4. Where alternative options are available, alternatives must only be proposed where they meet the same specified slip resistance criteria and have valid up to date test certificates to validate the slip resistance.
 5. No material shall be supplied or installed until the manufacturer's slip resistance test results have been submitted and approved by the Superintendent.
 6. As installed tests:
 - a) Certify that representative areas for all types fully installed into the project have been Site tested and comply with the required slip resistance design criteria. Representative areas are to be determined by the certifying authority and/ or as set out in the relevant standard, whichever is the greater.
 - b) Failure of the materials in the as-installed state to meet the required slip resistance as specified and provided in the batch testing or other manufacturer test results will require the defective materials to be removed and replaced with a new material of the same required slip resistance as specified. Materials re-laid are to be retested in situ. This process shall be continued until as-installed slip resistance values as specified are met. All such works shall be the Head Contractor's expense.
 7. Accelerated wear test:
 - a) Accelerated wear tests are to be carried out by a registered testing agency to verify that the slip resistance requirements specified are met after the accelerated wear tests were conducted.

- b) Testing results are to be provided and approved by the Superintendent prior to ordering any materials.

1.24 Flood Testing

- A. Flood test completed membranes to ASTM D5957.
- B. All wet areas, including balconies, are to be flood tested and other areas as directed by the Principal.
- C. Externally cover and seal all outlets and protect against damage from water pressure with temporary kerbs. Do not use plugs to seal outlets.
- D. Measure wall/floor junctions of adjacent spaces and of the slab soffit below for dryness using electrical resistance testing to AS 1884 Appendix A.
- E. Carefully flood to a minimum depth of 50mm, but in no case higher than existing kerb levels, and leave for a period of two days. Make a visual inspection of the wall/floor junction of adjacent spaces and of the slab soffit below for obvious water or moisture. Ensure regular inspection for leaks are made and record the results for each area.
- F. Test the same areas for dryness using a moisture meter, and compare the results to the measurements taken before the flood test.
- G. Provide temporary overflows of the same capacity as the roof outlets to maintain the flood level.
- H. On completion of testing, slowly drain tested areas ensuring that outlets do not overload or flood.
- I. Conformance:
 1. Evidence of water from the visual test: Failure.
 2. No visual evidence of water: Proceed with the moisture meter test.
 3. Increase in test results before and after flooding: Failure
- J. Where leaks have occurred, submit to the Superintendent detailed proposals for remedial measures.
- K. After acceptance by the Superintendent and completion of proposed work under the Contract, the flood test of repaired areas shall be re-applied. Only when a flood tested area has shown no leakage for a period of seven days will further work on that area be permitted.

1.25 Intent and Performance Requirements

- A. The waterproofing system (WPS) must be designed and installed by a specialist Waterproofing Head Contractor, approved by the product manufacturer and the Superintendent.
- B. Comply with the design documents which provide the design intent only.
- C. These documents will provide waterproofing systems compliant with the following performance criteria as a minimum and as relevant for each project area:
 1. Be fit for purpose
 2. Be waterproof.
 3. Accommodates the full range of the nominated movements, including shrinkage, structural, thermal and differential movements. Accommodate permanent and transient loads without performance compromise.
 4. Provides adequate means of dealing with vapour pressure, condensation, movement due to long term curing of the low shrinkage waterproof concrete substrates, corrosion and thermal movement.
 5. Compatible with applied finishes which may include landscaped overburden, asphalt road paving, tile/ stone paving and concrete paving without impairment of performance.
 6. Is certified that it will not produce any migration of phthalates, phenyls, aromatics nor plasticiser compounds into the drainage water or the soil.
 7. Is compatible with fertilizer components and suitable for landscaped areas
 8. The membrane material has complete resistance to intrusion by aggressive plant roots for landscape areas.
 9. Has curing time constraints which do not interfere with the programme for following trades
 10. Where exposed: is stable to naturally occurring radiation including UV.
 11. Can be repaired to same standard as undamaged installation.
 12. Where required to be trafficable, it is abrasion, impact, puncture and slip resistant to the degree necessary for the relevant traffic load.

13. Where exposed to aggressive chemicals, oils and fuels, is suitably resistant to the relevant risk
14. Will maintain waterproofing integrity at all large and small penetrations at all separation, joints, expansion and contraction joints, control and isolation joints, internal and external angles, at all terminations.

2 PRODUCTS

2.1 General Requirements

- A. Each waterproofing system shall be complete with all the necessary components, including primers, membranes, top coatings, geotextile fabric, drainage cells, flashings, overflashings, cappings, base angles, reglets, joint and penetration details, caulking, sealing, pointing, grouting, protection system, and all other required for proper completion of each installation.
- B. Above ground external waterproofing systems shall comply with the requirements of AS 4654.1 and AS 4654.2.
- C. All products shall comply with the manufacturer's current technical data sheets.
 1. Apply winter or summer blend appropriate to the prevailing weather.
- D. Materials which overlap, interface with or are used in conjunction with other waterproofing components or products, shall be compatible.
- E. Unless accepted to the contrary by the Superintendent, no proprietary systems and products shall be used unless accepted in writing by the Australian Building Codes Board.
- F. Liquid-applied membranes to wet areas are to comply with AS 3740, AS/NZS 4858, AS/NZS 3500 Set and SA variation to NCC Clause F1.7.
- G. For waterproofing admixtures to concrete, refer to the structural engineering documents.
- H. For membranes under slabs-on-ground, refer to the structural engineering documents.
- I. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Internal Wet Area Membrane

- A. Locations: Generally to all amenities, WCs, showers, powder rooms, laundries, cleaner's rooms and the like as nominated on the Design Drawings.
 1. Extent including but not limited to: Whole of the floor area with 200mm minimum turn up at walls, wall areas in around showers, wall areas at basin tubs and sinks.
 2. Substrate: Cementitious screed graded to fall on/ or new reinforced concrete.
 3. Overlay: Tiling, unless indicated otherwise on the Design Drawings and Schedules.
- B. Type:
 1. Membrane type: A 2-component cementitious acrylic-modified liquid waterproofing membrane with reinforcement, which forms a fully-bonded elastomeric sheet after curing.
 2. Manufacturer/ reference: Ardex WPM002 (Superflex Two Part Bathroom and Balcony), or acceptable equivalent.
 - a) Provide an additional membrane in the form of a tray under showers and other immersed wet floor areas.
 - b) Installation: This tray will be installed using a 1-part polyurethane membrane system.
 - c) System to be: Dampfix PU; Sikalastic 450; Sonoshield Sonoguard; Vulkem35; Enviro 500 PUR, or acceptable equivalent.
- C. Characteristics:
 1. Number of coats: 2.
 2. Total thickness (minimum): Floors: 1.2mm; Walls: 0.8mm.
- D. Performance requirements:
 1. Resistant to permanent wetness.
 2. Falls to floor wastes, inclusive of puddle flanges:
 - a) Generally: 1:80 minimum.
 - b) Shower areas: 1:60 minimum.

2.3 Sheet Membranes (Sub-Terrain Walls)

- A. Locations: Generally to below decking areas, sub terrain walls, lift pits and the like as nominated on the Design Drawings.
1. Substrate: New reinforced concrete and masonry walls.
 2. Overlay: As detailed on the Design Drawings.
- B. Type:
1. Membrane type: Self-adhesive PVC/ polyester reinforced sheet.
 2. Manufacturer/ reference: Wolfin GWSK, or acceptable equivalent.
- C. Characteristics:
1. Number of layers: 1.
 2. Total thickness (minimum): 2.3mm.
- D. Performance requirements:
1. Resistant to root attack.
 2. Resistant to permanent wetness.

2.4 Plant Room Pedestrian Membrane

- A. Locations: Generally to "wet" plant rooms, AC cupboards as nominated on the Design Drawings.
1. Extent: Floors including plinths with 150mm minimum turn up at walls.
 2. Substrate: New reinforced concrete slab.
 3. Overlay: None.
- B. Type:
1. Membrane type: A 1-component, UV resistant, highly elastic, moisture curing polyurethane waterproof membrane with anti-slip surface.
 2. Manufacturer/ reference: Sika Sikafloor-400N Elastic or acceptable equivalent.
- C. Characteristics (light to medium traffic):
1. Number of coats: 2.
 2. Total thickness (minimum): 1.9mm.
 3. Anti-slip surface of quartz sand applied between coats to suit anti-slip requirements.
- D. Performance requirements:
1. Resistant to permanent wetness.
 2. Resistant to ultraviolet light.

2.5 Plant Room Trafficable Membrane

- A. Locations: Generally to "wet" plant rooms maintenance traffic as nominated on the Design Drawings.
1. Extent: Floors including plinths with 150mm minimum turn up at walls.
 2. Substrate: New reinforced concrete slab.
 3. Overlay: None.
- B. Type:
1. Membrane type: Solvent free 2-component spray applied polyurethane waterproof membrane with slip resistance, approved primer and basecoat with aliphatic PU top coating.
 2. Manufacturer/ reference: Enviro HP1200 by Waterproofing Technologies, or acceptable equivalent.
- C. Characteristics:
1. Number of coats: 3.
 - a) First coat: HP1200 membrane.
 - b) Wear coat: Enviro HP900 PUR.
 - c) Anti-slip surface of quartz sand applied between coats to suit anti slip requirements.

- d) Aliphatic top coat: Enviro 800 PUR.
 - i. Colour: As selected by the Superintendent.

- D. Performance requirements:
 - 1. Resistant to permanent wetness.
 - 2. Resistant to ultraviolet light.

2.6 Spray Applied Membrane

- A. Locations: Generally to roof terrace and paved areas as nominated on the Design Drawings.
 - 1. Substrate: New reinforced concrete slab.
 - 2. Overlay: Paving in cementitious bedding or on pads for pedestrian traffic.
- B. Type:
 - 1. Membrane type: Solvent free 2-component spray applied polyurethane waterproof membrane approved primer and basecoat.
 - 2. Manufacturer/ reference: Enviro HP1200 by Waterproofing Technologies, or acceptable equivalent.
- C. Characteristics:
 - 1. Number of coats: 2.
 - 2. Thickness (minimum): 1.5mm.
- D. Performance requirements:
 - 1. Resistant to root attack.
 - 2. Falls: Minimum of 1:80.

2.7 Planter Box Membrane

- A. Locations: Generally to planter boxes as nominated on the Design Drawings.
 - 1. Substrate: New reinforced concrete slab.
 - 2. Overlay: Garden over geofabric and drainage cell.
- B. Type:
 - 1. Membrane type: Solvent free 2-component spray applied polyurethane waterproof membrane.
 - 2. Manufacturer/ reference: Enviro HP1200 by Waterproofing Technologies with approved primer and basecoat, or acceptable equivalent.
- C. Characteristics:
 - 1. Number of coats: 2.
 - 2. Thickness (minimum): 1.5mm.
 - 3. Geofabric and drainage cell over as specified.
- D. Performance requirements:
 - 1. Resistant to permanent wetness.
 - 2. Resistant to root attack.

2.8 Inverted Roof System

- A. Locations: Generally to external roof decks as nominated on the Design Drawings.
 - 1. Extent: Floors including plinths with 150mm minimum turn up at walls where applicable.
 - 2. Substrate: New reinforced concrete to fall at base and masonry, sheet, concrete or composite walls.
 - 3. Overlay: As indicated on the Design Drawings and Master Schedule.
- B. Type: Combined roofing system consisting of:
 - 1. Waterproof membrane type:
 - a) Plural component spray applied polyurethane waterproof membrane, approved primer and basecoat.
 - b) Manufacturer/ reference: Enviro HP1200 by Waterproofing Technologies with approved primer and basecoat, or acceptable equivalent.

- c) Characteristics:
 - i. Number of coats: 2.
 - ii. Thickness (minimum): 1.5mm.
 - iii. Aliphatic Pur top coat: Enviro 800 Pur to exposed areas.
- C. Insulation: Refer to the Master Schedule.
- D. Geotextile fabric: Refer to Drainage Cell clause specified.
- E. Ballast: Selected as per the Master Schedule. Stones to be washed and to entirely obscure membrane over black geofabric. Provide edge ballast guards as required.
 - 1. Drainage: To include ballast guards over outlets.
- F. Pavers: Proprietary precast concrete pavers cast in steel forms and flat on upper surface.
- G. Pavers with concave surface, chips, holes or any other defect will not be accepted. Support on fully adjustable polypropylene pads.
 - 1. Dimensions: 600mm x 600mm x 40mm.
 - 2. Pad supports: Tremco Polypads or acceptable equivalent.
- H. Performance requirements:
 - 1. Resistant to permanent wetness.
 - 2. Resistant to ultraviolet light.
 - 3. Falls: Minimum of 1:100.

2.9 Drainage Cell

- A. Locations: To all tanking or membrane locations where water may lie against a subterranean structure.
- B. Type: Proprietary cellular panels from recycled polypropylene with cover of geotextile fabric.
- C. Manufacturer/ reference: Refer to the Landscape Architect's details.
- D. Thickness:
 - 1. Generally: 30mm.
 - 2. Planters: 15mm.
 - 3. Installations more than two stories high vertically: 52mm.
- E. Geotextile fabric: Polymeric fabric woven from plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidenechloride, and containing stabilisers or inhibitors which provide resistance to deterioration caused by ultraviolet light.
- F. Marking: To AS 3705.
- G. Store materials clear of the ground and do not expose to sunlight for more than a total of 10 days.

2.10 Protection Board

- A. Protection board shall be 3mm polyethylene Colorscope Impact protection board.
- B. Joints of sheets shall be butt jointed and sealed with a 50mm wide black polythene pressure sensitive tape such as BEAR No. 500 as manufactured by Nortons Pty Limited.
- C. Application of protection board shall be followed by subsequent work within a suitable period of time to prevent deterioration due to ultraviolet exposure or Site conditions.

2.11 Mechanical Flashing

- A. Provide propriety extruded aluminium pressure seals to terminate membranes where required by the respective membrane manufacturers.
- B. Flashings to rise a minimum of 150mm (one block course) above the highest expected water level. Ensure compatibility with the free board level.
- C. Colour of flashing as nominated by the Superintendent to approved samples.
- D. Provide galvanised steel angle as underflashing with minimum M8 galvanised steel bolt fixing at 450mm centres. Fix steel angle on to level concrete substrate to provide positive upturns, together with packing and apply sealant at underside of steel angle prior fixing to an approved prototype.

3 EXECUTION

3.1 Generally

- A. Membrane installation shall only be undertaken by installers approved by the membrane manufacturer and in strict accordance with the manufacturer's instructions.
- B. Each membrane or membrane system shall be configured and installed in such a way that water or moisture entry is permanently prevented.
- C. At free edges seal or treat in such a way that a watertight seal is achieved.
- D. At interfaces with damp-proof courses, flashings and other waterproofing elements, ensure that junctions are effectively sealed using materials and methods compatible with the various elements.
- E. At kerbs, plinths, walls or other vertical obstacles, maintain continuity by turning membrane up and sealing to the vertical surface.
- F. The waterproofing systems shall come complete with flashings, over-flashings, seals and the like as required to provide a complete and watertight system. Form outlets, sumps, upturns, fillets and the like as necessary.
- G. Prime the substrate if so required by the manufacturer/ supplier, using materials and methods as recommended by them.
- H. At internal corners (wall/ slab junctions, etc) treat as required by the manufacturer/ supplier by forming fillets and/ or using fabric reinforcement compatible with the particular system. At external corners, round off or arris.
- I. Areas damaged during or following the installation shall be repaired to the satisfaction of the Superintendent and as recommended by the manufacturer/ supplier.
- J. If application continues from one day to the next, all exposed edges shall be sealed against water penetration.
- K. All surfaces shall be laid to fall to drainage outlets as indicated on the Design Drawings.
 - 1. Take spot levels to confirm required gradients and free board clearance to confirm compliance.
 - 2. Where any other trade finds it necessary to cut or deform in any way the completed membrane, flashings or accessories, then the subsequent making good of flashing or other protection of the opening, shall be carried out only by the Waterproofing Head Contractor.

3.2 Manufacturers' Recommendations

- A. For each membrane type, the installation shall be carried out in accordance with the manufacturer's published recommendations and instructions, including but not limited to handling, storage, substrate preparation, use, application and finishing/ curing.
- B. Keep a reference copy of each manufacturer's recommendations and instructions on Site.
- C. Allow manufacturers' technical personnel to observe work in progress and offer advice.
- D. Deliver materials to Site in original unopened containers and packages bearing the relevant product information.

3.3 Substrate Examination

- A. Obtain the installer's written certification for the suitability of substrate surfaces (including all fittings, fixtures, penetrations, falls, etc) for the proposed waterproofing systems prior to their application. Provide the Superintendent with an inspection programme (ITP) indicating critical stages for inspection of substrate.
- B. Prior to the application of the waterproofing system ensure that the moisture content of the substrate and other critical factors are within the range specified by the membrane manufacturers.
- C. Dryness test: To AS 1884.
- D. Ensure that the substrate is graded correctly to the required falls to drains and meet the minimum requirements of the manufacturer/ supplier.
- E. All surfaces to which the membrane is to be applied shall be clean, smooth, dry and free from dust, grit or sharp objects and any other contaminant likely to affect the bonding of the membrane or puncture the membrane. Remove all surface laitance, dust, etc, by stiff brooming and/ or scraping if necessary.
- F. Provide the Principal with an inspection programme indicating critical stages with hold and witness points for inspection and sign off.

- G. Commencement of installation shall signify total acceptance by the Head Contractor that the substrate is suitable for proper installation of the waterproofing system.

3.4 Substrate Preparation

- A. Substrates are to be prepared in full compliance with the waterproofing system manufacturer's written instructions and are to be in accordance with the ASTM D5295 guide.
- B. Remove all loose material and any contaminants or any other foreign matter likely to impair adhesion. It is the responsibility of the Head Contractor to identify the detailed requirements.
- C. Should any substrates not meet the requirements of a manufacturer, rectify substrates until they comply.
- D. If necessary, prior to commencement of the application, prepare concrete substrates by mechanical grit blast or grind abrading methods to remove all contaminants which might affect the adhesion.
- E. Following surface preparation, allow to treat all sharp protrusions, local lumps, protrusion exceeding 2mm from adjoining surface shall be smoothed and local indentations exceeding 5mm or excessive (more than 10 pinholes per 5cm²) or large (exceeding 5mm diameter and/ or 5mm depth) blowholes shall be filled with an approved compound and allowed to cure.
- F. Pre-treat all shrinkage and non-moving structural cracks under 1.6mm with an approved compound recommended by the membrane manufacturer. Extend crack pre-treatment material by a minimum of 100mm either side of crack. Cracks of 1.6mm and over, all moving structural joints and cold joints shall be routed to 6.4mm wide and 12.5 deep, insert joint backing rod and seal with an approved mastic or an approved compound recommended by the membrane manufacturer. All sealants shall be high performance natural cure polyurethane or as approved by the membrane manufacturer.
- G. Perform all tests, including moisture testing of the concrete substrate, prior to commencement of the application.
- H. No Site work on any membrane shall begin until such time as each manufacturer has certified in writing that the relevant substrates are acceptable in all respects.
- I. Remove all traces of grease, oil, wax, dirt, dust, loose and unstable materials and any other matter including traces of curing compound and surface retarders.
- J. Ensure that surfaces are thoroughly cured, dry and free of any non-conforming undulations.
- K. Membranes shall be applied in strict accordance with the manufacturers recommendations with regard to environmental conditions. Tests shall be undertaken and records kept verifying ambient conditions at commencement of work. Appropriate adjustments to curing times will be calculated and recorded for variations in temperature and humidity.
- L. Moisture content of substrates: To AS 1884 Appendix A. which requires an relative humidity of 75% or less, these tests are to be carried out every 100m² or as otherwise agreed with the Superintendent.

3.5 Termite Protection

- A. Where tanking membranes and termite protection occur in the same location, coordinate fully and provide Shop Drawings to illustrate proposed methods of coordination and installation, such that neither system is impaired.

3.6 Laying Sheet Membranes

- A. Prepare and prime as required by the manufacturer/ supplier.
- B. Lay sheets systematically and with minimum of joints. Edge laps shall be to the minimum required by the manufacturer/ supplier. Stagger all joints in multi-layer sheet membrane systems. All laps shall be rolled to achieve a total seal.
- C. Ensure that sheets are fully adhered and free of any deformity in the finished surface.
- D. Lay sheets without folds or ripples.

3.7 Installing Liquid-Applied Membranes

- A. Brush or roll on a minimum of two coats to achieve the total film thickness recommended by the manufacturer/ supplier.
- B. Prime corners and upturns before general coating.
- C. Minimum height of upturns to be 200mm, unless otherwise specified or nominated on the Design Drawings.
- D. Apply polyester fabric to internal corners and around outlets. Brush well in, smoothing out all wrinkles while wet. Lap edges at joints.

3.8 Installing Spray-On Membranes

- A. Spray the membrane in a single coat to a uniform thickness. Ensure continuity with other membranes, flashings and damp-proof courses.
- B. On a daily basis, test the whole of the previous day's membrane for flaws, pinholes and inadequate coverage. Rectify as necessary to comply with the specified requirements.
- C. When requested by the Superintendent, cut out any randomly-selected patches (maximum 10) to test membrane thickness and reinstate when directed. Should any areas be shown to not meet the specified requirements, rectify as necessary to comply.

3.9 Inverted Roof Installation

- A. Install insulation boards cutting neatly around obstacles and scribe to perimeters.
- B. Lay geotextile fabric over full extent of insulation and roofing to prevent any migration of ballast.
- C. At joins, lap a minimum of 150mm and eliminate all wrinkles.
- D. Mix the ballast to achieve even distribution and lay to a regular depth over the whole area.
- E. Install pavers to the levels shown and support each paver on all four corners. Adjust pedestals such that finished levels are even and that no pavers rock on their supports.

3.10 Movement Joints

- A. The membrane(s) shall be bonded with the structural movement joints, within the construction, to form a watertight joint while allowing for the maximum possible anticipated movement.
- B. In cases where a proprietary joint system is not used, treat the joint as recommended by the manufacturer/ supplier.

3.11 Joints

- A. Expansion, construction movement and transition joints.
- B. Provide metal gutters under expansion joints.
- C. The treatment and detailing of each joint, located in areas which will receive waterproofing membranes of this Specification, must be individually proposed. The membrane detail has to be endorsed by the manufacturer and be specific for the membrane system used. Extent of any expected movement has to be confirmed with the responsible structural engineer in a Movement Joint schedule.
- D. Construction Joints
 1. Take special care in the laying of membranes over construction joints to ensure complete watertightness of the joints has been achieved in conformity with the manufacturer's technical instruction manual and the warranty requirements herein specified.
 2. All waterproofing systems shall be required to accommodate without deterioration, live load and shrinkage movements.

3.12 Reglet Finish

- A. Where a membrane upturn is to finish against concrete without an over-flashing, dress into a cast-in reglet or 20mm x 20mm rebate formed in the concrete. Seal the joint using a gun grade sealant as recommended by the membrane manufacturer/ supplier.

3.13 Penetrations

- A. Minimise penetrations through membranes to the greatest possible extent.
- B. All detailing of membranes at penetrations, and over construction and movement joints, are to be designed and proposed individually and following recommendations by the manufacturers/ suppliers to achieve a complete moisture seal all around.
- C. Do not form penetrations in completed membranes unless accepted by the Superintendent or unless shown on Design Drawings. If accepted, carry out in strict accordance with the written recommendations of the manufacturer/ supplier and re-seal in such a way as to be completely and permanently watertight and be covered by the relevant warranty.
- D. Particular attention shall be given to careful workmanship around penetrations such as columns, pipes and conduits. Follow the advice of the manufacturers/ suppliers as to the materials and installation and make due allowance for differential movements.
- E. With sheet membranes, place a star-cut panel of waterproofing membrane of the appropriate width around the base of the penetrating element, ensuring that the star-cut edges are securely wrapped around to achieve a minimum lap of 150mm. Reinforce with additional layers as necessary to ensure complete sealing.

- F. With liquid-applied membranes, seal the junction with a proprietary two-component elastomeric liquid-applied detailing compound which is compatible with the membrane and applied in accordance with the manufacturer's/ supplier's recommendations.
- G. Horizontal and vertical penetrations shall be sealed with proprietary hydrophilic strips at junctions using an accepted sealing compound.
- H. With spray-applied membranes, carry the finish over the whole of the affected area, incorporating an accepted backing material.
- I. Where fixings penetrate membranes, seal as recommended by the membrane manufacturer until permanently watertight.
- J. On no account shall unauthorised penetrations of the membrane be made.
- K. Membranes around penetrations shall extend upwards to the heights recommended in the manufacturer/ supplier's manual along their surfaces to achieve a complete moisture seal all around.

3.14 Outlets

- A. Enter all membranes into drainage outlets such that all water and moisture above the level of the membrane (including water in tile beds) is discharged into the outlet.
- B. At floor wastes and sump outlets, turn membrane down into puddle flanges and adhere.

3.15 Drainage Cell Installation

- A. At vertical membranes below ground install the drainage cell in such a way that subterranean water is captured and carried away from the building to the subsoil drainage system. Wrap the drainage cell in geotextile fabric (including exposed edges) such that soil, silt and any other unwanted materials are prevented from entering the system.
- B. Butt the drainage cell panels tightly together such that no gaps remain.
- C. Install the geotextile fabric in such a way that laps are at least 150mm and configured so that joints do not pull apart.

3.16 Completion

- A. On progressive completion the Head Contractor and membrane manufacturer shall co-jointly inspect each individual waterproofing system installation with the Superintendent.
- B. Protection:
 - 1. Protect substrates from damage after preparation for membrane application.
 - 2. Protect membranes from damage of any kind between coats/ layers and after completion.
 - 3. After membranes have cured, cover with protective sheeting where necessary.
- C. The completed work under the Contract shall be inspected and all defects corrected in accordance with the Specification.
- D. All debris, surplus material and equipment shall be removed from Site upon completion of work under the Contract.

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SECTION 0416 -- RAINWATER SYSTEMS (ARCHITECTURAL REQUIREMENTS)

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Gutters, downpipes, sumps and rainwater heads.
 2. Acoustic treatment to internal downpipes.
 3. Syphonic drainage.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Minimum 300mm length of each type of gutter and downpipe.
 2. Details and samples of the acoustic insulation.
 3. Sample of syphonic drainage outlet and pipe coupling.
 4. Samples of gutter and downpipe support systems and fixings including gutter boards to box gutters.
 5. Sample of proposed guttering and downpipe junction including sumps, rainwater heads and overflows as applicable.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First completed installation of each type of pipework.
 2. First completed installation of each type of acoustic encasement.
 3. First completed installation of each type of syphonic drainage system.
 4. First completed installation of each type of guttering/ downpipe system.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Positions of downpipes set out and marked prior to fabrication of rainwater goods.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.10 Testing Requirements for Syphonic Drainage

- A. Provide evidence of independent tests that demonstrate the products to be incorporated comply with the performance requirements of the Specification. If such evidence is unavailable, carry out the necessary tests to demonstrate compliance.
- B. Provide Site testing in accordance with the testing methods and requirements of BS EN 12056: Part 3 Annex NF:
1. To determine the relationship between the flow rate entering the outlet and the depth of water on the flat roof at the approach to the outlet.

2. To determine the head loss coefficient for the outlet for use in the hydraulic design of syphonic systems.
 3. To check the effectiveness of the outlet at preventing entry of air, and the speed of response to changes in flow rate.
- C. Gutter testing:
1. Preparation: Temporarily block all outlets.
 2. Execution: Fill gutters to overflow level and after an interval of five minutes closely inspect for leakage.
 3. Employ the necessary measures to rectify any leakage and re-test.
- D. Downpipe testing:
1. Preparation: Temporarily block all outlets.
 2. Execution: Flood downpipes to overflow level and after an interval of five minutes, closely inspect for leakage.
 3. Employ the necessary measures to rectify any leakage and re-test.

2 PRODUCTS

2.1 General

- A. All rainwater drainage shall be in accordance with AS/NZS 3500.3.
- B. Pre-painted metal, metal and organic film/ metal laminated shape or sheet rainwater goods, metal accessories and fasteners shall comply with AS/NZS 2179.1.
- C. All rainwater collection pipework to be suitable for use with potable water in compliance with AS 3855 (Int) and testing to AS/ NZS 4020, unless nominated otherwise by the Superintendent.
- D. Refer to the Hydraulic Engineer's documentation and Master Schedule for further details.

2.2 Box Gutters

- A. Box gutters shall be folded to the profiles detailed on the Design Drawings from sheet steel, with selected Colorbond finish to match roof sheeting.
- B. Prefabricate box gutters to the required section and shape. Form stop ends, downpipe nozzles, bends and returns. Dress downpipe nozzles into outlets.
 1. Sheet thickness: Refer to the Master Schedule.
- C. Support framing shall comprise MS angles at maximum 700mm centres with Spandek support. Suspend from roof framing by means of MS threaded rods. Protect from corrosion by means of hot dip galvanising or by priming with a paint finish acceptable to the Superintendent.

2.3 Downpipes

- A. Downpipes shall be folded or rolled to the profiles detailed on the Design Drawings from sheet steel with selected Colorbond steel finish to match roof sheeting.
 1. Sheet thickness: 0.55mm minimum BMT. To be confirmed by the Superintendent.
- B. Provide pipe bends, offsets, fixing clips and any other accessories necessary to achieve the layout as indicated on the Design Drawings.
- C. Jointing of downpipes shall be by means of spigot-fitted pipes, in strict accordance with the manufacturer's written product data.
- D. Where sockets are supplied separately from the downpipes, these shall be lightly driven home on to the pipe, which shall be cut square and be free from dents or burrs. A light application of low modulus silicone sealant shall be applied to both surfaces.

2.4 Syphonic Drainage Goods

- A. Outlets, pipes and fittings shall be manufactured from HDPE (high density polyethylene) or acceptable equivalent.
- B. Outlets shall be provided with mounting plates and contact sheets compatible with the roofing membrane and gutter construction.
- C. The system shall be installed in accordance with the manufacturer's recommendations, using proprietary fixings and bracketry.

2.5 Stainless Steel Box Gutter

- A. Box gutters shall be folded to the profiles detailed on the Design Drawings from stainless steel sheet.

1. Sheet thickness: Refer to the Master Schedule.
 2. Finish: Refer to the Master Schedule.
- B. Support framing shall comprise MS angles at maximum 700mm centres with Spandek support. Suspend from roof framing by means of MS threaded rods. Protect from corrosion by means of hot dip galvanising or by priming with a paint finish acceptable to the Superintendent
- C. Provide a physical separation between stainless steel box gutters and Colorbond Zincalume roof cladding, flashings and the like, to ensure that bi-metallic corrosion does not occur. Expansion joints in the gutter shall correspond to joints in the structure. Joints shall be EPDM.

2.6 Stainless Steel Downpipes

- A. Downpipes shall be folded or rolled to the profiles detailed on the Design Drawings from stainless steel sheet.
1. Sheet thickness: Refer to the Master Schedule.
 2. Finish: Refer to the Master Schedule.
- B. Provide seamless downpipes supported at close centres and connected to sumps and gutters. Weld on spreaders at base as indicated on the Design Drawings to distribute water horizontally, with discharge holes and dammed ends.

2.7 Aluminium Gutters

- A. Gutters to be formed from Heavy grade cast aluminium to AS 1231 and AS 1874 and folded to profiles as detailed on the Design Drawings.
- B. Finish: Powder coated. Colour to be confirmed by the Superintendent.
- C. Provide gutter jointing brackets, gutter fixing brackets, stop-ends, running outlets, neoprene sealing gaskets, zinc plated fixing screws and other components deemed necessary in the formation of a composite system of rainwater discharge.

2.8 Aluminium Downpipes

- A. Downpipes shall be formed from heavy grade cast aluminium to AS 1231 and AS 1874 folded or rolled to profiles as indicated on the Design Drawings.
- B. Finish: Powder coated. Colour to be confirmed by the Superintendent.
- C. Provide all pipe bends, branches, access pipes, sockets, offsets, shoes, fixing clips, wall fixings and any other components necessary to achieve the layout indicated on the Design Drawings and the Mechanical Engineer's documents.
- D. Jointing of downpipes shall be by means of spigot-fitted pipes, in accordance with the manufacturer's written recommendations.
- E. Where sockets are supplied separately from the downpipes, they shall be lightly driven home on to the pipe, which shall be cut square and be free from dents or burrs. A light application of low modulus silicone sealant shall be applied to both surfaces. Use a block of wood or similar form of protection at the pipe and socket end to prevent damage when fitting.

2.9 Stainless Steel Rainwater Goods

- A. Stainless steel used for rainwater goods shall be grade 316.
- B. Brackets and fittings shall be incorporated to meet the design and shall be of the same material as the pipework, unless specified otherwise.

2.10 Pipe Insulation

- A. Composite acoustic insulation system incorporating glasswool blanket, loaded vinyl barrier and sisalation reflective foil.
- B. Manufacturer/ reference: Refer to the Master Schedule and the Acoustic Report.

2.11 Overflow

- A. Overflow on balcony to be concealed within slab, as shown on the Design Drawings and Master Schedule.

2.12 Fixings

- A. Refer to Section 0811.
- B. Adequate measures shall be taken to prevent bi-metallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces.
- C. Direct contact between aluminium or aluminium alloys and treated timber shall be avoided, unless with the prior acceptance of the Superintendent.

2.13 Sealant

- A. Sealant, where used for sealing joints in gutters, downpipes and the like, shall be silicone based, of a type recommended by the gutter manufacturer, complying with the requirements of Section 0811 and in a colour indistinguishable from that of the gutters, downpipes and accessories.

2.14 Fabrication Tolerances

- A. A high degree of accuracy shall be employed in the fabrication of rainwater goods and the support structure.
- B. Deviations in straightness shall not exceed $\pm 6.5\text{mm}$ per 1830mm length.

3 EXECUTION

3.1 Installation Generally

- A. Before commencing work:
1. Ensure that below ground drainage is ready to receive rainwater or that the discharge can be dispersed by accepted means to prevent damage or disfigurement of the building fabric.
 2. Ensure that any specified painting of surfaces that will be concealed or inaccessible is completed.
- B. Install pipework to ensure the complete discharge of rainwater from the building without leaking.
- C. Obtain all components for each type of pipework from the same manufacturer, unless specified otherwise.
- D. Provide access fittings and rodding eyes as necessary in convenient locations to permit adequate cleaning and testing of pipework.
- E. Avoid contact between dissimilar metals and other materials, which would result in electrolytic corrosion. Avoid corrosive staining, including consideration and assessment for areas of potential cathodic metallic particles to flow over a anodic surface.
- F. Adequately protect pipework from damage and distortion during construction. Fit purpose-made temporary caps to prevent ingress of debris. Fit all access covers, cleaning eyes and blanking plates as the work proceeds.
- G. Use stainless steel fastenings, suitable for the purpose and background, and compatible with the material being fixed.
- H. Rainwater goods shall be installed in the correct position, within tolerance, free of distortion, and in the correct relationship to the building structure.
- I. All fixings shall be installed in accordance with the manufacturer's recommended procedures.
- J. Acceptance shall be received from the Superintendent before drilling or cutting parts of the structure, other than where shown on the Shop Drawings.
- K. Provide isolating tape, plastic washers, or other suitable means to prevent bi-metallic corrosion between dissimilar metals, or between preservation treated timber and metal.

3.2 Builder's Work

- A. Comply with restrictions on the cutting of holes, chases, notches, etc, and methods of attachment to the building fabric.

3.3 Suitability of Structure

- A. Before commencing the renewal of the rainwater pipework and gutters, survey the structure, checking the existing finishes and gradients and report immediately to the Superintendent if the structure is deemed to be unsuitable or defective. If the structure is unsuitable, propose remedial action to render the structure satisfactory for the installation of new rainwater pipework and gutters. Suitability shall be confirmed to the Superintendent before starting work on Site.

3.4 Preparation

- A. Ensure that below ground drainage works have been prepared to receive the rainwater pipework and gutter installation.
- B. Surfaces rendered inaccessible subsequent to installation shall have been completed.
- C. The structural gutter trough shall be made good and shall be free from loose debris, etc.

3.5 Rainwater Outlets

- A. Outlets shall be securely fixed before connecting pipework.

- B. Junctions between outlets and pipework shall accommodate all movement in the structure and pipework.

3.6 Fixing Pipework

- A. Fix securely at specified centres plumb and/ or true to line.
- B. Make changes in direction of pipe runs only where shown on the Design Drawings, unless otherwise accepted.
- C. Fix branches and low gradient sections with uniform and adequate falls to drain efficiently.
- D. Fix externally socketed pipes/ fittings with sockets facing upstream.
- E. Provide additional supports as necessary to support junctions and changes in direction.
- F. Fix every length of pipe at, or close below, the socket collar or coupling.
- G. Provide a loadbearing support for vertical pipes at not less than every storey level. Tighten fixings as the work proceeds so that every storey is self-supporting and undue weight is not imposed on fixings at the base of the pipe.
- H. Isolate from structure where passing through walls or floors and sleeve pipes.
- I. Provide for thermal and building movement when fixing and jointing, and ensure that clearances are not reduced as fixing proceeds.
- J. Fix expansion joint pipe sockets rigidly to the building and elsewhere use fixings that allow the pipe to slide.

3.7 Jointing Pipework

- A. Joint using materials, fittings and techniques that will make effective and durable connections.
- B. Joint differing pipework systems with adaptors recommended by the manufacturer(s).
- C. Cut ends of pipes shall be clean and square with burrs and swarf removed. Chamfer pipe ends before inserting into ring seal sockets.
- D. Ensure that jointing or mating surfaces are clean and, where necessary, lubricated immediately before assembly.
- E. Form junctions using fittings intended for the purpose ensuring that jointing material does not project into bore of pipes, fittings and appliances.
- F. Remove surplus flux/ solvent/ cement/ sealant from joints.

3.8 Installation of Gutters

- A. Outlets and angles shall be positioned first, followed by full lengths of gutter and finally infill lengths cut to fit at the plain end.
- B. Ensure a minimum lap of 150mm is achieved at gutter joints with a minimum 1 degree fall to outlets.
- C. Make the necessary allowance for building and thermal movement, providing clearances recommended by the gutter manufacturer as work proceeds.
- D. Dress roofing underlay into gutter.
- E. Where brackets are being used, ensure a maximum spacing of 915mm on lineal runs with one additional bracket per angle or outlet.
- F. Position gutter as closely to the roof edge as possible, taking into consideration locality and roof/ slope/ finish.
- G. In general, use 38mm long, No. 12 quality zinc, cadmium or sherardised plated twin threaded roundhead screws with washers (countersunk screws for rafter brackets).
- H. Where high winds are expected, a small bead of sealant shall be applied between gutter and bracket as a flexible adhesive.

3.9 Syphonic Drainage Pipework

- A. Fix pipework neatly, securely and adequately to prevent movement during extreme operating conditions including oscillating pressure and cavitation.
- B. Fix pipes with the minimum number of joints, bends and offsets.
- C. All pipework shall be fully accessible for repair or replacement unless specified or shown otherwise.
- D. Completed pipelines shall be of smooth, consistent bore, clean and free from distortion, wrinkling, cracks and other defects.

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- E. All pipes and fittings including joint to the outlets shall be fusion welded by either electro sleeve coupling, or butt welded.
 - F. The system shall be installed by the manufacturer's accepted installers.
- 3.10 Internal Downpipes**
- A. Access: Provide access openings as follows:
 - 1. At each junction and bend.
 - 2. At the foot of each stack.
 - B. Acoustic insulation: Mineral fibre pipe insulation 50mm thick, spirally bound on with 1.5mm wire at 150mm pitch.
 - C. Building in: If pipes are built into masonry or concrete, spiral wrap the pipe (and insulation, if any) with building paper.
- 3.11 Joining Gutter to Pipework**
- A. Joints shall be formed using gaskets and sealing rings recommended by the manufacturer.
 - B. Cut pipe ends square and remove burr and swarf.
 - C. Chamfer pipe ends before inserting into ring seal sockets.
 - D. Clean and lubricate surfaces prior to union.
 - E. Remove all surplus jointing material, ensuring that it does not project into the pipe bore.
- 3.12 Pipework with Unsealed Joints**
- A. Ensure that pipes are firmly secured to prevent rattling at joints and fixings.
- 3.13 Electrical Continuity**
- A. Use clips or suitable standard couplings supplied for the purpose by the pipework manufacturer to ensure electrical continuity at all joints in metal pipes with flexible couplings that are to be earth bonded.
- 3.14 Intumescent Collars**
- A. To soil stacks/ vent pipes, rainwater pipes and other penetrations as necessary.
 - B. Follow manufacturer's recommendations for fixing. Do not use fixings incorporating plastic materials.
 - C. Fit tightly and accurately to structure and pipe to ensure maintenance of the fire resistance. Fill gaps between collar and structure and/ or pipe with intumescent material recommended by the collar manufacturer.

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3.19 Completion

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SECTION 0431 -- METAL CLADDING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Metal wall cladding.
 2. Rainscreen cladding.
 3. Metal flashings and cappings.
 4. Rainwater goods (Refer to Section 0416).
 5. Insulation.
 6. Roof access hatch.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm x 300mm samples of each type of metal cladding.
 2. Colour samples of all finish types 300mm x 300mm minimum size.
 3. 300mm length of each custom profiled extrusion, flashings and capping.
 4. All fixing types.
 5. 300mm x 300mm sample of each type of insulation and vapour barrier.

1.4 Mock-Ups

- A. Provide a mock-up in accordance with Section 0171 as follows:
1. Typical bay of cladding including all interfaces and openings.

1.5 Prototypes

- A. Provide a prototype in accordance with Section 0171 as follows:
1. Typical bay of cladding including all interfaces and openings.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First installed and accepted structural bay of each type, in location to be agreed.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Support structure prior to covering over with insulation cladding.
 2. Insulation prior to covering over.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.
- B. Warranties are to state that work will remain waterproof and weather-tight and extends to the repair and replacement of materials where leakage occurs, including associated work such as (but not limited to) flashings, rainwater goods and cladding.

1.10 Testing Requirements

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.
- B. Testing shall include:

1. Movement testing.
2. Load testing.
3. Deflection testing.
4. Wind loads.
5. Thermal movement.
6. Moisture movement.
7. Thermal performance.
8. Solar performance.
9. Air permeability.
10. Condensation.
11. Capillarity.
12. Weather and water resistance.
13. Acoustic.
14. Fire.

1.11 Wind Resistance Testing

- A. Carry out tests on the prototypes in accordance with AS 4040.2 or other acceptable standard as agreed with the Superintendent.
- B. Metal cladding general tests: Cladding and fastenings to AS 1562.1, in conjunction with the test procedures outlined in AS 4040.1, for resistance to concentrated load and to AS 4040.2 for wind pressure.
- C. Wind load pressure coefficients to be established in accordance with AS/NZS 1170.2. Refer to the Structural Engineer's documentation.
- D. At both positive and negative applications of the peak test pressure, there shall be no permanent damage to supports or cladding panels or anchors. Framing members must not buckle, panels must remain securely held and gaskets/ seals must not be displaced.

1.12 Sound Transmission Tests

- A. General: Test a representative specimen of each part of the cladding assembly required.
- B. Samples shall have an associated weighted sound reduction index (Rw) rated to AS/NZS ISO 717.1.

1.13 Waterproofing and Weathertightness Testing

- A. Test the weathertightness of the works using a suitable testing method as accepted by the Superintendent.
- B. Details of the test and a proposed method statement shall be submitted to the Superintendent for acceptance at least one month prior to the proposed testing on Site.
- C. All tests shall comply with the rules and standards laid down by the appropriate testing authorities.

1.14 Site Hose Testing

- A. Perform hose tests on 5% of all sealed joints. Check for any leaks and perform repairs, replacements and additional testing and inspections as necessary.

1.15 Thermal Performance Testing

- A. Thermography testing shall be carried out to ensure that insulation is continuous. A suitable thermal imaging method shall be proposed by the Head Contractor for acceptance by the Superintendent.

1.16 Seismic Requirements

- A. All seismic design loads on structures will be established in accordance with AS 1170.4. Refer to the Structural Engineer's documentation for details.
- B. Securely fix all plant and equipment to the building structure. Do not rely on gravity and/or friction to resist seismic forces.
- C. Anti-vibration mounts: Use horizontally restrained type.

- D. Components: Do not use components that will be damaged by earthquake conditions. Protect systems against the adverse effects of components such as mercury switches that, although not damaged by earthquake, may malfunction.

1.17 Fire Performance

- A. Cladding combustibility: Non combustible tested to AS 1530.1.
- B. Fire hazard properties:
1. Group number: To AS 5637.1.
 2. External combustible linings: Group number to NCC Spec C1.10 and AS 5637.1.
 3. External combustible attachments and insulation materials: Fire hazard indices tested to AS/NZS 1530.3, as follows:
 - a) Spread-of-Flame Index: 9.
 - b) Smoke-Developed Index: 8 if Spread-of-Flame Index > 5.
 4. Bonded laminated materials: Tested to AS/NZS 1530.3. Fire hazard indices, as follows:
 - a) Spread of Flame Index: 0.
 - b) Smoke-Developed Index: 3.
- C. Fire-resistance of building elements: To AS 1530.4.
- D. External cladding (including openings around windows and doors) must prevent the penetration of water, in accordance with FP1.4 of the NCC.

2 PRODUCTS

2.1 Metal Cladding Generally

- A. Install in accordance with SAA HB39 Installation code for metal cladding.
- B. Cladding systems are to be complete with the manufacturer's standard accessories and incidentals to complete the system.
- C. Provide subframing and/ or furring necessary to give proper support and to ensure that sheets remain perfectly flat.
- D. The cladding system is to be installed in accordance with the manufacturer's written instructions.
- E. All elements of the cladding systems must withstand the most severe loading or load combinations from the loads specified and designed for. Refer to the Structural Engineer's Documentations for details.
- F. General dead and live loads will be in accordance with AS/NZS 1170.1 or in accordance with statutory regulations, whichever are the most stringent.
- G. Human live loads, horizontal surfaces or near horizontal surfaces, which form part of the cladding system and which may carry human live loads, must be capable of supporting such loads without collapse, fracture, permanent distortion, failure of seals or fastenings, or other damage.
- H. Cladding is to accommodate all permanent and temporary incidental stresses that may arise during both the service life and construction phases. Such stresses must include those due to manufacture, transport, installation and in-service maintenance
- I. Acceptable corrosion protection for metal sheet cladding to be in accordance with NCC Table 3.5.1.1.
- J. Cladding to be a coordinated and integrated appearance. All associated componentry such as trims, joints and flashings are compatible in terms of performance and appearance.
- K. All exposed fixings and locks to cladding located in public areas will be vandal resistant and tamper proof requiring a specialised tool for removal.
- L. Acoustic treatments must be integrated within overall assemblies and materials and be capable of withstanding ambient conditions.
- M. Provide continuous single span sheet lengths, no end lapping permitted.
- N. Allow to locate expansion joints to gutters and cladding as required, to Superintendent approved locations.
- O. Provide vermin seals as nominated on the Design Drawings.
- P. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Metal Cladding

- A. Metal cladding including all standard incidentals to complete a waterproof and non-combustible cladding system.
- B. Metal cladding and associated cladding components are to be non-combustible, compliant with the NCC Deemed to Satisfy provisions and AS 5113.
- C. Fire resistance is to be determined in accordance with AS 1530 and the NCC.
- D. Where the external aluminium facade cladding system is to be used as an attachment to an external wall, as per the NCC, the cladding system is to comply with NCC Spec C1.10 and Spec C1.1 Clause 2.4.

2.3 Aluminium Rainscreen Cladding

- A. Solid aluminium cladding panel system with 75mm folded edges. Panels shall be removable for access to services where required.
 - 1. Thickness: Minimum 3mm, unless nominated otherwise.
 - 2. Nominal panel size: Varies as per the Design Drawings and Master Schedule.
 - 3. Profile: Where indicated, curve panel to suit radius as per the Design Drawings.
 - 4. Perforation: Refer to the Design Drawings and Master Schedule.
 - 5. Finish: As Scheduled.
- B. Fixing method: Refer to the Design Drawings, Master Schedule and the manufacturer's written instructions for details.
- C. Fixings within 15mm wide open joints. Incorporate drain holes into cladding elements.
- D. All fixings shall be vandal and tamper proof and only be removable using a specialist tool.
- E. Where cut panel joints or folds are visible (bottom or side edge of panels for instance) they are to be welded and ground smooth prior to finishing.

2.4 Roof Access Hatch

- A. Roof access hatch with insulated metal top and gas struts for assisted opening and operating safety.
 - 1. Size: Refer to the Master Schedule.
 - 2. Finish: Refer to the Master Schedule.
 - 3. Lockable from inside.

2.5 Insulation Generally

- A. Material: To meet the performance requirements, including NCC Clause C1.9 and shall have a Class 0 spread of flame and will be non combustible when tested in accordance with AS 1530.1.
- B. All insulation is to have Codemark Certificate of Conformity. Installation of insulation material is to be strictly in accordance with the conditions and limitations of the CodeMark Certificate of Conformity, including all manufacturers' requirements.
- C. Refer to Section 0819 for insulation, sarking and vapour barrier general requirements.
- D. Insulation shall satisfy all criteria as set out in Section J of the NCC as a minimum.
- E. Insulation shall be inert, durable, rot-proof, vermin-proof, environmentally friendly and not be degraded by action of moisture, extreme climate temperature, water or water vapour.
- F. The insulation shall satisfy the fire proofing, acoustic and thermal requirements detailed in the Specification.
- G. The selected material and its method of attachment to the supporting components shall eliminate the risk of bulging, sagging, delamination or detachment.

2.6 Breather Membrane

- A. Refer to Section 0819.
- B. Material: To meet the performance requirements, including NCC Clause C1.9, have a compliant spread of flame index and will be non combustible when tested in accordance with AS 1530.1.

2.7 Profile Fillers

- A. Type: Purpose made non-combustible profile fillers profiled to match the cladding profile.
- B. Location: Provide profiled fillers under flashings to the following:
 - 1. Ridges.
 - 2. Eaves.

- C. Profile fillers shall be perforated for ventilation and drainage of condensation at centres of crowns/ troughs as appropriate.

2.8 Vapour Control Layer

- A. Refer to Section 0819.
- B. Material: High performance reinforced membranes, protected both sides by rigid facings/ linings, to comply with NCC clause C1.9, have a compliant spread of flame index and be non combustible when tested in accordance with AS 1530.1.

2.9 Isolating Tape

- A. A type recommended for the purpose by the manufacturer. Apply to those surfaces of supports that would otherwise be in contact with works or accessories after fixing.

2.10 Cladding Support Structure

- A. Provide a structural steel cladding support structure, as necessary, having due regard for any requirements in excess of that for structural steel as shown on the Structural Engineer's drawings and also any requirements shown on the Design Drawings.

2.11 Mechanical Fixings

- A. Fastenings shall comply with Section 0811.

2.12 Fixing Anchors

- A. Shall be capable of adequate three-dimensional adjustment to accommodate building structure and cladding fabrication/ installation tolerances.
- B. All fixing anchors shall be stainless steel grade 316 and to the requirements of the NCC.

2.13 Fixings to Coloured Surfaces

- A. All fixings for coloured sheeting, flashings, cappings and the like are to be colour matched to the material being fixed by the use of epoxy painted heads to fixings or coloured snap caps over the head of the fixings.

2.14 Accessories Generally

- A. Cappings, closure pieces, flashings, trims, sills, gutters, fillers, spacers, tapes, sealants, fixings, etc, where not specified, shall be types recommended in by the manufacturer.

2.15 Aluminium Flashings and Cappings

- A. Flashings to AS/NZS 2904.
- B. Aluminium flashings, copings, panels and visible closers shall be formed from aluminium alloy sheets, complying with AS 1231. The alloy shall be selected to satisfy the requirements of the chosen finishing process.
- C. Aluminium flashings shall be at least 3mm thick. Aluminium sheet for copings, panels and visible closers shall be sufficiently thick to provide a visually flat surface.
- D. Flashings shall have finish to match adjacent cladding.
- E. Longitudinal joints shall have lapped or interconnecting joints, fully weather sealed. Simple butt joints and butt straps will not be acceptable. Joints, sealants, etc, shall be designed to accommodate thermal movements of all flashings.
- F. Achieve electrical continuity between conductive parts. Make provision for lightning protection integration requirements.
- G. Aluminium flashings shall be treated with anti-drumming insulation on the hidden face.

2.16 Fabrication Tolerances

- A. Comply with the following tolerances during component manufacture:
1. Length/ width: Maximum allowed deviation is the lesser of 1.5mm up to 3000mm and 3mm above 3000mm of design dimension.
 2. Squareness: Any diagonal length across the panel shall not deviate by more than the lesser of $\pm 3\text{mm}$ or $\pm 0.075\%$ of design dimension.
 3. Bow: The centre section of the element shall not bow by more than the lesser of 3mm or 0.075% of the length of the element measured from a straight line between the ends of the element.
 4. Straightness: No surface or edge shall deviate by more than +1.5mm from a 2000mm straight edge placed against it in a direction parallel to the long axis of the element.

5. Flatness: No surface shall deviate by more than +1.5mm from a 2000mm straightedge placed against it in any direction.
6. Twist: No section of the element shall be twisted by more than 1° from the section at either end of the element.
7. Thickness: Tolerances for flat rolled steel sheet thicknesses shall be in accordance AS/NZS 1365.
8. Tolerances shall not be cumulative.

2.17 Lightning Protection and Earth Bonding

- A. Bonding is required between individual sections of cladding, in accordance with AS/NZS 1768 and AS 1882, to ensure continuity between adjacent sections, both vertically and horizontally over the whole façade. Bonding between sections shall have a minimum cross section of 50mm x 50mm. Bolts used for bonding shall be a minimum size of M10.

3 EXECUTION

3.1 Generally

- A. The Head Contractor shall coordinate with the Superintendent and the Mechanical Services Head Contractor and obtain Shop Drawings including sizes and details of all penetrations prior to the setting out and commencement of the Works.
- B. All work under the Contract shall be true to detail with continuous profiles, free from marks, defects, flaws, steps, waves, or damage of any nature.
- C. Sheeting is to be installed in accordance with manufacturer's recommendations to achieve warranties.
- D. Metal sheets shall be installed in continuous single lengths unless specifically accepted otherwise.
- E. All work shall remain intact and waterproof under the ambient in-service and climatic conditions.
- F. Elements of framework and components shall be stored on Site such that they are not damaged, distorted or weathered unevenly.
- G. All support systems shall distribute loads evenly such that cladding material is not caused to distort and warp.
- H. All finished components shall be carefully packed in stillages or crates such that they are suitably separated and protected to prevent scratching, scuffing or other surface damage.
- I. Verify dimensions and levels of the structure.
- J. Setting out shall be such that all panels are installed in the correct position, within tolerance, and in the correct relationship to the building structure.
- K. All fixing bolts and anchors shall be installed in accordance with the manufacturer's recommended procedures.
- L. Obtain acceptance from the Superintendent before drilling or cutting parts of the structure, other than where shown on the Shop Drawings.
- M. Provide isolating tape, plastic washers or other suitable means to prevent bi-metallic corrosion between dissimilar metals.
- N. The finished work shall be square, regular, true to line, level and plane, with a satisfactory fit at all junctions.
- O. Design and installation shall be to AS 1562.1 and HB 39.

3.2 Assembly of Panels

- A. Panels shall be flat (1:1000) and assembled in order to achieve true straight lines, both horizontally and vertically for the full width and height of the building.
- B. Joints:
 1. Rigidly secure joints other than movement and open joints. Reinforce as required and fix with hairline abutments, unless detailed otherwise.
 2. Allow no lipping across joints.

3.3 Fixing Sheets Generally

- A. Cut sheets shall give clean, true lines with no distortion. Remove burrs.
- B. Holes for primary fastenings shall be 1.5mm larger than diameter of fastening unless self-drilling type with pilot point is used.

- C. Remove all drilling swarf, dust and any other foreign matter before finally fixing sheets into position.
- D. Check fastenings on completion and adjust as necessary to ensure that they are watertight and sheeting is secure but not buckled or distorted.

3.4 Fastenings Generally

- A. Type(s), size(s), material(s) and finish(es) shall be as recommended for the purpose by the cladding manufacturer.

3.5 Structure

- A. Check that the structure is in a suitable state to receive cladding before commencing fixing and obtain acceptance from the Superintendent.

3.6 Adjacent Finishes

- A. Do not fix cladding until final coats of paint have been applied to outer surfaces of supporting structure.

3.7 Sealing Laps

- A. Sealant: Type(s) recommended for the purpose by sheet manufacturer.
- B. Position in straight, unbroken lines immediately below fixing positions and parallel to edges of sheets. Place into corrugations. Do not allow to stretch or sag into position.
- C. Do not overcompress.

3.8 Movement

- A. Provide for deflections, displacements and other movements. Including but not limited to:
 1. Within the cladding systems.
 2. With the building structure (including fire stop and smoke flashing connections if applicable).
 3. All adjoining facade elements
 4. Caused by ambient temperature changes, wind loads, design dead and live loads and shrinkage.
- B. Provide cladding systems that accommodate for movements silently and without permanent deformation, reduction of performance, or other detrimental effects such as:
 1. Damage to or undue stress on structural elements, fixings and panels/ sheets.
 2. Failure of joint seals.
- C. Take into account differential movement between the cladding systems and adjoining façade elements as well as movement between building due to edge beam or slab deflections under designed loads, column or frame shortening, lateral deflection under wind load and the like.

3.9 Movement Joints

- A. Where movement joints are to be provided within or between structures or structural elements, ensure movements are accommodated by the cladding system without damage or distortion.
- B. Movement jointing systems will be visually compatible in finish and material with overall system.

3.10 Flashings

- A. Installation: Flash junctions, upstands, abutments and projections through the roof. Preform to required shapes if possible. Notch, scribe, flute or dress down as necessary to follow the profile of adjacent surfaces. Mitre angles and lap joints 150mm in running lengths. Provide matching expansion joints at 6000mm maximum intervals.
- B. 6000mm corresponds to the manufacturing length. Movement at these joints would be less than 1mm so all may not need to be fully-fledged expansion joints.
- C. Upstands: Flash projections above or through the roof with two part flashings, consisting of a base flashing and a cover flashing, with at least 100mm vertical overlap. Provide for independent movement between the roof and the projection.
 1. Wall abutments: Where a roof abuts a wall, provide flashing.
- D. Fixing to pipes: Solder or seal with neutral cured silicone rubber and either of the following:
 1. Secure with a clamping ring.
 2. Provide a proprietary flexible clamping shoe with attached metal surround flashing.

3.11 Insulation

- A. The insulation shall be attached to or supported within the works so as not to bulge, sag, delaminate or detach during installation or in situ during the life of work under the Contract.
- B. Install and secure as the work proceeds ensuring continuity between supports/ purlins/ rails/ spacers and leaving no gaps. Keep dry and do not compress.
- C. Cut back or debond the minimum necessary and to a clean straight line, ensuring that there are no gaps in insulation after fixing.

3.12 Breather Membranes

- A. Lay over insulation as the work proceeds, ensuring continuity.
- B. Lap sides and ends of sheets not less than 150mm to shed water away from insulation.
- C. Ensure that bottom edges overlap flashings, drips sills, etc, to allow free drainage to the exterior.

3.13 Vapour Control Layers

- A. Application: Provide a vapour permeable membrane behind external facing material which does not provide permanent weatherproofing or which may be subject to condensation forming on the internal face.
- B. Vapour control layers shall be fixed to ensure continuity of vapour control on the warm side of thermal insulation.
- C. Lay as the work proceeds, ensuring continuity.
- D. Lap sides and ends of sheets not less than 150mm and seal with adhesive tape.
- E. Seal with adhesive tape to pipes, ducts, structural members, etc, that pass through.
- F. Carefully check for tears and punctures and seal them with adhesive tape before covering.

3.14 Profile Fillers

- A. Locate where shown on the Shop Drawings and wherever necessary to close off corrugation cavities from the outside and inside of the building. Ensure a tight fit and leave no gaps.
- B. Where sealed laps are specified, bed profile fillers in sealant on top and bottom surfaces but do not obstruct channels for ventilation or condensation drainage.
- C. Close cavities at hips/ valleys with blocks cut from standard perforated profiled strips. Position blocks at right angles to troughs, equidistant from edge of sheet in sawtooth formation and bed in sealant on top and bottom surfaces. Ensure that seal is continuous from block to block.
- D. Fix in positions shown on the Shop Drawings, leaving no gaps and using an adhesive recommended by the profile filler manufacturer.

3.15 Penetrations

- A. Penetrations are to be kept to a minimum. Penetrations are to only occur where absolutely required.
- B. Where roof penetrations are required, submit to the Superintendent, the proposed methods or sealing and maintaining waterproofing integrity and watertightness.
- C. Use flexible EPDM polymer overflashings or a similar product equivalent in function, quality, etc. to the approval of the Superintendent.

3.16 Installation Tolerances

- A. Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length not exceeding 1000mm, less rate of change, and a maximum amplitude of 3mm. All the above shall be measured from an optical or laser reference line.
- B. The width of any joint shall not deviate from the nominal width by more than 1mm of the joint width, whichever is the lesser. Any variation shall be equally distributed with no sudden changes. The misalignment between joints shall not exceed 1mm.
- C. Line and level shall be within 2mm of the specified level. The cumulative slope between the same locations on any panel shall not exceed 1 in 1000.
- D. Work under the Contract shall be erected such that no point on any panel is more than 1mm from its theoretical plane. The cumulative slope between the same locations on any panel shall not exceed 1 in 1000.
- E. State the dimensional and detailed provisions intended to accommodate the construction tolerances of surrounding elements in order to ensure that all aspects of work under the Contract relate satisfactorily to the Works as a whole.
- F. All tolerances stated shall be measured and monitored at a mean temperature to be agreed with the Superintendent.

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- G. Before work begins on Site, the proposed method of dimensional setting out and crosschecking with adjacent trades and elements shall be submitted to the Superintendent.
 - H. Alternative tolerances to those specified may be permitted at the Superintendent's discretion, provided they are agreed in advance of the manufacture of components.
 - I. Work under the Contract, when installed, shall not be subject to warping or twisting, shall be strictly rigid, firm, free from vibration, knocking, rattles, squeaks and other noises when subject to the worst combination of environmental conditions and wind loads.
 - J. Tolerances shall not be cumulative.
- 3.17 Metal Separation**
- A. Requirement: Prevent direct contact between incompatible metals, and between green hardwood or chemically treated timber and aluminium or coated steel, by either of the following methods:
 - 1. Applying an anti-corrosion, low moisture transmission coating to contact surfaces.
 - 2. Inserting a separation layer.
- 3.18 Storage and Handling**
- A. Storage: Store metal sheeting materials away from uncured concrete and masonry, on a level base. Do not store materials in contact with other materials which may cause staining, denting or other surface damage.
 - B. Handling: Handle cladding materials as follows:
 - 1. Use gloves when handling pre-coated metal sheeting material.
 - 2. Protect edges and surfaces from damage. Do not drag sheets across each other or over other materials.
- 3.19 Completion**
- A. Remove: Excess debris, metal swarf, solder, sealants and unused materials.
 - B. Clean off: Exposed metal surfaces that interfere with uniform weathering or oxidation.
 - C. Replace: Materials that have been damaged or deteriorated.
 - D. Touch up: If it is necessary to touch up minor damage to pre-painted metal cladding, do not use spray paints.
 - E. Maintenance manual: Submit a manual of recommendations from the cladding manufacturer or supplier for the maintenance of the cladding system including, frequency of inspection and recommended methods of access, inspection, cleaning, repair and replacement.

SECTION END

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SECTION 0433 -- STONE CLADDING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. External mechanically fixed stone wall cladding.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm x 300mm samples of each type of stone cladding showing variation in colours and markings.
 2. Samples of waterproofing.
 3. Samples of visible accessories.
 4. Samples of fixing types.
 5. Stone samples for testing of stone properties and performance. Refer to testing requirements specified.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Provide a prototype in accordance with Section 0171 as follows:
1. Typical section of stone cladding (minimum of 2 full panels), including all interfaces and an opening.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First full height structural bay of each type of stone cladding installed on Site in location to be agreed.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Primary structure prior to installing subframing.
 2. Proposed stone source (quarry, storage yard).
 3. Proposed mason's yard.
 4. Materials stored at the yard or on site.
 5. The prepared stone sample range.
 6. Stone in worked condition at the mason's yard.
 7. Stone laid out before fixing.
 8. Items to be built-in located in their correct positions, including damp-proof course, flashings, bolts, cramps, brackets, structural fixings and rainwater goods.
 9. Completed stonework.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings and associated documents showing the following information:
1. Stonework setting out.

2. Position and identifying number of each stone.
3. Dimensions of each stone and lay of natural bed.
4. Lifting detail and fixing detail of each stone.
5. Panel dimensions: Including minimum thickness and slot fixing dimensions.
6. Fixings: Location and design of loadbearing and restraint fixings and their method of attachment to the cladding and structure, with calculations to verify the structural adequacy of the proposals.
7. Joints: The size and shape of panel joints, including control joints, showing:
 - a) The method of dealing with differential movements such as building structure creep and elastic shortening, drying shrinkage, thermal and moisture movements.
 - b) Provision for three way adjustment of the panel position.
8. Jointing: Methods of jointing and pointing panel joints, including control joints, with particulars of the materials to be used.
9. Cavity: Cavity width and provision for the following:
 - a) Cavity insulation.
 - b) Cavity drainage.
 - c) Cavity damp-proofing and condensation prevention.
10. Independent certification by a professional engineer of the design and documentation of the structural fixings.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Supplier's Data

- A. Submit statements from the stone supplier, with the following information:
 1. The supplier's experience in the required type of work.
 2. Production capacity for material of the required type, sizes and quantity.
 3. Particulars of established quality control procedures (if any), and the category of the procedures to the relevant standard.
 4. The physical properties of the required material.
 5. Lead times for delivery of the material to the site.

1.12 Appointment of Testing Laboratory

- A. For the purpose of testing, a qualified geologist/ stone consultant, working for an independent NATA accredited testing laboratory shall be appointed for the whole cycle of testing required. The laboratory shall certify that samples tested are from the same block(s) selected for the project. Continuing custody of samples, together with marking of blocks will be deemed essential. Deliver all samples to the testing laboratory, including the completion of all customs formalities (if appropriate) and the payment of all levies or duties.

1.13 Selection

- A. Quarry assessment: Quarry evaluation, in situ material variability and characteristics, production facility inspection and quality system assessment shall be carried out by an independent qualified geologist/ stone consultant experienced in the use of natural stone for external façades.
- B. Three representative approval testing blocks shall be selected by a qualified geologist/ stone consultant working for an independent NATA accredited testing laboratory. Testing shall be performed at an independent NATA accredited testing laboratory. The material selected for testing shall match the agreed project reference samples.
- C. The testing laboratory or supplier shall select testing samples at the quarry.

1.14 Stone Tests

- A. Obtain test samples for each type specified. Testing in accordance with BS EN 1469.
- B. Carry out tests at the following stages:
 1. Before awarding a stone supply contract.
 2. On dimension stone prepared for the works, at intervals during the course of the works.
- C. Natural stone tests:

1. Intact rock specimens: ASTM D7012.
 2. Dimension stone: ASTM C170/C170M.
 3. Surface absorption rate: ASTM C97/C97M.
 4. Porosity: ASTM C97/C97M.
 5. Wet and dry density: ASTM C97/C97M.
 6. Modulus of rupture: ASTM C99/C99M.
 7. Flexural strength: ASTM C880/C880M.
 8. Petrographic examination: BS EN 12407.
- D. Cast stone tests:
1. Compressive strength: BS 1217.
 2. Capillary absorption test (CAT): BS 1217.
 3. Initial surface absorption test (ISAT): BS 1217.
- E. Test certificates and reports shall be represented in their entirety and are to include all individual and mean values obtained.
- F. Visual inspection:
1. The rough edge of each block shall be sawn off exposing a fresh face. The face shall be visually inspected by an independent qualified geologist/ stone consultant for any visible defects, changes in structure or texture, and general conformity to the aesthetic criteria defined by the Superintendent and illustrated in agreed project reference samples.
 2. A test area shall be taken from the slab sufficient to prepare all the proposed tests in the project bedding orientation.
- G. Testing Frequency:
1. Production testing shall be carried out on every third block/ 15m³ reserved for the project.
- 1.15 Fixing Tests**
- A. The specific test methods and number of tests shall be appropriate to the scope, design and complexity of the project.
 - B. As a minimum each type of anchor or fixing shall have at least 10 tests carried out to destruction.
 - C. The actual number of tests to be performed and the test conditions (i.e. bedding/ rift orientation, dry, wet, cyclic loading) shall be determined by a construction professional based on the acceptance test data and technical performance data available for the particular fixing(s).
 - D. The type of test (shear, pull-out) shall be dictated by the nature of the anchor/ fixing (i.e. support and/ or gravity). Where appropriate, for example, tests shall be performed in different loading directions to simulate positive and negative wind loading with a gravity load applied.
 - E. Tensile tests: To BS 5080-1.
 - F. Shear tests: To BS 5080-2.
- 1.16 Results of Tests**
- A. Results shall confirm the suitability of the selected stone.

2 PRODUCTS

2.1 Stone Cladding Generally

- A. All stone cladding is to be:
 1. Consistent in colour and finish.
 2. Selected for the optimum matching of visual properties such as colour and pattern.
 3. Sound and free from defects liable to affect its strength, appearance, durability or proper functioning under the intended conditions of use.
 4. Firmly secured to backgrounds for the expected life of the installation.
 5. Resistant to expected impacts in use.
 6. Set out with joints accurately aligned in both directions, level and plumb.
 7. Complete with all fixings and components.

- B. Sandstone defects: Minor shale laminae or interbeds and minor concentrations of carbonaceous material (tea leaves) are acceptable in visible faces at ground level or in public areas. Neither defect is acceptable in carved or moulded work.
- C. All stone is to be treated for leaching prior to installation.
- D. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Stone Cladding

- A. Stone cladding system as detailed, including all other required incidentals, joints, finish, sealers, fixings waterproofing system and insulation, as required to complete the system.
- B. Supplier: Refer to the Master Schedule.
 - 1. Stone type: Refer to the Master Schedule.
 - a) Face finish: Honed, smooth external face finish, unless nominated otherwise.
 - b) Applied finish: Clear penetrating sealer as scheduled, which will not adversely affect the visual appearance of the stone. Refer to Section 0671.
 - i. With Anti-graffiti properties applied to publicly accessible areas.
 - 2. Joints: Approximately 5mm to 10mm open joints.
 - 3. Fixing: Mechanically fixed.

2.3 Support System and Fixings

- A. Support systems to be stainless steel.
- B. Fixings shall withstand all imposed dead and live loads, including wind and suction pressures appropriate to the degree of exposure and height above ground level.
- C. Fixings shall allow for three-way adjustment for proper fit within pre-cut mortices in the stone and to the substrate.

2.4 Sealants

- A. Assemblies with any form of sealant making air or water seals shall not be moved, twisted or distorted until the sealants have properly cured and set.
- B. Comply with BS 6213.
- C. Installed sealants shall provide a smooth continuous surface to the full width of the joint and be tooled flat.

2.5 Mortar

- A. Refer to Section 0821.

2.6 Insulation

- A. Insulation shall be inert, rot-proof, durable, vermin-proof, non-absorbent and not degradable by moisture or water vapour.
- B. Insulation shall be selected to eliminate the risk of bulging, sagging, delamination or detachment.

2.7 Tolerances of Manufacture

- A. Work under the Contract shall be free from vents, cracks, fissures, discoloration, or other defects that may adversely affect strength, durability or appearance.
- B. Sizes generally: Panels shall be cut accurately to size and be square at the back, i.e. without corners broken away which may impair the strength of the fixings system.
- C. Face dimensions:
 - 1. Units, other than where required to be shaped, shall be square at all faces so that any deviations in length or height dimensions are uniform and achieve uniform joint widths. Edges shall be square.
 - 2. Stone panels 50mm thick or less: ± 1 mm for dimensions up to 600mm and ± 1.5 mm for dimensions over 600mm.
 - 3. Stone panels over 50mm thick: ± 2 mm for dimensions up to 600mm and ± 3 mm for dimensions over 600mm.
 - 4. Curtain walling panels with sawn edges: ± 0.5 mm per metre.
 - 5. Curtain walling panels with handworked or moulded edges: ± 1 mm per metre.
- D. Squareness (length of diagonals): $\pm 0.5\%$ of the nominal dimension or a maximum ± 5 mm.
- E. Thickness:

1. Generally: $\pm 3\text{mm}$.
 2. Stone panels in stone faced concrete units: $+ 3\text{mm}$, $- 0\text{mm}$.
 3. Curtain walling panels: $+ 4\text{mm}$, $- 0\text{mm}$.
 4. Thicknesses behind fixing mortice positions shall be consistent.
- F. Flatness:
1. Polished or honed faces: $\pm 0.5\text{mm}$ per metre.
 2. Sawn or sandblasted faces: $\pm 1.5\text{mm}$ per metre.
 3. Flame exfoliated faces: $\pm 3\text{mm}$ per metre.
 4. Fine tooled or hammered faces: $\pm 2\text{mm}$ per metre.
- G. Edge straightness: $\pm 0.5\text{mm}$ per metre.
- H. Anchor hole position: 1mm .
- I. Bow and twist:
1. Maximum deviation of stone face from plane:
 - a) Finishes: $\pm 1.5\text{mm}$ in 1200mm .
 - b) Natural riven faces: $\pm 10\text{mm}$ in 1200mm .
- J. System Production:
1. All loadbearing and restraint fixings, including all jointing between units and adjacent elements as detailed, shall be designed and provided.
 2. Provide a range of samples to be inspected for selection.
 3. All stone materials shall match the colour and finish of a sample previously agreed with the Superintendent.

2.8 Finishes

- A. Finishes shall be established to the grades accepted for the samples, submitted to the Superintendent and accepted for inclusion in work under the Contract.
- B. The face of the work under the Contract shall have the specified finish with joints/ recessed/ chamfered edges as indicated on the Design Drawings.

3 EXECUTION

3.1 General

- A. Design and installation shall comply with BS 8298.

3.2 Accuracy

- A. Survey the structure, including any fixing inserts, before commencing erection.

3.3 Drainage Points

- A. Provide drainage weepholes at the base of the wall.

3.4 Storage

- A. Store stone as follows:
 1. Clear of the ground on its natural bed.
 2. On supports which do not locally overstress the stone.
 3. In conditions suitable to promote good seasoning without staining, marking or damage.

3.5 Cleaning

- A. Clean any dirt or blemishes from exposed surfaces.
- B. Wash and rinse in accordance with the manufacturer's recommendations.
- C. Protect adjacent surfaces from damage due to cleaning operations.
- D. Do not use cleaning materials or processes which could alter the character of exposed finishes.

3.6 Fixings

- A. Provide stone cladding fixings as follows:
 1. As required to secure cladding panels to the substrate.

2. Sufficient to support, restrain and resist the structural design loads on each cladding panel.
- B. Unsuitable fixings: Do not use:
 1. Stone block liners on the back face of panels.
 2. Epoxy resin bonded fixing.
- C. The torque figures or shim dimensions shall not exceed those recommended by the fixing manufacturer.
- D. The Superintendent shall be allowed to inspect at every course all fixings/ restraints and cavities before proceeding with the next course of stone units.
- E. Metals for fixing:
 1. Provide metal fixings as follows:
 - a) Corrosion resistant.
 - b) Non-ferrous metal or stainless steel.
 - c) Stamped for identification.
 - d) Compatible with the materials with which they will be in contact.
 - e) Effectively insulated from electrochemical reaction with incompatible materials.

3.7 Surface Treatments

- A. Abutting surfaces:
 1. Seal concealed faces of stone walling or facing panels where they abut concrete works.
- B. Dissimilar stones:
 1. Isolate contact surfaces of dissimilar types of stone with a membrane. Isolate sedimentary stonework from masonry to prevent salts movement.

3.8 Installation Tolerances

- A. Install work under the Contract horizontally or vertically as appropriate.
- B. Vertical joints shall be of equal size and installed at consistent centres.
- C. Horizontal joints shall be of equal size and be level.
- D. Work under the Contract shall present true and accurate straight lines and flat planes within the plane of the elevation.
- E. The gap between the stone slabs and the cladding support structure shall be constant.
- F. Joint widths shall not vary by more than 1mm (non-cumulative).
- G. Offset in plane shall not be more than 2mm.
- H. Horizontal joints shall be level to 2mm when measured against the relevant datum.
- I. Alignment between adjacent panels shall not exceed 2mm.
- J. Tolerances shall not be cumulative.

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SECTION 0438 -- FIBRE CEMENT WALL CLADDING**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Compressed fibre cement cladding.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. A 300mm x 300mm sample of each type of cladding, illustrating the surface finish and jointing details.
 2. All fixing types.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.
- B. Provide a prototype in accordance with Section 0171 as follows:
1. Typical bay including all interfaces and openings.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First installed full height structural bay of each type in location to be agreed.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Completed framing with vapour barrier and insulation in place prior to being covered over or concealed.
 2. Cladding in place prior to any caulking or flushing over of joints, as applicable, or application of surface finishes.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings of fibre cement wall cladding showing the following:
1. Control joints location and details.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Testing Requirements

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

1.12 Wind Resistance Testing

- A. Cladding general tests: cladding and fastenings to AS/NZS 1562.2, in conjunction with the test procedures outlined in AS 4040.1, for resistance to concentrated load and to AS 4040.2 for wind pressure.
- B. Wind load pressure coefficients to be established in accordance with AS/NZS 1170.2. Refer to the Structural Engineer's documentation.

- C. At both positive and negative applications of the peak test pressure, there shall be no permanent damage to supports or cladding panels or anchors. Framing members must not buckle, panels must remain securely held and gaskets/ seals must not be displaced.

1.13 Fire Performance

- A. Cladding combustibility: Non combustible tested to AS 1530.1.
- B. Fire hazard properties:
1. External combustible linings: Group number to NCC Spec C1.10 and AS 5637.1.
 2. External combustible attachments: Fire hazard indices tested to AS/NZS 1530.3, as follows:
 - a) Spread-of-Flame Index: 9.
 - b) Smoke-Developed Index: 8 if Spread-of-Flame Index > 5.
- C. Fire-resistance of building elements: To AS 1530.4.

2 PRODUCTS

2.1 Cladding Generally

- A. Flat fibre cement sheets to AS/NZS 2908.2.
- B. Provide a vapour permeable membrane to substrate before installation of top hats/ framing systems.
- C. All cladding shall be thermally broken between cladding and frames.
- D. Seal all fixing holes and edges prior to fixing.
- E. Cladding systems shall be complete with all standard and non-standard accessories and incidentals to complete the system.
- F. Provide subframing or furring necessary to give proper support and to ensure that sheets remain perfectly flat.
- G. Arrangement: Set out in even panels with joints coinciding with framing.
- H. Panel sizes and joint locations shall be as indicated on the Design Drawings and Master Schedule.

2.2 Compressed Fibre Cement Cladding

- A. High density, compressed fibre cement (CFC) panel cladding system.
1. Material: High density, compressed fibre cement (CFC).
 2. Joints: Flush or open expressed joints with backing strips to horizontal joints and gasket snap strips to vertical joints, as indicated on the Design Drawings.
 3. Finish: Pre-finished or an applied paint finish as nominated. Refer to Section 0671.
- B. Additional Information:
1. Support framing: Corrosion resistant metal support framing mechanically fixed to substrate/ primary structure, to suit the service conditions.
 2. Intermediate layer(s): Waterproofing/ vapour control layer, installed before support framing.
 3. Fire, smoke and acoustic stopping: Concealed and as required, to comply with the National Construction Code (NCC).
- C. Fixing: Concealed and mechanically fixed to framing.
1. Fixings methods and batten spacings to be determined in accordance with the Site's wind classification rating.

2.3 Wall Breather Membrane

- A. Refer to Section 0819.
- B. A vapour permeable membrane shall be fixed to the wall framing prior to fixing the top hat and intermediate top hat sections in place.
- C. Material: To meet the performance requirements, including NCC Clause C1.9 and shall have a compliant spread of flame index and will be non combustible as tested in accordance with AS 1530.1.

2.4 Sealant

-
- A. Joint sealant shall be polyurethane type such as James Hardie Joint Sealant, Bostik Seal 'n' Flex 2636, Sika Sikaflex - 11FC, or acceptable equivalent.
 - B. Sealant shall be applied strictly in accordance with the manufacturer's written instructions.
 - C. Colour shall be selected from the manufacturer's standard range and accepted by the Superintendent.

2.5 Filler over Screw Fixings

- A. Countersunk screws shall be flushed over with filling compound Megapoxy P1, Hilti CA 125, or acceptable equivalent.
- B. Where the temperature is below 15°C, filler shall be Hilti CA 273, or acceptable equivalent.

2.6 Fixings

- A. Refer to Section 0811.
- B. Cladding system to be fixed in accordance with the manufacturer's written instructions.
- C. Fixings shall be of a suitable type of stainless steel, non-ferrous metal or GRP and be such as to avoid bi-metallic corrosion.

2.7 Tolerances for Manufacture

- A. Deviations in panel length, width and diagonal dimensions shall not exceed ± 1 mm.
- B. The twist and warping shall not cause any point of the panel to be more than 0.5mm out of plane. The twist and warping shall not cause any point of the structural frame to be more than 2mm out of plane.

2.8 Quality of Finishes

- A. Finishes shall be uniform in colour, texture and appearance, unless specified otherwise.
- B. Finish shall match the agreed control samples. Disregard and replace any units that do not appear identical to the accepted samples.

3 EXECUTION

3.1 Generally

- A. All work shall be true to detail with continuous profiles, free from marks, defects, flaws, steps, waves, or damage of any nature.
- B. Setting out shall be such that all panels are installed in the correct position, within tolerance and in the correct relationship to the building structure.
- C. Obtain acceptance from the Superintendent before drilling or cutting parts of the structure.
- D. The finished work shall be square, regular, true to line, level and plane, with a satisfactory fit at all junctions.

3.2 Fixing Generally

- A. Cut sheets shall give clean, true lines with no distortion. Remove burrs.
- B. Remove all drilling dust and any other foreign matter before finally fixing sheets into position.

3.3 Adjacent Finishes

- A. Do not fix cladding until final coats of paint have been applied to outer surfaces of supporting structure, where applicable.

3.4 Breather Membranes

- A. Lay over insulation as the work proceeds, ensuring continuity.
- B. Lap sides and ends of sheets not less than 150mm to shed water away from insulation.
- C. Ensure that bottom edges overlap flashings, drips sills, etc., to allow free drainage to the exterior.

3.5 Installation Tolerances

- A. The maximum deviation from a flat plane shall be no greater than 4mm in 3000mm.
- B. The width of any joint shall not deviate from the nominal width by more than 1mm of the joint width. Any variation shall be equally distributed with no sudden changes. The misalignment between joints shall not exceed 1mm.
- C. Alternative tolerances to those specified may be permitted, at the Superintendent's discretion, provided they are agreed in advance.

-
- D. When installed, the works shall not be subject to warping or twisting, shall be strictly rigid, firm, free from vibration, knocking, rattles, squeaks and other noises when subject to the worst combination of environmental conditions and wind loads.
 - E. Tolerances shall not be cumulative.

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**SECTION 0451 -- WINDOWS/ SKYLIGHTS/ SCREENS/ LOUVRES/
GLAZED DOORS****1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. External windows.
 2. Glazed partitions.
 3. Glazed doors.
 4. Skylight.
 5. Louvres.
 6. Awning.
 7. Sunshade.
 8. Glazing.
 9. Screen.
 10. Visual indicators.
- B. Be responsible for the Detailed Design. Coordinate all interfaces with adjoining trades.

1.3 Tender Response

- A. Provide tender submittals in accordance with the requirements of Section 0171.

1.4 Tender Samples

- A. Not required.

1.5 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm minimum length sample of all framing and sill members in the proposed colour and finish.
 2. Joints made by proposed techniques.
 3. Sections proposed to be used for frames, sashes, louvres and slats.
 4. 300mm x 300mm sample of all glass types.
 5. Sample of visual indicators.
 6. Typical hardware components in the proposed materials and finishes shall include operating handle, hinge and locking device.

1.6 Mock-Ups

- A. Not required.

1.7 Prototypes

- A. Provide a prototype in accordance with Section 0171 as follows:
1. A section of work under the Contract comprising not less than 2000mm x 2000mm in the proposed materials and finishes. Incorporate at least one example of each component in the system, including attachments to the structure, flashing, caulking, sealing, glazing, operating hardware, locks and keys.

1.8 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first fully completed part of each type in an area as agreed with the Superintendent.

1.9 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Fabricated assemblies at the factory ready for delivery to the Site.
 2. Fabricated assemblies delivered to the Site, before installation.
 3. Openings prepared to receive installations (where installed in prepared openings).

1.10 Subcontractors

- A. Submit names and contact details of proposed manufacturers and Subcontractors.

1.11 Shop Drawings

- A. Submit Shop Drawings showing the following:
1. Full-sized sections of members.
 2. Hardware, fittings and accessories.
 3. Junctions and trim to adjoining surfaces.
 4. Layout (sectional plan and elevation) of each assembly.
 5. Lubrication requirements.
 6. Methods of assembly.
 7. Methods of installation, including fixing, caulking and flashing.
 8. Provision for vertical and horizontal expansion.
 9. Method of glazing, including: rebate depth; edge restraint; clearances and tolerances; glazing gaskets and sealant beads.
 10. Make allowance to design and certify structural integrity, nominating any changes in mullions etc.

1.12 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.13 Test Requirements

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.
- B. Where required, carry out project specific tests and provide certification to demonstrate that assemblies have been tested to meet the following:
1. Air infiltration: To AS 2047 and AS 4420.4.
 2. Watertightness: To AS 2047 and AS 4420.5. No water penetration shall occur under the test conditions as specified.
 3. Wind resistance: To AS/NZS 1170.2.
 4. Operation force test: To AS/NZS 4420.1.
 5. Deflection test: To AS 4420.2.
 6. Acoustic testing data, fire testing data, solar data and other testing results shall satisfy the performance requirements specified herein as required.
 7. Acceptance testing for all finishes as specified.
 8. Site hose testing as specified.
 9. Impact resistance of glazed partitions: Use the apparatus and procedure of the shot-bag test of AS/NZS 2208, Appendix D.
- C. If the testing data submitted is not deemed to be satisfactory by the Superintendent, laboratory tests shall be carried out to satisfy the requirements of the Specification to be agreed with the Superintendent.
- D. Test certificates do not relieve the Head Contractor of his responsibilities regarding the performance and service life requirements of the works.
- E. All external windows and sliding doors and treatment must provide acoustic insulation and glazing type in accordance with Structural, Council, BASIX, NCC, acoustic and authority requirements. Provide independent engineering calculations and testing to verify full compliance.

1.14 Site Hose Testing

- A. Carry out a Site water hose test in accordance with the recommendations of CWCT's Standard for Systemised Building Envelopes.
- B. Remedial work and retesting:
 - 1. Wherever leakage has occurred, make joints watertight to satisfy the requirements of the Specification.
 - 2. After all necessary remedial work has been completed and the required curing time, if any, has elapsed, retest all repaired joints following the same procedure as before. Should leakage still be found, take further remedial measures and repeat testing until all joints in the designated area are found to be satisfactory.
- C. Extent of testing: A minimum of 5% by length of all critical joints, at locations agreed with the Superintendent.

1.15 Acoustic Testing

- A. Where acoustic performance criteria is specified, arrange for testing of these systems or elements of the works by an accredited testing authority and in accordance with AS 5218, to confirm that the acoustic criteria is met.

1.16 Skylight Testing

- A. Carry out testing on single pitch, glazed skylights in accordance with National Roofing Contractors Association (NRCA) recommendations.

1.17 Weighted Sound Reduction Index (Rw) Tests

- A. Double glazed systems: Interpolation between test results for similar systems is acceptable only if:
- B. Dimensional (thickness or width) differences do not exceed a ratio of 1:1.5.
- C. Each tested system differs from the proposed system by not more than one of the following elements:
 - a) Cavity: Width dimension.
 - b) Cavity reveal: Acoustic absorption treatment.
 - c) First panel: Glass type, glass thickness.
 - d) Mounting: Seal type.

1.18 Type-Test Reports

- A. Submit type-test reports verifying conformity with AS 2047 as follows:
 - 1. Condensation resistance factor: To AAMA 1503.
 - 2. Fire resistance level: To AS 1530.4.
 - 3. Thermal resistance: To AAMA 1503.
 - 4. Weighted sound reduction index: Rated to AS/NZS ISO 717.1.

1.19 Seismic Requirements

- A. All seismic design loads on structures will be established in accordance with AS 1170.4. Refer to the Structural Engineer's documentation for details.

1.20 Openable Windows

- A. Protection of openable windows: Submit a certificate of on-site fall prevention in accordance with NCC D2.24 and NCC 3.9.2 and tested to AS 5203.

1.21 Opening Pressures

- A. The maximum opening pressures required to open non-fire rated doors on continuous accessible paths of travel shall be in accordance with AS 1428.1.
- B. The maximum opening pressures required to open fire rated doors shall be in accordance with AS 1905.1.

1.22 National Construction Code

- A. Comply with the relevant parts of the NCC including, but not limited to the following:
 - 1. NCC clause D2.19 Doorways and doors and D2.21 Operation of latch.
 - 2. NCC Clause D2.23 Signs on Doors.
 - 3. NCC Part D3 Access for people with a disability (D3.1, D3.2, D3.3, D3.6).

1.23 Identification of Doors

- A. Doors and door-frames shall be identified and labelled to match the Door Schedule.
- B. Plates shall be installed on the hinge edge of doors, in a position concealed when the door is closed and clearly visible when the door is open.

1.24 Marking

- A. Identification: Marked to show the following:
 1. Manufacturer's identification.
 2. Product brand name.
 3. Product type.
 4. Quantity.
 5. Product reference code and batch number.
 6. Date of manufacture.
 7. Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern.
- B. Window assemblies for housing: To AS 2047 Section 8.

1.25 Strength Requirements of Doors

- A. Strength of doors and frames:
 1. Provide evidence to demonstrate that doors, including frames and hardware, have been tested for the following and include written results:
 - a) Slamming shut impact.
 - b) Slamming open impact.
 - c) Heavy body impact.
 - d) Hard body impact.
 - e) Torsion.
 - f) Downward deformation.
 - g) Closure against obstruction.
 - h) Resistance to jarring and vibration.
 - i) Abusive forces on door handles.

1.26 Performance Requirements

- A. Comply with the general performance requirements of Section 0171 and the following specific requirements.

1.27 Fire Performance

- A. External combustible linings: Group number to NCC Spec C1.10 and AS 5637.1.
- B. External attachments, including but not limited to awning, sunshades, blinds and shading hoods: Fire hazard indices tested to AS/NZS 1530.3, as follows:
 1. Spread-of-Flame Index: 9.
 2. Smoke-Developed Index: 8 if Spread-of-Flame Index > 5.

1.28 Deflections

- A. The allowable deflection in the centre of any element of work under the Contract, when carrying a wind load of 60% of the design wind load shall be $L/90$ up to a maximum of 20mm.

1.29 Inertial Loads

- A. Work under the Contract shall be capable of accommodating inertial loads arising due to the acceleration/ deceleration of moving sections including opening lights, doors and vents of the building or enclosure. Consult the Superintendent regarding the motion requirements for such elements.

1.30 Thermal Movement

- A. Make allowance of ± 4 mm per 3000mm length of frame members to permit thermal expansion and contraction to take place freely in the plane of the units by the use of fully weatherproof horizontal and vertical expansion joints, as necessary, in the design of the units themselves and not in movable fixings between the units and the building structure.

- B. The design shall cater for all temporary and permanent conditions envisaged for work under the Contract.
- C. The assumed installation temperature for components of work under the Contract is 21°C.
- D. Calculations for suitable correction of this factor shall be submitted to the Superintendent if installation temperature varies significantly from 21°C.

1.31 Moisture Movement

- A. Work under the Contract shall withstand movement without permanent deformation or any reduction in the specified performance:
 - 1. Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air.

1.32 Thermal Performance Requirements

- A. No cold bridging shall occur through the framing elements of work under the Contract.
- B. Submit thermal calculations for the various components and the average thermal performance.
- C. Thermal movements shall not result in audible noise.

1.33 Air Permeability/ Infiltration

- A. Minimise airflow from the outside to the inside of the building through joints/ junctions to control concentrated airflow.
- B. Air infiltration, when tested generally in accordance with AS 2047, will be measured at a range of positive and negative pressures within AS 2047.
- C. Any air leakage shall be distributed and not concentrated at a single location.
- D. Provide actual air leakage test results.

1.34 Condensation

- A. Condensation shall not form, either on internal or external surfaces of framing members, glazing, solid panels, or interstitially within the construction of infill panels forming a part of work under the Contract, such that it may lead to damage or staining.
- B. Interstitial cavities within the construction, where condensation may occur, shall be adequately drained and ventilated to the outside, such that the formation of such condensation is not detrimental to the performance or causes damage or staining of work under the Contract.

1.35 Capillarity

- A. The Detailed Design, gaskets, seals, etc., shall take into account and eliminate any possibility of water migration to the inside of the building due to capillarity.

1.36 Weather and Water Penetration Resistance

- A. Work under the Contract shall be absolutely weatherproof and watertight, ensuring the prevention of water leakage onto the internal face of work under the Contract.
- B. Work under the Contract, including flashings and junctions with adjacent parts of the building, shall be fully weatherproof and watertight under all conditions with full allowance made for deflections and other movements.
- C. The Detailed Design and construction of work under the Contract shall be such that all rigid or fixed joints remain rigid and accommodate all thermal, building structure or other movements and any applicable loads without compromising their watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the glazing's watertightness.

1.37 Local Factors

- A. Visit the Site in order to become familiar with local requirements. Local microclimatic conditions shall be taken into account and grades of materials assessed as suitably durable for the location shall be selected. More appropriate materials shall be substituted if adverse effects are predicted.

1.38 Demountability

- A. Elements of the works shall be individually and independently removable ensuring access for maintenance.
- B. The removal of units shall not affect the performance or safety of any other units or adjacent work under the Contract.

2 PRODUCTS

2.1 General

- A. Refer to the Design Drawings, Door Schedule, Door Type Reference, Door Legend, Window Schedule and Master Schedule.
- B. Allow for the installation of reed switches to all operable bedroom window frames. Refer to Electrical Engineers' specification for details.
- C. Systems to be complete with frame, flashings, seals and all accessories installed as required to provide a complete system in accordance with the Specification.
- D. General dead and live loads to be established in accordance with AS/NZS 1170.1 or other statutory regulations, whichever are the most stringent.
- E. Wind load pressure coefficients to be established in accordance with AS/NZS 1170.2.
- F. Aluminium sections for framing are to be suitable aluminium alloys in profiles, sizes and grades, structural applications and applied finishes to suit the functional requirements and conditions in accordance with AS/NZS 1664.1 and AS/NZS 1664.2.
- G. All glazing and elements of glazing systems must take into account the requirement to withstand the most severe loading or load combinations and provide adequate means of dealing with thermal and differential movement.
- H. Provide additional stiffeners in to the aluminium sections as required.
- I. Removable panels and elements are only to be able to be removed using specialist tools or machinery to prevent unauthorised entry.
- J. Provide adequate means of dealing with thermal and differential movement.
- K. Glass will resist ambient climatic conditions and satisfy thermal, acoustic and other specified performance criteria.
- L. Facade types and metal components: Refer to the Design Drawings and Master Schedule.
- M. Joinery doors and frames: Refer to the Master Schedule.

2.2 Shopfront Glazing

- A. Shopfront style glazing with structural silicone glazing joints as required to complete a water and airtight system.
- B. Framing type and finish: As detailed on the Design Drawings and specified below.
- C. Glazing details: Clear Safety Glass. Grade A safety glass shall be in accordance with AS/ NZS 2208 and Section 0812 of this Specification. Refer to the Window Schedule and Door Schedule.
 - 1. Glass thickness shall be in accordance with AS 1288.
- D. Exposure category (design wind pressure): To AS/NZS 1170.2.
- E. Vision film and graphics as specified and in accordance with NCC requirements and as shown on the Window Schedule.
- F. Fixing: To the manufacturer's written instructions.
- G. Seals: High quality acoustical seals shall be fitted, and all air gaps fully sealed. Pack all voids to the surrounding structure and frame with dense insulation and fully seal.

2.3 Internal Glazed Partition System/ Window System

- A. Internal glazed partition system.
 - 1. Framing type and finish: As detailed on the Design Drawings, Master Schedule and specified below.
- B. Glazing details: Clear safety glass. Grade A safety glass in accordance with AS/NZS 2208 and Section 0812 of this Specification.
 - 1. Glass thickness to be in accordance with AS 1288.
- C. Vision film and graphics as specified and in accordance with NCC requirements and as shown on the Window Schedule.
- D. Fixing: To the manufacturer's written instructions.
- E. Seals: High quality acoustical seals are to be fitted, with all air gaps fully sealed. Pack all voids to the surrounding structure and frame with dense insulation and fully seal.

2.4 External Framed Windows

- A. External framed window suite.
 - 1. Framing type and finish: As detailed on the Design Drawings and specified below.

- B. Glazing details: Clear safety glass. Grade A safety glass in accordance with AS/NZS 2208 and Section 0812 of this Specification.
 - 1. Glass thickness to be in accordance with AS 1288.
 - 2. Refer to the Window Schedule and Door Schedule.
- C. Exposure category (design wind pressure): To AS/NZS 1170.2.
- D. Vision film and graphics as specified and in accordance with NCC requirements and as shown on the Window Schedule.
- E. Fixing: To the manufacturer's written instructions.
- F. Seals: High quality acoustical seals are to be fitted, with all air gaps fully sealed. Pack all voids to the surrounding structure and frame with dense insulation and fully seal.

2.5 Frameless Operable Glass Doorsets

- A. Frameless glass doorsets.
- B. Part of glazed window/ partition system.
 - 1. Glazing details: Clear safety glass. Grade A safety glass in accordance with AS/NZS 2208 and Section 0812 of this Specification.
 - a) Glass thickness to be in accordance with AS 1288.
- C. Hardware: Refer to Section 0455, the Hardware Schedule for details and the Door Schedule for operational requirements.
 - 1. Heavy duty top and bottom pivot kit with stainless steel cover plate.
 - 2. Cover plates shall be sealed using manufacturer's recommended sealing compound to seal against solvents and water.
 - 3. Doors shall include suitable stops and controllers to prevent over-run or impact damage when opening, and to ensure gentle closing without slamming.
- D. Where nominated on the Door Schedule, provide auto door operators and associated pivot system mounted in ceiling cavity as detailed in the Design Drawings.
- E. Vision film and graphics as specified and in accordance with NCC requirements.
- F. Fixing: To the manufacturer's written instructions.

2.6 Aluminium Framed Glass Doorsets Generally

- A. Aluminium framed glazed doorsets as part of an associated glazed window/ partition system to locations nominated in the Design Drawings. Refer to the Door Schedule and Door Elevations for details.
- B. Manufacturer/ reference: To match glazed partition systems.
 - 1. Finish: Powder coated or natural anodised, as detailed.
- C. Glazing details: Clear safety glass. Grade A safety glass in accordance with AS/NZS 2208 and Section 0812 of this Specification.
 - 1. Glass thickness to be in accordance with AS 1288.
- D. Sliding doors:
 - 1. Full length door tracks and operating gear as scheduled to suit size and weight of door leaves.
 - 2. Door operation shall be to the correct operational force and shall roll smoothly without sticking or jamming, and without excessive wear.
- E. Swing doors:
 - 1. Concealed door closer with stainless steel cover plate and top and bottom pivot hinges as nominated in the Window Types Schedule.
 - 2. Doors shall include suitable stops and controllers to prevent over-run or impact damage when opening, and to ensure gentle closing without slamming.
- F. Hardware: Refer to the Hardware Schedule for details and the Door Schedule for operational requirements.
- G. Exposure category (design wind pressure): To AS/NZS 1170.2.
- H. Vision film and graphics as specified and in accordance with NCC requirements.

- I. Fixing: To the manufacturer's written instructions.
- J. Seals: High quality acoustical seals are to be fitted, with all air gaps fully sealed. Pack all voids to the surrounding structure and frame with dense insulation and fully seal.
- 2.7 Specialised Doorset**
- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- 2.8 Canvas Retractable Awning**
- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- 2.9 Sunshade**
- A. Sunshade system as shown on the Design Drawings.
1. Material: Extruded aluminium.
 2. Size/ profile: Refer to the Design Drawings.
 3. Finish: Powder coated, external grade. Refer to Section 0671.
- B. Fixing: Concealed.
- 2.10 Skylight**
- A. Aluminium framed glass unit including flashing and over-flashing to complete a watertight skylight system.
- B. To comply with AS 4285.
- C. Glass: as nominated and in accordance with Section 0812.
- D. Finish to aluminium: Powder coated or anodised, as nominated.
- 2.11 Glass Types Generally**
- A. Manufacturer/ reference: Refer to the Master Schedule.
- B. Annealed Glass
1. Annealed glass manufactured by controlled cooling done in a lehr to prevent residual stresses in the glass.
 - a) Glass process method: Annealed.
 - b) Safety Category: Grade A in accordance with AS/NZS 2208.
 - c) Thickness: To comply with AS 1288.
 2. Colour tone: Clear.
- C. Laminated Glass
1. Two or more layers of sheets of glass bonded together by heat and pressure with an interlayer of PVB, EVA or a high strength ionoplast interlayer.
 - a) Glass process method: Laminated.
 - b) Safety Category: Grade A in accordance with AS/NZS 2208.
 - c) Thickness: To comply with AS 1288.
- D. Toughened Glass
1. Toughened glass manufactured by heating and rapidly cooling float glass to balance tensile and compressive stresses to achieve strengths 5 times greater than ordinary annealed glass.
 - a) Glass process method: Toughened.
 - b) Safety Category: Grade A in accordance with AS/NZS 2208.
 - c) Thickness: To comply with AS 1288.
 2. All toughened glass shall be 100% heat soaked in accordance with EN 14179-1 standard guidelines. Submit certificates for approval prior to incorporation of glass into the works. The Certificate will state compliance with the manufacturing process above and the standard under which the testing for compliance has been carried out.
- E. Toughened Laminated Glass
1. Toughened laminated glass comprises of each glass panel been toughened and bonded together using PVB or resin as the interlayer medium.
 - a) Glass process method: Toughened and laminated.

- b) Safety Category: Grade A in accordance with AS/NZS 2208.
- c) Thickness: To comply with AS 1288.
- 2. All toughened glass shall be 100% heat soaked in accordance with EN 14179-1 standard guidelines. Submit certificates for approval prior to incorporation of glass into the works. The Certificate will state compliance with the manufacturing process above and the standard under which the testing for compliance has been carried out.

F. Colourback Glass

- 1. Low iron glass with coloured background.
 - a) Thickness: To comply with AS 1288.

G. Mirror glass

- 1. Decorative mirror glass.
 - a) Glass process method: Toughened and laminated.
 - b) Safety Category: Grade A in accordance with AS/NZS 2208.
 - c) Thickness: As scheduled and to comply with AS 1288.
 - d) Colour: As scheduled.

H. Refer to the Design Drawings, Window Schedule, Door Schedule and Master Schedule.

I. Glazing to be in accordance with Section 0812 and the nominated performance requirements in the respective reports.

J. All glazing to be installed will be in accordance with clause F1.13 of the NCC.

K. Glass types and thicknesses to AS 1288, but not less than 6mm.

L. Glass thicknesses and types nominated are minimum performance requirements and are to be confirmed by the Head Contractor.

M. Noise reducing glazed assemblies

- 1. Labelling: Label each panel with a legible non-permanent mark, stating and certifying the Rw rating, and identifying the testing authority. Remove when directed.

2.12 Systems Generally

A. Systems to be complete with frame, seals and all accessories installed as required to provide a complete system in accordance with the Specification.

2.13 Stiffeners

- A. Stiffeners are required to windows and doors as nominated on the Design Drawings to suit the nominated sizes and loading.
- B. All structural requirements of stiffeners to be approved by the Structural Engineer.

2.14 Glazing Materials

A. Glazing materials (including putty, glazing compounds, sealants, gaskets, glazing tapes, spacing strips, spacing tapes, spacers, setting blocks and compression wedges): Appropriate for the conditions of application and the required performance.

B. Compounds, sealants and tapes

- 1. Glazing tapes: To AAMA 800, Products coded 804.3, 806.3, or 807.3, as applicable.
- 2. Glazing compounds: To AAMA 800 Products coded 802.3 (Types I or II), or 805.2, as applicable.
- 3. Narrow joint seam sealer: To AAMA 800, Products coded 803.3.
- 4. Exterior perimeter sealing compound: To AAMA 800 Products coded 808.3.
- 5. Non-drying sealant: To AAMA 800 Products coded 809.2.
- 6. Expanded cellular glazing tape: To AAMA 800 Products coded 810.1.

C. Jointing materials

- 1. Requirement: Provide recommended jointing and pointing materials which are compatible with each other and with the contact surfaces and non-staining to finished surfaces. Do not provide bituminous materials on absorbent surfaces.

D. Elastomeric sealants

- 1. General: Provide elastomeric sealants as documented.

2. Sealing compound (polyurethane, polysulphide, and acrylic): To ASTM C920 or ISO 11600.
3. Sealing compound (silicone): To ASTM C920 or ISO 11600.
4. Sealing compound (butyl): To ASTM C1311.

E. Priming

1. Application: Apply the recommended primer to the surfaces in contact with sealant materials.

F. Control joints

1. Depth of elastomeric sealant: One half the joint width or 6mm, whichever is the greater.
2. Foamed materials (in compressible fillers and backing rods): Closed-cell or impregnated types which do not absorb water.
3. Bond breaking: Provide backing rods, and other back-up materials for sealants, which do not adhere to the sealant.

2.15 Visual Indicators on Glazing

A. Contrasting visual indicators to glazing.

B. To comply with AS 1428.1 and the National Construction Code (NCC).

C. System:

1. Type, material and pattern: Refer to the Design Drawings.

D. Performance requirements:

1. Indicative location(s): Fully glazed doors, sidelights and any glazing capable of being mistaken for a doorway or opening, where there is no chair rail, handrail or transom, is to be clearly marked with a contrasting visual indicator.

2.16 Louvre Assemblies

A. Provide metal louvre blades, mounted in a metal surround frame or subframe, and able to withstand the permissible-stress-design wind pressure for that location, without failure or permanent distortion of members, and without blade flutter.

B. Where nominated, service louvres will be removable or hinged to permit equipment access. Removable louvres are only to be removable using specialist tools to prevent unauthorised entry. Hinged panels will have a tamper proof lock flush mounted to frame.

C. Open area ratio: refer to Mechanical Engineer's details.

D. Fixed metal louvres

1. Provide metal louvre blades, mounted in a metal surround frame or subframe, installed as for metal window installations.

E. Vermin proof screens to louvres:

1. Requirement: Provide stainless steel mesh screen behind louvres to prevent the entry of vermin, birds, rodents and wind blown leaves and papers.

2.17 Aluminium Frames Generally

A. Material, construction and installation to be in accordance with AS 2047 and Section 0813.

B. Assemble frames from aluminium sections, including necessary accessories such as buffers, pile strips, strike plates, fixing ties or brackets and cavity flashing, with suitable provision for fixing nominated hardware.

C. Where frame include a threshold member, provide a self-draining section with anti-skid surface.

D. Aluminium framing will be pre-finished with protective coatings, built in or fixed to prepared openings.

E. Provide provisions for fixing hardware including hinges and locksets, using 6mm aluminium back plates and lugs. Mount strike plates, locksets, flush bolts and the like flush with the face of the frame.

F. Provide suitable cut-outs and fixing cleats.

G. Aluminium frame finishes:

1. Powder coatings: Refer to Section 0813.
2. Anodised: Refer to Section 0816.

3. Nominated finishes to aluminium sections shall be factory applied and protected until Practical Completion.
- H. Frame sections to be not less than the cross sectional dimensions indicated on drawings. Provide larger size sections if necessary to meet performance requirements specified for review by the Superintendent.
- I. Transoms to be strengthened to prevent twisting from the use of slide arm closers to all external double aluminium doors.
- J. Provide angles to frames as required and shown on Design Drawings.
- K. Form junctions so that no fixings, such as pins, screws, pressure indentations and the like are visible on exposed faces. Show on Shop Drawings fixings which will be exposed. Cut edges, drill holes, rivet joints and clean flat sheets, neat, free from burrs and indentations. Remove sharp edges without excessive deformation.
- L. Fit mitred joints accurately to a fine hairline.
- M. Pre-assemble and match mark before delivery.
- N. All frames are to have the capacity to install fly screens (provision of extra track on window and door sections).

2.18 Stainless Steel Door Frames

- A. Continuously welded from stainless steel sheet sections, including accessories such as buffers, strike plates, spreaders, mortar guards, switch boxes, fixing ties or brackets, and cavity flashing with provision for fixing documented hardware and electronic security assemblies..
 1. Stainless steel grade: 316
 - a) Finish: To match adjacent stainless steel window/ partition framing.
 2. Thickness: 1.6mm. To be confirmed by the Superintendent.
- B. Finish: Continuous weld and grind the welds smooth for a seamless finish.
- C. Accessories: Provide mortar guards, fixing lugs and reinforcing plates for the specified hardware.
- D. Fixings: All fixings will be stainless steel grade 316.
- E. All necessary cut outs, core drilling of doors etc. to be provided to suit specified hardware, including items by others such as conduits, reed switches etc.
- F. Reinforce frames to facilitate the attachment of hinges and closers by means of 4mm thick stainless steel back plates and lugs welded on. Screw-fix hinges into tapped holes in the back plates. Frames shall receive a spreader, full width of the jamb to stop twisting and bowing of door frame when under full operational door load.
- G. All frames are to have the capacity to install fly screens (provision of extra track on window and door sections).

2.19 Preparation for Sealants

- A. Joint preparation sealants: Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which could interfere with the bond of sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by the sealant manufacturer. Roughen vitreous and glazed joint surfaces if recommended by sealant manufacturer.
- B. Prime or seal joint surfaces where indicated, and where recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate on to adjoining surfaces.

2.20 Installation of Sealants

- A. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- B. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces.
- C. Install sealant to depths as recommended by sealant manufacturer.
- D. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength internal cohesive strength and surface durability.

- E. Remove excess caulking compound and sealant and leave surfaces neat, smooth and clean, without smears on surrounding work. Tool joints where recommended by manufacturer or where required. Remove cartons and debris from site as the work progresses.

2.21 Support Structure

- A. Provide a structural steel support structure, as necessary, having due regard for any requirements in excess of structural steel shown on the Structural Engineer's Drawings and also any requirements shown on the Drawings. The structural steelwork shall comply with the Structural Engineer's Steelwork Specification, including protective coatings.

2.22 Ancillary Materials

- A. Trims
1. Timber: Solid timber at least 19mm thick, mitred at corners.
- B. Extruded gaskets and seals
1. Provide seals as documented.
 2. Materials: Non-cellular (solid) elastopressive seals as follows:
 - a) Flexible polyvinyl chloride (PVC-U): To BS 2571, 100% solids with high consistency, ultraviolet stabilised.
 - b) Rubber products (neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber): To BS 4255-1.
- C. Flashings
1. Corrosion resistant, compatible with the other materials in the installation, and coated with a non-staining compound where necessary.
 2. Visible flashings and weathering are to be of the same material and finish as the exposed framing members of the window and door systems, unless otherwise nominated.
 3. Standard: To AS/NZS 2904.
 4. Aluminium flashings (where nominated):
 - a) Aluminium flashings shall be formed from aluminium alloy sheets, complying with AS 1231. The alloy shall be selected to satisfy the requirements of the chosen finishing process.
 - b) Aluminium flashings, sheet for copings, panels and visible closers shall be sufficiently thick to provide a visually flat surface.
 - c) Flashings shall have finish to match adjacent cladding.
 - d) Longitudinal joints shall have lapped or interconnecting joints, fully weather sealed. Simple butt joints and butt straps will not be acceptable. Joints, sealants, etc, shall be designed to accommodate thermal movements of all flashings.
 - e) Achieve electrical continuity between conductive parts. Make provision for lightning protection integration requirements.
 - f) Aluminium flashings shall be treated with anti-drumming insulation on the hidden face.
- D. Nylon brush seals
1. Dense nylon bristles locked into galvanised steel strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door with double sided PVC-U foam tape.
- E. Door thresholds
1. Door thresholds throughout the development will be provided in accordance with Clause D2.14 and D2.15 of the NCC.
 2. Fix 150mm from each end and at 600mm maximum centres.
- F. Pile weather strips
1. Standard: To AAMA 701/702.
 2. Location: To all external windows and glass doors.
 3. Materials: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised.
 4. Finned type: A pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

- G. Weather bars
1. Provide a weather bar under hinged external doors, locate under the centres of closed doors.

2.23 Tolerances for Manufacture

- A. Adhere to the design tolerances.
- B. Show the provisions intended to accommodate the construction tolerances of the surrounding elements. Obtain any further information necessary from the Superintendent when completing the Shop Drawings.
- C. Specific tolerances shall be adhered to. The accuracy required for the tolerances of work under the Contract shall be:
1. Level of horizontal members: $\pm 2\text{mm}$ from datum in any 1500mm, non-cumulative.
 2. Plumb of vertical members: $\pm 2\text{mm}$ in the height.
- D. Submit to the Superintendent a detailed list of tolerances to which the components will be fabricated, within the requirements of the Specification and overall geometric requirements. As a minimum the statement of tolerances shall include the following:
1. Thickness.
 2. Out of plan.
 3. Straightness normal to plane.
 4. Longitudinal.
 5. Horizontal.
 6. Vertical.
 7. Diagonal.
 8. Eccentricity.
- E. All finished metal surfaces shall be flat and free from undulations and irregularities.
1. Twist of frame: $\pm 1.5\text{mm}$ with no warping of frame.
 2. Line of frame: $\pm 2\text{mm}$. Overall difference between adjacent standards shall not exceed 2mm.

2.24 Lightning Protection and Earth Bonding

- A. Bonding is required between individual sections of cladding, in accordance with AS/NZS 1768 and AS 1882, to ensure continuity between adjacent sections, both vertically and horizontally over the whole façade. Bonding between sections shall have a minimum cross section of 50mm x 50mm. Any bolts used for bonding shall be a minimum size of M10.
- B. Carry out bonding to structural steelwork at intervals at no greater than 10m horizontally and 20m vertically. The first level of bonding to the structural steelwork shall be at the highest floor level of each part of the building.
- C. Provide studs/ bolts for subsequent connection.
- D. All straps/ connections shall be concealed.
- E. No straps shall be fixed along copings.

2.25 Security

- A. All operable windows shall be fitted with window locks to suit the application and as recommended by the manufacturer.
- B. Operable windows are to comply with the NCC. Clause D2.24 of NCC Volume One, and Clause 3.9.2.5 of NCC Volume 2, as follows:
1. Operable windows to bedrooms, where the floor below the window is more than 2000mm above the surface beneath, shall be fitted with a device to restrict the opening, or a suitable screen, so a 125mm diameter sphere cannot pass through. The device or screen must also be able to withstand an outward horizontal force of 250N.
 2. The device or screen can have a child resistant release mechanism which can enable the device or screen to be removed, unlocked or overridden. Where a child resistant mechanism is utilised, the window must also be provided with a barrier below it that has a minimum height of 865mm, does not permit a 125mm sphere to pass through it, and does not have any horizontal or near horizontal elements between 150mm and 760mm that facilitate climbing.

- C. Protection of openable windows: To AS 5203.
 - 1. Fall prevention: To NCC D2.24 , NCC 3.9.2.6 and NCC 3.9.2.7.
- D. Refer to the NCC for further requirements, and ensure all relevant windows are compliant.

2.26 Hardware

- A. Refer to Section 0455.

3 EXECUTION

3.1 General Requirements

- A. All work under the Contract shall be true to detail with continuous profiles that are free from marks, defects, flaws, steps, waves or damage of any nature.
- B. All work under the Contract is to be durable and remain intact, weatherproof and waterproof under the ambient in-service atmospheric and climatic conditions.
- C. All work under the Contract must be undertaken by fully qualified, skilled and experienced personnel.
- D. Store all elements on Site such that they are not damaged, distorted or weathered unevenly.
- E. Carefully pack all finished components in stillages or crates such that they are suitably separated and protected to prevent scratching, scuffing or other surface damage.
- F. Verify dimensions and levels of the structure.
- G. Set out work under the Contract such that all elements are installed in the correct position, within tolerance, and in the correct relationship to the building structure.
- H. Install all fixings in accordance with the manufacturer's recommended procedures.
- I. Keep materials dry until fixed.
- J. Obtain permission from the Superintendent before drilling or cutting parts of the structure.
- K. Set out material at evenly spaced centres, straight, parallel and truly aligned with other features where shown on the Design Drawings.
- L. Finished work under the Contract shall be square, regular, true to line, level and plane, with a satisfactory fit at all junctions, maintaining the design lines, section profiles and stiffness of components.

3.2 Storage and Handling

- A. Store in a clean, dry area and unaffected by weather, to the manufacturer's recommendations. Protect from building materials and loose debris such as wet plaster, mortar, paint and welding splatter.
 - 1. Handling: Handle frames to the manufacturer's recommendations and the following:
 - 2. Stack upright, off the ground and against a flat, vertical surface.
 - 3. Carry in the vertical position with sashes locked.
 - 4. Do not rack frames out square.
 - 5. Do not remove any bands and corner bracing until after installation.

3.3 Installation of Windows and Glazed Doors

- A. General: Install windows and glazed doors frames as follows:
 - 1. Plumb, level, straight and true within acceptable building tolerances.
 - 2. Fixed or anchored to the building structure in conformance with the wind action loading requirements.
 - 3. Isolated from any building loads, including loads caused by structural deflection or shortening.
 - 4. Allow for thermal movement.
 - 5. Provide for deflections, displacements and other movements, including:
 - a) Within the glazed assemblies and door assemblies.
 - b) Between the glazing elements and door assemblies and the building structure (including fire stop and smoke flashing connections if applicable), and all other adjoining façade elements (e.g. cladding, masonry).

- c) Movements caused by ambient temperature changes, wind loads, design dead and live loads and shrinkage.

3.4 Weatherproofing

- A. Flashing and weatherings: Install flashings, weather bars, drips, storm moulds, caulking and pointing so that water is prevented from penetrating the building between the window frame and the building structure under the prevailing service conditions, including normal structural movement of the building.
- B. Provide adequate means of dealing with vapour pressure, condensation and corrosion.

3.5 Fixing

- A. Fasteners and fastener spacing: Conform to the recommendations of the manufacturer.
- B. Fasteners: Conceal fasteners.
- C. Packing: Pack behind fixing points with durable full width packing.
- D. Prepared masonry openings: If fixing of timber windows to prepared anchorages needs fastening from the frame face, sink the fastener heads below the surface and fill the sinking flush with a material compatible with the surface finish.

3.6 Movement

- A. Provide glazed assemblies and doors to accommodate movements silently and without permanent deformation, reduction of performance, or other detrimental effects such as:
1. Damage to, or undue stress on, structural elements, fixings, glass and panels;
 2. Failure of joint seals;
 3. Loss of normal function in operable elements.
- B. Within glazed assemblies movements must not:
1. Reduce the glass "bite" to less than 75% of the design dimension;
 2. Reduce the clearance between framing members and non-structural infill units (e.g. glass) or between framing members and operable units (e.g. doors) to less than the minimum specified by the respective unit manufacturer.
- C. Where movement joints are to be provided within or between structures or structural elements, ensure all movement is accommodated by the glazed assemblies and door systems without damage or distortion.

3.7 Metal Separation

- A. Prevent direct contact between incompatible metals, and between green hardwood or chemically treated timber and aluminium or coated steel, by either of the following methods:
1. Applying an anti-corrosion, low moisture transmission coating to contact surfaces;
 2. Sleeves or gaskets of plastic film;
 3. Bituminous felt;
 4. Mastic;
 5. Inserting a separation layer;
- B. Separation material is not to be visible on exposed surfaces.

3.8 Joints

- A. General: Make accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.
- B. Sealants: If priming is recommended, prime surfaces in contact with jointing materials. If frames are powder coated, apply a neutral cure sealant.

3.9 Operation

- A. General: Make sure moving parts operate freely and smoothly, without binding or sticking, at correct tensions or operating forces and are lubricated.

3.10 Repair of Finish

- A. Polyester or fluoropolymer coatings: Contact supplier for approval to apply touch up products, otherwise replace damaged material.

3.11 Trim

-
- A. General: Provide mouldings, architraves, reveal linings, and other internal trim using materials and finishes matching the window frames. Install to make neat and clean junctions between frames and the adjoining building surfaces.

3.12 Louvre Assemblies

- A. Installation: Screw fix stiles and mullions to the building structure. Provide weather strips to heads and sills.
- B. Framed adjustable louvres
 - 1. Installation: Screw fix the main frame to the building structure with monel or stainless steel screws or masonry anchors of the type recommended by the louvre manufacturer.
- C. Metal louvres
 - 1. General: Provide metal louvre blades mounted in a metal surround frame or subframe, installed as for metal window installations.

3.13 Building In

- A. Will not be permitted except where specifically stated on the Design Drawings.
- B. Where building in is permitted, components shall be braced and protected as necessary to prevent distortion and damage during erection of adjacent structure.

3.14 Completion

- A. Maintenance manual: Submit the window and glazed door manufacturer's published instructions for operation, care and maintenance.
- B. Trade clean: Clean with soft clean cloths and clean water, finishing with a clean squeegee. Do not use abrasive or alkaline materials.
- C. Extent: All frames and glass surfaces inside and out.

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SECTION 0453 -- DOORSETS

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Timber doorsets.
 2. Smoke doorsets.
 3. Fire doorsets.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 500mm x 500mm sample of each type of door specified, taken from one corner showing seals, edge strips, and door protection.
 2. 500mm length of each type door frame section and joint in the nominated material and profile.
 3. Samples of sealants, gaskets, beads and all other trims necessary for a completed system in the nominated finish and colour.
 4. Samples of each type of seal.
 5. Samples of glazing materials.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed of each type, in locations as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Door frames in place before building into masonry.
 2. Door frames installed before fixing trim.
 3. Doors hung and prior to the installation of door furniture.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings showing details of each assembly, component and connection and information relevant to fabrication, surface treatment and installation.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Test Requirements

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

- B. Door assemblies within openings, including hardware (refer to Section 0455), shall achieve the fire rating indicated on the Door Schedule and be independently tested to the relevant parts of AS 1530 or have CodeMark certification to assure NCC compliance. Copies of test certificates or assessments shall be provided for inspection.
- C. Weighted sound reduction index (Rw): To AS/NZS ISO 717.1.
- D. Copies of test certificates shall be submitted to the Superintendent prior to manufacture.

1.12 National Construction Code

- A. Comply with the NCC including, but not limited to the following:
 1. NCC clause D2.19 Doorways and doors and D2.21 Operation of latch.
 2. NCC Clause D2.23 Signs on Doors.
 3. NCC Part D3 Access for people with a disability (D3.1, D3.2, D3.3, D3.6).
 4. NCC Part C Protection of openings including C3.2, C3.4 (C3.5 Doorways in fire walls) C3.6, C3.7, C3.8.

1.13 Identification of Doors

- A. Doors and door-frames shall be identified and labelled to match the Door Schedule.
- B. Fire door-sets shall be fitted with identification plates in accordance with the relevant Standards, verifying compliance of manufacture and installation, and stating fire-resistance rating.
- C. Plates shall be installed on the hinge edge of doors, in a position concealed when the door is closed and clearly visible when the door is open.

1.14 Opening Pressures

- A. The maximum opening pressures required to open non-fire rated doors on continuous accessible paths of travel shall be in accordance with AS 1428.1.
- B. The maximum opening pressures required to open fire rated doors shall be in accordance with AS 1905.1.

1.15 Strength Requirements

- A. Strength of doors and frames:
 1. Provide evidence to demonstrate that doors, including frames and hardware, have been tested for the following and include written results:
 - a) Slamming shut impact.
 - b) Slamming open impact.
 - c) Heavy body impact.
 - d) Hard body impact.
 - e) Torsion.
 - f) Download deformation.
 - g) Closure against obstruction.
 - h) Resistance to jarring and vibration.
 - i) Abusive forces on door handles.

2 PRODUCTS

2.1 Doorsets Generally

- A. Timber and composite doors: To AS 2688 .
- B. Doors and doorways are to comply with AS 1428.1, clause 13.
- C. Operational forces at the door handle are to comply with AS 1428.1, clause 13.5 where applicable.
- D. Doorset components shall be as detailed in the Door Schedule including but not limited to the following:
 1. Leaf sizes and configurations.
 2. Door frame types and finishes.
 3. Meeting stiles.
 4. Operating requirements.

5. Performance requirements:
 - a) Fire resistance ratings.
 - b) Acoustic ratings.
 - c) Thermal rating.
6. Acoustic, fire and smoke seals.
7. Refer to the Section J Compliance Report for thermal and acoustic requirements.
8. Hardware, also refer to Section 0455.
9. Cladding types and finishes.

2.2 Solid Core Timber Doorsets Generally

- A. Weatherproof Grade A bond plywood, fine sanded smooth without grain evident and faced to finger jointed timber sub-frame sized to suit hardware. Doors shall be in-filled with moisture resistant solid core infill panels comprising moisture resistant timber strip blockboard, fully bonded to each other, the sub-frame, and to facings on each side.
- B. Door thickness: As shown on the Design Drawings, in the Door Schedule and generally to the minimum sizes as follows:
 1. Generally: Minimum 40mm finished, unless detailed otherwise.
- C. Door frame: As nominated in the Door Schedule.
- D. Finish: Applied finish unless nominated otherwise in the Door Schedule.
- E. Edge strips: Minimum thickness 10mm. Increase overall thickness to greater than 15mm to accommodate the full depth of the rebate in doors with rebated meeting stiles. Apply to the external edges of door after the facings are bonded to the door framing/core and finish flush with outside surface of the facings. Bevel square edged doors as necessary to prevent binding between the leaves.
- F. Air supply and exhaust requirements to Mechanical Engineer's drawings and specifications. Provide undercuts and grilles to doors only where nominated in the Door Schedule.
 1. Sizes as required by the Mechanical Engineer.
- G. Rebated/ Square edged meeting stiles to 1½ leaf and double leaf doors as nominated on the Door Schedule.
- H. Door protection: Where nominate on the Door Schedule provide door protection in the form of stainless steel kickplates to heights detailed in the Design Drawings.
- I. Mortise type power transfers shall be supplied and installed where electric mortise locks are scheduled. The Head Contractor should allow for a fire rated power transfer in all such conditions.
- J. Metal clad where nominated in the Door Schedule and as specified.

2.3 Fire Resistant Doorsets Generally

- A. Fire resistant doorsets: To AS 1905.1 and NCC specification C3.4.
- B. Manufacturer: Pyropanel or acceptable equivalent.
- C. Door thickness: Minimum 48mm finished, unless nominated otherwise on the Design Drawings and in the Door Schedule.
- D. Internal materials: Inert mineral materials containing no asbestos products.
- E. Fire resistance level (FRL): As detailed in the Door Schedule. Door fire rating levels shall generally perform to fire rated levels of the Fire wall it is installed to.
- F. Framing: Increase the width of door leaf members or provide additional members to accommodate hardware and grooves so that items of furniture shall be contained within framing members and shall not encroach on the core materials.
- G. Frames: As recommended by the fire door manufacturer.
- H. Fire doors pressure differentials to comply with AS 1668.1, clause 4.7.
- I. All fire doors shall be self latching and self closing.
- J. Where electronic security is provided to fire door sets, doors shall switch to Failsafe upon building fire mode activation or power failure unless nominated otherwise in the Door Schedule or the Design Drawings.
- K. Fire rated vision panels shall be installed to doors where nominated on the Door Schedule. Refer to the door elevations detail drawings for sizes and types.

- L. Provide signage to fire doorsets in accordance with NCC Clause D2.23. Refer to the Door Schedule for details.
- M. Rebated/ Square edged meeting stiles to 1½ leaf and double leaf doors as nominated on the Door Schedule.
- N. Where nominated on the Door Schedule, provide seals to door head, sill, stiles and frames.
- O. Finishes: Applied finish unless nominated otherwise in the Door Schedule.

2.4 Smoke Doorsets Generally

- A. Smoke doors shall comprise of solid core doors integrated with door seals to perimeter and sills. Smoke doors shall be capable of resisting smoke at 200 degrees Celsius for 30 minutes at a minimum when tested to AS 1530.7.
- B. Size: Refer to the Door Schedule.
- C. Thickness: Minimum 40mm thick finished, unless nominated otherwise on the Design Drawings and in the Door Schedule.
- D. Smoke doorsets: To AS 6905 and NCC Spec C3.4.
 - 1. Constructed so that smoke will not pass from one side of the doorway to the other and including the following:
 - a) Smoke doors shall be side hung to swing in direction of egress or in both directions.
 - b) Doors shall be in the closed position at all times in manual operation or if door is on hold opens, they shall automatically close upon detection of smoke or on power failure.
 - c) Provide smoke or fire rated perimeter seals, sill drop seals and where applicable seals to rebated meeting stiles to all smoke doors.
 - d) All smoke doors shall be self latching and self closing.
- E. For doors in path of egress, doors shall conform to NCC clause D2.7 for "Non-combustible construction or fire protective covering".
 - 1. Flush doors faced with 1.0mm thick galvanised or zincaneal steel sheet to inside face of door leaf and extended over and across hardwood edge strips. Attach to door leaves with waterproof adhesive using a press.
 - 2. Metallic coated sheet steel: To AS 1397.
- F. Initial opening force for smoke doors at the handle position shall not exceed 50N. The force stated excludes the effects of differential building pressures. Refer to AS 6905 Table A1 for recommendation of door closer power sizes in relation to door sizes and opening force requirements.
- G. Where electronic security is provided to smoke door sets, doors shall switch to Failsafe upon building fire mode activation or power failure unless nominated otherwise in the Door Schedule or the Design Drawings.
- H. Power transfers shall be supplied and installed where electric mortise locks and strikes are scheduled. The Contractor shall allow for a fire rated power transfer in all such conditions.
- I. Rebated/ Square edged meeting stiles to 1½ leaf and double leaf doors.
- J. Finishes: Applied finish unless nominated otherwise in the Door Schedule.

2.5 Semi-Solid Core Doorsets Generally

- A. Internal grade plywood faced semi-solid core door comprising of larger pieces of particleboard or wood blocking to cavities of additional structural intermediates.
 - 1. Door thickness: As shown on the Design Drawings and in the Door Schedule.
 - 2. Door frame: As nominated in the Door Schedule.
 - 3. Finishes: Applied finish unless nominated otherwise in the Door Schedule.
- B. Door seals shall satisfy the acoustic and fire/ smoke requirements as nominated in the Door Schedule and the Acoustic Engineer's documentation.

2.6 Internal Cavity Sliding Doorsets

- A. Plywood faced flush panel solid core door with hardwood edges.
- B. Door frame: Cavity sliding set.
- C. Finish: Painted. Refer to Section 0671.

2.7 Timber Generally

- A. Refer to Section 0815.

2.8 Metal Clad Doors

- A. Flush doors faced both sides with 0.6mm thick galvanised steel sheet extended over and across hardwood edge strips on all edges and fixed with waterproof adhesive using a press.
- B. Metallic coated sheet steel: To AS 1397.

2.9 Stone Clad Doors

- A. Hidden/ secret doors clad with stone to match surrounding cladding. Refer to Section 0433.

2.10 Timber Door Frames

- A. Hardwood: To AS 2796.1.
 - 1. Grade: Select.
- B. 38mm thick kiln dried hardwood frames and 12mm stops. Depth of frame to suit wall thickness.
- C. Joints:
 - 1. Morticed head and through tenons.
 - 2. Trenched head:
 - a) Bare faced tenons on jambs.
 - b) Full let-in jambs.
- D. Heads of fasteners: Conceal where possible, otherwise sink the head below the surface and fill the sinking flush with a material compatible with the surface finish.
- E. Fixing to metal frames: Provide 6mm countersunk metal thread screws.
- F. Fixing to thresholds: Dowel external door frames to thresholds other than timber with 10mm diameter brass dowels 100mm long.

2.11 Steel Door Frames

- A. Continuously welded from metallic-coated steel sheet sections, including accessories such as buffers, strike plates, spreaders, mortar guards, switch boxes, fixing ties or brackets, and cavity flashing with provision for fixing documented hardware and electronic security assemblies, and pre-finished with a protective coating.
 - 1. Coated steel sheet to AS 1397.
 - 2. Thickness:
 - a) General: 1.1mm.
 - b) Fire rated doorsets: 1.6mm as required to suit fire resistance levels.
 - c) Security doorsets: 1.6mm.
- B. Finish: Grind the welds smooth, cold galvanise the welded joints, shop prime and apply final paint finish. Refer to Section 0671 for paint details.
- C. Accessories: Provide mortar guards, fixing lugs and reinforcing plates for the specified hardware.
- D. All necessary cut outs, core drilling of doors etc. to be provided to suit specified hardware, including items by others such as conduits, reed switches etc.
- E. Reinforce frames to facilitate the attachment of hinges and closers by means of 4mm thick back plates and lugs welded on. Screw-fix hinges into tapped holes in the back plates. Frames shall receive a spreader, full width of the jamb to stop twisting and bowing of door frame.
- F. Adequately fix or anchor to the building structure.
- G. Frames are not to carry any building loads, including loads caused by structural deflection or shortening.

2.12 Meeting Stiles

- A. General: Bevel square edged doors as necessary to prevent binding between the leaves.
- B. Rebated meeting stiles: If not double acting doors, provide rebated meeting stiles or fix equivalent metal T stop to one leaf. Form rebates to suit standard rebated hardware.
- C. Refer to the Door Schedule for selections.

2.13 Door Handing

- A. Door handing is determined when approaching door from the outside with the indicated swing whether it be swinging out or in.
- B. Confirm correct handing requirements before manufacturing and ordering.

2.14 Glass Types

- A. Low E insulating glass unit. Refer to Section 0812.
- B. Refer to the Acoustic Report and ESD report for additional requirements.
- C. View panels: Clear laminated safety glass panel with mitred hardwood beads in upper part of door.
- D. View panels to fire rated doorsets: Glazing shall be selected to ensure the required fire rating of the doorset is maintained and the complete system shall be tested accordingly.
 - 1. Nominal thickness: As scheduled.
 - a) Glass thickness to suit acoustic, ESD and windload requirements
 - 2. Tint/ temper/ coating: Low-E.
 - 3. Interlayer: To be confirmed.
 - 4. Coating: None
- E. Performance requirement:
 - 1. SHGC: NFRC100-2001 (maximum)
 - 2. U-Value (NFRC100-2001) **W/m²K maximum centre pane.
 - 3. Visible light transmittance: ** minimum.
 - 4. External visible reflectance: **maximum.

2.15 Tolerances

- A. A high degree of accuracy is required in the fabrication of doorsets.
- B. Accurately cut and form materials to the required shape and with all exposed surfaces and edges true and free from irregularities and defects, using techniques that will not impair the strength of materials used.
- C. All elements shall be square, regular to level and plane with all junctions fitting to the stated tolerances.
 - 1. Squareness: The difference between the lengths of diagonals of a door: Maximum 3mm.
 - 2. Twist: The difference between perpendicular measurements taken from diagonal corners: Maximum 3mm.
 - 3. Surface (face) misalignment, at the meeting edges of double swing doors in the closed position: 5mm.
 - 4. Nominal size (mm):
 - a) Height: ± 2 .
 - b) Width: $+ 2, - 0$.
- D. Allow for concealed wireways. Make allowance for connection to equipment within the framing system, back to the building power supply (to allow for wiring). Coordinate provisions for electrical service, sensing devices and final connections. Connect all parts of equipment with insulated wiring as required for operation.
- E. Where applicable ensure that the shadow gaps are maintained at the head and jamb conditions.
- F. State the tolerances intended to accommodate surrounding constructional elements in order to ensure that all aspects of the installation interface satisfactorily with the building as a whole.

2.16 Finishes

- A. Nominated finishes to aluminium sections shall be factory applied and protected as required during the entire construction period.
- B. Timber doors shall be spray painted to the manufacturer's written recommendations.
- C. External and wet area timber doors are to be double undercoated on all surfaces and edges.
- D. Paint finishes shall be stable, fade resistant, durable and of uniform texture and colour.
- E. Minor scratches and blemishes shall be repairable with the coating manufacturer's recommended product and system, matching the original finish for colour, texture and gloss.

- F. Applied facing to doors:
1. Applied facings shall be factory bonded where practical. Fully faced doors shall be factory matched with door-frames to minimise requirement for site adjustments.
 2. Use moisture-resistant adhesive or other suitable concealed methods. Mechanical fixings shall not be visible in the completed work. Exposed edges to be a smooth finish.
 3. Unless nominated otherwise, applied facings shall be to the full width of the door.
 4. Unless nominated otherwise, apply to both faces of doors, with matching edge protection.

2.17 Preservative Treatment

- A. Treat all timber in the door construction with preservative treatment as follows:
1. Moisture content of timber at time of treatment shall be as specified for the component at the time of delivery. After treatment, timber shall be surface dry before use.
 2. Treatment: Organic solvent pressure impregnation to AS/NZS 1604. The preservative treatment shall be compatible with all applied finishes.

2.18 Flashings and Weatherings

- A. Standard: To AS/NZS 2904.
- B. Provide flashings and weatherings which are corrosion resistant, compatible with other materials in the installation, and coated with a non-staining compound where necessary.

2.19 Jointing Materials

- A. Provide recommended jointing and pointing materials which are compatible with each other and with the contact surfaces and non-staining to finished surfaces. Do not provide bituminous materials on absorbent surfaces.

2.20 Pile Weather Strips

- A. Standard: To AAMA 701/702.
- B. Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised.
- C. Finned type: A pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

2.21 Door Seals Generally

- A. Seals where nominated in the Door Schedule and as specified.
1. Weather/ draught seals to external doorsets.
 2. Acoustic seals to suit nominated acoustic ratings.
 3. Intumescent fire and smoke seals to suit nominated fire resistance levels.
 4. Seals are to be neatly fitted and flush with frames, stiles and rebates. Seals are not to hinder the operation of doors, closers and other door hardware.
 5. Maintain the manufacturer's nominated tolerances and prevent doors from binding and sticking.
- B. All gaps around windows and door frames to be sealed with appropriate flexible sealant.

2.22 Extruded Gaskets and Seals

- A. Type: Non cellular (solid) elastopressive seals in accordance with AS 2047 and ISO 11600.
- B. Material:
1. Flexible polyvinyl chloride (PVC-U): To BS 2571, 100% solids with high consistency, ultra-violet stabilised.
 2. Rubber products (neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber): To BS 4255-1 or ISO 11600.

2.23 Nylon Brush Seals

- A. Dense nylon bristles locked into galvanised steel strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door with double-sided PVC foam tape.

3 EXECUTION

3.1 Installation

- A. Particular attention shall be paid to the interface between the door frames and walls when preparing the Shop Drawings and during installation. Interfacing requirements shall be in accordance with the visual requirements indicated on the Design Drawings.
- B. During construction, doors and hardware shall be protected after fitting, and care shall be taken to avoid fitting any doors and hardware while "wet" trades are still in progress. Doors and hardware shall be kept away from abrasives, acids and other corrosive materials.
- C. Security doors shall comply with AS 5040.
- D. Fire resistant doorsets shall comply with AS 1905.1.

3.2 Protection of Components

- A. Do not deliver components to Site which cannot be put immediately into suitable dry, covered storage with a dry floor. Stack on bearers, separated with spacers to prevent damage to, and by, projecting hardware, beads, etc.

3.3 Protection of Components after Installation

- A. All door frames shall have protective coverings during storage and after installation to protect factory applied finishes. Door leaves shall be protected during on-Site operations.

3.4 Moisture Content

- A. Timber to be used in doors shall be fully seasoned with moisture content complying with AS 2796 (Hardwood) and AS 4785 (Softwood) with both requiring moisture content between 9% and 14% at time of delivery and fabrication.
- B. All timber shall be subjected to controlled drying to ensure that the moisture content, if not otherwise specified, is suitable for the situation. Timber shall remain stable and free from expansion, contraction or other movements detracting from the required performance or appearance.
- C. Moisture content of all elements with doors and frames should be equal at the time of fabrication and should match the anticipated moisture content in service. Door components shall be acclimatised to the final service environment before assembly if equilibrium moisture content in service is likely to be significantly different to that of timber at time of manufacturer.
- D. During delivery, storage, fixing and thereafter to Practical Completion maintain conditions of temperature and humidity to suit the specified moisture content(s) of timber components. When instructed by the Superintendent, test components with an accepted electrical moisture meter used in accordance with the manufacturer's written recommendations.

3.5 Hardware

- A. Assemble and fix carefully and accurately using fastenings with a matching finish supplied by the hardware manufacturer. Prevent damage to hardware and adjacent surfaces. At completion check, adjust and lubricate as necessary to ensure correct functioning.

3.6 Sealant Joints

- A. Sealant for door frames shall be in accordance with Section 0811.

3.7 On-Site Dimensions

- A. Take responsibility for all dimensions and for checking dimensions on Site prior to manufacture.
- B. Accommodate any given tolerances and differences between actual Site dimensions and dimensions shown on the Design Drawings.

3.8 Fixing of Door Frames

- A. Fixing centres for door frames: When not pre-drilled or specified otherwise, position fixings 150mm from each end of jamb, adjacent to each hanging point and at 600mm maximum centres.
- B. Frames: Install the frames as follows:
 - 1. Fixed or anchored to the building structure.
 - 2. Isolated from any building loads, including loads caused by structural deflection or shortening.
- C. Brackets: Metallic-coated steel:
 - 1. Width: Minimum 25mm.
 - 2. Thickness: Minimum 1.5mm.
- D. Depth of fixing for building into masonry:
 - 1. Brackets: Minimum 200mm.

2. Expansion anchors: Minimum 50mm.
 3. Plugs: Minimum 50mm.
 4. Rods: Minimum 60mm.
- E. Jamb fixing centres: Maximum 600mm.
- F. Steel frames:
1. Building into masonry: Attach galvanised steel rods to jambs, build in and grout up.
 2. Fixing to masonry openings: Build in hairpin anchors and install locking bars, or use proprietary expansion anchors and screw twice through jambs at each fixing.
 3. Fixing to stud frame openings: Attach galvanised steel brackets to jambs and screw twice to studs at each fixing.
- G. Timber frames:
1. Building into masonry: Screw galvanised steel brackets twice to jambs and build in.
 2. Fixing to masonry openings: Build in seasoned timber plugs to masonry joints or use proprietary expansion anchors and screw twice through jambs at each fixing.
 3. Fixing to stud frame openings: Back screw twice to jambs at each fixing.
 4. Fixing to thresholds: Dowel external door frames to thresholds other than timber with 10mm diameter brass dowels, 100mm long.
 5. Heads of fasteners: Conceal if possible, otherwise sink the head below the surface and fill the sinking flush with a material compatible with the surface finish.

3.9 Fixing of Louvre Grilles

- A. Screw fix with countersunk heads and mount 350mm from the bottom of the door to the underside of the grille. Provide hardwood trim to opening and provide hardwood fixing beads.

3.10 Installation Tolerances

- A. Visual requirements shall be as follows:
1. Elements shall be straight and flat.
 2. Gaps to head and jambs of doors to frames shall be 3mm all round.
 3. Thresholds shall have a 7mm gap where located above a carpeted floor.
 4. Fire rated door thresholds shall maintain the recommended sill clearance by the fire door manufacturer. Generally not less than 3mm or greater than 10mm in accordance with AS 1905.1.
 5. The maximum variation from plumb shall be ± 1.5 mm.
 6. Take responsibility for checking dimensions on Site.

3.11 Priming/ Sealing

- A. Before fixing components ensure that surfaces of timber that will be inaccessible after installation are primed or sealed as specified.
- B. Double prime exterior and wet area timber doors.

3.12 Corrosion Protection

- A. Before fixing, apply two coats of bitumen solution or an accepted mastic impregnated tape, to surfaces of door components which will come into contact with concrete slabs.

3.13 Door Thresholds

- A. Door thresholds shall be provided in accordance with Clause D2.14 and D2.15 of the NCC.
- B. Fix 150mm from each end and at 600mm maximum centres.

3.14 Fire Rated Doors/ Doorsets

- A. Fire rated doors are to be installed, tested and tagged by an appropriately qualified and recognised installer. Certificates shall be issued to the Superintendent confirming that the door installations meet the nominated fire ratings.
- B. Fire rated doors are not be modified in anyway that will compromise the integrity of the fire door test, including, drilling, screwing, altering and the like.

3.15 Sealant Joints to Fire Rated Door Assemblies

-
- A. Prepare joints and apply sealant in accordance with Section 0811 and as per the tested door assembly.
 - B. Finish triangular fillets with a flat or slightly convex profile.
- 3.16 Seals**
- A. Provide purpose-made proprietary seals to meet requirements for weather, draught, smoke and acoustic sealing. Provide fixings, rebates, grooves and clearances as necessary for installation and operation of the seals. Allow seals unwound from coils to settle before use.
 - B. Door closers must be able to close the door at normal latching speeds and for the doors to latch effectively without being obstructed by the seal.
 - C. Seals must not hinder the normal operation of the door.
- 3.17 Trim**
- A. General: Provide mouldings, architraves, reveal linings, and other internal trim as detailed on the Design Drawings using materials and finishes matching the door frames. Install to make neat and clean junctions between the frame and the adjoining building surfaces.
- 3.18 Flashings and Weatherings**
- A. Installation: Install flashings, weather bars, drips, storm moulds, caulking and pointing to prevent water from penetrating the building between the door frame and the building structure under the prevailing service conditions, including normal structural movement of the building.
- 3.19 Weather Bars**
- A. Provide a weather bar under hinged external doors; locate under the centres of closed doors. Height shall be to suit door.
- 3.20 Preparation for Decoration**
- A. Timber doors shall be sanded and arrises removed for decoration.
- 3.21 Operation**
- A. Ensure moving parts operate freely and smoothly, without binding or sticking, at correct tensions or operating forces and that they are lubricated where appropriate.
- 3.22 Completion**
- A. Maintenance: Submit manufacturer's published recommendations for service use.
 - B. Protection: On or before Practical Completion, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

SECTION END

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SECTION 0454 -- OVERHEAD DOORS (ROLLER SHUTTERS)**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Scope of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Roller shutters.
 2. Sectional overhead doors.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm x 300mm minimum sized sample of each type of overhead door.
 2. A 300mm minimum length sample of each type of door track/ guide.
 3. Samples of fire and smoke seals as applicable.
 4. Samples of acoustic and draught seals as applicable.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed of each type in a location as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Framing or structure to receive tracks and motor.
 2. Tracks and guides installed before shutters are hung.

1.8 Subcontractors

- A. Submit names and contact details for proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings showing details of each assembly, component and connection and information relevant to fabrication, surface treatment and installation for the following:
1. Roller shutters.
 2. Sectional overhead doors.

1.10 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Test Requirements

- A. Arrange for testing by an accredited independent testing specialist and/or provide independently certified test data/ certification to demonstrate compliance with the Specification.
- B. Fire shutters shall comply with AS 1905.2 and have been tested in accordance with AS 1530.4.
- C. Shutters installed to prevent the passage of smoke shall comply with AS 6905 and have been tested to AS 1530.7.

1.12 Strength Requirements

- A. Strength of shutters, tracks and guides:

1. Provide evidence to demonstrate that shutters, including hardware, have been tested for the following and include written results:
 - a) Slamming shut impact.
 - b) Slamming open impact.
 - c) Heavy body impact.
 - d) Hard body impact.
 - e) Torsion.
 - f) Downward deformation.
 - g) Closure against obstruction.
 - h) Resistance to jarring and vibration.
 - i) Abusive forces on hardware.

2 PRODUCTS

2.1 General

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Roller Shutters

- A. Shutter shall be fitted with windlock clips and guides to provide additional support for lateral loads.
- B. Bottom rail:
 1. Provide a stiffening member as follows:
 - a) Interlocking with the bottom edge or lowest part of the curtain.
 - b) Extending between the inner faces of the vertical guides.
 - c) Formed or adapted as required to follow the contour of a sloping floor or threshold.
 - d) Adapted to house a locking device, if required.
 2. Bottom rail shall be fitted with a PVC weather seal.
- C. Perforations: Refer to the Design Drawings.
- D. Finish: Powder coated in accordance with Section 0813.
- E. Drum:
 1. Maximum drum deflection: 1/360th of the span.
 2. Springs: Helical torsion springs housed in the drum and arranged to counterbalance the curtain weight without exceeding the safe working stress of the spring material.
- F. Operation:
 1. Motorised with emergency chain for periods of power failure, or when motor has been disengaged.
 - a) Safety features: Photo-electric beams at opening to prevent door closing when opening is obstructed.
 2. Manual chain operation.
 - a) Install so that the force required to operate the door manually does not exceed 220N.

2.3 Sectional Overhead Doors

- A. Proprietary system comprising a door of linked horizontal panels hinged together, weather lapped at the horizontal joint, fitted with rollers running in side tracks fixed to the building structure which guide the door when opened to a position above and behind the opening, and inclusive of the manufacturer's standard operating gear, hardware and accessories necessary for satisfactory performance.
 1. Side tracks: Roll form from galvanised steel sheet. Where necessary, to carry door loads without distortion, reinforce horizontal track sections with a galvanised rolled steel channel.
 2. Counterbalancing: Counterbalance the door by a torsion spring system connected to the door by cables of galvanised steel multi-strand wire rope, or by an equivalent system.
 3. Operation (As nominated in the Master Schedule):

- a) Provide electric motor incorporating limit switches, manual safety stop and reversing mechanism, and overload cut-out, operated by a battery-powered radio remote controller (supplied as part of the system), and also by a direct push-button or key switch. Provide a motorised system which is capable of manual operation in the event of power failure. Locate operating switch 1500mm above floor level.
- b) Manual operation: Install so that the force required to operate the door manually does not exceed 220N.

2.4 Fabrication Tolerances

- A. A high degree of accuracy is required in the fabrication of shutters.
- B. Accurately cut and form materials to the required shape and with all exposed surfaces and edges true and free from irregularities and defects, using techniques that will not impair the strength of materials used.
- C. Wireways shall be allowed for connection to equipment within the framing system, back to the building power supply (to allow for wiring). Coordinate provisions for electrical service, sensing devices and final connections. Connect all parts of equipment with insulated wiring as required for operation.
- D. State the tolerances intended to accommodate surrounding constructional elements in order to ensure that all aspects of the installation interface satisfactorily with the building as a whole.

3 EXECUTION

3.1 Installation

- A. Installation shall be in accordance with the manufacturer's written instructions.
- B. When preparing Shop Drawings and during installation, particular attention shall be paid to the interface between shutters, guides and walls. Interfacing requirements shall be in accordance with the visual requirements as indicated on the Design Drawings.

3.2 Protection of Components

- A. Do not deliver components to Site which cannot be put immediately into a suitable dry, covered storage area with a dry floor. Stack on bearers, separated with spacers to prevent damage to projecting hardware, etc.

3.3 Protection of Components after Installation

- A. All shutters shall have protective coverings during storage and after installation to protect factory applied finishes. Door leaves shall be protected during on-Site operations.

3.4 Hardware

- A. Assemble and fix carefully and accurately using fastenings with a matching finish supplied by the hardware manufacturer. Prevent damage to hardware and adjacent surfaces. At completion check, adjust and lubricate as necessary to ensure correct functioning.

3.5 On-Site Dimensions

- A. Take responsibility for all dimensions and for checking dimensions on Site prior to manufacture.
- B. Accommodate any given tolerances and differences between actual Site dimensions and dimensions shown on the Design Drawings.

3.6 Installation Tolerances

- A. All shutters shall be installed so that surfaces are straight and flat.
- B. The maximum variation from plumb shall be $\pm 1.5\text{mm}$.

SECTION END

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SECTION 0455 -- HARDWARE

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings and the Door Hardware Schedule, provides particular requirements with respect to the following:
 - 1. Hardware to doors.
 - 2. Hardware to windows.
 - 3. Miscellaneous hardware.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
 - 1. One sample of each hardware type in the specified finish.
 - 2. A complete sample board of standard items. The exact extent to be agreed.

1.4 Mock-Ups

- A. Not required.

1.5 Prototype

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
 - 1. First hardware item of each type installed in location to be agreed.

1.7 Witness Points

- A. Not required.

1.8 Subcontractors

- A. Hardware generally: Submit names and contact details of proposed suppliers and Subcontractors.
- B. Automatic door operators: Submit names and contact details of the proposed supplier and Subcontractor.

1.9 Shop Drawings

- A. Submit Shop Drawings showing details of each assembly, component and connection and information relevant to fabrication, surface treatment and installation for the following:
 - 1. Automatic door operators.
 - 2. Door closers including but not limited to pivot kits, hydraulic closers and the like.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Test Requirements

- A. Provide manufacturer's test data.
- B. Automatic controllers shall be tested in accordance with AS 5007. Provide test certificates confirming controllers have complied with all requirements of the test methods as a minimum.
- C. The provision of test data does not relieve the Head Contractor of his responsibilities with respect to guarantees provided for the hardware.

2 PRODUCTS

2.1 Hardware Generally

- A. Refer to the Door Hardware Schedule.
- B. Locks and hardware are to be in accordance with AS 4145.1 and AS 4145.2.

- C. Door operational forces at the door handle are to comply with AS 1428.1, clause 13.5 where applicable.
- D. All kick plates, door closers, escutcheons, hinges, flush bolts, panic hardware, lock cases, thumb turns, striking plates, cylinders and the like, shall be as scheduled and from a range to match the finish of the door furniture.

2.2 Master Key Provision

- A. All cylinders and lever mechanism locks are to be keyed under an agreed master key plan.
- B. Establish whether the master key plan requires integration within an existing scheme.
- C. Agree master key and suiting proposals, in writing, with the Superintendent and manufacturer prior to order placement.

2.3 Butt Hinge Sizes

- A. Conform to Hinge Table A and Hinge Table B below (not applicable to cupboard doors), in which length (l) is the dimension along the knuckles, not including hinge tips, if any, and width (w) is the dimension across both hinge leaves when opened flat and (t) is for thickness.
- B. Steel, stainless steel, brass and bronze butt hinges for timber doors in timber or steel frames: To Hinge Table A.
- C. Aluminium hinges for aluminium doors, or for doors of other materials in aluminium frames: To Hinge Table B.

2.4 Hinge Materials

- A. Aluminium framed doors in aluminium frames: Stainless steel or high tensile aluminium with fixed stainless steel pins in nylon bushes and with nylon washers to each knuckle joint.
- B. Doors fitted with closers: Provide low friction bearing hinges.
- C. Brass hinges: For brass hinges used for door leaves exceeding 30kg or door leaves controlled by door closers, provide bronze or stainless steel washers to each knuckle joint.
- D. Power transfer hinges: Make sure they do not assume any load and are installed with other compatible hinges.

2.5 Hinge Pins

- A. Exterior or security doors opening out: Provide fixed pin hinges or security hinges.

2.6 Hinge Table A

<i>Table 1 - Hinge Table A</i>		
Nominal door leaf size (H x W x T) (mm)	Door leaf weight (kg - approx)	Number of hinges
2040 x 400 x 35	19	2
2040 x 600 x 35	29	2
2040 x 720 x 35	35	3
2040 x 820 x 35	39	3
2040 x 920 x 35	44	3
2040 x 1020 x 35	49	4
2040 x 720 x 40	37	3
2040 x 820 x 40	42	3
2040 x 920 x 40	48	3
2040 x 1020 x 40	52	4
2040 x 720 x 50	45	3
2040 x 820 x 50	50	3
2040 x 920 x 50	57	3
2040 x 1020 x 50	68	4
2400 x 720 x 40	50	4
2400 x 820 x 40	52	4
2400 x 920 x 40	55	4

2400 x 1020 x 40	60	4
2400 x 1220 x 50	72	5
2040 x 920 x 70	88	Nominate pivot hinges

2.7 Hinge Table B

<i>Table 2 - Hinge Table B</i>			
Nominal hinge size (L x W x T) (mm)	Door leaf weight (kg – approx)	Knuckles (minimum)	Screws/hinge leaf (minimum)
100 x 70 x 3	30	3	3
100 x 80 x 3.5	50	5	4
130 x 50 x 3.4	75	Interfold	3

2.8 Number of Hinges

- A. Fire doors: To AS 1905.1.
- B. Provide hinges to solid core doors to Hinges table A. The table can be used to determine the quantity of hinges required for the nominated door leaf sizes and weights only. For door leaf sizes not specified or with applied finishes use the weight of the door to determine the quantity of hinges required. For door leaves over 80kg, nominate pivot hinges.
- C. The size of the hinge is determined by the door leaf thickness:
 1. 35mm to 43mm thick door: 100mm x 75mm butt hinges with a minimum thickness of 2.5mm.
 2. 44mm to 55mm thick door: 100mm x 100mm butt hinges with a minimum thickness of 2.5mm.
 3. > 55mm thick door: Refer to the door by Door Hardware Schedule.
- D. Hinge pin: The symbol # refers to the pin type. Supply fixed pins to doors opening out or designated as a security doors.
- E. Wide throw: If necessary, provide wide throw hinges to achieve the required door swings in the presence of obstacles such as nibs, deep reveals and architraves.

2.9 Overhead Door Closers

- A. Door controllers: To AS 4145.5.
 1. Functions:
 - a) Closers shall be matched to the sizes and weights of the doors.
 - b) Closers shall override latches and/ or door seals when fitted.
 - c) Closers shall hold unlatched doors shut under normal working conditions.
 2. Fire door closers:
 - a) Tested and certified for use as components of fire-resisting door assemblies to AS 1905.1. Submit evidence of testing by an approved laboratory.
 - b) Fix on the opening side of the door unless specified otherwise.
 - c) Closers shall have no mechanical hold open facility.
 - d) Closers shall close positively against smoke seals where fitted.
 - e) Closers shall have arms of iron, steel or other metal with a melting point not less than 800° C.
 3. Surface mounted closers:
 - a) Shall be mounted on opening face of door except where they will be obstructed or where specified otherwise.

2.10 Automatic Door Operators

- A. Automatic sliding door operator gear shall be fully concealed above ceiling level or in an overhead pelmet as detailed on the Design Drawings. Provide full access for maintenance purposes. Doors shall be operated by movement sensors as standard.
- B. Flush mounted photoelectric cells in jambs to prevent doors from closing if the door threshold is obstructed.
- C. Fail safe operation to satisfy Building Code of Australia and AS 5007 upon failure or on fire signal.

2.11 Locks to Internal Doors

- A. To AS 4145.2.

2.12 Latches

- A. To BS EN 12209 or the AS equivalent. Alternatively as accepted by the Superintendent.
- B. Latch springs shall be strong enough to prevent unsprung lever handles drooping.

2.13 Locks/ Latches for Fire Rating Doors

- A. Locks/ latches shall not compromise the fire performance of the door and shall be accepted for the purpose by the door leaf manufacturer.
- B. Components critical to the retention of the door in a closed position must not have a melting point lower than 800°C.
- C. Comply with AS 1905.1.

2.14 Escape Doors

- A. Locks specified for security purposes on escape routes shall be fitted with a means of withdrawing the bolt without the use of a key.

2.15 Bolts Generally

- A. Provide bolts to:
 - 1. Match door furniture and sized to suit height, weight and function of door.
 - 2. Secure the first closing leaf on double doors.
- B. Privacy Bolts: Shall incorporate an external emergency release facility.

2.16 Furniture Generally

- A. Lever handles, door knobs, pull handles and plates, kick plates, stops, escutcheons and seals shall comply with BS EN 1906.

2.17 Materials

- A. Stainless Steel:
 - 1. Stainless steel shall be austenitic, non-magnetic grade 304.
 - 2. Material for stainless steel bolts shall be grade 304 stainless steel and comply with the dimensional requirements specified in AS 1110.1. Bolt strength shall be equivalent to grade A or B bolts. Washers for stainless steel bolts shall be formed from grade 304 stainless steel.
 - 3. Stainless steel hardware shall be satin finished as specified in the Door Hardware Schedule and be consistent in colour and texture, both individually and collectively. The accepted finish shall be established on the basis of reference samples provided to the Superintendent.
 - 4. Door stiles and rails shall be mortised and adequately reinforced to receive hinges, strikes, locksets, closers, floor bolts and all other hardware items on the Door Hardware Schedule.
- B. Aluminium alloy and coatings shall comply with AS 1231.

2.18 Finish

- A. Chromium/ Cadmium Plating:
 - 1. Chromium plating on metal to AS 1192, Service Condition 2, unless otherwise specified.
 - 2. Chromium plating on plastic to AS 1406, Service Condition 2, unless otherwise specified.
 - 3. Cadmium plating on threaded components to AS 1897, Service Condition 2, unless otherwise specified.

2.19 Padlocks

-
- A. To AS 4145.4.

2.20 Rebated Doors

- A. For mortice locks or latches to rebated doors, provide purpose-made rebated pattern items.

2.21 Strike Plates

- A. Use strike plates provided with the locks or latches. "Universal" strike plates are not acceptable.

2.22 Window Hardware

- A. Hardware generically: Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use, suitable for use with associated hardware, and fabricated with fixed parts firmly joined.
- B. Locks and catches shall comply with AS 4145.2.
- C. Window catches: Provide two catches per sash to manually latched awning or hopper sashes over 1000mm wide.
- D. Openable windows are to be fitted with a device to restrict the opening to a maximum width of 125mm and capable of withstanding an outward horizontal force of 250N. In accordance with the NCC.

3 EXECUTION

3.1 Generally

- A. The hardware supplier/ installer shall be a current member of the Locksmiths Guild of Australia Inc, hold licences where required by Commonwealth or State law, and shall ensure that their employees maintain the high professional standards expected of the craft of locksmithing.
- B. The correct installation of all the hardware is essential to achieve the performance levels specified and required. Door hardware locations from finished floor level to centre line of hardware shall be as follows, unless noted otherwise on the Hardware Schedule:
 1. Lever handles/ knobs: 1000mm.
 2. Push plate/ pull handle: 1070mm.
 3. Cylinder escutcheon: 1064mm.
 4. Kick plate (to top of plate): 600mm.

3.2 Fixings

- A. All items of door hardware shall be supplied complete with stainless steel screws to the type and length recommended in writing by the manufacturer and suitable for fixing to wood or metal, as appropriate to suit the door leaf and frame. Fit lever handles positively to roses by screw thread fixing and by countersunk screws to the spindle. Fit the roses or back plates back to back with countersunk head, back to back through fixings. All other visible fixings shall have countersunk heads.

3.3 Hinges

- A. Metal frames: Fix hinges using metal thread screws.

3.4 Installation Generally

- A. Hardware shall be installed and checked for correct operation. Each item shall be maintained and protected against damage by other trades. On completion adjust, clean and lubricate in accordance with the manufacturer's recommendations.
- B. Coordinate the hardware installation with other trades and form holes, mortices, chases, etc.
- C. Reinforce and prepare hollow constructions to receive hardware. Provide wiring, conduits, accessories, etc, for electrical items. Protect hardware during construction. Remove fixed items before finishing or decoration processes, make good finishes, execute protective and decorative painting where required and refix, check, clean and lubricate hardware on completion.
- D. All timber or metal doors shall be factory mortised to receive hardware, to ensure correct preparation and avoid the potential for negation of fire ratings. Site mortising is not acceptable.

3.5 Window Hardware

- A. Proprietary window systems: Provide the standard hardware and internal fixing points for personnel safety harness attachment, where required by and complying with the governing regulations.

3.6 Keys

- A. Immediately before Practical Completion, replace cylinders to which the Head Contractor has had key access during construction with new cylinders that exclude the Head Contractor's keys.
- B. For locks keyed to differ and locks keyed alike, verify quantities against key records, and deliver to the Superintendent at Practical Completion.
- C. Key codes: Submit the lock manufacturer's record of the key coding system showing each lock type, number and type of key supplied, key number for re-ordering, and name of supplier.
- D. Number of Keys Table

<i>Table 3 - Number of Keys Table</i>		
Key code	Key type	Minimum number of keys
GGMK	Great grandmaster keys	2
GMK	Grandmaster keys	2
MK	Master keys	2 per code group
KD	Locks keyed to differ	2 per lock
KA	Locks keyed alike:	
	- 2 locks in code group	4
	- 3 to 10 locks in code group	6
	- 11 to 40 locks in code group	10
	- 41 and over locks in code group	1 per 4 locks or part thereof

- E. Key Handover
 1. At Practical Completion account for and adequately label all keys.
 2. Provide the Superintendent with an itemised schedule and retain a duplicate schedule as a receipt.
 3. The master keys shall be issued by the cylinder/ key supplier direct to the Superintendent.

3.7 Completion

- A. Adjustment:
 1. Leave the hardware properly adjusted with working parts in working order, and clean, undamaged, properly adjusted, and lubricated where appropriate.
 2. Automatic door operators: Maintain and adjust the system throughout the Defects Liability Period.
- B. Maintenance:
 1. Automatic door operators: Submit the installer's proposal for continuing maintenance after completion on an annual renewal basis.
 2. Manual: Submit the manufacturer's published recommendations for use, care and maintenance of the hardware provided.
- C. Record documents:
 1. Door Hardware Schedule: Submit an amended schedule, prepared by the door hardware supplier, showing changes to the Contract Door Hardware Schedule caused as follows:
 - a) By the acceptance of a hardware sample.
 - b) By the acceptance of an equivalent to a specified proprietary item.
 - c) By a Contract variation to a door hardware requirement.

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2.3	Fixings	3
3	EXECUTION	4
3.1	Workmanship	4
3.2	Installation	4
3.3	Identification and Registration Label(s)	4
3.4	Operating/ Maintenance Manual	4
3.5	Cleaning	4

SECTION 0458 -- ROOF ACCESS SAFETY SYSTEMS**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Fall arrest systems to roofs.
 2. Anchorage abseiling points.
- B. Ensure that all interfaces are fully coordinated prior to commencement.
- C. Refer to the PPR for further requirements.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Pedestal brackets with safety eyebolts of each proposed type.
 2. Travelling anchor/ sliding mechanism of each proposed type.
 3. Fixed anchor brackets of each proposed type.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First installed of each specified type in locations to be agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the completed installation with the Superintendent (a minimum of two working days notice shall be given).
1. Shop fabricated or assembled items ready for delivery to the site.
 2. Commencement of shop or site welding.
 3. All equipment attachments with concealed fixings, before they are covered.
 4. Site erected assemblies on completion of erection, before applying finishes.
 5. Steel surfaces prepared for, and immediately before, site applied finishes.
- B. Installation inspector: Registered Height Safety Inspector.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings detailing all components including methods of assembly and fixing. The Shop Drawings shall include the following:
1. Plans and elevation indicating set-outs of the facade and roof access system.
 2. Access coverage plans.
 3. Detailed sections of all elements e.g. anchor points, brackets, guard rails, horizontal lifelines.
 4. Means of protections of parapet cladding.
 5. Interfaces with other trades.
 6. Anchor plans / set out of anchors.
 7. Co-ordinated details of cast in anchors and structural fix anchors, indicating anchor, concrete, pre-stressing and rebar locations and interface details with steel structure.

1.10 Other Submissions

- A. Materials:
 - 1. Manufacturer's data: Submit manufacturer's published product data including standard drawings and details.
 - 2. Stainless steel: For each batch of stainless steel to be used, submit the certificate of compliance or test certificate specified in the applicable standard.
- B. Execution:
 - 1. Welding procedures: Submit details of proposed welding procedures before fabrication.
 - 2. Welding dissimilar metals: Submit the following details:
 - a) Type and thickness of materials to be welded.
 - b) Proposed joint preparation and welding procedures.
 - c) Proposed filler metal.
 - d) Expected dilution (proportion of fused parent metal in the weld metal).
 - 3. Fastenings to aluminium (including aluminium alloys): If cadmium-plated steel fastenings are proposed, submit proposals to the Superintendent.

1.11 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.12 Testing

- A. Provide full test documentation to prove that work under the Contract complies with the specified performance requirements together with a written statement of compliance for each aspect with cross reference to specific test data.
- B. Arrange for testing by an accredited testing specialist or provide independent certified test data to demonstrate compliance with the Specification.
- C. Manufacturing, marking and labelling of single point anchors shall be in accordance with AS/NZS 5532.
- D. On completion of the installation, the installer is to carry out all tests to confirm the system's competence in accordance with AS/NZS 1891 series, for anchorage systems and issue a test certificate and two copies of user instructions and maintenance manuals for the overall installation.

1.13 Performance Requirements for Fall Arrest System

- A. Provide suitable safety support systems for the purpose of carrying out periodic maintenance and cleaning for areas of roofing as indicated on the Design Drawings.
- B. Take full responsibility for the design, final detailing, supply and installation of work under the Contract and associated components/ accessories specified herein, including satisfying all testing requirements to meet the requirements of this Specification and Building Control, as indicated on the Design Drawings.
- C. Coordinate with the specialist safety harness manufacturer to ensure that all work related to the above is provided and agreed in the correct/ exact locations.
- D. Comply with all current regulatory and occupational health and safety requirements.
- E. Provide calculations and documentary evidence to demonstrate that system components, fixings and support posts as detailed on the Design Drawings are capable of satisfying the design loadings of the system. These shall be supplied to the Superintendent for acceptance and for submission to the Local Authority.
- F. Work under the Contract shall be designed and fabricated to resist all dynamic and impact loads likely to be placed upon it without any permanent deformation, failure damage or reduction of performance as a result of the following dynamic and impact loads:
 - 1. The dynamic load exerted by operatives performing their intended tasks.
 - 2. The impact loads exerted by the operation of any safety devices or sudden arrest or braking of motion.
 - 3. The system loading requirements shall be based on the principle of supporting a minimum of two operatives.
 - 4. The maintenance operative shall be attached to the system at all times to satisfy all current regulatory and occupational health and safety requirements.

5. Travelling anchors/ sliding mechanisms shall be capable of traversing over the support brackets without detachment, and capable of accepting an industry standard shock absorbing lanyard attachment.

1.14 Performance Requirements for Anchorage Abseiling Equipment

- A. Provide suitable safety support systems for the purpose of carrying out periodic maintenance and cleaning (capable of taking the load of two operatives) for areas of roofing as indicated on the Design Drawings.
- B. Work under the Contract shall be designed to provide anchorage for use with abseiling/ rope access techniques for the cleaning and maintenance of façade elements indicated on the Design Drawings. Indicate locations of anchorage points on the Shop Drawings.
- C. Comply with all relevant occupational health and safety requirements.
- D. Provide calculations and documentary evidence to demonstrate that system components, fixings and support brackets are capable of satisfying the design loadings of the system. These shall be supplied to the Superintendent for acceptance, and for submission to the local authority.
- E. The system loading requirements shall be based on the principle of supporting a minimum two operatives.

2 PRODUCTS

2.1 Fall Arrest System

- A. Systems shall be designed and installed by a specialist in accordance with the AS/NZS 1891 series and AS/NZS 1170.
- B. System shall comprise:
 1. Minimum 8mm thick stainless steel cable, to AS 1394 and AS 2759, connected to and including anchor brackets fixed to structure, to meet the performance requirements.
 2. All transfasteners, anchor brackets, shock absorbers, clamps and associated fittings as required.
 3. Suitable travelling mechanisms.
 4. Stainless steel D rings and anchorage supports.
 5. Body harness including energy shock absorbing lanyards to AS/NZS 1891.1.
 6. Horizontal lifeline and rail systems to AS/NZS 1891.2.
 7. Fall-arrest devices AS/NZS 1891.3.
- C. Steel: All elements shall be grade 316 stainless steel electro polished to provide corrosion protection. Refer to Section 0813.
- D. Stainless steel plate, strip and sheet shall be in accordance with Section 0813.
- E. Travelling mechanisms and associated equipment shall have protective rubber or similar covering to cushion and prevent damage, breaking or scratching to glass, flashings or sealants.
- F. Provide suitable identification and safety signage in accordance with all relevant standards.

2.2 Anchorage Abseiling Points

- A. Systems shall be designed and installed by a specialist in accordance with AS/NZS 1891 series and AS/NZS 1170.
- B. System shall comprise:
 1. Minimum M12 stainless steel grade 316 safety eyebolts, connected to and including anchor brackets fixed to the structure to meet the performance requirements.
 2. Stainless steel plate, strip and sheet shall be in accordance with Section 0813.
- C. Industrial rope access systems:
 1. Industrial rope access systems/ specifications to AS/NZS 4488.1.
 2. Industrial rope access systems, selection, use and maintenance to AS/NZS 4488.2.

2.3 Fixings

- A. Refer to Section 0811.
- B. All structural fixings shall be stainless steel grade 316 of a size recommended by the manufacturer to achieve the performance criteria of the Specification.

-
- C. All structural fixings shall be capable of physical inspection in accordance with AS/NZS 1891 and Health and Safety Directives.

3 EXECUTION

3.1 Workmanship

- A. Installation shall be by an approved installer, in accordance with the manufacturer's instructions.
- B. Upon completion of the installation, the system shall be inspected and fully tested (as specified) and a test certificate covering a time period as agreed with the Superintendent shall be issued to the Superintendent. A "non-perishable" notice showing date and period of validity of the test certificate shall be attached, as applicable, to the system at each access point or device.
- C. Protect all elements of the system against damage, corrosion, disfigurement and any other occurrence that will cause detriment to the performance of the system.
- D. Before commencing installation carry out a visual and geometrical survey of the supporting building structure and fabric. Report immediately to the Superintendent if the structure/ fabric will not allow the required accuracy, security and achievement of performance when erected and fixed.

3.2 Installation

- A. All fixings shall be installed in accordance with the manufacturer's recommended procedures.
- B. Isolating tape, plastic washers or other suitable means to prevent bimetallic corrosion shall be provided between dissimilar metals.
- C. Workmanship shall be to AS/NZS 1891.
- D. External systems shall be securely bonded to the lightning protection system.

3.3 Identification and Registration Label(s)

- A. Provide and fix to each system a permanent label that states:
1. Manufacturer's name, address and telephone number.
 2. Name and/ or reference code of Site and system.
 3. Serial number and year of manufacture.
 4. Maximum number of users to be attached at any one time.
 5. Date of installation and last inspection.
 6. Whether the system is designed for "arrest" or "restraint".
- B. The label(s) shall be located in positions such that they can be easily read.

3.4 Operating/ Maintenance Manual

- A. Before Practical Completion provide printed instructions and recommended procedures to be established by the Superintendent for operating and routinely maintaining the equipment. Provide drawings and diagrams where appropriate. The information must include:
1. Instructions for assembling/ erecting equipment for use.
 2. Comprehensive operating instructions, including safety and emergency procedures, for all motions including upward, downward and lateral travel, and slew.
 3. Servicing and planned maintenance procedures, including assembly instructions where maintenance necessitates dismantling of machinery parts.
 4. List of replacement parts, with references.
 5. Recommended procedures for testing equipment.
- B. Maintenance to be in accordance with AS/NZS 1891.4.

3.5 Cleaning

- A. Leave all areas of the building affected by the installation of the systems clean and free from debris.

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SECTION 0522 -- PARTITIONS AND LININGS

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Metal stud partitions.
 2. Insulation.
 3. Wall/ partition linings.
 4. Ceiling linings.
 5. Wall access panels.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 500mm x 500mm sample of all wall lining types.
 2. 500mm length of all metal framing components.
 3. Wall access panels, grilles, etc.
 4. All fixing types.
 5. All insulation material.
 6. Cavity barrier material.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First completed of each type of partition in locations as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Completed wall framing including the installation of all noggings prior to covering over.
 2. Installation of all 'in wall' services prior to covering over.
 3. Wall framing lined on one side only and with insulation in place prior to lining the other side of the wall.
 4. Set out of all movement joints.

1.8 Subcontractors

- A. Submit name and contact details of proposed manufacturers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings of each partition type, showing the following details and associated information where applicable:
1. Dimensions, clearances, tolerances.
 2. Door frame details.
 3. Glazing methods.
 4. Large scale details of construction methods of assembly, trim, jointing and finishing.

5. Methods of fixing partitions and linings.
6. Method of providing reticulation of services, access to services, and service outlets.
7. Proposed location of access panels.
8. Proposed penetration sealing methods.
9. Performance data of components and assemblies.
10. Specification of materials and finishes.

1.10 Warranties

- A. Prior to Practical Completion a written warranty shall be submitted to the Superintendent for the following:
1. Materials and workmanship in the form of interlocking warranties from the supplier and the installer.
 2. Refer to Annexure part K of the contract for required warranty periods.
 3. The warranty shall include particular reference to failure of, or due to, the following but not limited to:
 - a) Structural integrity.
 - b) Cracking or opening of joints.
 - c) Instability or deflection under applied loads.
 - d) Accessories and trims, including corrosion.
 - e) Correct moisture-resistant, fire-resistant and acoustic-rated systems, if applicable.

1.11 Test Requirements

- A. Provide manufacturer's published and certified data to demonstrate all fire, structural and acoustic performance requirements as follows:
1. Fire hazard properties:
 - a) Group number: To NCC Spec C1.10 and AS 5637.1.
 - b) Average specific extinction area (non-sprinklered buildings): < 250 m²/kg to AS/NZS 3837.
 - c) Smoke growth rate index (non-sprinklered buildings): < 100 to AS ISO 9705 and NCC Spec A2.4.
 2. Fire resistance level: To AS 1530.
 3. Impact resistance of lightweight partitions: To withstand impact without permanent deformation, damage, failure of fastenings, etc.
 - a) Test method: Use the apparatus and procedure of the sand-bag test of ASTM E695 and NCC Specification C1.8.
 4. Pressure resistance: To withstand a uniformly distributed load normal to the plane of the partition without permanent deformation or damage or excessive deflection:
 - a) Test method: ASTM E72 and NCC Specification C1.8.
 5. Weighted sound reduction index (R_w): Rated to AS/NZS ISO 717.1.
 - a) Installed partitions: Submit a certificate from an independent testing authority as evidence that the partition systems installed conform to the documented weighted sound reduction index (R_w).
 - b) All R_w values nominated refer to laboratory tested values.
 - c) When testing in-situ, D_{n,T,w} and D_{n,T,w} D_{n,T,w} and D_{n,T,w} values (or D_w tested in both directions if agreed) are to be obtained.

2 PRODUCTS

2.1 Partitions Generally

- A. Refer to the Master Schedule for product selection and details.
- B. Refer to the Design Drawings for further details on partition types.

- C. Lining thickness and number of layers to either side of stud frame shall be as nominated in the partition types, and as detailed on the Design Drawings, to achieve the required fire and acoustic ratings of the partition system.
- D. All components incorporated in external walls, common walls, internal non-load bearing fire-resisting walls and shaft walls are to comply with Deemed-To-Satisfy provisions of Clause C1.9 of the NCC, with a compliant spread of flame index and are to be non-combustible in accordance with AS 1530.1.

2.2 Linings Generally

- A. Plasterboard to AS/NZS 2588.
- B. A cellulose fibre reinforced cement sheet to AS/NZS 2908.2.

2.3 Partition Studwork System

- A. Stud gauge (BMT) shall satisfy the latest requirements published by Rondo Building Services Pty. Ltd.
- B. Additional supports shall be provided at service outlets, access hatches and other similar locations as required to provide adequate fixing points for the nominated wall linings.
- C. Partitioning and framing to be spaced and supplied to suit the weight of associated wall linings.
- D. Ensure that adequate in-wall support for joinery, fixtures and fittings, handrails, services and the like, is provided in the form of noggings or mounting plates.
- E. Metal studwork shall be fabricated from hot dip zinc coated and iron zinc alloy coated sheet steel to AS 1397, fixed by zinc or cadmium plated self-drilling and self-tapping countersunk headed screws.
- F. Provide boxed studs or similar stiffening/ strengthening techniques as recommended by the manufacturer at door openings, window openings and adjacent glazed partitions able to take anticipated dead and live loads.
- G. Where nominated or required, install Rondo Quiet Studs in accordance with the manufacturer's written instructions.

2.4 Plasterboard

- A. Gypsum core standard grade classification plasterboard to AS/NZS 2588. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.
 2. Where 13mm thick plasterboard lining is specified, stud/ furring spacings shall be at 600mm maximum centres.

2.5 Moisture Resistant Plasterboard

- A. Moisture resistant plasterboard classification to AS/NZS 2588, with additives to the core, face, and back linerboards at manufacture to reduce the water absorption rate and make it resistant to moisture and humidity. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.
 2. Where 13mm thick plasterboard lining is specified, stud/ furring spacings shall be at 600mm maximum centres.

2.6 Fire Resistant Plasterboard

- A. Fire resistant grade classification to AS/NZS 2588, with mineral fibres and additives to the core to improve core adhesion at high temperatures and strength. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2.7 Wet Area Fire Resistant Plasterboard

- A. Fire and moisture resistant grade classification to AS/NZS 2588, with mineral fibres and additives to the core to improve core adhesion at high temperatures and strength and to reduce the water absorption rate and make it resistant to moisture and humidity. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
- B. Manufacturer/ reference: Refer to the Master Schedule.

1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2.8 Impact Resistant Plasterboard

- A. Impact grade classification to AS/NZS 2588, with a glass fibre reinforced gypsum core plus a fibreglass mesh or denser core. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2.9 Flexible Plasterboard

- A. Flexible plasterboard to AS/NZS 2588 composed of an enhanced gypsum encased in a heavy duty linerboard. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
 1. Thickness: Twin layers, 6.5mm each.
 2. Edge detail: Staggered to a minimum of 200mm to avoid aligned joints.

2.10 Shaftliner

- A. Glass fibre reinforced gypsum core encased in a heavy duty linerboard with fire and acoustic performance. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
 1. Thickness: 25mm.

2.11 Fibre Cement Board

- A. A cellulose fibre reinforced cement sheet to AS/NZS 2908.2.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.
 2. Finish: Applied paint finish. Refer to Section 0671.
- C. Fixing: Fixing methods and batten spacings to be determined in accordance with the Site's wind classification rating and the manufacturer's written instructions.

2.12 Metal Lining

- A. Manufacturer/ reference: Refer to the Master Schedule.
 1. Type/ finish: As scheduled.
- B. Ensure metal lining is adequately supported and remains perfectly flat or to profiles as indicated, as applicable, without oil-canning or any visual distortion.

2.13 Insulation Generally

- A. Refer to Section 0819 for insulation, sarking and vapour barrier requirements.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Thickness: As scheduled.
 - a) To suit the performance requirements of the partition systems as specified by the Acoustic Consultant
 2. Insulation only R value: As scheduled.
- C. Insulation shall be inert, durable, rot-proof, vermin-proof, environmentally friendly and not be degraded by action of moisture, extreme climate temperature, water or water vapour.
- D. The insulation shall satisfy the fire proofing, acoustic and thermal requirements detailed in the Specification and applicable reports.

2.14 Plywood Lining

- A. Provide plywood to the extent of all window openings to allow for future fixing of window furnishings.
- B. Provide plywood lining as a base substrate for drywall lining to be affixed to where nominated in the Design Drawings and detailed in the Wall type schedule.
- C. Plywood shall comply with AS/NZS 1604.3 with Hazard Classification to Table 1 and AS/NZS 4491.
- D. WBP grade plywood, EWPA certified, shall satisfy the requirements of:
 1. Interior use: To AS/NZS 2270. Bond type C.

2. Minimum bond quality: To AS/NZS 2754.1, with thickness to suit the design requirements.
3. Ensure that fastenings do not protrude above the surface of the sheet. Fastenings shall be of a type recommended for the purpose by the fastenings manufacturer.

E. Finish shall be suitable for its location, sanded:

1. Visible surfaces with clear finish: Veneer quality A.
2. Other visible surfaces: Veneer quality B.

2.15 Timber Generally

A. Refer to Section 0815.

2.16 Partition Access Panels

- A. Partition access panels shall be as required to access all in-wall services and as otherwise shown on the Design Drawings.
- B. Partition access panels to have rim locks and concealed metal frames.
- C. Manufacturer/ reference: Refer to the Master Schedule.
 1. Size: As indicated on the Design Drawings.
 2. Colour: to match adjacent wall colour.
- D. Fire rating: To match the associated partitions' fire rating as a minimum.

2.17 Furring Channels

- A. Furring channels system comprising cold formed steel to AS 1397 and galvanised with a zinc coating class Z275.
- B. Select as appropriate from the following components:
 1. Furring channels 28mm: Rondo part no. 129, 28mm furring channel or acceptable equivalent, generally.
 2. Furring channel clips: Rondo part no. 237, furring channel anchor clip or acceptable equivalent.
 3. Furring channels 38mm: Rondo, 38mm furring channel or acceptable equivalent.
 4. Furring channels to column linings: Rondo part no. 333, 13mm furring channel or acceptable equivalent.
 5. Masonry anchors: Ramset Dynabolts, M6 thread minimum 50mm long or acceptable equivalent.
 6. Impact isolation clips: Boral or CSR acoustic isolation clips with Rawlplug masonry anchor mounting or acceptable equivalent.

2.18 Noggings

- A. Provide additional studs and noggings within the stud frame as required to support wall mounted fittings and fixtures indicated on the Design Drawings. Where precise fixing points for wall mounted fittings and fixtures cannot be determined, provide a panel of 19mm thick plywood within the wall to allow for variable fixing locations.
- B. Unless otherwise indicated, noggings shall generally be stud depth x 35mm wide, spaced at not more than 1350mm centres. Provide additional noggings for fixtures and flexible sheet linings as necessary.
- C. Nogging locations:
 1. Provide noggings to all wall fixed items shown and as recommended by the manufacturer. Coordinate and incorporate requirements for fixing of all security and AV equipment.
- D. Coordinate the exact location and provision of nogging in conjunction with the relevant manufacturer, supplier before installing the particular items.

2.19 Trims to Sheet Lined Walls

- A. Corner guards:
 1. External corner guard: External angles shall be reinforced with galvanised metal external corner bead fixed to face of linings at 300mm centres or adhesive fixed. Blend finishing coats into sheet. Where installed under waterproof membrane to tiled walls, epoxy adhesive fix to wall linings.

2. Proprietary Item: Rondo P32 Plasterlock corner bead or acceptable equivalent. High traffic areas to receive Rondo P55 heavy duty Plaster-Lock Corner Bead or acceptable equivalent.
- B. Free ends:
1. Stopping bead: Where sheets are required to finish up to a free edge, the edge shall be formed against a galvanised stopping bead adhesive fixed to face of sheet. Blend finishing coat into sheet.
 2. Proprietary item:
 - a) Proprietary item: Rondo P13 (13mm sheet).
 - b) Proprietary item: Rondo P14 (16mm sheet).
- C. Internal angles:
1. Internal stud wall corner: Internal wall angles shall be stopped up flush and smooth.
 2. Reinforce at the front with a galvanised internal corner bead adhesive fixed to face of sheets.
 3. Proprietary Item: Rondo PS17 Internal Corner Bead.
- D. Shadow line trim:
1. Shadow line stopping bead: Where sheets are required to finish up to a shadow line, the edge of the sheet shall be formed against a galvanised shadow line stopping bead adhesive fixed to face of sheet. Blend finishing coat into sheet.
 2. Proprietary item: Rondo P50 Shadowline Stopping Angle, unless nominated otherwise, as detailed on the Design Drawings.
- E. Movement (control) joints:
1. Proprietary system: Provide the manufacturers recommended movement joints in runs of plasterboard and fibre cement board lined partitions. Locations shall be accepted by the Superintendent, but they must not be greater apart in distance than recommended by the manufacturer.
 2. Type: Rondo P35 Control Joint comprising galvanised steel setting beads and PVC rubber flexible joint. Blend finishing coat into sheet.

2.20 Wall Breather Membrane

- A. Refer to Section 0819.
- B. Material: To meet the performance requirements, including NCC Clause C1.9, have a compliant spread of flame index and will be non combustible when tested in accordance with AS 1530.1.

2.21 Fixings

- A. Drywall screws and wafer head drywall screws for channel to bracket fixings. Screw sizes to be in accordance with the manufacturer's written instructions.

2.22 Flanking Noise, Penetrations and Junction Coordination

- A. Acoustically seal all service penetrations passing through sound rated partitions.
- B. Seal sound rated partitions at the building façade junction so as to maintain the required acoustic performance of the partitions.
- C. Ensure audible sound leakage through building discontinuities is minimal. In particular, ensure that gaps between partition heads and ceiling system are acoustically sealed.
- D. Provide prepared penetrations for electrical services as required by the Electrical Engineer's documents.
- E. Make good all penetrations due to minor services (services, cables etc.) so that the sound isolation quality of the wall is not degraded and that audible sound leakage at the penetration does not occur. Tightly pack insulation around cables and seal with approved sealant.
- F. Where services carry vibration or noise, provide an oversized penetration which shall be packed with fibreglass and sealed using a silicone or similar flexible sealant to both finished faces of the penetration, installed in accordance with the sealant manufacturer's recommendations. Where the gap between the service and the surrounding structure is larger than 15mm, provide a metal flashing cover over the fibreglass filler and seal using a flexible sealant. Ensure that the metal flashing does not transfer vibration into the adjacent structure.
- G. Ensure that the required overall sound insulation of the partition is maintained.

- H. Penetrations are to be acoustically sealed so that the acoustic rating of the form of construction being penetrated are to comply with the nominated acoustic ratings.
- I. If not stated otherwise, and notwithstanding the above, a construction separating two areas of a separate occupancy and any penetrations therein, shall comply with the minimum acoustic requirements.
- J. Penetrations are to be sized for pipes passing through walls to allow a uniform clearance of 10mm -15mm around the item and this space is to be packed through its depth with fibreglass or equivalent. The joints on both sides are to be sealed using an approved acoustic sealant at 12mm minimum depth. Penetrations made through slabs are to be sealed for the full depth of the penetration, with a cement grout, to achieve an airtight seal.
- K. Any alternative sealing details utilised shall be designed to maintain the acoustic rating of the walls, ceilings and floors that they penetrate. Alternative details are to be submitted to the acoustic consultant for review.
- L. All gaps around perimeter of acoustic rated walls, ceilings and adjoining constructions are to be acoustically sealed using an approved acoustic sealant.
- M. The perimeter of all acoustically treated tiled floor areas are to be isolated from the adjoining wall construction with a 5mm gap. The gap is to be filled with an approved acoustic floor underlay or acoustic sealant.
- N. Gaps between the wall cladding and adjoining constructions, such as soffits, are to be sealed.
- O. Acoustic insulation material located in the ceiling space may be cut around access panels for easy access (however the acoustic insulation must be laid on top of the access panel as well).
- P. An airtight seal is to be achieved where full height partitions meet the underside of the slab.
- Q. Plasterboard sheeting with mineral fibre (achieving the required R_w or D_w performance) in the cavity can be used between the top of masonry walls and the underside of the roof. The plasterboard sheeting must push up against the underside of the slab and any gaps or penetrations must be acoustically sealed.

2.23 Services Penetrations

- A. Penetrations through acoustic rated walls shall be sealed to ensure that the sound insulation and noise criteria performance requirements are not compromised.
- B. Holes in walls, ceilings, floors, façades or roofs etc. for penetrations are to be sized to accommodate ducts with the minimum clearance that is practicable.
- C. Once ductwork or pipework is installed, the hole around it is to be sealed according to the details shown on the Service Engineer's documents (or equivalent detail agreed in writing by the Superintendent).
- D. Acoustic lagging is to be absent as ducts and pipes pass through the thickness of the wall, ceiling, floor, façade or roof, and, where permissible, thermal lagging is to also be removed.

2.24 Fire Stop Sealant

- A. Refer to Section 0681.
- B. Caulk all perimeter gaps and control joints in fire rated partitions.

2.25 Accessories

- A. Beads, Joints and Angles:
 1. All metal beads, edges, angles and trims shall be obtained from Rondo Building Services, or acceptable equivalent.
 2. Beads/ angles: Galvanised mild steel edge beads to suit the plasterboard thickness shall form a positive perimeter edge.
 3. Jointing tape: Minimum 53mm wide.
 4. External wall corners to receive Rondo P32, or acceptable equivalent, Plaster-Lock Corner Beads. High traffic areas to receive Rondo P55 heavy duty Plaster-Lock Corner Beads.
 5. Internal wall corners to receive Rondo PS17, or acceptable equivalent, Internal Corner Beads.
 6. Wall to ceiling junctions to receive Rondo P50, or acceptable equivalent, Shadowline Stopping Beads.
 7. Wall to door and/ or window frame junctions to receive Rondo P50, or acceptable equivalent, Shadowline Stopping Beads.

8. Rondo 552, 553 or 554 steel angles shall be provided as required for support backing at internal wall corners prior to fixing of wall linings.
9. Control joints, where required, to be Rondo P35 Control Joints with PVC rubber flexible joint.
10. Acoustic sealant shall be applied, as appropriate, at all junctions with walls, floors, ceilings and around openings. It shall be applied as a continuous bead leaving no gaps.
11. Air pressure sealant shall be applied, as appropriate, to perimeter junctions with walls, floors and ceilings, air gaps around openings and other potential leakage points including framing members and around fire stops, applied as continuous bead.

2.26 Cavity Barriers

- A. Provide continuous vertical barriers using mineral fibre or acceptable equivalent material using strip cut fibre where indicated on the Design Drawings or otherwise required.

2.27 Sound Barriers

- A. Provide continuous vertical barriers using mineral fibre or acceptable equivalent material using strip cut fibre where indicated on the Design Drawings or otherwise required.

3 EXECUTION

3.1 General

- A. Steel stud wall systems are non load bearing unless noted otherwise.
- B. Substrates to be plumb, level, in true alignment and to the lining manufacturer's recommendations in accordance with AS/NZS 2589 clause 4.2.
- C. Provide partition systems that resist the effects of changes in temperature and humidity and corrosive environments.
- D. Support system to be checked and certified by independent registered structural engineer prior to installation.
- E. Include structural assessment to ensure the system and all loads on the partitions are taken in to account.
- F. Provide and locate all required in wall support to suit internal joinery fitout and equipment as scheduled and nominated.
- G. All service penetrations through walls and linings are to be fully sealed. Ensure fire rated sealant of same or higher rating to wall where walls are nominated as fire rated.

3.2 Movement

- A. Building movements:
 1. General: Provide for differential movement within the partitions, and between the partitions and the building caused by building movements, including (but not limited to):
 - a) Edge beam or slab deflections under designed dead and live loads.
 - b) Column or frame shortening (elastic, creep, shrinkage etc.).
 - c) Lateral, upward and downward deflection under wind load.
 - d) Seismic activity.
 - e) Joints in partitions coinciding with movement and seismic joints in the building
 - f) Control joints in ceilings where structure supporting soffit will naturally deflect and cause cracking. Assess structure and recommend locations with Superintendent.
 - g) Control joints in partition linings as recommended by the lining manufacturer.

3.3 Installing Metal Stud Partitions

- A. Comply with the requirements of AS/NZS 2589 clause 4.2.
- B. Fix metal stud partitions in accordance with the manufacturer's recommendations.
- C. Position studs at equal centres, maintaining sequence across openings. Provide additional studs, as necessary, to support all vertical edges of boards.
- D. Provide studs in single lengths without splices. Rotate intermediate studs into tracks for friction fixing. Screw fix jamb studs, corner studs and wall intersection studs to tracks.
- E. Stud service holes are to be factory pre-cut flared holes, or provide site cut holes punched or drilled on the centreline of the member and fit proprietary plastic bushes or grommets. Splice additional stiffening to studs if site cut service holes exceed 1/3 the depth of the member.

- F. Where more than one layer of plasterboard is applied, joints between layers shall be staggered.
- G. Fix plasterboard to each stud and along all edges with proprietary screws at appropriate centres, not less than 10mm from the edge of the board. Heads shall be set in a depression, without breaking the paper or the gypsum core.
- H. Where indicated on the Design Drawings, as required for fire or acoustic purposes, or where required for integrity of the installation, partitions shall be extended up between recesses and services to the underside of the structure over.
- I. Where external equipment or handrails are fixed to partitions, install continuous galvanised mild steel plate to the inside of the plasterboard lining to provide a secure fixing point.
- J. All openings shall be framed out on all sides with metal studding and be cross-braced to the metal stud uprights on two opposite sides where possible.
- K. Perimeter framing members are to be securely fixed to the adjoining structure and bedded in resilient compound, or the joints are to be caulked so that there are no voids between the framing members and the adjoining structure.

3.4 Fixing Furrings

- A. Furring channels shall be fixed running horizontally for vertically fixed sheet linings. They shall be placed at 600mm maximum centres. Pack using metal spacers to provide plumb and straight fixing background.

3.5 Storage and Accuracy

- A. Work under the Contract shall be installed using continuous profiles, being free from marks, defects, flaws, steps, waves, or damage of any nature.
- B. Store all materials on Site in accordance with the manufacturer's written recommendations.
- C. Verify dimensions and levels of the structure before installation commences.
- D. Obtain permission from the Superintendent before drilling or cutting parts of the structure, other than where shown on the Design Drawings.
- E. Install work under the Contract square, regular to line, level and plane at all junctions fitting to the stated tolerances.

3.6 Insulation

- A. Insulation shall be accurately trimmed to fit between studs. Fix insulation to wall top and bottom plates as well as to intermediate noggings to ensure that there is no sagging of the insulation material over time.
- B. There are to be no gaps in the insulation that will compromise the effectiveness of the system.

3.7 Preparation of Backgrounds

- A. Remove all loose material by thoroughly brushing the structure to be lined.
- B. Noggings, bearers, etc., required to provide fixing points for heads of partitions running parallel with, but offset from, main structural supports, or to support fixtures, fittings and services, shall be accurately positioned and securely fixed. After fixing boards, the positions of noggings and bearers shall be marked for following trades.
- C. Carry out all works in accordance with the materials and workmanship recommendations of the manufacturer.

3.8 Fixing Requirements

- A. Installation of plasterboard shall comply with AS/NZS 2589.
- B. The fixing, jointing and finishing of work under the Contract, where not specified otherwise, shall be as recommended by the board manufacturer.
- C. Boards shall be fixed only in areas that have been made weathertight.
- D. Boards shall be cut neatly and accurately without damage to core or tearing of paper facing.
- E. Keep cut edges to a minimum and position at internal angles wherever possible, with masked bound edges of adjacent boards at external corners.
- F. Fix boards securely and firmly to suitably prepared and levelled backgrounds, with heads of fastenings set in a depression, without breaking the paper or the gypsum core. Finishes shall appear flush, smooth and flat with surfaces free from bowing and abrupt changes of level. Damaged boards shall not be used.

3.9 Fixing Using Dabs

- A. Apply plaster dabs in accordance with the board manufacturer's written recommendations, using an appropriate adhesive recommended by the manufacturer.
- B. Apply continuous seal to all perimeters of walls in accordance with the board manufacturer's written recommendations.

3.10 Movement Joints

- A. Provide movement joints as necessary and/ or as shown on the Design Drawings.
- B. Install movement joints in accordance with the manufacturer's written recommendations.

3.11 Joints in Plasterboard

- A. Lightly butt joints between tapered edges of boards, leaving a 3mm gap where cut unbound edges occur.
- B. Plasterboard sheets are to be laid horizontally throughout the project.
- C. Allow no horizontal joints in surfaces exposed to view except where the height of the wall exceeds the maximum available length of the board. Precise joint positions not shown on the Design Drawings shall be agreed with the Superintendent. Horizontal joints in two layer boarding shall be offset by a minimum of 600mm and position noggings to support the outer layer horizontal joints as recommended by the manufacturer.
- D. Where plasterboard edges abut dissimilar materials and at points of stress, install appropriate edge beads as recommended by the manufacturer.
- E. Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.
- F. Butt joints: Make joints over framing members or otherwise provide back blocking.
- G. Where one layer is required on both sides of a wall, fasten to the studs with joints staggered on opposite sides.
- H. Where two layers of plasterboard are required, the second layer is to be fastened over the first layer so that the joints do not coincide with those of the first layer.
- I. All joints shall be taped and veneer skimmed in accordance with the manufacturer's written recommendations.
- J. External corner joints: Make joints over metallic-coated steel corner beads.
- K. Dry joints: Provide square edged sheet and finish with a UPVC joining section.
- L. Control joints:
 1. Control joints are to be installed to allow for structural movement. Allowance for movement to be made through the frame, lining and any tiles.
 2. Control joints to be installed in accordance with the manufacturer's written instructions, at all construction joints in the building and at the following minimum locations:
 - a) Non-tiled internal walls with fibre cement outer layer, at 7200mm maximum centres.
 - b) Tiled internal walls with fibre cement outer layer, at 4200mm maximum centres.
 - c) Walls with plasterboard outer layer, at 12m maximum centres.
 - d) External walls: Refer to the appropriate installation manual.
 - e) At junctions with other building elements.
 - f) At changes of lining material.
 - g) At changes of structural support systems.
 - h) At each storey or rise of studs.
 3. All control joint locations shall be agreed with the Superintendent prior to installation.
- M. Joints in tiled areas: Do not apply a topping coat after bedding perforated paper tape in bedding compound.

3.12 Taping and Finishing

- A. Cut edges of boards shall be lightly sanded to remove paper burrs. Apply a PVA sealer to exposed cut edges and any other plaster surface to which tape is applied.
- B. Fill joints and gaps, cover with continuous lengths of tape and fully bed. Where joints are to be covered with finish, feather out to provide a smooth seamless surface.

- C. All external angles shall be protected by the use of drywall angle beads with plasterboard edge beads at all visible jointed abutments. Joint finish shall be applied to all external angles. When jointing is complete and dry, apply drywall primer to the complete surface ready to receive decoration.
- D. All beads shall be flush with the board.
- E. Nail and screw depressions shall be filled with joint filler to provide a flush and smooth surface.
- F. On completion of joint, angle and spotting treatments a surface finish shall be applied to provide a continuous, consistent finish to the surface of boards.
- G. Unless nominated otherwise, flush plasterboard walls shall achieve a minimum of level 4 finish in accordance with AS/NZS 2589.

3.13 Fire Sealing of Fire Rated Elements

- A. Refer to Section 0681.
- B. Where required, ensure that penetrations, joints and perimeters of fire rated elements are effectively sealed with a suitable fire resistant material and that the integrity of the building element is maintained.

3.14 Sound Barriers

- A. Align accurately with partition heads and fix tightly at all perimeters and joints in accordance with the manufacturer's recommendations. Include steel support sections to ensure permanent stability and continuity with no gaps.
- B. Seal any gaps at junctions of sound barriers with partition head, suspended ceiling, structural soffit, walls, ducts, pipes, etc., using mineral wool or suitable sealant.
- C. Acoustic rated partitions: If a suspended ceiling of equivalent sound insulation rating is not provided, either extend the partitions to the underside of the structural soffit, or provide acoustic plenum baffles. The ceiling and baffle to provide a combined rating equivalent to the partition rating.

3.15 On-Site Dimensions

- A. All dimensions shall be checked on Site prior to commencement of the installation.
- B. The works shall accommodate any given tolerance as well as differences between actual Site dimensions and dimensions shown on the Design Drawings.

3.16 Installation Tolerances

- A. Maintain the planning grid and distribute tolerances equally to achieve the following:
 1. Straight lines and flat planes in all directions.
 2. A final finished surface position within 5mm of its notional position when measured in accordance with AS/NZS 2588.
- B. All dimensions shall be checked on Site prior to commencement of installation.
- C. The installation shall accommodate all required tolerances including differences between actual Site dimensions and dimensions shown on the Design Drawings.
- D. Take account of the installation tolerance requirements such that repetitive units are accurately located, relative to gridlines.
- E. Erect in alignment and in relation to established lines and grades as shown on the Design Drawings.
- F. Joint alignment tolerance are to meet the following requirements:
 1. Panel sizes < 600mm: +/- 2mm.
 2. Panel sizes > 600mm: +/- 3mm.
- G. Flatness tolerance are to meet the following requirements:
 1. No visible oil canning.
 2. Panel sizes < 600mm: +/- 1mm from design profile.
 3. Panel sizes > 600mm: +/- 2mm from design profile.
- H. The maximum variation in height of any part of work under the Contract from given datum shall be 2mm.
- I. The maximum offset in plane, level or section between any two adjacent sections shall be 1mm.
- J. The maximum variation in plan over a distance of 1800mm shall not exceed 2mm.

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SECTION 0531 -- SUSPENDED CEILINGS

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Suspended ceiling systems:
 - a) Metal panel ceilings.
 - b) Plasterboard ceilings.
 - c) Fire rated ceilings.
 2. Eaves and soffit linings.
 3. Ceiling access panels.
 4. Ceiling insulation.
 5. Air grille/ diffuser.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Ceiling material: Lining and ceiling units, with insulation, showing the extremes and mean of variation in colour, pattern, or texture of the proposed finish.
 2. Suspension system: Sections proposed for the suspension system, including suspension rods, clips, wall angles and trim.
 3. One of each type of ceiling access panel in the nominated finish.
 4. Methods: Methods of jointing, fixing, height adjustment, retaining and removing ceiling units.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first 10m² of each type in location as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. The suspension system before installation of the ceiling panels or lining.
 2. Prior to control joint installation.
 3. Completed ceiling before installation of fittings and Site painting, if applicable.
 4. The completed ceiling.

1.8 Subcontractors

- A. Submit name and contact details of proposed manufacturers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings showing the relevant details of the ceiling system as follows:
1. Grid set out and extent of all ceiling types. Show all services outlets and demonstrate that all services have been adequately coordinated.

2. Calculations: Structural design calculations demonstrating the ability of the system to perform to requirements.
3. Demountability: Methods of achieving demountability.
4. Details: Large scale details of construction, suspension system, methods of assembly, trim and fixing, showing dimensions, clearances and tolerances.
5. Partition attachment: Method of attaching heads of partitions to the ceiling support members.
6. Proposed location of access panels.
7. Specification: Specification of material to be used, finish to exposed members, corrosion protection, performance data of components and assemblies and other pertinent information.
8. Vibration reduction: Method of reducing contact vibrations between structure and ceiling.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Test Requirements

- A. Provide evidence of independent tests carried out to demonstrate that the products comply with the Specification or carry out such tests necessary to demonstrate compliance.
- B. Such tests to demonstrate compliance in respect of the following criteria:
 1. Fire resistance.
 2. Air leakage.
 3. Acoustic integrity.
 4. Structural stability.
- C. Fire hazard properties:
 1. Group number: To NCC Spec C1.10 and AS 5637.1.
 2. Average specific extinction area (non-sprinklered buildings): < 250 m²/kg to AS/NZS 3837.
 3. Smoke growth rate index (non-sprinklered buildings): < 100 to AS ISO 9705 and NCC Spec A2.4.
- D. Fire resistance level: To AS 1530.4.
- E. Weighted suspended ceiling normalised level difference: To AS/NZS ISO 717.1.
- F. Weighted sound absorption coefficient: AS ISO 11654, as tested to AS ISO 354.

2 PRODUCTS

2.1 Ceilings Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- B. Ceiling heights are as nominated on the Design Drawings.
- C. Coordinate suspended ceilings with structural and service requirements and install to the manufacturer's written instructions. Allow for the integration of all services.
- D. Suspended ceilings including strength, serviceability, stability and durability requirements are to be in accordance with AS/NZS 2785.
- E. Wind load pressure coefficients are to be established in accordance with AS/NZS 1170.2. Refer to the Structural Engineer's documentation.
- F. Seismic design loads are to be established in accordance with AS 1170.4. Refer to the Structural Engineer's documentation for further requirements.
- G. Ceiling materials are to have a diffuse reflectance not less than 30%.
- H. Ceiling joints are to be coordinated with the placement of lighting, signs, and access to mechanical and electrical systems and other equipment, as well as acoustic treatments.
- I. Exposed fixings and locks to ceilings and soffits, located in public areas, are to be vandal resistant and tamper proof requiring a specialised tool for removal.
- J. Acoustic treatments are to be integrated within overall assemblies and materials and be capable of withstanding the ambient conditions.

K. Acoustic Insulation: As per Acoustic Consultant Specification.

L. Thermal Insulation: As per Section J requirements.

2.2 Suspended Plasterboard Ceiling

A. Suspended flush plasterboard lining on concealed suspended ceiling system.

B. Gypsum core standard grade classification plasterboard to AS/NZS 2588. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.

1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2. Finish: Painted. Refer to Section 0671.

C. Insulation where nominated and as specified.

2.3 Suspended Moisture Resistant Plasterboard Ceiling

A. Suspended flush moisture resistant plasterboard lining on concealed suspended ceiling system.

B. Moisture resistant plasterboard classification to AS/NZS 2588, with additives to the core, face, and back linerboards at manufacture to reduce the water absorption rate and make it resistant to moisture and humidity. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.

1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2. Finish: Painted. Refer to Section 0671.

C. Wall junctions: Provide Rondo P50 shadow stopping angles generally and square set finish to plasterboard bulkheads at internal and external corners.

D. Insulation where nominated and as specified.

2.4 Suspended Fire Resistant Plasterboard Ceiling

A. Suspended flush fire resistant plasterboard lining on concealed suspended ceiling system.

B. Fire resistant grade classification to AS/NZS 2588, with mineral fibres and additives to the core to improve core adhesion at high temperatures and strength. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.

1. Thickness: 3mm x 16mm fire rated plasterboard.

2. Finish: Painted. Refer to Section 0671.

C. Insulation where nominated and as specified.

D. Fire resistance: As nominated on the Design Drawings and/ or Fire Engineering Report.

2.5 Suspended Acoustic Plasterboard Ceiling

A. Suspended flush acoustic plasterboard lining on concealed suspended ceiling system.

B. Acoustic grade classification plasterboard with a high density gypsum core encased in heavy duty linerboards to AS/NZS 2588. Exposed surface suitable for decoration and tapered edges for smooth seamless jointing.

1. Thickness: 13mm, or as otherwise nominated in the Design Drawings.

2. Finish: Painted. Refer to Section 0671.

C. Insulation where nominated and as specified.

2.6 Suspended Metal Ceiling Tiles

A. Metal pan ceiling tile system as detailed on the Design Drawings.

1. Perforations: As detailed.

2. Perimeter trim to comprise matching metal trims.

B. Provide an IAB (integrated acoustic backing) black fabric backing to panels.

C. Insulation where nominated and as specified.

D. Metal cladding and associated cladding components are to be non-combustible, compliant with the NCC Deemed to Satisfy provisions, AS 5113 and the AS 1530 suite.

E. Refer to Section 0431 for further details of metal cladding.

2.7 Suspended Ceilings Generally

A. Structural soffit: Concrete slab soffit or underside of metal deck roof as applicable.

B. Ceiling height shall be as nominated on the Design Drawings.

- C. Allow for the integration of services shown on the Design Drawings.

2.8 Ceiling Access Panels

- A. Flush ceiling access panels with rim lock and concealed metal frame.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Size: As indicated on the Design Drawings.
 - 2. Colour: To match adjacent ceiling colour.
- C. Fire rating: To match the associated ceiling system as a minimum.
- D. Quantity: Allow one access panel for every 10m² of flush plasterboard ceiling at locations to be advised.

2.9 Suspension System Generally

- A. Proprietary suspension system fixed to structural framing or under slab in accordance with the manufacturers written instruction.
- B. Extent of system: Include hangers, fixings, main runners, cross members, primary channels, perimeter trims, splines, clips, bracing, bridging, etc., which are necessary to complete the ceiling system and achieve the performance specified.
- C. Materials: Steel.
 - 1. Colour: White, unless nominated otherwise.
- D. Top fixings: Suitable for structure.
- E. Hangers: Height adjustable solid steel ceiling rods.

2.10 Insulation

- A. Refer to Section 0819.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Thickness: As scheduled.
 - a) To suit the performance requirements of the partition systems as specified by the Acoustic Consultant
 - 2. Insulation only R value: As scheduled.
- C. Provide insulation directly above the ceiling lining to areas as indicated on the Design Drawings.
- D. Insulation to extend a minimum of 1000mm each side of internal partitions nominated as requiring acoustic insulation.

2.11 Smoke Barriers

- A. Provide smoke barriers in ceiling voids where necessary, comprising two layers of plasterboard and all supports.
- B. The joints between panels shall be sealed with a serrated compressible neoprene strip.

2.12 Perimeter Trims Generally

- A. Unless specified otherwise in the product selections the following shall be included.
- B. Plasterboard ceilings, where ceilings abut walls, provide treatment as indicated on the Design Drawings:
 - 1. Rondo P50 shadow stopping angles. Gaps between the wall and the metal edge of the stopping angle shall be filled with a paintable flexible sealant.
 - 2. Square set cornices.
 - 3. Selected cornices to profiles as indicated.
- C. Rondo Shadowline wall angle to acoustic tile ceilings.
- D. Fixings to perimeters: BZP raised head screws.
- E. Fixing centres (maximum): 450mm.

2.13 Tiles and Plank Ceilings

- A. Tiles shall have square edges on all sides incorporating a black neoprene seal around tiles, recessed from the face of the ceiling panel.

- B. Tiles shall incorporate factory formed penetrations with upturned edges, to receive downlighters, smoke detectors, PA speakers, sprinkler heads or other service penetrations required where shown on the Design Drawings. All additional supports necessary at the location of penetrations to receive such fittings shall be allowed for.
- C. Panels shall be protected against the effects of corrosion after fabrication and prior to application of finishes.
- D. All cutting and drilling of ceilings, panels and associated members, including apertures for services, shall take place before the application of painted finishes. Site cutting or drilling is not permitted.
- E. No exposed cut ends shall remain uncoated or unfinished.

2.14 Support Systems and Fixings

- A. Manufacturer/ reference: Rondo or acceptable equivalent.
- B. Mild steel suspension systems shall be hot dip galvanised to AS/NZS 4680 with cold rolled channels and sections.
- C. Aluminium framing members shall be fabricated using only appropriate grades, strengths and thicknesses to provide full structural compliance. The wall thickness of aluminium extrusions shall be sufficient to ensure rigidity in the lengths required in the final installation.
- D. Fixings and suspension system shall be fully concealed including all hangers, fixings, main runners, cross members, primary channels, perimeter trims, splines, clips, bracing, bridging, etc., which are necessary to complete the installation and achieve the performance specified.
- E. Corrosion resistant anchors, inserts, fasteners and other such devices shall be used in accordance with Section 0811.
- F. Use only continuous profiles free from marks, defects, flaws, steps, waves or any other damage.

2.15 Manufacturing Tolerances

- A. A high degree of accuracy is required in the fabrication of work under the Contract in order to ensure accurate assembly on Site. This shall include the requirement to accurately locate repetitive units in relation to gridlines without accumulation of tolerances and that all joints are matched for level and alignment. The manufacturing tolerances below shall be maintained.
- B. Tile position:
 - 1. Metal ceiling tiles: $\pm 0.5\text{mm}$ in any direction.
- C. Face deflection of tiles not exceeding 600mm in any direction:
 - 1. At edge 1mm.
 - 2. At centre 2mm.
- D. Face deflection of tiles exceeding 600mm in any direction:
 - 1. At edge 1.5mm.
 - 2. At centre 3mm.
- E. Edge straightness when suspended: 0mm to -0.3mm per metre concave.
- F. Flatness criterion: 1:1000.
- G. Squareness: 0.15mm per 300mm length.
- H. Side flange angle: 90° :
 - 1. $+0.5^\circ$ relative.
 - 2. $+2^\circ$ to face.
- I. Edge perforated/ plain border:
 - 1. $+0.7\text{mm}$.
 - 2. -0.7mm .

2.16 Factory Applied Finishes

- A. Prepare panels to receive factory finish. This shall include rinsing, degreasing, sealing and priming in accordance with the manufacturer's instructions.
- B. Ensure measures taken to guarantee uniformity in texture, colour and appearance without irregularities or distortions following finish applications.
- C. Factory apply the following finish:

1. Powder coating: Refer to Section 0813.

2.17 Sealants

- A. Fire rated sealant: Non-hardening sealant compatible with the ceiling materials and documented fire rating.
- B. Acoustic sealant: Non-hardening sealant compatible with the ceiling materials and rated to Rw 65.

3 EXECUTION

3.1 General

- A. Design and Installation shall be to AS/NZS 2785.

3.2 Movement

- A. Building movements:
 1. General: Provide for differential movement within the ceilings, and between the ceilings and the building caused by building movements, including (but not limited to):
 - a) Edge beam or slab deflections under designed dead and live loads.
 - b) Column or frame shortening (elastic, creep, shrinkage etc.).
 - c) Lateral, upward and downward deflection under wind load.
 - d) Seismic activity.
 - e) Joints in ceilings coinciding with movement and seismic joints in the building
 - f) Control joints in ceiling where structure supporting soffit will naturally deflect and cause cracking. Assess structure and recommend locations with the Superintendent.
 - g) Control joints in ceiling linings as recommended by the lining manufacturer.

3.3 Suspension System

- A. Install the suspension system in accordance with the manufacturer's recommendations with appropriate fixings to the substrate soffit.
- B. Install within the fixing zones indicated on the Design Drawings.
- C. Work under the Contract shall be base fixed, with a sliding head connection to the primary structure made from concrete or steel.
- D. Take every precaution to ensure that no chemical or electrolytic action takes place where dissimilar metals and/ or materials are used together, and to isolate metal components from cementitious surfaces. Necessary insulation shall be provided wherever dissimilar metals come into contact.
- E. All inaccessible steel shall be hot dip galvanised.
- F. All alloys shall be similarly finished to match accepted samples.
- G. Allow for access for maintenance of services.

3.4 Plasterboard Ceilings

- A. To AS/NZS 2589.
- B. Fix, joint and finish in accordance with the system manufacturer's instructions. Provide movement joints for the area of ceiling and coordinate with structural movement joints.
- C. Boards shall be screwed neatly and accurately without damaging surfaces. Any damaged board shall be replaced.
- D. Heads of screws shall be set below the surface of boards and filled to form a flush surface.
- E. Joints of boards applied in two or more layers shall be staggered ensuring that all edges and ends are fully supported and screwed to grid members.
 1. Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before installing following layers.
 2. Stagger all sheet joints by minimum 200mm.
- F. Unless specified to a higher standard, flush plasterboard ceilings shall achieve a level 4 finish in accordance with AS/NZS 2589.
- G. Upstands, bulkheads, coffers and the like as shown on the Design Drawings shall have internal and external stainless steel corner stopping beads.

1. Brace bulkheads to prevent lateral movement. If the ceiling is terminated at a bulkhead, provide for seismic requirements.
 2. Bulkheads are to be avoided where possible and cannot proceed without acceptance of Shop Drawings.
- H. Determine the number of plasterboard layers required to achieve the performance requirements of the Specification.
- I. Suspension system shall be suitably robust and installed in accordance with the manufacturer's recommendations.
- J. Install within the zones indicated on the Design Drawings and incorporate a sliding head connection to the primary support structure.

3.5 External Suspended Soffits

- A. Support external suspended soffits on rigid members capable of carrying the loads from imposed actions. Install members to minimise any eccentricity, and ensure that the upward and downward loads from wind actions are carried through to the supporting structure.

3.6 Ceiling Penetrations

- A. Where partitions terminate at the suspended ceiling (i.e. the suspended ceiling is continuous above the partition), ceiling penetrations within 1000mm of the partition shall be acoustically treated.

3.7 Movement Joints

- A. Movement joints shall be installed to the manufacturer's recommendations.
- B. Provide movement joints as appropriate for the area of ceiling and/or to coincide with movement joints in the surrounding structure.

3.8 Fire Stopping

- A. All gaps at junctions with walls, cavity barriers, ducts, pipes and other penetrations shall be sealed using tightly packed mineral wool, intumescent sealant or other fireproof material to prevent penetration of smoke and flame.
- B. The installation shall be in accordance with the manufacturer's approved tested prototypes.

3.9 Air Diffuser/ Ventilation Grilles

- A. Ventilation grilles are to be integrated, set flush, with a colour to match the adjacent ceiling finish, unless nominated otherwise.

3.10 Air Plenum Barrier

- A. Air plenum barriers shall comprise rigid or semi-rigid non-porous sheets with smooth non-dusting surfaces having the same fire spread rating as that required for membrane materials exposed within the void.
- B. Air plenum barriers shall be fixed securely at perimeters and joints, using methods recommended by the barrier manufacturer to ensure permanent stability. All edges and joints shall be effectively sealed to prevent air leakage.

3.11 Seismic Requirements

- A. Design Drawings highlight partition walls that are full height (slab to slab) for acoustic or fire rated purposes. The ceiling bracing design is to allow for all other partition walls to be braced by the ceiling system and allow for these loads in addition to the self-weight of the ceiling system.
- B. Self-weight shall include ceiling frame, linings, tiles, insulation and an additional 10kg/m² dead load to allow for lighting and minor services. Allow for all additional loads due to parts and components fixed to the ceiling system as nominated on the architectural and services drawings.
- C. The ceiling bracing design shall nominate any additional walls (if any) that are required to extend full height as part of the bracing methodology, noting that there are significant concentrations of services within the ceiling void in many areas that may inhibit these opportunities.
- D. Independently assess the capacity of the full height partition wall framing used to restrain the ceiling frame under the bracing methodology (if any) to resist the loads transferred by the ceiling. Where ceilings have a "fixed" connection to the perimeter walls ensure that:
1. The partition members can withstand the seismic load applied by the ceiling.
 2. The fixings, connections and/or bracing of the partition members can accommodate the required seismic loads.
 3. Where required by the manufacturer the perimeter partition is noggged continuously at ceiling level.

- E. Provide sufficient separation to all other full height partition walls not used within the bracing methodology to ensure these walls are not loaded by the ceiling frame during a seismic event.
- F. The bracing system must be independent of the building façade and provide detailing to allow seismic movement between the façade and ceiling systems.
- G. Provide ceiling bracing at maximum 9000mm centres in each horizontal direction, but not less than required by calculation. Ceiling bracing locations shall be clearly nominated on the Shop Drawings and shall be coordinated with the building services. Ductwork, cable trays, pipework and electrical conduits and the like must be independently supported and braced separately from the ceiling system (by services contractor).
- H. Attach safety wires to light fixtures and cushion head boxes, except where supported and braced independently of the ceiling or specifically detailed within the ceiling system otherwise to prevent fall during seismic events. Safety wire to be 2mm galvanised soft annealed mild steel wire. Use minimum 4 twists within 40mm of each end to develop full wire tension. Alternatively use load rated wire and clips.
- I. All anchors in concrete used to transmit structural loads by means of tension and shear between the concrete structure and the ceiling framing shall be qualified for use in cracked concrete and suitable to resist seismic loads. Refer to Structural Engineer's details.
- J. All hangers and associated fixings in an overload condition must be capable of carrying at least 50% additional load to avoid progressive collapse in accordance with AS/NZS 2785.

3.12 Installation Tolerances

- A. Grid dimensions as shown on the Design Drawings shall be maintained ± 1 mm.
- B. Finished ceiling levels shall be as shown on the Design Drawings ± 2 mm in 1000mm length.
- C. Check all Site dimensions before commencement of installation.
- D. Accommodate all specified tolerances and differences between actual Site dimensions and dimensions shown on the Shop Drawings.
- E. Joints between panels shall be consistent, square and flush, being clamped together by the support system. Where gaskets are installed in joints, they shall not vary in width by more than 10% of the width of the gasket in place.
- F. Panel to panel lipping or plan offset shall not exceed 0.5mm and shall be non-cumulative across any ceiling.
- G. Grid creep across any ceiling shall not exceed 1.5mm in a 10m length.
- H. Install square, regular to line, level and plane within specified tolerances. Do not use cartridge or power activated methods for top fixing or rivets for bottom fixing of hangers.
- I. Obtain acceptance before drilling or cutting parts of the structure.

3.13 Setting Out and Protection

- A. Adequately protect from damage and dirt.
- B. Set out accurately, free from undulations and lipping, with all lines and joints straight and parallel to the planning grid.
- C. Fix securely with additional bracing and stiffening as necessary to provide a rigid system.
- D. Light fittings, grilles, fire and smoke barriers, etc., shall be in the correct positions relative to the ceiling grid, prior to commencing installation. Common setting out points shall be used.

3.14 Suspension Rods

- A. Straighten before use and install vertically without bends or kinks. Do not allow rods to press against any fittings within the void.
- B. Fix securely at top and bottom with tight bends to loops to prevent any vertical movement.
- C. Top fixings:
 1. To steel: Nuts and bolts.
 2. To concrete: Masonry anchors.
- D. Spacings: 1200mm maximum centres not more than 150mm from spliced joints. The last rod shall not be greater than 60mm from the adjacent work.
- E. Obstruction: Where obstructions prevent vertical installation either:
 1. Brace designed rods against lateral movement.

2. Hang ceiling system on an appropriate rigid sub-grid bridging across obstructions and supported to prevent lateral movement.

- F. Extra rods: Provide as required to carry additional loads.
- G. Failure: Provide a ceiling system where failure of any one suspension point does not cause a progressive failure of the ceiling.

3.15 Insulation

- A. Fit accurately and firmly with no gaps.
- B. Lay out insulation in the widest practical widths to suit spacings of grid members, with closely butted joints.
- C. Do not cover electrical cables (unless they have been sized accordingly). Cut insulation carefully around electrical fittings.
- D. Completely cover ceilings leaving no gaps.

3.16 Bracing

- A. Secure with additional bracing and stiffening as necessary to give a stable ceiling system resistant to design loads and pressures.

3.17 Top Fixing

- A. Building structure: Verify suitability.
- B. Aerated concrete: Fix through from the top of the concrete unit and provide a system of primary channels.
- C. Structural steel: Drill or use suitable proprietary clips/ adaptors.
- D. Metal roof decking: Fix to sides of corrugations.

3.18 Handling and Storage

- A. Comply with the manufacturer's recommendations and AS/NZS 2785.

3.19 Remedial Works

- A. Repair all damage when directed by the Superintendent.
- B. All remedial works to surface finishes shall only be accepted if a perfect match is achieved.
- C. Failure to comply with this requirement will require replacement of the component.

3.20 Completion

- A. Maintenance manual: On completion, submit a manual of recommendations for the care and maintenance of the ceiling and operating instructions for demounting if applicable.
- B. The following spares shall be provided to the Superintendent in appropriately labelled and sealed boxes:
 - 1. General: Supply spare matching tiles, 2% of area used for each type and accessories of each type for future replacement purposes. Store the spare materials on Site where directed.
 - 2. Supporting system: One spare member (hanger or framework member) for every 100 members (or part thereof) of the same type installed in the ceiling.
 - 3. Tiles, panels, strips: One spare unit for every 50 units (or part thereof) installed in the ceiling.

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SECTION 0551 -- JOINERY

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Built-in joinery and specialist furniture including:
 - a) Benchtops.
 - b) Cupboard, drawer and shelf units.
 - c) Wardrobe units.
 - d) Electrical equipment in cupboards.
 - e) Vanity benches.
 - f) Joinery bulkheads.
 - g) Purpose made loose and/ or free standing cupboards.
 2. Materials:
 - a) Timber.
 - b) Laminates.
 - c) Two pack coatings.
 - d) Metal.
 - e) Glass.
 - f) Porcelain panel.
- B. Ensure that all interfaces are fully coordinated prior to commencement.
1. This shall include but not be limited to:
 - a) The reticulation of services to and within joinery items.
 - b) The building in of fittings, fixtures, services outlets and the like.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Door front.
 2. Drawer front.
 3. One sample of each type of hardware.
 4. 300mm x 300mm sample of each substrate, surface and finish.

1.4 Mock-Ups

- A. Provide a mock-up in accordance with Section 0171 as follows:
1. Full scale junctions and elements of all typical joinery items.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed of each type of joinery and/ or item of specialist furniture specified in location as agreed with the Superintendent.

1.7 Hold Points

- A. Do not proceed with installation of wall mounted joinery, fittings or fixtures until it has been confirmed to the Superintendent that adequate support structure has been provided within the wall.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings of all joinery fitments for review by the Superintendent. The Shop Drawings shall show all relevant details of manufacture, assembly, hardware components, installation and finish. Where items of joinery are required to reticulate services such as power, data, and the like, the Shop Drawings shall demonstrate that all services have been adequately coordinated and segregated where required by the relevant regulations.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Test Requirements

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

2 PRODUCTS**2.1 Joinery Generally**

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- B. Where possible, joinery shall be constructed in modular units to allow for future disassembly and reuse.
- C. Where possible, joinery that has a reduced environmental impact relative to available alternatives shall be installed into the Works. The installed joinery shall conform to either of the following:
 1. Third party certified, such as Good Environmental Choice Australia (GECA), as recognised by the Green Building Council of Australia (GBCA).
 2. Joinery of high ecopreferred content, modular design and able to be disassembled for relocation and reuse.
- D. Where alternative products, materials or systems are offered, to that specified, the alternative shall be accepted by the Superintendent prior to commencement. Head Contractor nominated alternatives to that specified shall have environmental impact characteristics equal to or better than that specified.

2.2 Cupboard, Drawer and Shelf Units

- A. Purpose made cupboard, shelf and drawer units.
- B. Construct non-standard width units as necessary to suit on-Site dimensions.
- C. Carcass sides, intermediate divisions, back and floor to be constructed from 18mm thick MDF. Cut back sides and intermediate divisions to allow for a clear toe recess.
- D. Provide Furnco or similar adjustable levellers for true level and alignment. Secure to floor.
- E. 18mm MDF kickplate to toe recess with selected plastic laminate finish. Height as indicated on the Design Drawings.
- F. Scribe accurately to the floor and provide a silicone seal at the floor junction.
- G. Internal surfaces of cupboard and drawer units, including fixed/ adjustable shelves to be white laminate finish.
- H. Front and back of cupboard doors and drawer fronts shall receive selected laminate finish.
- I. All edges to doors and drawers shall receive ABS edge strips in colour matching the laminate door/ drawer face.
- J. All external faces of cupboard, drawer and shelf units including toe recess/ plinth and infill fillets/ panels shall be in the selected laminate finish.
- K. Cupboard door hinges shall be concealed 180° opening Blum or Hafele type hinges. Number of hinges to suit size and weight of door. All cupboard door hinges shall incorporate a soft close mechanism to minimise noise.
- L. All door hinges are to be stainless steel.
- M. Drawer sides and back to be constructed from 16mm MDF. Drawer base from 6mm plywood trenched into sides, front and back. White laminate finish.
- N. Drawer sliders shall be Blum or Hafele type drawer runner soft close, or acceptable equivalent, unless nominated otherwise.

- O. Drawers to be fitted with ball bearing type slides with adjustable stop to prevent accidental full withdrawal of drawer from carcass.
- P. Drawers and doors to underbench units and tall cupboard units to be fitted with selected handles screw fixed from the inside of the drawer/ door fronts.
- Q. Overhead cupboard doors shall be fitted with selected handles, screw fixed from the inside of the door fronts.
- R. Fixed shelves shall be either 18mm or 25mm MDF as detailed on the Design Drawings recessed into sides and/ or intermediate divisions of carcass. Glued and secured with concealed non-corrosive mechanical fasteners. ABS edging to front edge.
- S. Adjustable shelves shall be either 18mm or 25mm thick MDF as detailed on the Design Drawings and supported on four stainless steel shelf support lugs. Front edge shall be ABS edge stripped. All other edges to be laminate edge stripped. Provide a series of accurately drilled holes in the carcass sides/ intermediate divisions to allow for six shelf positions each spaced 50mm apart. Each hole to be fitted with a stainless steel bush to receive the shelf support lugs.
- T. Where indicated on the Design Drawings provide cupboard and drawer locks to accepted samples. Allow for master keying of locks to later direction by the Superintendent.
- U. Provide cutlery inserts, wire baskets and any other accessory items where detailed on the Design Drawings.
- V. Coordinate with electrical services where the Design Drawings indicate integral lighting is required to cupboards.
- W. Include a 20mm wide scribed fillet to either side of joinery units where the joinery is 'wall to wall'.
- X. Overhead units and tall cupboard units shall include a fixed solid front panel over plus side returns where applicable forming a bulkhead that extends to the underside of the ceiling. The bulkhead shall finish flush with cupboard doors and be 18mm proud of shelf units. Finish shall match adjacent walls.

2.3 Electrical Equipment in Cupboards

- A. Where electrical equipment such as fridges, washing machines and the like are concealed within cupboard units, provide ventilation slots in the joinery units to prevent heat build up within the cupboard. Locate vents to the acceptance of the Superintendent.
- B. Where detailed on the Design Drawings, fridge doors shall be integrated with the joinery unit doors.
- C. Coordinate all services as necessary.

2.4 Wardrobe Units

- A. Purpose made wardrobe cupboard and shelf units as detailed on the Design Drawings.
- B. Construct generally as for tall cupboard and shelf units but without a solid panel over to ceiling height.
- C. Where indicated on the Design Drawings provide a proprietary 25mm diameter anodised aluminium hanging rail.
 1. Refer to the Master Schedule for details.

2.5 Metalwork Finish

- A. All metalwork and associated fixings concealed in the completed work shall be either:
 1. Hot dip galvanised (self finish) in accordance with Section 0814, or
 2. Factory or Site applied zinc coated steel, to the acceptance of the Superintendent.
- B. All metalwork and associated fixings exposed in the finished work shall be of selected powder coat finish in accordance with Section 0813, unless noted otherwise.

2.6 Two Pack Coating

- A. Two-pack polyurethane factory applied spray paint finish with high resistance to scratches, dents and general wear and tear to suit nominated substrates.
- B. Two-pack coatings shall be non-yellowing, moisture-resistant and shall be re-coatable on-site for maintenance and repair.
- C. Carry out application of two-pack coatings in dust-free factory spray-booths where practicable. Rectify any damage on-site after installation.

- D. Finished surface quality shall be free of defects and smooth over each element, with consistent appearance over the entire work.
- E. The minimum and maximum dry film thickness of each coat shall comply with the product data of the selected manufacturer. Apply additional coats if required for high build thickness with the approval of the coating manufacturer and Superintendent.
- F. Preparation and installation shall be as per the manufacturer's written instructions.

2.7 Hardwood Timber

- A. Hardwood timber generally shall be to profiles as indicated on the Design Drawings with species as nominated.
- B. Grade: Select.
- C. Finish: As nominated and in accordance with Section 0671.

2.8 Timber Veneers

- A. Where indicated on the Design Drawings, veneers shall be decorative timber veneers with matching solid edge strips. Veneers shall be to AS/NZS 2097, AS/NZS 2098 and as follows:
 - 1. Cut: Crown cut, unless nominated otherwise.
 - 2. Matching: Unless nominated otherwise veneers shall be book matched.
 - 3. Apply veneers with edges tight butted, with no gaps or other open defects. Set out veneers so that veneers are aligned in regular uniform symmetry, unless otherwise specified.
 - 4. Finished components shall be free from bow, twist, scratches, chipping, pimpling, depressions, glue spill, staining and other defects. Sand to a fine, smooth finish, free from sanding marks.
 - 5. Where timber veneer is used for benches and desktops, it shall have minimum 2 layers of veneer unless nominated otherwise on top and to visible side surfaces and also balancing veneer to all other sides.
 - 6. Timber veneers shall be cut out of the door or shark nose edged where handles are integrated into door and drawer fronts.
 - 7. Plywood board with veneer finish shall have an exposed end grain.
 - 8. Edge strips: Double layer of veneer.

2.9 Timber Generally

- A. Refer to Section 0815.

2.10 Melamine Finish

- A. Melamine surfaced high pressure decorative laminate, specifically designed for wet areas where resistance to moisture is required.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Colour/ finish: As scheduled.
- C. Unless otherwise noted, allow edges to have matching ABS edge strip.

2.11 Plastic Laminate Faced Panels

- A. The core material to all plastic laminate-faced panels shall be to the following minimum standards:
 - 1. Plywood, particleboard or MDF as follows:
 - a) Thickness: 18mm minimum unless otherwise indicated or specified.
 - b) MDF Type: MDF (HMR) (moisture resistant) to AS/NZS 1859.2.
 - c) Plywood: Type WBP.
 - d) Particleboard: Moisture resistant to AS/NZS 1859.1.
 - 2. Adhesives shall be compatible with the type and durability class of the core material and shall be as recommended by the manufacturer.
 - 3. Preserving treatment: Organic solvent with water repellent in accordance with AS/NZS 1604.2 and AS/NZS 1604.3.
 - 4. Moisture content shall be appropriate to the core materials to suit the internal environmental conditions.

5. Formaldehyde emission class: E0.
- B. Laminate shall be high-pressure laminate to AS/NZS 2924.1, unless specified otherwise.
- C. Laminate Thickness (minimum):
 1. For horizontal surfaces fixed to a continuous background: 1.2mm.
 2. For vertical surfaces fixed to a continuous background: 0.8mm.
 3. For edge strips: 0.4mm.
- D. Unless otherwise noted, form edgings using solid grade high-pressure laminate to match laminate facings in colour and texture.
 1. Edges including rebated edges shall be fully lipped and bevelled on all sides so as to show no black lines.

2.12 Compact Grade Laminate

- A. Compact grade laminate to AS/NZS 2924.1.
- B. Machine cut to sizes as shown on the Design Drawings.
- C. Concealed fixings shall be used unless otherwise indicated on the Design Drawings.
- D. Exposed edges shall be chamfered/ bevelled and polished to avoid sharp edges.
- E. Compact laminate shall be of a solid colour type throughout to ensure that solid colour laminate is always visible at edges. ie no black edges are acceptable.
- F. Concealed panel edges shall be square and clean-cut.

2.13 Stainless Steel Generally

- A. Stainless steel shall be in accordance with Section 0813.
- B. Stainless steel shall be made from corrosion resistant nickel chromium steel to ASTM A666, Type 304.
- C. Grade 316L shall be used in corrosive environments.
- D. Where Site or shop welding is required, use manual inert gas tungsten-arc welding in accordance with AS/NZS 1554, carried out by welders certified in accordance with AS 1796. Welds shall be continuous and of a material and technique suited to the sections being assembled. Weld finish shall be smooth with all flux residues removed and no surface defects (eg undercut, porosity, deep ridges, etc).
- E. All fixings shall be of sufficient strength for their purpose.

2.14 Mild Steel Sections

- A. Refer to Section 0813 for material, surface preparation, and welding requirements. Refer to Section 0814 for requirements for items to be galvanised.
- B. Before and after making permanent connections in frames and other structural elements that are assembled before delivery to Site, check the fit for accuracy.
- C. Distortion: Welding procedures shall be such that distortion is reduced to a minimum and local distortion rendered negligible in the final fabrication. Corrections if necessary shall be undertaken by a method that has received acceptance from the Superintendent.
- D. No welds other than those shown on the Shop Drawings which have been reviewed without objection, even for temporary attachments or repairs, shall be placed without agreement of the Superintendent.
- E. Holes in hollow sections: Vent holes in hollow sections shall be sealed to prevent the ingress of moisture. Submit to the Superintendent the proposed method of achieving this requirement.

2.15 Metals

- A. Refer to Section 0813.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Colour/ finish: As scheduled.
- C. Metals shall be free from defects that will impair their strength, durability, performance or appearance. Metals used in exposed work shall be produced to the highest commercial standards of flatness, free from surface blemishes including waves, striations, tool and die marks, other defects and/ or impurities and manufacturers' names and identifying numbers. Profiles shall be true to angle or curvature as required with sharp edge and corners.

2.16 Glass/ Mirror

- A. Glass shall be toughened and clear unless otherwise specified or indicated on the Design Drawings.
- B. All exposed glass edges shall be polished and rounded or chamfered as specified.
- C. Ensure that holes for bolted fixings are preformed and accurately formed to suit glass fixing type and size to provide neat fixing connection.
- D. Comply with Section 0812 for glass standards as applicable to toughened glass for internal conditions. However, toughened glass for furniture, desks, etc, is not required to be heat soak tested.

2.17 Gaskets

- A. All gaskets shall be bonded and mechanically fixed to their appropriate panels. All gaskets shall be manufactured from neoprene profiles as shown on the Design Drawings.
- B. The colour of all gaskets shall be black, unless nominated otherwise by the Superintendent.
- C. Gaskets shall not shrink, warp nor deteriorate over the service life of the system.

2.18 Hardware

- A. All hardware shall be assembled, installed and adjusted as necessary in accordance with the manufacturer's recommendations.
- B. Finishes of fixing screws which will be visible in the completed work shall match the finish of the particular hardware item.

2.19 Concealment of Fixings

- A. Unless specified otherwise, heads of screws and other fixing devices shall not be exposed on external surfaces which will be visible in the completed works.
- B. Where fixing screws in exposed surfaces cannot be avoided, they shall be deeply countersunk and the screw holes filled with putty, finished flush and sanded to achieve a smooth surface finish.
- C. Screws which are required to be removable for maintenance access or other purposes shall be chromium plated and countersunk. Provide coloured caps to match the surface finish.

2.20 Protection

- A. Protect all joinery units from potential damage by other trades until Practical Completion.

3 EXECUTION

3.1 Materials

- A. Use materials, fixers, sealing and finishing materials that satisfy current environmental legislation and do not produce emissions of any sort that may be considered harmful.
- B. All doors and drawers are to be constructed from water resistant material and be UV stabilised.

3.2 Installation Generally

- A. Do not commence installation before the surrounding areas are made watertight, wet trades have finished their work, and the building is well dried out.
- B. Install work under the Contract securely using adequate concealed fixing components, without causing stress or distortion to panels and doors. Visible fixings shall not be used.
- C. Before, during and after installation, temperature and humidity shall be maintained at levels approximating to those that will prevail after the building is occupied.

3.3 Installation Tolerances

- A. A high degree of accuracy shall be employed in the fabrication and installation of work under the Contract and support structures.
- B. On-Site dimensions:
 - 1. All dimensions shall be checked on Site.
 - 2. The final design shall accommodate all specified tolerances and differences between actual Site dimensions and dimensions shown on the Shop Drawings.
 - 3. Cut-outs for interfacing works shall be within ± 1 mm of the dimensions shown on the Design Drawings.

3.4 Moisture Content

- A. During delivery, storage, fixing and thereafter to Practical Completion, conditions of temperature and humidity shall be maintained to suit specified moisture content(s) of timber components. Components shall be tested with an agreed moisture meter, to the manufacturer's recommendations.

3.5 Workmanship

- A. Workmanship shall be of high quality and accuracy using fully proven practices and shall meet the established benchmarks.
- B. Setting out shall be accurate and in accordance with the Design Drawings. Check all dimensions on Site and notify the Superintendent of any discrepancies.
- C. Set out accurately to ensure frames, panels and doors are plumb, level and accurately aligned.
- D. All joints shall be horizontal or vertical, with all edges and joints square, unless otherwise indicated on the Design Drawings.
- E. Methods of fixing and fastenings shall be according to the manufacturer's recommendations unless specified otherwise.
- F. Do not cut, plane or sand pre-finished surfaces unless otherwise agreed with the Superintendent.
- G. Adjust hinges so that gaps around doors are consistent.
- H. Doors and drawers shall be accurately aligned and not binding. Adjust as necessary to ensure smooth operation.

3.6 Fixtures, Fittings and Appliances

- A. Taps and fixtures shall be fixed securely ensuring a watertight seal.
- B. Refer to Section 0555.

3.7 Sealant Pointing

- A. Sealant shall be silicone based. Refer to Section 0811.
- B. Sealant colour shall be as agreed with the Superintendent.

3.8 Fitting Trims

- A. Wherever possible, trims shall be in unjointed lengths between angles or ends of runs. Where running joints are unavoidable, acceptance of location and method of jointing shall be obtained from the Superintendent. Angle joints shall be mitred unless otherwise specified.

3.9 Hardware

- A. Assemble and fix carefully and accurately using fastenings with matching finish supplied by the hardware manufacturer. Prevent damage to hardware and adjacent surfaces.

3.10 Protection

- A. Do not deliver components to Site until required and do not remove protective packaging/coverings until immediately before required for fixing.
- B. Stack boards, panels, shelving, etc, flat on bearers and separated by spacers where necessary to prevent damage to or from projections.
- C. Keep components and completed work clean and dry, and adequately protect from physical damage until Practical Completion.

3.11 Completion

- A. Doors and drawers shall be accurately aligned and not binding. Adjust as necessary to ensure smooth operation.
- B. Hardware shall be checked and adjusted as necessary to ensure correct functioning.
- C. Cleaning:
 - 1. All joinery shall be thoroughly cleaned at Practical Completion removing all finger marks, glue overruns and the like as well as all rubbish, offcuts and sawdust from the inside of cupboards, drawers and shelves.
 - 2. All protective tapes, films and the like shall be removed.
- D. Ensure that work is defect free at Practical Completion.

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SECTION 0552 -- ARCHITECTURAL METALWORK

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Balustrades and handrails.
 2. Grilles, vents and perforated metal panels.
 3. Bollards.
 4. Ladders.
 5. Corner guards.
 6. Metal mesh storage cage.
 7. Bike rack.
 8. Letterboxes
 9. Trench drain.
 10. Stair nosing.
 11. Architectural metalwork.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 1000mm length of balustrade and handrail type showing proposed fixings and quality of welds.
 2. Each specified finish on an appropriate substrate.
 3. All fixing types.
 4. One sample of each type of architectural metalwork.
 5. Each type of joint.
 6. Protective coatings and finishes such as galvanising, anodising, powder coating, anodised finishes, and paint coatings on external mild steel components.
 7. A sample of each type of mechanical finish, such as polishing, sand blasting, and other specialist finishes nominated.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First complete installation of each type, in location to be agreed.

1.7 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.8 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Shop fabricated or assembled items ready for delivery to the Site.
 2. Commencement of shop or Site welding.

3. Site-erected assemblies on completion of erection, before covering up by cladding and encasing.
4. Steel surfaces prepared for, and immediately before, Site applied finishes.

1.9 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.10 Shop Drawings

- A. Submit Shop Drawings showing the following information:
 1. Details of fabrication, components, surface treatment, connection, transport and erection.
 2. Details of fabrication involving other trades or components.
 3. Information necessary for Site assembly.
 4. Proposals for the break-up of large items as required for delivery to the site.
 5. Proposed method of fixing and joining the modules of large items.
 6. Details of steel type and grade.
 7. Hot or cold forming and post weld heat treatment.
 8. Location, type, size and categories of welds, bolts and bolt holes.
 9. Surface preparation methods and coating system (if shop applied).
 10. Temporary works such as lifting lugs, support points, temporary cleats and bracing which may be required for transport and erection.
 11. Submit detailed shop drawings for fabrication and installation of major metalwork items. Show plans, elevations and detailed sections; indicate materials, finishes, fasteners, and anchorage and accessory items. Provide setting diagrams and full scale templates of blocking, anchorage, sleeves and bolts installed by others.

1.11 Other Submittals

- A. Materials:
 1. Manufacturer's data: Submit manufacturer's published product data including standard drawings and details.
 2. Stainless steel: For each batch of stainless steel to be used, submit the certificate of compliance or test certificate specified in the applicable standard.
- B. Execution:
 1. Welding procedures: Submit details of proposed welding procedures before fabrication.
 2. Welding dissimilar metals: Submit the following details:
 - a) Type and thickness of materials to be welded.
 - b) Proposed joint preparation and welding procedures.
 - c) Proposed filler metal.
 - d) Expected dilution (proportion of fused parent metal in the weld metal).
 3. Fastenings to aluminium (including aluminium alloys): If cadmium-plated steel fastenings are proposed, submit proposals to the Superintendent.

1.12 Testing Generally

- A. Provide evidence/ testing data and reports to demonstrate that all materials/ products proposed have been tested to meet the standards specified herein.
- B. Where testing has not previously been carried out on products/ materials proposed, arrange for tests to be carried out to comply with the Specification to the satisfaction of the Superintendent.
- C. The provision of testing data or the carrying out of tests shall not relieve the Head Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

1.13 Weld Test

- A. Have welds or test plates tested by an independent testing authority. In the event of test failure, rectify the defect and repeat the test.

1.14 Stainless Steel Test

- A. Before fabrication commences, submit satisfactory evidence to the Superintendent that relevant procedure test plates have passed the tests specified in AS/NZS 1554.6.

2 PRODUCTS

2.1 Architectural Metalworks Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Chain Wire Storage Cage

- A. To AS 1725.
 B. Galvanised chain wire mesh storage cage with lockable gates.
 C. Frame: Fully welded 50mm diameter galvanised steel tube framing to cage and gate.
 D. Mesh: Galvanised chain wire mesh.
 E. Gates: Hinged gate, fully welded tubular steel galvanised frame with infill chainwire mesh double tied to the frame, lockable.

2.3 Bike Rack

- A. Proprietary bike rack system fixed to concrete slab. To AS 2890.3.
 B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Type/ material/ protective coating: As scheduled.
 C. Fixing: Bolt fixings into concrete slab using dome head nuts and washers.

2.4 Corner Guards

- A. Type and material: Folded mild steel plate.
 1. Type/ size: As scheduled.
 B. Installation: Fix to masonry anchors using countersunk-head bolts flush with surface.

2.5 Balustrades and Handrails Generally

- A. Balustrades to comply with the relevant NCC, including D2.16.
 B. Handrails to comply with AS 1428.1.
 C. Fixing: Refer to the Design Drawings and Structural Engineer's documentation.

2.6 Glass Balustrades

- A. Clear laminated toughened safety glass in accordance to Section 0812.
 B. To meet AS 1288 requirements.

2.7 Timber Handrails

- A. Selected hardwood timber.
 B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Minimum grade: Select.
 2. Size: As scheduled.
 3. Finish: As scheduled.
 C. Finish: Clear timber sealer, unless detailed otherwise. Refer to Section 0671.

2.8 Steel Balustrades

- A. Steel handrail/ balustrade system.
 1. Height/ size: As scheduled.
 2. Setout: As scheduled.
 3. Finish/ colour: As scheduled.
 B. Fixings: Refer to the Design Drawings details.

2.9 Stainless Steel Balustrades/ Handrails

- A. Grade: 316 externally and to internal corrosive environments, grade 304 to other internal locations.
 1. Finish: Linished to #4 finish, unless nominated otherwise.
 B. Fixings: Stainless steel brackets with solid stainless steel rods or on posts as required.

2.10 Aluminium Balustrades/ Handrails

- A. Aluminium hollow sections.
 - 1. Height/ size: As scheduled.
 - 2. Setout: As scheduled.
 - 3. Finish/ colour: As scheduled.
- B. Fixing method: As nominated on the Design Drawings.
- C. Aluminium in concrete, cementitious screeds or mortar:
 - 1. Protect finished aluminium elements that are to be embedded, with an epoxy coating, including to the inside, cut ends and outside of the aluminium sections.

2.11 Stainless Steel Bollards

- A. Circular hollow section stainless steel bollards fixed to substrate, lockable and removable where indicated.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Product code: As scheduled.
 - 2. Size: As scheduled.
 - 3. Material/ finish: As scheduled.
 - 4. Grade: 316.
- C. Fixed bollards to be core drilled and epoxy filled into concrete slab.
 - 1. Removable where nominated.

2.12 Steel Bollards

- A. Galvanised steel fixed bollard, lockable and removable where indicated on the Design Drawings.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Product code: As scheduled.
 - 2. Size: As scheduled.
 - 3. Finish: As scheduled.
- C. Fixed bollards to be core drilled and epoxy filled into concrete slab.
 - 1. Removable where nominated.

2.13 Stair Nosing

- A. Stair nosing to comply with accessibility standards AS/NZS 1428.4.1.
- B. Stair nosing shall comply with the luminous contrast requirements stated in AS 1428.1 Appendix B. Slip rating shall conform to the NCC Table D2.14 as a minimum.
- C. Installation: As recommended by the manufacturer to suit substrate.

2.14 Ladders and Platforms Generally

- A. Design, construction and installation for fixed platforms and ladders: To AS 1657.
- B. Installation to be performed by an organisation independently certified to AS/NZS 4801 Standard for Health and Safety Management Systems.

2.15 Letterbox

- A. Letterboxes constructed using an outside surround casing of heavy duty architectural grade aluminium extrusion section with internal shelves and dividers, where detailed, laser cut from 2mm aluminium material slotted and folded into shape forming an internally seamless individual box.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Type/ product code/ finish/ size: As scheduled and as detailed on the Design Drawings.
 - 2. Font: To the Superintendent's selection.
- C. Mail boxes to comply with Australian Standards and Australia Post.

2.16 Grated Trench Drain

- A. Heavy duty drain with associated edge framing installed into poured in situ concrete slab drainage channel.

-
1. Ductile iron slotted grate to comply with AS 1428.2.
 2. Refer to the Hydraulic Engineer's drawings for locations.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Size: Refer to the Hydraulic Engineer's documentation.
 2. Finish: As scheduled.
- C. Installation: As per the manufacturer's written instructions.
- 2.17 Grated Trench Drain- Architectural Finish**
- A. Stainless steel grate and drainage channel installed into poured in situ concrete.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Size: Refer to the Hydraulic Engineer's documentation.
 2. Grade: 316 unless nominated otherwise in the schedule.
- C. Installation: As per the manufacturer's written instructions.
- 2.18 Materials Generally**
- A. Refer to the following sections of the Specification:
1. Glazing to Section 0812.
 2. Powder coating to Section 0813.
 3. Galvanised coatings to Section 0814.
 4. Anodising to Section 0816.
- 2.19 Fixings**
- A. Refer to Section 0811.
- B. All fixings shall conform to all statutory requirements in respect of strength and type.
- C. Fasteners: Provide required bolts, screws, inserts, fasteners, templates and other accessories required for a complete installation.
- D. Adequate measures shall be taken to prevent bimetallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces. Attention is drawn to PD 6484 Commentary on Corrosion at bimetallic Contacts and its Alleviation.
- E. Direct contact between aluminium or aluminium alloys and treated timber shall be avoided, unless with the prior acceptance of the Superintendent.
- F. Only fixings that are suited to the likely stresses, movements and vibrations in use without allowing any wobble, creaks or deflection of any fixtures or fittings shall be used.
- 2.20 Welding**
- A. Provide finished welds that are free from surface and internal cracks, slag inclusion, and porosity.
- B. Butt weld quality: Not inferior to the appropriate level recommended in AS 1665 Appendix A for aluminium.
- C. Conform to requirements of AS/NZS 1554, Part 1 for details of joints, the techniques of welding employed, the appearance and quality of welds made and the methods used to correct defective work.
- D. Welds exposed to view (visual requirements): Grind smooth to the Superintendent's acceptance.
- E. Concealed welds: Grind smooth before galvanising.
- F. Tack or skip welding: At regular intervals and very neat. Not permitted if material is to be hot dip galvanised. Remove weld spatter.
- G. Certification: Only welders who have previously been qualified by tests may weld. Tack welding or skip welding will NOT be permitted where items are to be galvanised. Weld continuously formed joints and connections to exclude water and to permit draining during galvanising.
- 2.21 Connection Design**
- A. General: Design fabricated items so that possible work is done before delivery. Fully protect for transport. Take possible care to prevent damage.
- B. Welding External Items: Conform to the recommendations of AS/NZS 1554, noting particularly the design criteria.

- C. Flanges: Concealed where possible. Sleeve connecting railings inside railing sections and secure with flush or set screws. Except where access is impossible, connection screws and bolts will be on the underside of joints.
- D. Fasteners on the top of railing sections will not be permitted.
- E. Weld shop connections for steel fabrications, and bolt field connections.
- F. Provide smooth finishes to exposed surfaces with sharp well-defined lines and arrises. Mill to a close fit machined joints. Design necessary lugs, brackets and similar items so that work can be assembled and installed in a neat, substantial manner.
- G. Provide ample strength and stiffness by using appropriate metal thickness of assembly and supports.
- H. Provide holes and connections as required to accommodate all required work and for site assembly of metalwork. Drill or punch and ream in the shop.

2.22 Brazing

- A. General: Ensure brazed joints have sufficient lap to provide a mechanically sound joint. Do not use butt joints relying on the filler metal fillet only.

2.23 Fabrication Tolerances

- A. Ensure that in addition to the general requirements of the Specification:
 1. A high degree of accuracy shall be employed in the fabrication of work under the Contract and its support structure.
 2. Deviations in length, width and diagonal dimension shall not exceed $\pm 1\text{mm}$.
 3. The twist and warping shall not cause any point to be more than 0.5mm out of plane. The twist and warping shall not cause any point of the structural frame to be more than 2mm out of plane.
 4. Thickness: Tolerances for flat rolled steel sheet thicknesses shall be in accordance AS/NZS 1365.

3 EXECUTION

3.1 Workmanship Generally

- A. Install in the correct position, within tolerance, and in the correct relationship to the building structure.
- B. Protection shall remain in place until all work is complete. All protective measures shall be replaced following any inspections by the Superintendent.
- C. Acceptance shall be received from the Superintendent before drilling or cutting parts of the structure, other than where shown on Shop Drawings.
- D. Isolating tape, plastic washers, or other suitable means to prevent bimetallic corrosion shall be provided between dissimilar metals, or between preservative treated timber and metal.
- E. Support posts, stanchions, mullions and the like shall be at even centres, unless nominated otherwise.

3.2 Installation Tolerances

- A. All work shall be erected in proper alignment in relation to established lines and grids shown on the Design Drawings.
- B. The vertical plane of any element shall be within $\pm 1.5\text{mm}$ of the theoretical position.
- C. Adjacent elements shall not deviate from their intended horizontal or vertical alignment by more than $\pm 2\text{mm}$.
- D. Any diagonal length shall not deviate by more than the lesser of $\pm 3\text{mm}$ or $\pm 0.075\%$ of design dimension.
- E. The centre section of an element shall not bow by more than the lesser of 3mm or 0.075% of the length of the element measured from a straight line between the ends of the element.
- F. Any edge shall not deviate by more than $\pm 2\text{mm}$ from a 2000mm straightedge placed against it in a direction parallel to the long axis of the element.
- G. Any surface shall not deviate by more than $\pm 2\text{mm}$ from a 2000mm straightedge placed against it in any direction.
- H. No section of the element may be twisted by more than 1° from the section at either end of the element.

3.3 Completion

- A. Removal of temporary coatings: On or before completion of the work, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

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**SECTION 0555 -- SANITARY/ KITCHEN/ LAUNDRY APPLIANCES/
FITTINGS**

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Toilet suites.
 2. Sinks and washbasins.
 3. Baths.
 4. Showers.
 5. Tapware.
 6. Fire safety equipment.
 7. Mirrors.
 8. Sanitary hardware and accessories.
 9. Kitchen appliances, furniture, equipment, and accessories.
 10. Laundry appliances, furniture, equipment, and accessories.
 11. Sundry fixtures.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. One of each fixture, fitting, appliance and accessory specified.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed and accepted of each type specified in location as agreed with the Superintendent.

1.7 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.8 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

2 PRODUCTS

2.1 Products Generally

- A. All sanitaryware, kitchenware, laundry hardware, fittings, fixtures, accessories and equipment shall be as nominated in the Master Schedule.
- B. Water efficient fixtures and fittings.
1. Water efficient sanitary fixtures and fittings complying with the requirements of the WELS Standard AS/NZS 6400 shall be used. The Head Contractor shall confirm the star ratings of all water using fixtures and fittings installed into work under the Contract including tapware, toilets, showers, flow controllers and dishwashers, as applicable, prior to installation.

- C. Where the Head Contractor seeks to install an alternative product to that nominated in the Specification or schedules, the alternative shall be accepted by the Superintendent prior to installation. Head Contractor nominated alternatives to products that carry a water star rating shall have a rating equal or better than that specified.
- D. Install in accordance with the manufacturer's instructions and ensure that adequate in-wall or in-ceiling support, as applicable, is provided in the form of noggings, mounting plates, unistrut framing and the like.
- E. The Head Contractor shall coordinate with all other trades as necessary to ensure that adequate in-wall and in-ceiling support is provided.

2.2 Materials Generally

- A. All fixtures shall be free from imperfections, true to line, angles, curves and colours, smooth, watertight and complete in every respect.
- B. All fixtures shall be of fired vitreous chinaware of the best quality, non-absorbent and burned so that the whole mass is thoroughly fused and vitrified, producing a material, white in colour, which when fractured shows a homogeneous mass, close grained and free from pores.
- C. One manufacturer shall supply all fixtures, unless specified otherwise.

2.3 Sealant Pointing

- A. Sealant shall be silicone based with fungicide. Refer to Section 0811.
- B. Colour shall be white unless specified otherwise.

2.4 Product Data

- A. Submit to the Superintendent for review, copies of technical data prepared for each product or material proposed, which lists the specified performance of each material and product to be used.
- B. Comply with the requirements of the following:
 1. Toilets: To AS 1172.
 2. Accessible toilet suites: To AS 1428.1.
 3. Sinks, basins and troughs: To AS/NZS 1730.
 4. Baths: To AS/NZS 2023.

2.5 Glass

- A. Mirror glass, glazed shower screens etc. shall comply with Section 0812.

2.6 Fire Safety Equipment

- A. Provide fire extinguishers and fire blankets in accordance with AS 2444.
 1. Fire blankets: To AS/NZS 3504.
- B. Smoke alarms/ detectors shall comply with AS 3786, AS 1670.1 and NCC Specification E2.2a.
- C. Evidence of suitability: Submit evidence of suitability for use, to NCC A5.0, for all fire protection products.

2.7 In-Ceiling Support

- A. Provide and install unistrut framing within the ceiling for ceiling mounted equipment.
- B. Coordinate installation of unistrut framing with the Ceiling Head Contractor and any other trades as necessary.

2.8 Accessories

- A. All accessories and sundry items shall be as nominated on the Master Schedule.
- B. Install in accordance with the manufacturer's instructions and ensure that adequate in-wall support is provided in the form of noggings, mounting plates and the like.
- C. Coordinate all relevant Subcontractors to ensure that adequate in-wall support is provided.

3 EXECUTION

3.1 Installation Generally

- A. All appliances, fixtures and fittings shall be installed in accordance with the manufacturer's recommendations.
- B. Assemble and install fixtures, fittings and accessories so that surfaces designed with falls drain as intended.

- C. Use non-ferrous or stainless steel fastenings unless otherwise specified.
- D. On Practical Completion, remove protective coverings, tapes, etc, and check for damage and defects. Test for satisfactory operation and replace all damaged or defective components/ accessories. Thoroughly clean the whole installation.
- E. Noggings, bearers, etc, required to support appliances fixtures and fittings shall be accurately positioned and securely fixed.
- F. Apply sealant in accordance with Section 0811.

3.2 Sanitaryware

- A. Toilet seats and lids shall be stable when raised.
- B. Cisterns:
 - 1. Cistern operating components shall be as recommended by the cistern manufacturer. The ball valve shall match the pressure of the water supply.
 - 2. Fix cisterns at heights recommended by the manufacturer unless otherwise specified or shown on the Design Drawings.
 - 3. Fix overflow pipe to falls and locate to give visible warning of discharge.
- C. Wastes/ overflows shall be bedded in waterproof jointing compound and fixed with a resilient washer between appliance and backnut.

3.3 Workmanship

- A. Units shall be manufactured and rigidly assembled by skilled workmen to the complete satisfaction of the Superintendent. Reinforcing shall be provided as required to ensure a rigid and secure assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints. All joints, corners and mitres shall be accurately fitted. Fastenings shall be concealed. Threaded connections shall be made up tightly so that threads are entirely concealed.
- B. All joints and corners shall be accurately fitted to shapes and dimensions shown, with all lines, angles and surfaces in true alignment, plumb, level and in proper plane.
- C. Use the proper thickness of metal, adequate stiffeners, supports and proven details of assembly so that the finished material conforms to the highest standards of the industry. Reinforce members and joints with steel plates, bars, rods or angles for rigidity and strength as needed to comply with performance requirements.
- D. All exposed work shall be carefully matched to produce continuity of line and design. Joints in exposed metalwork shall be accurately fitted and rigidly secured with hairline contacts. Exposed joints in flat surfaces shall be flush, unless otherwise shown. End joints shall have sleeves of the same outline as the exposed shapes to assure good alignment.
- E. Do not install units that have members that are warped, bowed, deformed or otherwise damaged or defaced. Remove and replace such members as directed.
- F. Accurately cut and form the materials to the required shape and profile with all exposed surfaces free from irregularities and defects. Carefully fit and match all components before assembly to maintain continuity of line between them. Provide hairline joints between contact surfaces of non-welded joints, unless shown otherwise. Complete all cutting, drilling, welding, etc, before the application of final finishes.
- G. Drill, countersink and tap components as necessary to receive threaded fasteners. Use concealed fasteners wherever possible. Set out exposed fasteners where permitted in an even manner.
- H. Accurately align components and rigidly secure all non-moving joints by welding or fixing with machine screws or bolts. Reinforce joints and components as necessary to achieve the required strength and provide proper joint fixing. Ensure that no areas of unfinished material are visible in the finished work. Drive in all exposed fasteners level and flush with the adjacent surfaces. Disassemble work under the Contract only to the extent necessary to facilitate transportation to Site.
- I. All elements of framework and associated beads and strips shall be stored on Site such that they do not get damaged or distorted.

3.4 Fixing of Taps

- A. Taps shall be fixed securely, making a watertight seal with the appliance or fixture.

3.5 Fixing Mirrors

- A. As detailed on the Design Drawings.

-
- B. Concealed fixing: Fully back glass on to 13mm thick waterproof particleboard sheet with all edges flush. Accurately provide an opening in the wall fully noggged to provide an even 3mm gap all around the mirror. Fit mirror into wall recess with packers as necessary so that the mirror finishes flush with the wall lining. Glue backing to wall framing with manufacturer approved adhesive and seal joint around mirror with clear waterproof silicone. Ensure silicone does not contact silver coating.

3.6 Installation of White Goods

- A. Prior to Practical Completion, install all white goods documented as being part of work under the Contract and ensure that they are in working order.

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SECTION 0556 -- TRIMS/ SUNDRY ITEMS**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Skirting.
 2. Wall protection rails.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm minimum length sample of all skirting and trims in specified finishes.
 2. 300mm minimum length of corner guards and wall protection rails in specified finish.

1.4 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.5 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed and accepted of each type in a location as agreed with the Superintendent.

1.6 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

2 PRODUCTS**2.1 Generally**

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Softwood Skirting

- A. Timber skirting with concealed fixings, mitred at corners and splayed joints in running lengths, suitable for decoration.
1. Species: Pinus.
 2. Profile: As indicated on the Design Drawings.
 3. Finish: Painted. Refer to Section 0671.
- B. Fixing: Screwed and pelleted at centres not exceeding 600mm.

2.3 Wall Protection Rails

- A. Galvanised protection rails to nominated location.
1. Size, profile: As scheduled.
 2. Finish: As scheduled.
- B. Fixing: To be confirmed.

2.4 Wall Protection Panels

- A. As detailed and to protect the partitions appropriately to use and impact.

2.5 Timber Generally

- A. Refer to Section 0815.
- B. All visible surfaces shall be sanded to give smooth, flat surfaces suitable to receive specified finishes. Arrises shall be eased unless specified otherwise.
- C. Before fixing, timber end grains for external components shall be sealed with primer and allowed to dry.

- D. Protect complete items against damage, dirt, moisture and other deleterious substances.
- E. Maintain moisture content of timber and wood based boards during storage and installation, within the range specified for the component.
- F. All finishes shall be compatible with the finishes specified for adjacent materials.

3 EXECUTION

3.1 Installation

- A. Workmanship: Refer to Section 0815.
- B. Methods of fixing and fastening: Refer to Section 0811.
- C. Straight runs: Form in single lengths wherever possible.
- D. Running joints: Location and method of forming shall be agreed with the Superintendent where not detailed.
- E. Joints at angles: Mitre unless shown otherwise.
- F. Moisture content of timber and wood based boards: Maintain within the range specified for the component during storage and installation.

3.2 Fixing

- A. Fixing and jointing methods and types, sizes, quantities and spacings of fastenings shall be suitable having regard to:
 - 1. Nature of and compatibility with product/ material being fixed and fixed to.
 - 2. Recommendations of manufacturers of fastenings components, products or materials being fixed and fixed to.
 - 3. Materials and loads to be supported.
 - 4. Conditions expected in use.
 - 5. The appearance, which shall be subject to acceptance by the Superintendent.

3.3 Fixing Through Finishes

- A. Fastenings and plugs (if used) shall have ample penetration into the backing.

3.4 Packings (where required)

- A. Provide suitable tight packings at fixing points to take up tolerances and prevent distortion.
- B. Use non-compressible, rot-proof, non-corrodible materials and position adjacent to fixing points.
- C. Packings shall not intrude into zones that are to be filled with sealant.

3.5 Nailing Generally

- A. No fewer than two nails shall be used in joints and, where appropriate, opposed skew nailing.
- B. Do not use masonry nails without permission. Nails shall be driven in fully without splitting or crushing the material being fixed.
- C. Nail heads that will be visible in the completed work shall be punched below surfaces.

SECTION END

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SECTION 0572 -- LOOSE FURNITURE, FITTINGS AND EQUIPMENT**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Window blinds.
 2. Curtains/ curtain track.
 3. Parcel lockers.
 4. Loose furniture and equipment.
 5. Miscellaneous fittings and fixtures.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. An appropriately sized sample of each type of curtain/ blind material and a 300mm minimum length sample of the track mechanism and all accessories.
 2. A 300mm x 300mm sample of each type of fabric.

1.4 Mock-Ups

- A. Not required.

1.5 Prototype

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first installed and accepted of each type in a location as agreed with the Superintendent.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Items fabricated and ready to be delivered to the site.
 2. Items delivered to site before installation.
 3. Building locations or substrates prepared to receive items before they are installed.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Shop Drawings

- A. Submit Shop Drawings showing the following details and associated information where applicable:
1. Construction, assembly and fixing details for custom designed (non-standard) furniture items.
 2. The proposed layout for furniture installations.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Testing

- A. Arrange for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.
- B. Fire hazard indices for all materials: Tested to AS/NZS 1530.3.

2 PRODUCTS

2.1 Furniture, Fittings and Equipment Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Furniture, Fittings and Equipment Groupings Generally

- A. The following three classifications are applicable to the supply and installation of furniture, fittings and equipment:
1. Supply and fix (Group 1 Items):
 - a) Items under this classification shall be supplied and installed into the Works by the Head Contractor.
 - b) Take delivery of the items and store them safely until they can be incorporated into the Works. The items shall be protected as necessary until the Works achieve Practical Completion.
 - c) Arrange for the items to be connected to the required supply and waste services as applicable and ensure that the items are in proper working order.
 2. Fix only (Group 2 Items):
 - a) Items under this classification shall be supplied (ordered and purchased) by others. The Head Contractor shall install them into the Works.
 - b) Advise when the items are required for delivery to the Site.
 - c) Take delivery of the items and store them safely until they can be incorporated into the Works. The items shall be protected as necessary until the Works achieve Practical Completion.
 - d) Arrange for the items to be connected to the required supply and waste services as applicable and ensure that the items are in proper working order.
 3. Supply and install by others (Group 3 Items):
 - a) Items under this classification shall be supplied (ordered and purchased) and installed by others.
 - b) Where these items are installed into the Works by others prior to Practical Completion, protect them as necessary until the Works achieve Practical Completion.

2.3 Curtains/ Curtain Tracks

- A. Generally to external windows and internal glazed screens where nominated on the Design Drawings or where scheduled.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Curtain:
 - a) Type: Sheer curtain with clear acrylic wands.
 - b) Heading/ hem/ fall: As scheduled.
 - c) Fabric: As scheduled.
 2. Curtain track:
 - a) Type: Surface mounted track for hand operation.
 - b) Size, finish: As scheduled.

2.4 Sheer Blinds/ Blockout Blinds

- A. Generally to external windows and internal glazed screens where nominated on the Design Drawings or where scheduled.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Blind edges meet as close to each other as possible to eliminate glancing light.
 2. Materials: As scheduled.
- C. Operation (As nominated):
1. Independent motorised operation with interface to BMS, in case of failure, with manual override.
 2. Manual chain operation.

- D. Installation as per the manufacturer's written instructions.
- E. Stainless steel chains to comply with Australian Standards Global Green Tag: Green Rate Level ALCA Rate Eco Point 0.37.
- F. All blinds and screens must meet the following criteria:
 1. The blinds must provide glare reduction to at least 95% of the area of viewing façade and skylights;
 2. Blinds must be controlled by all affected occupants within each individual space; and
 3. Blinds must have a visual light transmittance (VLT) of 10%.

2.5 Cable Access

- A. Where electrical and data outlets are provided under bench and desk tops, provide cable access ports in the bench and/ or desk top in locations as agreed with the Superintendent.

2.6 Fabrics

- A. Standard: To AS 2687.
- B. Performance classification (minimum):
 1. 3 (commercial light duty).
- C. Wool and woolblend fabrics:
 1. Woolmark/ Woolblendmark: Required.
- D. Fabric surfacing: Prepare and apply so that the finished surface is smooth and without irregularities.
- E. Fabric upholstery: Make the front of the upholstered component in one piece between pipings, if any, with side joins at the rear or underside. Fix with upholsterer's staples.
- F. Piping: 3mm diameter beads with core.

2.7 Timber Generally

- A. Refer to Section 0815.

2.8 Total Volatile Organic Compounds

- A. Materials used in the manufacture of tables, chairs and desks shall meet the TVOC (total volatile organic compound) emission limits when tested in accordance with the requirements of the US EPA's Environmental Technology Verification test method or California specification 01350.
- B. Where available, details of third-party certification shall be provided.
- C. The manufacturer/ supplier of loose furniture shall confirm the TVOC limits of their products prior to installation.

2.9 Accuracy of Fabrication

- A. Take exact Site dimensions as necessary before starting fabrication. Report any discrepancies to the Superintendent without delay and obtain instructions before proceeding.
- B. Permissible deviations for panels:
 1. Length: $\pm 1.5\text{mm}$.
 2. Width: $\pm 1.5\text{mm}$.
 3. Squareness: $\pm 1.5\text{mm}$ in 1000mm (taking longer of two sides at any corner as a baseline and measuring the deviation of the shorter side from the baseline perpendicular).
 4. Flatness (of panels with a core thickness of 12mm and over, as delivered to Site): $\pm 1\text{mm}$ under a 600mm straightedge.

3 EXECUTION

3.1 Installation

- A. Do not commence installation before building is weathertight, wet trades have finished their work and the building is well dried out.
- B. Before, during and after installation, temperature and humidity shall be maintained at levels approximating to those that will prevail after the building is occupied.
- C. Fix securely using manufacturer's fixing components without causing distortions to components.
- D. Ensure all white goods and electrical equipment are in perfect working order.

3.2 Fixtures/ Furnishing Systems

-
- A. Reinforcing shall be provided as required to ensure a rigid and secure assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints. All joints, corners and mitres shall be accurately fitted. Fastenings shall be concealed. Threaded connections shall be made up tightly so that threads are entirely concealed.
 - B. Accurately cut and form the materials to the required shape and profile with all exposed surfaces free from irregularities and defects. Carefully fit and match all components before assembly to maintain continuity of line between them. Provide hairline joints between contact surfaces of non-welded joints, unless shown otherwise. Complete all cutting, drilling, welding, etc, before the application of final finishes.
 - C. Accurately align components and rigidly secure all non-moving joints by welding or fixing with machine screws or bolts. Reinforce joints and components as necessary to achieve the required strength and provide proper joint fixing. Ensure that no areas of unfinished material are visible in the finished work. Drive in all exposed fasteners level and flush with the adjacent surfaces. Disassemble components only to the extent necessary to facilitate transportation to Site.

3.3 Installation Tolerances for Fixtures/ Furnishings

- A. A high degree of accuracy shall be employed in the fabrication and installation of the Works.
- B. On-Site dimensions:
 - 1. All dimensions shall be checked on Site.
 - 2. The final design shall accommodate all specified tolerances and differences between actual Site dimensions and dimensions shown on the Shop Drawings.

3.4 Hardware

- A. Assemble and fix carefully and accurately using fastenings with matching finish supplied by the hardware manufacturer. Prevent damage to hardware and adjacent surfaces. At completion, check, adjust and lubricate as necessary to ensure correct functioning.

3.5 Protection

- A. Do not deliver components to Site until required and do not remove protective packaging/ coverings until immediately before required for fixing.

3.6 Spares

- A. Spare FF&E: Supply spare matching F,F&E items of each type (at least 2% of the quantity installed) for future replacement purposes. Store the spare materials on Site.
 - 1. Storage location: On Site as directed by the Superintendent.

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SECTION 0581 -- SIGNAGE

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Statutory signage.
 2. Non-statutory signage.
 3. General signage.
 4. Way finding signage.
 5. Amenities signage.
 6. Building name.
 7. Apartment number signage.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Standards

- A. Signage shall comply with the following standards:
1. Design and use of signs generally: To AS 2342.
 2. Design and use of safety signs: To AS 1319.
 3. Emergency escape lighting and exit signs: To AS 2293.
 4. Design and use of Braille and tactile signage: To AS 1428.1 and AS 1428.4.2.

1.4 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. An appropriately sized sample of each type of sign demonstrating proposed lettering/ numbering, fonts and sizes as well as background materials, colours and finishes.
 2. Fixing devices and techniques.
 3. All digital output test strips and examples of substrate finish, output resolution including anti-graffiti coatings.
 4. All vinyl films.

1.5 Mock-Ups

- A. Provide a mock-up in accordance with Section 0171 as follows:
1. Full-sized Site mock-up required of all publicly visible building sign types.

1.6 Prototypes

- A. Not required.

1.7 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first sign/ notice of each type installed in location as agreed with the Superintendent.

1.8 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Custom-built graphics items fabricated and ready to be delivered to the site.
 2. Graphics items delivered to site before installation.
 3. Building locations or substrates prepared to receive graphics items before they are installed.

1.9 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.10 Shop Drawings

- A. Submit Shop Drawings showing the following information where relevant:
 - 1. Layout, construction and fixing details for custom designed (non standard) sign systems.
 - 2. Large scale (full size if practicable) lettering layouts for individual letter signs.
 - 3. Full-sized spacing templates for individually mounted characters.
 - 4. Location template drawings for anchorages to permanent construction. Show type of anchorage.
 - 5. Wiring diagrams for illuminated signs.
- B. Provide a digital file to be read by the Windows operating system of the graphics in a format to be accepted by the Superintendent for future signs.

1.11 Maintenance Manual

- A. Provide a maintenance manual containing a technical specification of the supplied item(s) and setting out a detailed method statement covering proposed methods for all routine maintenance procedures, including how panels are removed and changed. Include a description of equipment requirements for maintenance as well maintenance and changeability procedures and recommendations for the use and care of the item(s). Include the names and addresses of the manufacturers and suppliers of each component, including relevant manufacturer product warranties. Provide repair methodology for each sign type should they be liable to vandalism.

1.12 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

1.13 Test Requirements

- A. Provide evidence/ testing data and reports to demonstrate that all materials/ products proposed have been tested to meet standards specified herein.

2 PRODUCTS**2.1 Signage Generally**

- A. Provide all general, directional, regulatory and room identification signage as nominated, described and detailed on the Master Schedule.

2.2 Braille Signage

- A. Provide signs suitable for the sight impaired including Braille, pictobraile and tactile signage. Braille and tactile signage must comply with NCC Clause D3.6 (a) (i) (ii), AS 1428.1 Clause 8.1 (a) (i) (A) International symbol of access, raised symbols, text and Braille, AS 1428.4.2 and the ABA Australian Braille Authority.
- B. Include Braille and tactile signage in accordance with AS 1428.4.2 for:
 - 1. Public toilets.
 - 2. Paths of travel and changes of direction in public areas.
- C. Submit a schedule of all Braille signs indicating the plain text meanings.
- D. The mounting height for Braille signs must be nominal 1300mm above floor level. Verify mounting height.

2.3 Fire Safety Equipment Signage

- A. Comply with the signage requirements for portable fire extinguishers and fire blankets in accordance with the following standards:
 - 1. Portable fire extinguishers to AS/NZS 1841.
 - 2. Fire hydrant installations to AS 2419.
 - 3. Portable fire extinguishers and fire blankets to AS 2444.

2.4 Illuminated Signs Generally

- A. Photoluminescent exit signs: To NCC E4.8(b).
- B. Illumination levels shall be uniform. Ensure legibility of message/ graphic as set out in the Design Drawings and as would be generally required of each sign type function and location. Lamp placement shall be such to ensure even, consistent illumination of any area, void of hot or cold spots. Provide luminaires complete with lamps and accessories.

- C. Internally illuminated structures shall be custom fabricated. They are to be ventilated as required and when used externally to include drain holes and insect screens as required. Easy access for lamp replacement shall be provided and external lamps shall be fitted with vandal resistant fastenings. All illuminated sign boxes shall be fabricated with weatherproof shut off switches for maintenance purposes.

2.5 Amenities Signage

- A. Provide signage identifying all amenities, such as toilets, change rooms and similar areas.
 B. To be in accordance with the relevant ISO/ International Standards for signage symbols.

2.6 Materials

- A. Aluminium:
 1. Plate for engraving: Alloy and temper designation 6063-0.
 2. For casting: To AS 1874.
 B. Stainless steel: Surface finish designation 4 (general purpose polished).
 C. Plastics:
 1. UPVC sheet: Semi-rigid sheet.
 2. Rigid cellular polystyrene: To AS 1366.3, class VH for cut-out shapes.
 D. Vinyl:
 1. 1.2mm thick sheet vinyl. Individually laser cut letters.
 E. Acrylic sheet:
 1. Acrylic sheet used for signs:
 a) Shall be cast, colourless, clear and break resistant.
 b) Shall have good resistance to dilute acids, limited resistance to organic solvents and good resistance to alkalis.
 F. Photoluminescent exit signs: To NCC E4.8(b)

2.7 Manufacturing Tolerances

- A. Glass and acrylic tolerances:
 1. Manufactured glass/ acrylic sizes shall not exceed ± 1 mm on each straight length and diagonal.
 2. After final processing, the deviation in flatness at any peak shall not exceed 0.13mm and the difference between adjacent peaks shall not exceed 0.08mm. Where bow tolerance and wave tolerance differ, the stricter requirements shall prevail.
 B. Metal tolerances:
 1. Sheet length, width and diagonal dimensions shall not exceed ± 1 mm.
 2. Metal and glass shall be smooth and flat. The required flatness criterion shall be 1:1000 gradient. Permitted deviation of panel widths and lengths shall not be in excess of ± 2 mm.
 C. Submit to the Superintendent a detailed list of tolerances to which work under the Contract is to be fabricated within the requirements of the Specification, for the overall geometric requirements.
 D. The dimensional and detailed provisions intended to accommodate the construction tolerances of surrounding elements, in order to ensure that all aspects of work under the Contract relate satisfactorily to the project as a whole, shall be stated and shown on the Shop Drawings.
 E. Intracutting of acrylic lettering: ± 0.25 mm.
 F. Alignment of butt joints: ± 0.5 mm.

2.8 Fabrication

- A. General: Form graphics items accurately with clean, well defined edges or arrises, free from blemishes.
 B. Engraving: Precision machine engraving resulting in sharp edges and smooth excavated surfaces, filled with the colour, or excavated to expose the substrate in two-colour sheet plastic engraving.
 C. Casting: Produce shapes free from pits, scale, blow holes or other defects. Hand or machine finish if necessary.

- D. Cut-out shapes: Cut from solid material and hand finish as necessary.
- E. Moulding: Form individual plastic hollow three-dimensional characters and shapes by a vacuum moulding or equivalent process.
- F. Built-up shapes: Fabricate individual three-dimensional shapes by building up the faces and edges from separate pieces neatly and securely joined.
- G. Photoprinting: Permanently print the characters on plate or sheet materials.

2.9 Statutory Signs

- A. All signage shall be in accordance with the NCC, and any other relevant standards.

3 EXECUTION

3.1 Installation Generally

- A. Ensure that the final appearance is of a uniform quality.

3.2 Fixings

- A. All fixings selected shall be suitable for their intended purpose and adequate to comply with the performance requirements. Fixings shall not be visible.
- B. All bolts, screws, nuts and anchors shall be of adequate strength for their designed purpose.
- C. All necessary and appropriate fasteners and fixings shall be supplied.
- D. Fixings shall conform to all statutory requirements in respect of strength and type.
- E. Prevent bimetallic corrosion between dissimilar metals.
- F. Use fixings, which are suited to the stresses, movements and vibrations in use without allowing any wobble, creaks or deflection of any fixtures or fittings.
- G. Fix items that require accessibility or removal with screws bolts and hinges.
- H. Access panels shall be removable independently of any other panels.
- I. Design to withstand all vibrations caused by traffic, aircraft, wind effects or any other such shocks, strains, stresses and movements including the operation of smoke detectors and any mechanical ventilation devices that may be imposed by the users. Suitable devices for absorbing or damping any such vibration shall be included.
- J. Design so as not to transmit any drumming noise as a result of vibration, shocks or stress. Use sound deadening material in all areas.

3.3 Photometric Data

- A. Supply complete photometric data for the fittings, including optical performance, produced by an acceptable independent testing laboratory. Data shall be developed according to methods of the International Commission on Illumination (CIE).
- B. The letters of each individual sign are to be supplied on removable backing strips to allow accurate installation.
- C. Signage to doors shall be located centrally, level and according to Australian Standards.
- D. External signage will be exposed to the elements and will require regular maintenance procedures. Ensure that signage is weatherproof to prevent moisture entering any illuminated sign form, light box/ LED or any internal spaces. Sign structure to be sealed and/ or drained to prevent water/ dirt/ insect ingress.
- E. Folded edges and edge finishing shall be smooth and free from defects, oil canning, warping and dents. Folded or rebated panel skin may interlock to provide stability and sealed to prevent water/ dirt ingress. Jointing of panels to be hairline, smooth and flush to front face.

3.4 Signs/ Notices Tolerances

- A. A high degree of accuracy is required in the fabrication and installation of work under the Contract and support structure.
- B. On-Site dimensions:
 1. Take responsibility for checking all dimensions on Site.
 2. Accommodate any given tolerances and differences between actual Site dimensions and dimensions shown on the Design Drawings.

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SECTION 0611 -- RENDERING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Sand cement render.
 2. Proprietary render.
 3. Plaster.
 4. Accessories.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. All accessories.

1.4 Sample Panels

- A. Prior to commencement of work under the Contract, a sample panel of rendered finish, in panel sizes of nominally 2000mm x 2000mm, including final coat of paint, shall be built on Site, but away from work under the Contract. The sample panels shall include all associated beads, angles and accessories. Obtain acceptance from the Superintendent prior to commencement of construction for each type. If a panel is rejected, the Head Contractor shall construct other sample panels of each type until acceptance is obtained from the Superintendent.

1.5 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first 5m² of each type, in location as agreed with the Superintendent.

1.6 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Background immediately before commencement of work.
 2. Each completed coat before the application of subsequent coats.
 3. Completed work before application of decorative finishes.

1.7 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.8 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

2 PRODUCTS

2.1 Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Cement Sand Render to Internal Walls

- A. Cement and render to internal walls
1. Thickness, excluding dubbing out: 10mm in a single coat.
 2. Finish: Steel trowel smooth finish, ready to receive decoration as specified in Section 0671.

2.3 Proprietary External Render

- A. Pre-blended polymer modified cement render as detailed.
- B. Manufacturer/ reference: Refer to the Master Schedule.

- C. Apply to masonry substrates strictly in accordance with the manufacturer's written instructions.
1. Two-coat application to achieve an average thickness of 13mm.
- D. Finish: Wood float sand finish, ready to receive decoration as specified in Section 0671.
- E. Ruled joints shall be struck where detailed on the Design Drawings.

2.4 Hard Set Render to Internal Walls

- A. Undercoat:
1. Pre-mixed plaster, high impact, resistance undercoat.
 2. Admixture shall be water retaining and to the manufacturer's recommendations.
 3. Thickness, excluding dubbing out: 11mm.
- B. Final coat:
1. Pre-mixed gypsum finish plaster.
 2. Thickness: 2mm.
 3. Finish: Smooth, ready to receive decoration as specified in Section 0671.

2.5 Mixes

- A. General: Select a mix ratio to suit the conditions of application in conformity with the Mixes table.
- B. Measurement: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.
- C. Plaster mixing: Machine mix for 3 to 6 minutes.
- D. Strength of successive coats: Make sure successive coats are no richer in binder than the coat to which they are applied.

2.6 Mixes Table – Cement Render

<i>Table 1 - Mixes Table - Cement Render</i>					
Mix Type		Substrate	Upper and lower limits of proportions by volume		
			Cement	Lime	Sand
- Single or multi-coat systems with integral finishing treatments - Base coats in multi-coat systems with cement or gypsum finishes	CRS	Dense and smooth concrete and masonry	1	0	3
			1	0.5	4.5
	CRM	Regular clay or concrete masonry	1 1	0.5 1	4.5 6
	CRW	Lightweight concrete masonry and other weak substrates	1 1	1 2	6 9
	CRF	Cement render base coats	1 1	1 2	6 9
	CRF	Cement render base coats	1 1	1 2	5 6

2.7 Mix Table – Gypsum Finish Coat, by Volume

<i>Table 2 - Mix table – Gypsum finish coat, by volume</i>					
Mix type	Substrate	Upper and lower limits of proportions by volume			
		Gypsum	Cement	Lime putty	Sand

Gypsum finish coats	GPF	Cement render base coats	1 1	- -	1.5 2	- -
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2.8 Mix Table – Gypsum Finish Coat, by Weight

<i>Table 3 - Mix table – Gypsum finish coat, by weight</i>	
Gypsum plaster (kg)	Lime putty (kg)
17	25
34	50
51	75

2.9 Plaster Thickness Table

<i>Table 4 - Plaster thickness table</i>		
Substrate	Cement render, total thickness of single or multi-coat work (mm)	Gypsum/lime plaster (mm)
Dense concrete walls	15 max	3 max
Dense concrete ceilings	9 max	3 max
Blockwork	12 min	3 max
Lightweight concrete and blocks	12 min	3 max
Metal lath measured from the face of the lath.	18 min	3 max

2.10 Plaster Materials

- A. Cement type to AS 3972: GP.
- B. Off-white cement: Iron salts content shall be 2.5%.
- C. Lime: To AS 1672.1.
- D. Sand: To HB 161, graded to Table 1 of the Appendix.
- E. Pigments: Manufactured either synthetically or from naturally occurring mineral ores, resistant to lime bloom and efflorescence.
- F. Standard: To BS EN 12878.
- G. Pigment proportions: Shall be 5% by weight of cement.

2.11 Beads/ Stops

- A. All edge beads/ corner beads/ stop beads/ angle beads to external render shall be stainless steel or PVC to suit render thickness.
- B. All beads to internal render/ plaster shall be galvanised steel or PVC to suit plaster thickness.

2.12 Movement Joints

- A. Provide movement joints to render to coincide with structural movement joints in the substrate or at changes in the substrate.
- B. Movement joints shall be formed using proprietary PVC or stainless steel joint beads to suit the render thickness.
- C. Galvanised steel beads may be used for internal applications in lieu of stainless steel.

2.13 Expanded Metal Lathing Generally

- A. Metallic coated sheet steel expanded to a mesh by slitting and stretching:
 1. Coating class Z275 (minimum).

2. Self-furring type: Metal lath with staggered indentations which hold the body of the sheet 10mm clear of the substrate.
 - B. Expanded metal lathing for external render
 1. Stainless steel rib-lath shall be fixed to the entire face of the wall/ soffit.
 2. Stainless steel hammer screws fixed through ribs, sized to suit mesh.
- 2.14 PVA Bonding Agent**
- A. Polyvinyl acetate emulsion shall only be used in dry conditions, and as specified by the manufacturer.
- 2.15 PVA Sealer**
- A. Sealer of polyvinyl acetate emulsion shall be as recommended by the coating material manufacturer.
- 2.16 Finish Treatments**
- A. Bag: Rub the finish coat when set firm.
 - B. Carborundum stone: Rub the finish coat when set hard with a carborundum stone to achieve a finish free from sand.
 - C. Foam float: Float finish coat on application with a wood or plastic float to an even surface and finish with a foam float to achieve a fine sand textured finish.
 - D. Steel trowel: Steel trowel finish coat to produce a tight, matt, smooth surface with no hollows, abrupt changes of level or trowel marks. Water brush shall not be used and excessive trowelling or over polishing avoided.
 - E. Wood or plastic float: Float the finish coat to an even surface with a dry wood or plastic float as wet sheen has disappeared from the surface, to give an even overall texture.

3 EXECUTION

3.1 General

- A. To HB 161.

3.2 Suitability of Structure

- A. Before commencing installation, survey the structure, checking line, level and plumb and report immediately to the Superintendent if the existing structure is unsuitable to receive the specified finish.
- B. If the structure is unsuitable, propose remedial action, to the Superintendent, to make the structure suitable.

3.3 Mixing of Materials

- A. No admixtures containing calcium chloride shall be used.
- B. Mix materials thoroughly to a uniform consistency in a suitable forced action mechanical mixer.
- C. Use materials while sufficiently plastic to ensure full compaction.

3.4 Background Preparation

- A. Remove efflorescence, dust and other loose material by thoroughly dry brushing.
- B. Remove all traces of paint, grease, dirt and other materials incompatible with coating, by scrubbing with water containing detergent. Wash off with plenty of clean water and allow to dry before applying coatings, unless specified otherwise.
- C. Keying/ bonding: Prepare backgrounds for the type of coating to be applied. Methods other than those specified shall be submitted for review by the Superintendent.
- D. Treatment of organic growths: Only biocides recommended for the purpose and approved by the Pesticides Safety Precautions Scheme shall be used.
- E. Smooth concrete surfaces: Where no keying mix or bonding agent is specified and where a good key/ bond cannot be gained, use suitable expanded metal lath as specified to ensure plaster/ render adheres correctly. The first undercoat shall be applied through and round the mesh to fully bond with the solid background.
- F. Previously painted surfaces: Remove all paint by needle hammering or other suitable method.

3.5 Acceptance of Backgrounds

- A. Before preparation or application of coatings ensure that:

1. Backgrounds are secure, adequately true and level to achieve specified tolerances, free from contamination and loose areas, reasonably dry and in suitable condition to receive specified coatings.
2. All cutting, chasing, fixing of concealed conduits, service outlets, etc., and making good of the background, is completed.

3.6 Mix Proportions

- A. Unless stated otherwise, all mixes shall be in accordance with manufacturer's instructions.

3.7 Contamination

- A. Do not allow contamination of one type of material by another, or by any set material.

3.8 Initial Set

- A. Do not use mixes after initial set has taken place. Do not retemper or reconstitute mixes, unless permitted by the manufacturer of proprietary mixes.

3.9 Scaffolding

- A. Use independent scaffolding to avoid putlog holes and other breaks in coatings.

3.10 Cleanliness

- A. Protect thoroughly all existing work under the Contract and approaches using suitable boards, sheets, etc. Clean all droppings off finished work immediately.

3.11 Cold Weather

- A. Do not carry out external work when air temperature is below 3°C.
- B. Take all necessary precautions to enable internal coating work to proceed without damage when air temperature is below 3°C.

3.12 Tolerances

- A. Do not allow sudden irregularities on the finished surface.
- B. The variation in gap under a 1800mm straightedge placed anywhere on the surface shall be not more than 3mm.

3.13 Angle Beads/ Stops

- A. Provide beads/ stops at all external angles and stop ends except where specified otherwise.
- B. Cut neatly, form mitres at return angles and remove sharp edges, swarf and other potentially dangerous projections.
- C. Fix securely, using the longest possible lengths, plumb, square and true to line and level, ensuring full contact of wings with background. Use mechanical fixings for external beads/ stops.
- D. After coatings have been applied, remove coating material while still wet from surfaces of beads/ stops that are to be exposed to view.

3.14 Movement Joints

- A. Form joints in coatings to coincide with movement joints in background.
- B. Stop beads at internal angles.
- C. Ensure that joints extend through coating to background.

3.15 Application Generally

- A. Apply each coating firmly to achieve good adhesion and in one continuous operation between angles and joints.
- B. All coatings shall be not less than the thickness specified, firmly bonded, of even and consistent appearance, free from rippling, hollow, ridges, cracks and crazing.
- C. Finish surfaces to a true plane, to correct line and level, with all angles and corners to a right angle unless specified otherwise, and with walls and reveals plumb and square.
- D. Prevent excessively rapid or localised drying out.
- E. When render is applied to a substrate with weepholes, ensure that no materials clog or block the weepholes as work progresses.

3.16 Dubbing Out

- A. If necessary to correct background inaccuracies, dub out in thicknesses of not more than 10mm using the same mix as the first coat. Allow each coat to set sufficiently before the next is applied. Cross surfaces of each dubbing out coat.

3.17 Undercoats Generally

- A. Apply firmly, rule to an even surface and cross scratch each coat to provide a key for the next coat.

3.18 Combing

- A. Combing, where specified, shall be carried out as the coating stiffens using a suitable comb to produce evenly spaced, wavy horizontal lines, approximately 20mm apart and 5mm deep, to provide a key for the following coat, with no penetration through the coat.

3.19 Textured/ Patterned Finish(es)

- A. Textured/ patterned finishes shall be consistent and even. Carry out the work on each surface as one continuous operation. Use only one operative if necessary to avoid variations in technique which may result in differences of appearance, especially under oblique lighting.

3.20 Drying Out

- A. Each undercoat and final coat shall be kept damp for the first three days by covering with polythene sheet and/ or spraying with water. Prevent drying out too rapidly and allow no forced heat. Rendering shall be carried out in the shade whenever possible. Allow each coat to dry out thoroughly to ensure that drying shrinkage is substantially complete before applying the next coat.

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SECTION 0612 -- SCREEDS

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Fine concrete screeds.
 2. Proprietary polymer screeds.
 3. Granolithic screeds.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Movement joint and edge restraints, minimum 300mm long.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First structural bay of each screed type, in location to be agreed.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Prepared substrate with insulation, separating layer and reinforcement in place prior to pouring screed.

1.8 Subcontractors

- A. Submit name and contact details of proposed manufacturers and Subcontractors.

1.9 Slip Resistance and Slip Resistance Testing

- A. Pedestrian areas shall be stable, safe and minimise the risk of slipping or tripping due to slippery surfaces or misaligned joints. Slip resistances shall comply with the requirements of HB 197 and HB 198.
- B. Provide slip resistance test certificates to confirm that slip resistance values are in accordance with AS 4663.
- C. Where additional topical surface treatment is applied to concrete floor surfaces, provide slip resistance test certificates to confirm that slip resistance values for surface treatment are in accordance with AS 4586. Test the surfaces once the sealer has been applied to concrete in accordance with AS 4663.
- D. Arrange and pay for on-site slip resistance testing of all types of concrete floor surfaces that are left exposed in the finished work and in sufficient number to cater for all areas and conditions including ramps, steps entrances etc. Testing shall be undertaken by a registered testing laboratory. Tests shall include wet pendulum and dry floor friction testing in accordance with AS 4663.

2 PRODUCTS

2.1 Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Bonded Screed

- A. Manufacturer/ reference: Ardex A38 Rapid Set Screed Cement or acceptable equivalent.

- B. Substrate shall be primed with a bonding slurry comprising Ardex A51 Primer and Bonding Agent.
- C. Allow for falls to kitchen floor. Head Contractor to achieve falls with screed.

2.3 Self-Levelling Polymer Screeds

- A. Where the structural slab does not achieve the specified tolerances for flatness and level for the nominated floor finish, the surface shall be rectified using a proprietary self-levelling polymer screed.
- B. Manufacturer/ reference: Ardex K12 Levelling and Smoothing Compound or acceptable equivalent.

2.4 Granolithic Screeds

- A. Granolithic screed bonded to substrate.
- B. Mix constituents shall be as follows:
 1. Cement to AS 3972: GP.
 2. Fine aggregate of natural sand of uniform colour.
 3. Coarse aggregate, graded from 10mm maximum.
 4. Mix proportions of cement:fine aggregate:coarse aggregate shall be 1:1:2.

2.5 Proprietary Products

- A. Where any screed/ topping is described as "proprietary", all materials, mix, proportions, admixtures, mixing methods, minimum/ maximum thicknesses and workmanship shall be in accordance with the recommendations of the manufacturer even though that manufacturer may not supply all the required materials.

2.6 Mixes

- A. General: Provide toppings as follows or select mix proportions to the Mix proportion table:
 1. Air entrainment: 3%.
 2. Nominal coarse aggregate size: 0.3 x topping thickness.
 3. Slump: 80mm.
 4. Standard strength grade: N25.
- B. Water quantity: The minimum necessary to achieve full compaction and prevent excessive water being brought to the surface during compaction.

Table 1 - Mix Proportion Table				
Mix type	Thickness (mm)	Upper and lower limits of proportions by weight		
		Cement	Fine aggregate	Coarse aggregate
Bonded – cement and sand	35	1 1	3 4.5	0 0
Bonded – fine concrete	40	1 1	3 3	1 2
Floating – fine concrete	100	1 1	3 3	1 2
Granolithic	Floors: 25 Skirtings: 13	1	2	1, of 2mm - 3mm
Separated – fine concrete	70	1 1	3 3	1 2

2.7 Screeds Generally

- A. Head Contractor to confirm thickness, reinforcement coverage and falls.

2.8 Void Formers

- A. Void former insulation blocks, including steel load spreaders and straps laid over mesh layer.
- B. Provide steel fixings to tie straps to screed/ slab.

2.9 Cast-in Conduits

- A. Cast-in conduits shall comprise:
 1. Overlay with 500mm wide strip of steel fabric, or
 2. Welded mesh, manufactured in rolls from mild steel wire not less than 1.5mm diameter, mesh size 50mm x 50mm.
- B. Place the reinforcement at mid depth between the top of the conduit and the screed surface.

2.10 Pipe Ducts/ Trunking

- A. Before laying screed, ensure that preformed access ducts are securely fixed to the base and accurately levelled in relation to the finished floor surface.

2.11 Joint Requirements

- A. Manufacturer/ reference: Latham or acceptable equivalent.
- B. Provide structural movement joints to accommodate the following:
 1. Primary movement joints: Aluminium extrusions as recommended in writing by the manufacturer.
 2. Control joints: Movement centre joints recommended in writing by the manufacturer and generally comprising the following:
 - a) 6mm thick neoprene inserts in black or beige.
 - b) Wire ties at 200mm centres, to manufacturer's written recommendations.
 3. Perimeter movement shall be allowed for at the edges of screeds against solid walls. A 6mm closed cell compressible polyethylene strip shall be installed to suit the screed depth with a two-part polysulphide sealant.

3 EXECUTION

3.1 Workmanship

- A. The screed shall not be altered to accommodate other trades unless such work is clearly specified on the Design Drawings.

3.2 Suitability of Bases and Laying Screeds

- A. Bases shall be flat to accommodate the specified levels and flatnesses of finished surfaces, considering the permissible minimum and maximum thicknesses of the screed.
- B. Bases shall be clean, dry and free from contamination, eg plaster, dirt, dust and oil.
- C. For bonded screeds:
 1. The mortar matrix from the surface of the slab shall be completely removed to expose coarse aggregate over the entire area of the hardened base of the slab using abrasive blasting or, for in situ slabs only, pneumatic scabbling. Remove dust and debris.
 2. Wet bases for several hours before laying screed. Remove free water, and then brush in recommended bonding agent or cement slurry.
 3. Where a slurry is used, the screed shall be laid while slurry is still wet to ensure a good bond.

3.3 Screed Preparation and Installation

- A. Mix screeds in a force action mixer.
- B. Cure screeds using polythene sheeting or as specified by the manufacturer. Areas likely to be subject to excessive wear before the floor covering is laid, shall be protected to a suitable level.
- C. Take account of high relative humidity levels that may be encountered on Site and adjust the curing procedures adopted accordingly.
- D. After laying screeds, the building shall not be artificially heated during the first four to six weeks, and the flooring shall not be subjected to sudden increases in temperature.

3.4 Proprietary Screed Preparation and Installation

- A. The preparation and installation of proprietary screeds shall be in strict accordance with the manufacturer's printed instructions. Any deviations from these instructions shall be approved by the manufacturer prior to works commencing.
- B. Screeds shall be laid by specialists who are trained and approved licensees of the manufacturer.

3.5 Batching Requirements

- A. Ensure that proportions of mixes made with dense aggregates are specified by weight and are batched by weight. Volume batching shall only be permitted on the basis of the previously established weight:volume relationship(s) of the particular materials, using accurate gauge boxes.

3.6 Mixing Requirements

- A. Admixtures used shall not contain calcium chloride.
- B. Water content of mixes shall be the minimum necessary to achieve full compaction and low enough to prevent excessive water being brought to the surface during compaction.
- C. Mix materials thoroughly to a uniform consistency. Mixes other than non-fines shall be mixed in a suitable forced action mechanical mixer. A free fall type (drum) mixer shall not be used.
- D. Use material while sufficiently plastic for full compaction.

3.7 Weather Requirements

- A. Do not lay screeds unless their surface temperature is maintained above 5°C for not less than four days thereafter.
- B. In hot weather reduce the time between operations with water retaining admixtures added to ensure that premature drying does not take place.

3.8 Levels of Floor Screeds

- A. The permissible deviation in level of surface of screeds (allowing for thickness of coverings) and toppings from datum to be 5mm.

3.9 Flatness of Floor Screeds

- A. No sudden irregularities shall occur. When measured with a slip gauge the variation in gap under a straightedge placed anywhere on the surface shall be not more than the following:
 1. Screeds to receive resilient finishes, adhesive fixed carpet or dust sealer: 3mm under a 3000mm straightedge.
 2. Screeds to receive sheet or tile finishes bedded in adhesive:
 - a) 5mm under a 3000mm straightedge.
 - b) 2mm under a 1000mm straightedge.
 3. Enclosed staircases: 2mm under a 1000mm straightedge.

3.10 Joint Requirements

- A. Screeds shall be cast continuously, as far as possible without defined joints, using "wet screeds" between strips or bays. The positions of bay joints shall be confirmed and coordinated as follows:
 1. Forms, where applicable, shall be square edged with surfaces securely fixed. Wet material shall be compacted thoroughly at edges to give level, closely abutted joints with no lipping.
 2. Alternatively, screeds shall be cast continuously, bay joints being formed with proprietary dividing strips.
- B. The structural movement joint covers shall be fixed in accordance with the manufacturer's written recommendations and installation guidelines. Also:
 1. Be responsible for the installation and performance of all floor interfaces and seek confirmation of movement and loading requirements.
 2. Structural movement joints shall be situated immediately over or cantilevered in relation to the structural joints in the slab.
 3. Joints shall be installed in lengths of 4000mm with the minimum length at the end of runs being at least 1000mm. At joints, joint covers shall be either invisibly spliced or joint sections staggered such that the joint is continuously linked.
 4. The horizontal width of the movement joint shall be set at the time of installation, taking account of thermal expansion at the time of installation.
 5. Movement joint covers shall be fixed to the base (and upstands) by means of expanding bolt anchors at centres recommended by the movement joint manufacturer. All anchor bolts shall be zinc plated.
 6. Movement joint covers shall be fixed such that the upper surface of the joint finishes flush with the top of adjacent floor finishes.

3.11 Timing

-
- A. All finishing operations shall be carried out at optimum times in relation to the setting and hardening of the material. Surfaces shall not be wetted to assist surface working. Cement shall not be sprinkled on to surface.

3.12 Trowelled Finish to Receive Applied Floor Finishes

- A. Screed shall be floated to an even surface with no ridges or steps.
- B. Screed shall be hand or power trowelled to give a uniform smooth appearance, but not a polished surface. It shall be free from trowel marks and other blemishes and be suitable to receive the specified flooring material as per the Specification.
- C. Adequately protect the surface from construction traffic.
- D. If the surface of the screed is not suitable to receive the specified flooring material, make good by application of a smoothing compound.
- E. Where screeds are applied to build up the base so that junctions of floor finish are flush, the screed shall be feathered out from the junction to an appropriate distance, as agreed with the Superintendent, to ensure a gradual change in level.

3.13 Wood Floated Finish

- A. Use a wood float to give an even, slightly coarse texture with no ridges or steps.

3.14 Smooth Floated Finish

- A. Use a hand float, skip float or power float to give an even surface with no ridges or steps.

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SECTION 0631 -- TILING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Ceramic floor tiling.
 2. Ceramic wall tiling.
 3. Stone floor tiling.
 4. Stone and precast terrazzo wall tiling.
 5. Tactile indicators.
 6. Stair nosing.
 7. Underlay
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Three tiles of each type.
 2. Six tiles of each stone type representing the full range of colour and markings.
 3. Six 300mm x 300mm terrazzo tiling samples illustrating the range variation.
 4. Three of each type of tactile indicator.
 5. Grout sample.
 6. Movement joint material, minimum 300mm.
 7. Trial set-out: On horizontal surfaces make a trial set-out for each area.
 8. Samples of each type of sealer, trim, movement joint and accessory.

1.4 Sample Panels

- A. In accordance with Section 0171, provide the following sample panels:
1. Prepare sample panels of each type of finish minimum 2000mm x 2000mm. Include samples of junction details and trim. Preserve each accepted panel until related work is complete.

1.5 Mock-Ups

- A. Not required.

1.6 Prototype

- A. Not required.

1.7 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First 9m² of each type, in location to be agreed.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Substrate immediately before tiling.
 2. Initial and trial set-outs.
 3. Control joints before sealing and grouting.

4. Completion of tiling.

1.10 Shop Drawings

- A. Submit Shop Drawings showing the relevant details of the tiling system as follows:
 1. Tiling set-out.
 2. Typical jointing, expansion joints, caulking ducts.
 3. Falls to wastes, and penetration details.

1.11 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.12 Testing Generally

- A. Include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.
- B. Ceramic tiles shall be tested to AS 4459.
- C. Marking and classification of tiles with regard to water absorption and shaping to AS ISO 13006.
- D. Marking and classification of tile adhesive to AS ISO 13007.1.
- E. Weighted normalised impact sound pressure level to AS ISO 717.2 as measured for the acoustic underlay as part of the entire tiling system.

1.13 Impact Testing

- A. Carry out impact tests to establish the soundness of all screeded substrates. Testing shall include both light tap and heavy weight impact using 4kg, in compliance with a screed tester. Alternative substrate testing methods may be put forward for consideration and acceptance by the Superintendent.

1.14 Stone Tests

- A. Carry out the following CSIRO BEST (Built Environment Stone Tiles) test methods:
 1. CSIRO BEST-1: Petrography.
 2. CSIRO BEST-2: Water Absorption, Porosity and Density.
 3. CSIRO BEST-3: Flexural Strength.
 4. CSIRO BEST-4: Impact Resistance.
 5. CSIRO BEST-5: Scratch Hardness.
 6. CSIRO BEST-6: Abrasion Resistance.
 7. CSIRO BEST-7: Thermal Expansion.
 8. CSIRO BEST-8: Thermal Shock.
 9. CSIRO BEST-9: Dimensional Stability.
 10. CSIRO BEST-11: Chemical Resistance.
 11. CSIRO BEST-12: Acid Immersion Test.
 12. CSIRO BEST-13: Stain Resistance.
 13. CSIRO BEST-14: Weatherability.
- B. Visual inspection:
 1. The rough edge of each block shall be sawn off exposing a fresh face. The face shall be visually inspected by an independent qualified geologist/ stone consultant for any visible defects, changes in structure or texture, and general conformity to the aesthetic criteria defined by the Superintendent and illustrated in agreed project reference samples.
 2. A test area shall be taken from the slab sufficient to prepare all of the proposed tests in the project bedding orientation.

1.15 Slip Resistance and Slip Resistance Testing

- A. Test Certificates:
 1. Installed pedestrian surfaces shall be stable, safe and minimise risk of slipping or tripping due to slippery surfaces or misaligned joints. Slip resistance shall comply with AS 4586.

2. Slip resistance test certificates shall be provided in accordance with the relevant codes (AS 4586, AS 4663, HB 197 and HB 198) to confirm slip resistance ratings are as per that specified for each tile. Batch testing to be carried out in accordance with the requirements of AS 4586 and provision of certification that the batches provided to the project have been tested not more than 12 months prior to their installation into the project.
3. Where no slip resistance criteria is specified, materials complying with HB 197 and HB 198 recommendations for specific usages will be submitted for approval prior to ordering. Provide test certification for these tiles in the same manner as those covered by the specified slip resistance rating.
4. Where alternative tile options are available, alternatives must only be proposed where they meet the same specified slip resistance criteria and have valid up to date test certificates to validate the slip resistance.
5. No material shall be supplied or installed until the manufacturer's slip resistance test results have been submitted and approved by the Superintendent.
6. As installed tests:
 - a) Certify that representative areas of the tiled area for all types fully installed into the project have been Site tested and comply with the required slip resistance design criteria. Representative areas are to be determined by the certifying authority and/ or as set out in the relevant standard, whichever is the greater.
 - b) Failure of the materials in the as-installed state to meet the required slip resistance as specified and provided in the batch testing or other manufacturer test results will require the defective materials to be removed and replaced with a new material of the same required slip resistance as specified. Materials relaid are to be retested in situ. This process shall be continued until as-installed slip resistance values as specified are met. All such works shall be to the Head Contractor's expense.
7. Testing results for all tiles are to be provided and approved by the Superintendent prior to ordering any materials.

2 PRODUCTS

2.1 Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- B. Standard: To AS ISO 13006 and AS 3958.2.
- C. Tactile ground surface indicators: To AS/NZS 1428.4.1.
- D. Floor tiling:
 1. Background/ base: Power floated concrete slab or graded screed.
 2. Bedding: Mortar unless detailed otherwise.
- E. Wall tiling:
 1. Background/ base: Rendered blockwork/ fibre cement lined stud partition.
 2. Fixing: Adhesive fixed. Mechanical fixing as required for larger format tiles.
- F. Stair nosing:
 1. Anti slip tape.
 2. Colour: As scheduled. To comply with luminance contrast requirements of AS/NZS 1428.4.1. when viewed against the substrate in dry or wet conditions. Head Contractor to supply complying alternative colours for Superintendent's selection with verification certificate
 3. Finish: To comply with slip resistance requirements.
- G. Preparation and installation to be in accordance with the manufacturer's written instructions.
- H. Damp-proof membrane: As specified in Section 0411.
- I. Grout (as selected and specified below):
 1. Cement based.
 2. Grout colour: to match the tile, unless nominated otherwise.
- J. Coves, nosing and skirting: Provide matching stop-end and internal and external angle tiles moulded for that purpose.

- K. Provide discrete brushed aluminium angles to all exposed tiled corners to bathroom and ensuites.
- L. Movement joints:
 - 1. Perimeter: As specified at all perimeters including door thresholds and around columns and stairs.
 - 2. Structural: As specified to coincide with structural movement joints in base.

2.2 Accessories

- A. General: Provide tile accessories which match the composition, colour and finish of the surrounding tiles and as documented.

2.3 Floor Impact Noise Control

- A. Provide a proprietary reconstituted rubber underlay under all tiled floors.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Thickness: As scheduled.
- C. Underlay to be chemically fixed using a suitable adhesive in accordance with the manufacturer's recommendations.
- D. Where rubber underlay is used in areas requiring a waterproof membrane, the membrane shall be applied to both sides of the underlay.

2.4 Cement Based Grout

- A. Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.
- B. General purpose cement based grout: Mix with fine sand. Provide minimum water consistent with workability.
 - 1. For joints < 3mm: 1 cement: 2 sand (by volume).
 - 2. For joints 3mm: 1 cement: 3 sand (by volume).
- C. Pigments for coloured grout: Provide colourfast fillers compatible with the grout material. For cement-based grouts, provide lime-proof natural or synthetic metallic oxides compatible with cement.
- D. Cement based tiling beds and grouts are to contain an admixture or mechanism which inhibits the movement of water containing calcium hydroxide to the surface of the paving.

2.5 Stone Quality

- A. Arrangements shall be made for the Superintendent, and others as necessary, to inspect samples of stone in the respective quarries which represent the range of variations in appearance. Acceptance by the Superintendent shall be obtained before confirming orders with suppliers or proceeding with production.
- B. Stone shall be free from vents, cracks, fissures, discoloration, or other defects, which may adversely affect strength, durability or appearance. It shall be dressed and worked before delivery to Site in accordance with the Design Drawings.

2.6 Movement Joint Metal Edgings

- A. Movement joint metal edgings shall be provided as follows:
 - 1. Material shall be stainless steel unless specified otherwise.
 - 2. Size of angled edging strip shall be specifically selected to enable fixing into the substrate so that the top edge finishes flush with the floor finish.

2.7 Sealant Movement Joints

- A. Sealant movement joints shall be provided where necessary:
 - 1. The colour shall be to accepted samples by the Superintendent prior to installation.
 - 2. Preparation and application shall be in accordance with Section 0811. Joints shall extend through tiles and bedding to substrate. Joints shall coincide with any movement joints left in the substrate.

2.8 Preformed Strip/ Section Movement Joints

- A. Where shown on the Design Drawings, install Latham Neoprene X-Pansion Tile Strip preformed expansion joints, or acceptable equivalent, in accordance with the manufacturer's written recommendations.

2.9 Perimeter Sealant Movement Joints

-
- A. Joints: Extend through tiles and bedding to base/ background. Centre over joints in base/ background.
1. Width: 10mm unless detailed otherwise.
 2. Sealant: Bostik Seal N Flex FC or Zbond 6S, with polyethylene foam backing, or acceptable equivalent (to be confirmed).
 3. Colour: To accepted samples.
- B. Preparation and application shall be in accordance with Section 0811.
- 2.10 Structural Section Movement Joints to Floors**
- A. Manufacturer/ reference: Schluter Systems Dilex EKS N, or acceptable equivalent.
1. Insert colour: To accepted samples.
 2. Bedding: Bed in 1:3 cement:sand.
- B. Installation: Centre over joints in base. Set to exact finished level of floor.
- C. Fixing to base: Adhesive.
- 2.11 Stone Sealer**
- A. Thin uniform film of proprietary seal shall be applied to stone and accepted by the stone manufacturer in writing as suitable for each application.
- B. Sealer shall not affect the slip resistance requirements or the natural appearance of the stone.
- 2.12 Mortar Bedding**
- A. The mortar bedding shall be:
1. A proprietary epoxy resin based compound to obtain satisfactory adhesion.
 2. Cement based from the range 1:3 – 1:4 cement: sand (by volume) to obtain satisfactory adhesion.
 - a) Cement based tiling beds and grouts are to contain an admixture or mechanism which inhibits the movement of water containing calcium hydroxide to the surface of the paving.
- B. Tile mortar bedding compound shall be accepted by the tile manufacturer and applied strictly in accordance with the mortar manufacturer's written recommendations.
- 2.13 Waterproofing**
- A. Where tiles are in wet areas the Head Contractor shall waterproof behind the tiles in accordance with Section 0411 and AS 3740.
- 2.14 Tolerances**
- A. Tile sizes stated in the Specification are nominal and the actual sizes required to meet the joint sizes, etc, to be determined.
- B. To AS 3958.1 clause 5.4.6.
- 2.15 Damage**
- A. Tiles that are chipped, scratched, damaged or have any other physical imperfections shall not be used in work under the Contract.

3 EXECUTION

3.1 Fixing Generally

- A. To AS 3958.1.
- B. Prime if recommended by the adhesive manufacturer.
- C. Cut tiles: Neat and accurate.
- D. Fixing: Provide adhesion over entire background/ base and tile backs.
- E. Final appearance: Before bedding material sets, make adjustments necessary to give true, regular appearance to tiles and joints when viewed under final lighting conditions.
- F. Allow no unintended colour/ shade variations within the tiles for use in each area/ room, with permissible variegated tiles being evenly distributed.
- G. Clean surplus bedding material from joints and faces of tiles, without disturbing tiles.

- H. Cuts shall be at the perimeter of the floor or around openings, obstacles, etc, and be trimmed in accordance with the Design Drawings. All cuts shall be made with a diamond tipped wet-saw and all exposed cut edges shall receive an arris to match uncut tiles. Proprietary tile cutting machines can be used if acceptance is received from the Superintendent.
- I. Prepare wall surfaces for tiling using a suitable adhesive compound to fill in any excessive indentations prior to applying the suitable adhesive compound.
- J. Set out the tiling plumb and square to the floor or wall finish.
- K. Clean tiles prior to completion. The initial clean shall be according to the manufacturer's instructions.
- L. On completion, when joints are hard, polish tiling with a dry cloth and protect.

3.2 Background Suitability

- A. Before the commencement of tiling, the background and bases shall be:
 - 1. Sufficiently flat to permit specified flatness of finished surfaces, bearing in mind the permissible minimum and maximum thicknesses of the bedding material.
 - 2. Allowed to dry out by exposure to the air for not less than the base manufacturer's written recommendations.

3.3 Preparation

- A. Preparation of backgrounds to AS 3958.1 section 4.
- B. Scrub new in situ concrete with water containing detergent to completely remove mould, oil, surface retarders and other materials incompatible with the bedding. Rinse with clean water and allow to dry, unless specified otherwise.
- C. Blockwork walls shall be prepared for tiling using an accepted adhesive compound, to fill in any excessive indentations prior to applying the general adhesive.

3.4 Mortar

- A. As recommended in writing by the manufacturer and applied strictly in accordance with printed recommendations.
- B. All tiles shall be bedded in accordance with the manufacturer's instructions.

3.5 Checking Tile Adhesion

- A. Verify that there is adhesion over the whole tile area.

3.6 Joint Widths

- A. Tile to tile grout joint widths between tiles shall be controlled by using spacer pegs.
- B. Tile to tile grout joint widths shall be as scheduled $\pm 0.5\text{mm}$ (maximum 1.5mm) or as accepted by the Superintendent.
- C. Tile to tile mastic joint widths shall be $6\text{mm} \pm 1\text{mm}$ or as accepted by the Superintendent.

3.7 Grouting

- A. Grout shall be sanitised and match the tiles. Do not apply grout until the bedding material has hardened sufficiently. The joints shall be a minimum of 5mm deep and free from dust and debris. All joints shall be completely filled, tooled to an accepted profile and wiped down to leave free from blemishes.
- B. Tiles shall be grouted, as soon as set firm, using a proprietary tested product.
- C. All grout joints shall be installed to the full depth of the tile joint. Remove all debris from the joints prior to grouting.
- D. The grout joints shall be "washed" joints. That is the grouting shall be washed out to the bottom line of the arris.

3.8 Level of Floor Tiling

- A. The permissible deviation in level for tiling shall be $\pm 2\text{mm}$ of the stated datum.

3.9 Level of Tiling across Joints

- A. The maximum deviation between tile surfaces either side of a joint, including movement joints, shall be:
 - 1. Joints less than 6mm wide: 1mm.
 - 2. Joints 6mm or greater in width: 2mm.

3.10 Flatness of Floor Tiling

- A. Sudden irregularities to the finished surfaces shall not occur. The variation in gap under a 3000mm straightedge placed anywhere on the surface shall be not more than 2.5mm.

3.11 Floor Wastes

- A. Prevent off-cuts, mortar, grout or other debris from entering floor wastes.
- B. At the end of each working day, inspect floor wastes, and remove all debris.
- C. At the completion of each installation area, inspect floor wastes and the full distance of horizontal pipes to the nearest vertical riser, using suitable fibre-optic lighting and inspection equipment.
- D. Remove all debris and verify the full internal diameter is free of obstructions and is free flowing. Coordinate and cooperate with the hydraulic services trade.

3.12 Falls and Levels

- A. Grade floor tiling to even and correct falls to floor wastes and elsewhere as required. Make level junctions with walls. Where falls are not required, lay level.
- B. Unless nominated otherwise the following gradients shall apply as a minimum:
 - 1. Falls generally: 1:100 minimum
 - 2. Falls to shower areas: 1:60 minimum.

3.13 Control of Movement

- A. Requirement: Provide control joints carried through the tile and the bedding to the recommendations of AS 3958.1, clause 5.4.5, and as follows:
 - 1. Floor locations:
 - a) Over structural control joints.
 - b) To divide complex room plans into rectangles.
 - c) Around the perimeter of the floor.
 - d) At junctions between different substrates.
 - e) To divide large tiled areas into bays.
 - f) At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
 - 2. Wall locations:
 - a) Over structural control joints.
 - b) At junctions with different substrate materials where the tiling is continuous.
 - c) At vertical corners in shower compartments.
 - d) Depth of joint: Right through to the substrate.
 - e) Sealant width: 6mm to 25mm.
 - f) Depth of elastomeric sealant: One half the joint width, or 6mm, whichever is the greater.

3.14 Setting Out

- A. Finishes to fixed areas for floor tiles shall be set out on a grid and coordinated on to this grid, except where indicated on the Design Drawings.
- B. Joints shall be true to line, continuous and without steps.
- C. Joints in walls shall be parallel to the main axes of the space or specified features.
- D. Cut tiles shall be kept to a minimum, as large as possible and in unobtrusive locations.
- E. Where positions of movement joints are not specified, agree them with the Superintendent.

3.15 Junctions with Other Floor Finishes

- A. Unless stated otherwise, provide 25mm x 25mm x 3mm natural anodised aluminium L-shaped trim, at the junction ensuring that floor finishes, on each side, and the top of the trim are finished at the same height.

3.16 Joints

- A. Fully bed movement joints in accordance with the manufacturer's instructions.
- B. All wall tiling trims shall be of a proprietary type fit for their purpose.

-
- C. Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut tiles, submit a proposal for the Superintendent's consideration.

3.17 Completion

- A. Submit a manual describing the required care and maintenance of the tiling, including procedures for maintaining the slip-resistance grading, stating the expected life of the slip-resistance classification.
- B. Spare Tiles: Supply spare matching tiles and accessories of each type (at least 2% of the quantity installed) for future replacement purposes. Store the spare materials on Site.
1. Storage location: On Site as directed by the Superintendent.
- C. Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

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SECTION 0652 -- CARPET**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Broadloom carpet.
 2. Rugs.
 3. Entrance mats including perimeter frame and trims.
 4. Underlay.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Submit labelled production run samples illustrating the range of colour, pattern, texture and pile yarn available in the required carpet types.
 2. Underlay: Submit one labelled sample at least 600mm x 600mm.
 3. Penetrations: Submit one production carpet sample with a penetration access cut.
 4. Stitching: Submit one sample, at least 1000mm long, of a stitched seam.
 5. A 500mm x 500mm entrance mat sample including edge frame and trims.
 6. A 500mm minimum length sample of all accessories.
- B. Provide samples of every dye lot and manufacture run.

1.4 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first 10m² of each type of carpet, including underlay, accessories, and 3000mm of typical seam. In location as agreed with the Superintendent.

1.5 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Each batch of material upon delivery to Site.
 2. Prepared substrate immediately prior to carpet installation.
 3. Fixings, edge strips, and underlay installed ready to lay carpet.
 4. Completed installation after cleaning and before covering for protection.

1.6 Subcontractors

- A. Submit name and contact details or proposed suppliers and Subcontractors.

1.7 Shop Drawings

- A. Submit Shop Drawings indicating the proposed layout, including all seam locations and jointing methods.

1.8 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.9 Testing

- A. Submit certified test reports independently verified for each type of carpet. Reports shall verify that the material will meet all requirements of the Specification. Previously completed test reports, provided by the manufacturer, will be acceptable if current and indicative of products used on this project.
- B. Submit results, as follows:
1. Critical radiant flux: To AS ISO 9239.1.

2. Smoke development rate (non-sprinklered buildings): Maximum 750 percent-minutes to AS ISO 9239.1.
 3. Slip resistance: To AS 4586.
- C. Arrange for the Australian Wool Testing Authority Limited (AWTA) to:
1. Take random samples in accordance with AS/NZS 2119.
 2. Conduct the specified testing.
 3. Submit the original copy of each relevant test report to the Superintendent.
- D. Traffic Class: AWTA Test No 7 - 486242 - JS.

1.10 Test Groups

- A. General: In the Tests table the letters T, S and Q each comprise one test group, defined as follows:
1. Type test group (T): Tests on samples of carpet having the same specification, but not necessarily from carpet manufactured for the project. Authenticated test reports less than 12 months old are acceptable.
 2. Specification test group (S): Tests on samples taken before laying from carpet manufactured for the project.
 3. Quality assurance test group (Q): Tests on samples taken from the site during laying or from the manufacturer's premises before dispatch to the site.
- B. Requirement: Perform the documented number of tests for each test group (T, S or Q) as follows:
1. For each type of carpet documented.
 2. For each documented area (or part of) of installed carpet.

1.11 Number of Tests Schedule

<i>Table 1 - Number of tests schedule</i>		
Test group type	Number of tests	Per installed area
T	One only	not applicable
S	One	each 5000 m ²
Q	Three	each 5000 m ²

- A. Properties to be tested: Test the properties in each group, by the appropriate test method, as described in the Tests table.

1.12 Tests Table

<i>Table 2 - Tests table</i>		
Carpet property	Test method	Test group
Colour fastness: To artificial light	AS 2001.4.21	T S Q
Colour fastness: To water	AS 2001.4.E01	T S
Colour fastness: To rubbing	AS/NZS 2111.19.1	T S
Colour fastness: To shampoo solution	AS/NZS 2111.19.2	T S Q
Colour fastness: To solvents	AS 2001.4.16	T S
Treatment: For insect resistance	AS 2001.6.1	S
Dichloromethane extractable matter of pile	AS 2001.3.4	S Q
Pile structure: Total pile mass	AS/NZS 2111.11	S
Pile structure: Pile mass above substrate	AS/NZS 2111.4	S Q
Pile structure: Tuft density	AS/NZS 2111.9	S
Pile structure: Tuft withdrawal force	AS/NZS 2111.15	S Q

Burning behaviour	AS/NZS 2111.18	T
Electrostatic protection: Electrical resistance	AS 4155.6	S
Electrostatic protection: Electrostatic propensity	AATCC TM 134	S
Soft underlay property: Mass per unit area	AS/NZS 2111.3	Q
Soft underlay property: Fibre content	AS 2001.7	Q
Soft underlay property: Performance	AS 4288	T
Soft underlay property: Thickness	BS 4051	Q
Soft underlay property: Thickness deviation	AS 4288	Q
Soft underlay property: Extractable matter	AS 2001.3.4	Q
Tile dimensions	BS 5921	S Q
Pile yarn construction: Yarn count	AS 2001.2.23	S
Pile yarn construction: Twist level	AS 2001.2.14	S

1.13 Carpet

- A. Wear classification: To AS 2001.
- B. Abrasion: Test to AS 2001.
- C. Tear test: When tested for tear resistance to AS 2001 samples torn in the warp (arrow) direction and in the weft (across arrow) direction shall not tear using a force less than 4kg.
- D. Dimensional change: When tested to AS/NZS 2001.4.5 for stability and when reacting to heat and water the carpet dimensional change shall not exceed 1%.
- E. Colourfastness test: When tested to AS 2001.4 series, as appropriate, for deterioration of colour when exposed to light, the carpet shall achieve a minimum light fastness grade of 5.
- F. Fire resistance for carpet flooring is to be in accordance with NCC Spec C1.10 Clause 3 and AS ISO 9239.1.
- G. Electrostatic propensity: Provide a maximum electrostatic propensity value for carpet of 2500 V at a relative humidity of 25%, when tested to AATCC TM 134.

2 PRODUCTS

2.1 General Requirements

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.
- B. Tolerances: To AS/NZS 1385.
- C. Where possible carpets shall be chosen that use fusion-bonded technology to adhere the carpet fibres to the backing, or use peel-and-stick carpeting that requires no glues for installation. These options reduce or eliminate volatile organic compounds (VOCs) that cause air quality problems.

2.2 Floor Finishes Generally

- A. Where possible, new flooring shall have a reduced environmental impact relative to available alternatives.
- B. Where flooring is not GECA certified, provide documentation from the product manufacturer/ supplier as necessary to satisfy the requirements described in Section 0171.

2.3 Broadloom Carpet

- A. Waterproof backed composite level loop pile carpet sheeting.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 1. Range/ colour: As scheduled.
 2. Roll width: 3660mm
 3. Underlay: Regupol 5512. SBR Rubber bound with polyurethane binder. 5mm thick

4. Carpet Thickness: 8.7mm +/- 10%
 5. Grading: Residential Heavy Duty
 6. Construction: Tufted
 7. Environmental grade: ACCS ECS: Level 4.
- C. Base: Power floated concrete.
- D. Underlay: Include where detailed, scheduled, required and as specified below.
- E. Method of laying: Direct stick using a water based adhesive or dual bond adhesive fixed where underlay is nominated.
- F. Preparation: Make good as specified. Ensure there are no ridges, undulations or the like in the substrate that may cause premature wear to the carpet.

2.4 Rugs

- A. Inlay and loose or designer's rugs as detailed.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Range, colour, shape: As scheduled.
 2. Thickness and grading: As scheduled.
 3. Environmental grade: ACCS ECS: Level 4.
- C. Base: Power floated concrete.
- D. Preparation: Make good as specified. Ensure there are no ridges, undulations or the like in the substrate that may cause premature wear to the carpet.
- E. Underlay: As scheduled.
- F. Fixing: Adhesive fixed.
- G. Secure rug edges in place with concealed fixing system.
- H. Inlay rug setdowns: Coordinate and adjust set-downs as required to accommodate the depth of pile of custom rugs, including underlay and backing, as applicable, to ensure the required finished surface with adjacent flooring, as nominated on the Design Drawings, is achieved.

2.5 Entry Mat

- A. Recessed aluminium framed entrance mat to comply with AS 1428.1 Clause 7.4.2 requirements.
- B. Manufacturer/ reference: Refer to the Master Schedule.
1. Matting construction: As scheduled.
 2. Inserts: As scheduled.
 3. Matwell frame shall be natural anodised aluminium.
- C. The frame shall be installed so that the upper edge is flush with the adjacent floor finish.
- D. Provide a drainage point within the slab recess where indicated. Refer to the Hydraulic Services documents.

2.6 Underlay

- A. Standard underlay: To AS 2455.1.
- B. Fibre cement underlay: Minimum 5mm thick.
- C. Hardboard underlay:
1. Standard: To AS/NZS 1859.4.
 2. Classification: General purpose medium board, manufactured specifically as flooring underlay.
 3. Thickness: 5.5mm.
- D. Soft underlay:
1. Standard: To AS 4288.
 2. 60% animal fibre and 40% jute, reinforced with polypropylene scrim with a minimum mass of 50g/ m², or hessian fabric with a minimum mass of 150g/ m².
 3. Tolerance on mass: 0 to +20%.
 4. Cellular plastics (polymeric): High density polymeric foam sandwiched between reinforced carrier fabric.

5. Cellular rubber: Heavy-duty vulcanised rubber, waffle pattern, with a backing of reinforcing fabric:
- a) Reinforcing fabric: Either hessian, spun nylon or polyester.

2.7 Total Volatile Organic Compounds (TVOCs) in Carpets

- A. At least 95% of carpets applied on-site are to comply with one of the following two compliance methods:
1. The product is certified under a recognised Product Certification Scheme (listed on the GBCA website) or other recognised standards. The certificate must be current at the time of project registration or submission and list the relevant product name and model.
 2. Carpets are to be selected to maintain TVOC emissions below the limits as nominated within Table 3 below.

<i>Table 3 - Carpet Test standards and TVOC emissions limits.</i>	
ASTM D5116 – Total VOC limit	0.5mg/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

- B. Adhesives: Refer to limits provided in Section 0811.
- C. Provide the Superintendent with the following:
1. Data sheets provided by the supplier and signed by the supplier's representative confirming the VOC content of each carpet installed into the works.
 2. Certification confirming the supply and installation of each carpet type into the Works.
- D. Obtain acceptance from the Superintendent before substituting any specified carpet. Head Contractor nominated alternative carpets must have a TVOC level equal or better than that specified.
- E. At the end of the project, undertake a final audit to ensure that the correct products have been used.
- F. Compliance testing: The American Carpet and Rug Institute Green Label or ASTM D5116.
- G. Provide confirmation from the supplier of the type and quantity of each carpet supplied for the project.
- H. The carpet's backing material shall be PVC free.

2.8 Batching

- A. Carpet laid in a single area and of a single specified type, quality, colour and design, must come from one manufacturing batch and dye lot.

2.9 Expansion Joints

- A. At expansion/ movement joints in the substrate provide proprietary expansion joints and ensure an accurate and even transition over the joint.
- B. Refer to the Design Drawings for details and locations.

2.10 Adhesive

- A. To AS 2455.1.
- B. Adhesives: Compatible with the floor covering material, and suitable for bonding it to the subfloor.

2.11 Adhesive Fixed Carpet

- A. Adhesive fixed carpet shall reflect the performance requirements of the installation on the basis of a minimum of seven years continuous use of service without a significant loss of appearance. For comparative purposes the adhesive fixed carpet shall be classified as suitable for "Extra Heavy Duty" (Category "A").
- B. To ensure continuing compliance with the Specification, test data shall be required to show quality control compliance with the Specification during production of the adhesive fixed carpeting, at intervals of not more than 500m² production runs.

- C. Hot-melt adhesive tapes
1. Commercial grade glass fibre and cotton thermoplastic adhesive coated tape 60mm wide on a 90mm wide metal foil base and backed with silicon-coated release paper.

2.12 Stain and Soil Resistance

- A. Provide one or more of the following:
1. Fluoro-treatments: Fluorochemical soil and liquid repelling chemical treatment applied during manufacturing.
 2. Stain blockers: Colourless acid-based dye stain blocker applied to dyed fibres.

2.13 Insecticides

- A. Insecticide: Provide carpets and underlays composed entirely of materials either inherently resistant to insect attack, or treated against insect attack, including by moth and carpet beetle, by application of insecticide to the yarn during the dyeing or scouring process.
- B. Standard: To Woolmark Product Specification E 10.
- C. Approved insecticides: Provide insecticides listed in the Approved insecticides table.
- D. Alternatives: Other agents may be used provided they comply with the recommended application levels promulgated from time to time by the Woolmark Company for Level 4 protection.

2.14 Approved Insecticides Table

<i>Table 4 - Approved insecticides table</i>		
Insecticide	Minimum level of application (per cent on weight of wool pile fibre)	
	Dyebath application	Scouring application
Eulan U33	0.36%	0.45%
Mitin LP	0.44%	0.54%
Perigen	0.25%	0.32%

3 EXECUTION

3.1 Workmanship Generally

- A. All bases shall be rigid, dry, sound smooth and free from grease, dirt and other contaminants before coverings are applied.
- B. Finished coverings shall be accurately fitted tightly jointed, securely bonded, smooth and free from air bubbles, rippling, adhesive marks and stains.
- C. The setting out of the pattern shall be agreed with the Superintendent before ordering the floor finish materials.
- D. The materials shall be delivered to Site in original packaging clearly marked with the batch number.
- E. No materials shall be laid until the building is weathertight, wet trades have finished their work, the building has dried out, all paintwork is finished and dry, and floor service outlets, duct covers and other fixtures around which the materials to be cut have been fixed. The Superintendent shall be informed not less than two working days before commencing laying.
- F. Before laying commences, the materials shall be thoroughly conditioned by unpacking and spreading out in the spaces where they shall be laid. Minimum time and temperature shall be as recommended in writing by the manufacturer.
- G. Do not lay over expansion or movement joints located in the substrate.
- H. Before, during and after laying, the temperature and humidity shall be maintained at the approximate levels that will prevail after the building is occupied.
- I. Joints shall be made on the centre line of the door leaf unless specified otherwise.

3.2 Junctions with Other Floor Finishes

- A. Unless indicated otherwise on the Design Drawings, junctions with other floor finishes shall occur at doorways and be centred on the door when in the closed position.

- B. Maintain the finished floor level at junctions with other floor finishes. Diminishing strips at changes in floor finishes will not be accepted. Provide 25mm x 25mm x 3mm natural anodised aluminium L-shaped trim, at the junction ensuring that floor finishes, on each side, and the top of the trim are finished at the same height.

3.3 Preparation

- A. Standard: To AS 2455.1 or AS 2455.2 as appropriate.
- B. Substrate preparation:
1. Suitably prepare the substrate to receive the carpet installation, including the following:
 - a) Stripping and cleaning: Remove deleterious and loose material, including existing floor coverings and surface treatments which could adversely affect adhesion. Leave the surface dust-free and clean.
 - b) Repairs: Make good to the surface finish as necessary. Infill depressions with a suitable filler, and remove high spots and projections. If necessary lay a steel-trowelled underlay to concrete substrate.
 - c) Fixtures and fittings: Remove door stops and other fixtures, and refix in position undamaged on completion of the installation.
 2. Concrete substrates: Test concrete substrate for dryness using the hygrometer test method described in AS 2455.1 Appendix B. If necessary use artificial means for drying out the substrate before installation.
 - a) Ensure that concrete slabs are ready for the installation of floor finishes within the construction program. Curing agents must be approved and removed following curing by mechanical or chemical means as recommended by the manufacturer to allow suitable drying time.
 - b) Provide all measures necessary to ensure installation of floor coverings meets with AS 1884 and warranty conditions.
 - c) If the moisture content does not meet the conditions of AS 1884, provide a suitable and timely solution, including a suitable moisture barrier or a deeply penetrating liquid curing compound, in accordance with the concrete and resilient floor finish manufacturer's written instructions.
- C. Substrate Tolerance Table

<i>Table 5 - Substrate tolerance table</i>		
Property	Length of straightedge laid in any direction	Max. deviation under the straightedge
Flatness Class B	3000mm	6mm
Smoothness	150mm	1mm

- D. Timber substrate correction: Remove projections. If conformance with the Substrate tolerance table cannot be achieved, fix an underlay in brick pattern with joints avoiding substrate joints.
- E. Moisture content: Do not commence installation unless:
1. Concrete: The moisture content of the concrete has been tested to AS 2455.1 Appendix B and the values in AS 2455.1 clause 2.4.2 (c) have been obtained.
 2. Timber, plywood or particleboard substrates: The moisture content has been tested to AS/NZS 2098.1 for plywood and AS/NZS 1080.1 for timber and particleboard, and values obtained as follows:
 - a) Air conditioned buildings: 8 to 10%.
 - b) Intermittently heated buildings: 10 to 12.5%
 - c) Unheated buildings: 12 to 15%.
- F. Conditioning:
1. Stabilise the room temperature for seven days before, and two days after laying carpet as follows:
 - a) Areas with air conditioning installed: Run air conditioning at operational temperature.

- b) Air conditioned areas not operational: Maintain a room temperature range between 10°C and 35°C.
 - c) Underfloor heating: Turn off heating and allow substrate to stabilise at the temperature recommended by the carpet manufacturer.
 - d) Non-air conditioned areas: Install at between 10°C and 35°.
2. Underlay: Expose both faces of each sheet of underlay for more than 24 hours before fixing.
 3. Unroll the carpet and soft underlay and allow them to come to the temperature of the in-service environment before laying.

3.4 Entry Mat Installation

- A. Prepare the base of the mat recess ensuring an even transition occurs between the entrance mat and the adjacent floor finish.
- B. Entrance mat setdowns shall be provided with drainage points to prevent build up of water within the recess.
- C. Install mats and frames to finish flush with surrounding floor finishes. Installation shall be in accordance with the manufacturer's published instructions and recommendations.
- D. After correct installation of frames, store mats and provide temporary infill until immediately before Practical Completion.

3.5 Dampness

- A. Where coverings shall be laid on new wet-laid bases ensure that:
 1. Drying aids have been turned off for not less than four days.
 2. Readings are taken in all corners, along edges and at various points over the area being tested.
 3. Carpets shall not be laid until the moisture content of the substrate is in accordance with the requirements of AS 2455.1.

3.6 Adhesive

- A. Primer shall be used where recommended by the adhesive manufacturer and shall be allowed to dry thoroughly before applying adhesive.
- B. Spread the adhesive evenly, pressing down firmly and rolling (if recommended) to ensure full contact and a good bond overall.
- C. Remove all surplus adhesive from exposed faces of coverings as work under the Contract proceeds.

3.7 Laying Carpet Sheetting

- A. Submit a floor covering plan to the Superintendent before commencing installation.
- B. Standard: To AS 2455.1.
- C. Setting out:
 1. General: Lay the carpet in continuous lengths without cross joins in the body of the area.
 2. Where unavoidable cross joins may occur at doorways. Locate the cross joins directly below the closed doors. Other than at doorways, cross joins will not be accepted.
 3. Joints in underlay: Ensure joints in underlay do not coincide with carpet joints. Do not carry underlay over carpet grippers or edge strips.
 4. Partition layout: Confirm that permanent partitions have been installed before starting carpet laying.
- D. Fixing underfelt:
 1. To timber floors: Secure underfelt with staples at 100mm centres at edges and joints, in parallel lines 600mm apart.
 2. To concrete floors: Glue continuously at edges and joints with a 100mm wide strip to each piece, and at 600mm centres both ways with 150mm diameter patches.
- E. Seaming methods:
 1. Woven carpet: Machine or hand sew. Do not provide glued taped seams.
 2. Tufted carpet: Seam with hot melt adhesive tape.
- F. Carpet installation

1. Gripper system: To AS 2455.1 clause 3.5.
2. Direct stick system: To AS 2455.1 clause 3.6.
3. Double bond system: To AS 2455.1 clause 3.7.
4. Pre-applied underlay adhesive system: To AS 2455.1 clause 3.8.
5. Hook and loop system: To AS 2455.1 clause 3.9.

G. Cutting laid carpet:

1. Method: Where penetrations through laid carpet are necessary for electrical, telephone or other outlets, cut the carpet either by cross cutting or by cutting rectangular or circular openings.
2. Cutting holes in concrete floors: Protect the carpet and remove concrete particles and dust on completion. Replace the cut carpet over the opening without any signs of fraying or other damage, and fix with a peel-up adhesive, or resew.

3.8 Laying Rugs

- A. Standard: To AS 2455.1.
- B. Setting out:
 1. Joints in underlay: Ensure joints in underlay do not coincide with carpet joints. Do not carry underlay over carpet grippers or edge strips.
- C. Fixing underfelt:
 1. To timber floors: Secure underfelt with staples at 100mm centres at edges and joints, in parallel lines 600mm apart.
 2. To concrete floors: Glue continuously at edges and joints with a 100mm wide strip to each piece, and at 600mm centres both ways with 150mm diameter patches.
- D. Install frames to inset rugs to finish flush with surrounding floor finishes.

3.9 Seams

- A. Accurately match patterns at seams.

3.10 Completion

- A. Prior to Practical Completion, replace all damaged and defective work including that damaged by the work of other trades and where instructed by the Superintendent.
- B. At Practical Completion provide evidence that carpets and adhesives used in the Works are within the TVOC limits specified and undertake audits as necessary to ensure that specified products have been used.
- C. Maintenance manuals:
 1. Submit a maintenance manual containing the technical specification plus the manufacturer's recommendations for care and maintenance of each type of carpet installed in the Works. Include the names and addresses of the suppliers and manufacturers of each.
 2. Standard: To AS/NZS 3733.
- D. Spares:
 1. Supply spare matching materials of each type, colour and design of carpet from the same batch for future replacement purposes.
 2. Quantities:
 - a) Broadloom carpet: Full or part rolls of each type equal to 2% of the total quantity installed in the works. If different dye batches of carpet have been used in the buildings, spares of each batch must be provided.
 3. Offcuts: Retain carpet offcuts exceeding 0.5m² in area and 450mm in both length and width.
 4. Offcuts shall be additional to the full or part roll spares nominated above.
 5. Label spare and offcut material appropriately, including the location of the laid area corresponding to each batch. Securely and separately package each batch in a suitable wrapping.
 6. Storage locations: Deliver wrapped and labelled spares to a nominated storage location on Site as directed by the Superintendent.

E. Cleaning:

1. Final cleaning: When the installation is complete, clean the carpet as necessary to remove extraneous matter, marks and soiling and to lift the pile where appropriate.
2. Protection: Leave finished work under the Contract undamaged and adequately protected until Practical Completion.

SECTION END

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SECTION 0671 -- PAINTING/ CLEAR FINISHING**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Internal opaque coatings.
 2. External opaque coatings.
 3. Steel protective coatings.
 4. Powder coating.
 5. Sealers/ coatings.
 6. Line marking paint.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 300mm x 300mm sample of each paint type and colour on a representative substrate.
 2. 300mm x 300mm sample of sealer on the specified substrate.

1.4 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. The first 9m² of each paint system on each type of substrate as applicable through the Works, in a location as agreed with the Superintendent.
 2. The dry film thickness (DFT) of each benchmark shall be measured and accepted as meeting the required DFT as specified or as recommended by the manufacturer.

1.5 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.6 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days notice shall be given):
1. Coating stages:
 - a) Completion of surface preparation.
 - b) After application of primer, sealer and/ or undercoats, where applicable.
 - c) After application of final top coat.

1.7 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.8 Testing

- A. To AS 1580.0
- B. Provide technical information/ test certificates to demonstrate that materials meet the requirements of the Specification.
- C. Testing and provision of data shall not relieve the Head Contractor of his responsibilities regarding the performance requirements, service life and warranties provided.
- D. Undertake random ultrasound testing of paint finishes to ensure that the minimum specified dry film thicknesses are being achieved throughout the Works. Results shall be tabulated and supplied to the Superintendent on a fortnightly basis.
- E. Paints shall be tested by an accredited laboratory and in accordance with Good Environmental Choice Australia Standard No. GECA 23-2005 'Australian Voluntary Environmental Labelling Standard: Architectural and Protective Coatings'.

1.9 Slip Resistance and Slip Resistance Testing

- A. Painted non-slip areas shall be stable, safe and minimise the risk of slipping or tripping due to slippery surfaces or misaligned joints. Slip resistances shall comply with the requirements of HB 197 and HB 198.
- B. Provide slip resistance test certificates to confirm that slip resistance values are in accordance with AS 4663.
- C. Arrange and pay for on-site slip resistance testing of all types of painted floor surfaces in the finished work and in sufficient number to cater for all areas and conditions including ramps, steps entrances etc. Testing shall be undertaken by a registered testing laboratory. Tests shall include wet pendulum and dry floor friction testing in accordance with AS 4663.

2 PRODUCTS

2.1 Source of Materials

- A. Coating materials shall be obtained from one source.
- B. Use only the premium paint brands, products and systems specified. Where the Head Contractor wishes to use alternatives, these must be accepted in writing by the Superintendent prior to commencement.
- C. All materials shall be as recommended for the intended application. Provide a warranty from the manufacturer for the particular surface and the conditions of exposure.
- D. Paint systems are to conform with AS/NZS 2311 and the AS 3730 series as a minimum.

2.2 Painting Generally

- A. Australian Paint Approval Scheme (APAS) specifications: Provide paints and other materials which are scheduled in the APAS List of Approved Products as complying with cited APAS specifications.
- B. Refer to the Master Schedule and the Design Drawings for product selection and details.
- C. Dry Film Thickness (DFT) is to be confirmed for each system, individual coatings and application by the manufacturer in writing before commencing.
- D. Quality: Provide only the premium quality lines specified or alternatives only when specifically accepted in writing by the Superintendent. All products shall be delivered to, and kept on Site in their original containers.
- E. The preparation and application of the nominated paint systems shall comply with the manufacturer's current written instructions.
- F. A minimum of 3 coats of paint to be applied to all painted surfaces unless the material or the surface requires additional number of coats to achieve a uniform and even finish. Paintwork will be considered defective if blemishes or application defects such as wrinkling, paint runs, colour and gloss variation, paint sags, bare and starved painted areas, surface cracks, dust, irregular or coarse brush marks, sanding marks, uniformity of gloss, blistering and other irregularities in the surface are visible from a normal viewing position.

2.3 Total Volatile Organic Compounds (TVOC's) in Paints

- A. At least 95% of paints, adhesives and sealants applied on-site, including both exposed and concealed applications, are to be selected that comply with the TVOC limits as summarised below. The following items are excluded:
 1. Glazing film, tapes, and plumbing pipe cements;
 2. Products used in car parks;
 3. Paints, adhesives and sealants used off-site, for example applied to furniture items in a manufacturing site and later installed in the fitout; and
 4. Adhesives and mastics used for temporary formwork and other temporary installations.
- B. Total VOC values must reflect the final ready to use product, inclusive of tints (in the case of paints) and given in grams of VOC per litre (g/L) of ready to use product.

Table 1 - Maximum TVOC Content Limits for Paints, Adhesives and Sealants	
PRODUCT TYPE/ SUB-CATEGORY	MAX TVOC CONTENT (G/L OF READY-TOUSE PRODUCT)
General purpose adhesives	50
Interior wall and ceiling paint, all sheen levels	16

Interior wall and ceiling paint, all sheen levels (for the purposes of targeting innovation point for ultra-low VOC paints)	5
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

- C. All liquid-applied finishes used in an internal application and applied on Site shall meet the above TVOC limits. This shall include exterior grade and solvent based paints used in an interior application. Values shall reflect the ready-to-use product as mixed, inclusive of tints.
- D. The Head Contractor shall provide a register of all paints, sealers, varnishes used to confirm that the correct products have been used. The register shall include the volume of product used, TVOC level, date and location of purchase, area of application and any other relevant data as requested by the Superintendent.
- E. Obtain acceptance from the Superintendent before substituting any specified paint system.
- F. At the end of the project, undertake a final audit to ensure that the correct products have been used.
- G. Where available, details of third-party certification shall be provided.

2.4 Line Marking Paint

- A. Colour: White (blue for disabled symbols).
- B. Linemarking shall include international access symbol to disabled access car spaces, directional arrows, text, space numbering, and be in accordance with AS 1428.1.
- C. Line Marking for disabled access areas: All spaces and markings to be in accordance with AS/NZS 2890.6.

2.5 Powder Coating

- A. Refer to Section 0813.

2.6 Combinations

- A. General: Do not combine paints from different manufacturers in a paint system.
- B. Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the top coats.

2.7 Delivery

- A. Deliver paints to the Site in the manufacturer's labelled and unopened containers. Ensure containers of materials specified by an APAS specification code are labelled accordingly.

2.8 Tinting

- A. General: Provide products that are colour tinted only by the manufacturer or supplier.

2.9 Toxic Ingredients

- A. Comply with the requirements of the Poisons Standard - Schedule 1 (SUSMP) Part 2 Section 7.

2.10 Colour Selection

- A. From the standard colour chart of the nominated manufacturer.
- B. Standard: From the Australian colour range specified in AS 2700.
- C. From samples:
 1. For paint systems: By requiring the paint to be mixed or tinted to match samples provided.
 2. Consult the paint manufacturer to ensure that the colours selected are of satisfactory durability and opacity, and will comply with requirements in the specified number of coats.
 3. For clear timber finishes: By reference to coated samples.

2.11 Paint Conformance Table

- A. The following table will be read in conjunction with AS/NZS 2311 and the AS 3730 series Australian Standards for paint type conformance as a minimum.

<i>Table 2 - Paint Type Conformance Table</i>		
Full gloss solvent-borne: exterior	B5	AS 3730.6 and AS/NZS 3750.22
Full gloss solvent-borne: interior	B5	AS 3730.6
Flat latex: exterior	B6	AS 3730.7
Flat latex: interior	B6	AS 3730.1
Low gloss latex: exterior	B7	AS 3730.8
Low gloss latex: interior	B7	AS 3730.3
Semi gloss latex: exterior	B8	AS 3730.9
Semi gloss latex: interior	B8	AS 3730.2
Gloss latex: exterior	B9	AS 3730.10
Gloss latex: interior	B9	AS 3730.12
Wood primer, solvent-borne	B10	AS 3730.13
Wood primer, latex	B10A	AS 3730.17
Metal primer for steel, lead and chromate free	B11	AS 3730.21 AND AS/NZS 3750.19
Metal primer, latex	B11A	AS 3730.15
Metal primer for metallic-coated surfaces solvent-borne	B12	AS 3730.21
Metal primer for metallic-coated surfaces, latex	B12A	AS 3730.15
Two-pack etch primer for metals, chromate free	B13	AS/NZS 3750.17
Zinc-rich organic binder/primer for steel	B14	AS/NZS 3750.9
Concrete and masonry sealer	B15	AS 3730.22
Undercoat, solvent-borne	B17	AS 3730.14
Undercoat, latex: exterior	B17A	AS 3730.18
Undercoat, latex: interior	B17A	AS 3730.18
Furniture varnish, one-pack	B19	AS 3730.25
Two-pack clear gloss floor finish	B20	AS 3730.27
Exterior latex stain, opaque	B22	AS 3730.16
Exterior stain, lightly pigmented	B23	AS 3730.28
One-pack paving paint for concrete	B24	AS 3730.29
Two-pack epoxy enamel	B29	AS 3750.10
Two-pack high build epoxy	B29	AS/NZS 3750.4
Texture finish latex coating for masonry and concrete: exterior	B38	AS/NZS 4548 Parts 1 to 4
Texture finish latex coating for masonry and concrete: interior	B38	AS/NZS 4548 Parts 1 to 4
Full gloss polyurethane (2-pack) for steel	B44	AS/NZS 3750.6

3 EXECUTION

3.1 Coating Generally

- A. Application: In accordance with all relevant sections of AS/NZS 2311.
- B. Conditions: Maintain suitable temperature, humidity and air quality during application and drying.
- C. Surfaces shall be clean and dry at the time of application.
- D. Thinning and intermixing or additives of coatings is not permitted unless recommended by the manufacturer.
- E. Priming coats shall be of adequate thickness and shall suit the surface porosity. Apply as soon as possible on the same day that preparation is completed.
- F. Finish:
 - 1. Even, smooth and of uniform colour. Free from brush marks, sags, runs and other defects.
 - 2. Paint will be consistent in colour, gloss level, texture and dry film thickness.
 - 3. Cut in neatly.
 - 4. In all cases where paint is spray applied, the surface shall be back-rolled to the acceptance of the Superintendent.

3.2 Compatibility

- A. Where surfaces have been treated with preservatives or fire retardants, the later coating materials shall be compatible with the treatment and not inhibit its performance.
- B. All steelwork shall have received corrosion protection treatment. Coatings are to be compatible and are to maintain the integrity of the protective system.

3.3 Structure

- A. The concrete structure may have inherent cracks measuring up to 0.3mm in width, due to the loading of the structure. Decoration and preparation of the concrete surfaces shall therefore not take place until the structure and roof are complete. Fill the cracks within the structure as stated below.

3.4 Preparation

- A. When removing or partially removing coatings, the methods used shall not damage the substrate or adjacent surfaces, or adversely affect subsequent coatings.
- B. Damaged areas of plasterboard/ dry lining shall be made good before commencing new coating finishes.
- C. Materials used in preparation shall be of the types recommended by their manufacturers and by the coating manufacturer for the situation and surfaces being prepared.
- D. Surfaces shall be fully rubbed down and prepared. Touch up the primer and corrosion protection coats of any steelwork after removing, or partially removing, existing coatings. The methods used shall not damage the substrate or adjacent surfaces, or adversely affect subsequent coatings. The preparatory coatings used shall be of the types recommended by the coating manufacturer for the situation and surfaces being prepared to receive new finishes.
- E. Apply stoppers/ fillers after priming and use water-based stoppers/ fillers before priming, unless otherwise recommended in writing by the manufacturer. Water based stoppers/ fillers shall be patched after priming.
- F. Where doors are delivered to Site in a finished condition, any necessary protection shall be provided to the doors when applying coatings to the frames and the like, allowing sufficient drying times to coatings to ensure that the doors are not marked in any way with the coating material.
 - 1. External door frames, pre-primed or not, apply the primer coat to all sides, including the reverse side, prior to installation.
- G. Timing/ making good:
 - 1. Allow an interval of at least the period recommended in writing by the manufacturer between successive coats of paint.
 - 2. Make good all unsatisfactory paintwork with additional coats of material.

3.5 Suitability of Surface

- A. Application of coatings shall not occur until the surfaces and conditions within any given area to receive the specified coatings are acceptable.
- B. The Head Contractor shall inspect surfaces to be painted prior to commencement and shall notify the Superintendent in writing if their condition is defective or unsuitable for work to proceed.

- C. The Contractor's commencement of work shall deem the surface as being acceptable.

3.6 Inspection for Protective Coating Work

- A. Together with the applicator, where Site coats are to be applied, alert the paint manufacturer seven days prior to the start of the application programme and permit the paint manufacturer to inspect the work in progress and prepare inspection reports in accordance with the standard conditions of Contract. The paint manufacturer shall forward a copy of any inspection report direct to the Superintendent. Technical support from the paint manufacturer does not relieve the Head Contractor of his contractual responsibility to ensure that the coatings are applied in accordance with the Specification. Where the paint manufacturer does not have an inspection/quality control support system, employ an independent testing authority to verify compliance of the coating systems with the Specification.

3.7 General Requirements for Protective Coating Work

- A. Surface preparation and coating: To the recommendations of AS/NZS 2312.1.
- B. When removing or partially removing coatings, the methods used shall not damage the substrate or adjacent surfaces, or adversely affect subsequent coatings.
- C. Materials used in preparation shall be of the types recommended by their manufacturers and by the coating manufacturer for the situation and surfaces being prepared.
- D. Surfaces shall be fully rubbed down and prepared. The primer and corrosion protection coats of any steelwork shall be touched up after removing, or partially removing, existing coatings. The methods used shall not damage the substrate or adjacent surfaces, or adversely affect subsequent coatings. The preparatory coatings used shall be of the types recommended by the coating manufacturer for the situation and surfaces being prepared to receive new finishes.
- E. Oil based stoppers/ fillers shall be applied after priming; water based stoppers/ fillers shall be used before priming unless otherwise recommended in writing by the manufacturer. Water based stoppers/ fillers shall be patched after priming.
- F. There shall be an interval of at least the periods recommended in writing by the manufacturer between successive coats of paint.
- G. Application of coatings shall not occur until the surfaces and conditions within any given area to receive the specified coatings are acceptable.

3.8 Blast Cleaning Steel

- A. Blast cleaning will be in accordance with AS 1627.4.
- B. Oil and grease shall be removed by washing with white spirit or steam.
- C. Steel shall be blast cleaned in dry atmospheric conditions using an abrasive of suitable type and size, free from contamination by fire, moisture and oil, removing any existing coatings in the process.
- D. Abrasive residues shall be removed.
- E. Prime surfaces as soon as possible after blast cleaning, and in any case within four hours.

3.9 Bristle Blast

- A. Remove all surface contamination such as oil, grease or dirt by washing with an alkaline detergent and rinse with fresh potable water. Repeat until the surface is clean.
- B. Remove any loose or flaking coating back to a hard edge by MBX® BRISTLE BLASTER® or similar appropriate power tool (not a grinder). Feather back all edges to remove ridges.
- C. Abrade the remaining surfaces to provide a suitable key for the new coating.
- D. Ensure that all remaining coatings are tightly adhered to the substrate by crosshatch adhesion test. If existing coating fails adhesion test, it must be removed.

3.10 Pre-Primed Steel

- A. Defective primer, corrosion and loose scale: Abrade back to bare metal.
- B. Bare areas: Reprime.

3.11 Galvanised, Sherardised and Electroplated Steel

- A. Pre-treatment: Apply one of the following (in accordance with the manufacturer's written instructions):
1. T-Wash/ mordant solution to blacken whole surface.
 2. Etching primer recommended by coating system manufacturer.

3.12 Uncoated Steel - Manual Cleaning

-
- A. Remove oil and grease.
 - B. Abrade corrosion, loose scale, welding slag and spatter to remove.
 - C. Treat residual rust with a proprietary removal solution.
 - D. Apply primer as soon as possible.
- 3.13 Workshop Coating of Concealed Joinery Surfaces**
- A. General: Apply coatings to all surfaces of components.
- 3.14 Staining Timber**
- A. Primer: Apply if recommended by stain manufacturer.
 - B. Stain: Apply in flowing coats. Brush out excess stain before set. Produce uniform depth of colour.
- 3.15 Varnishing Timber**
- A. First coat: Thin with white spirit. Brush well in and lay off avoiding serration.
 - B. Subsequent coats: Rub down lightly between coats along the grain.
- 3.16 Water Repellent**
- A. Application: Liberally flood surface, giving complete and even coverage.
- 3.17 Organic Growths**
- A. Loose growths and infected coatings: Scrape off and remove.
 - B. Treatment biocide: Apply appropriate solution to growth areas and surrounding surfaces.
 - C. Dead growth: Scrape off and remove.
 - D. Residual effect biocide: Apply appropriate solution to prevent growths from returning.
 - E. Biocides: Types listed in current Safe Work Australia guides.
- 3.18 Priming**
- A. Joinery:
 1. Before priming preservative treated timber, retreat any cut surfaces.
 2. All end grain shall be liberally coated allowing it to soak in before recoating it.
 3. Concealed joinery surfaces: Where one or more additional coats are specified to be applied in the factory, they shall be applied to all surfaces, including those that are concealed when incorporated into the building.
 - B. Primary concrete surface preparation:
 1. Remove mould oil by washing the surface with a detergent solution, rinsing with clean water and allowing to dry. Sand down to remove any projections or fins.
 2. Remove bond breakers or release agents using an appropriate wash process.
 3. Fill holes, cracks, blemishes and formwork marks following the coating manufacturer's recommended instructions, sanding down to achieve a smooth surface. Inspect prepared surfaces prior to the application of the finish coat.
 4. Remove all visible signs of organic growth by using high-pressure water jet equipment.
 5. All surfaces shall be clean and suitably dry. eg with a moisture content less than 5% and free from anything that may interfere with the adhesion of the materials to be applied.
 6. Remove loose or flaking material using high-pressure water jet equipment, grit blasting, needle gunning or burning off.
- 3.19 Finishes to Building Services Generally**
- A. If exposed to view (including in plant rooms), paint new building services and equipment. Surfaces painted or finished off-site.
 - B. Exceptions: Do not paint chromium or nickel plating, anodised aluminium, GRP, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Surfaces with finishes applied off-site need not be re-painted on-site provided the corrosion resistance of the finish is not less than that of the respective finish documented.
 - C. Conform to the recommendations of AS/NZS 2311 Sections 3, 6 and 7 or AS/NZS 2312.1 Sections 6, 7 and 8, as applicable.
- 3.20 Finishes**

-
- A. Once applied the finish shall not slump, flow, crack, flake, split, sag, pit, bubble, blister, float, effloresce, craze, shrink, break, wrinkle, crinkle, yellow, chalk, fade, discolour, powder, stain, bleed or lose its finish or gloss in any way. Take full account of the extremes of all atmospheric and environmental conditions.
 - B. All surface finishes shall be dry to handle.
 - C. Unless otherwise specified, do not over thin paint sealant so as to change in any way its surface colour, gloss, opacity or finish. Add nothing to the paint to change in any way its consistency or constitution.
 - D. Allow no variation in final surface finish.
 - E. All paints shall be anti-mould and stable in humid conditions and suitable for hot climate exposure.

3.21 Protection of Adjacent Surfaces

- A. Provide adequate protection to adjacent surfaces that are completely pre-finished or have a fair-faced natural finish as specified, eg stainless steel/ mild steel. Splashes resulting from work carried out on Site shall be cleared from floors, walls, hardware, glass and all other surfaces. On completing the work under the Contract, chips, cracks, discoloration, etc, shall be made good or replaced if it cannot be adequately cleaned or repaired as directed by the Superintendent. Ensure that adjacent elements are removed and refixed where appropriate, prior to and after applying coatings.

3.22 Completion

- A. Maintenance manual: Submit the paint manufacturer's published recommendations for maintenance.
- B. Spares: Provide a minimum of 2% of the quantity of each paint type and colour used on the project, in clearly marked tins.

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SECTION 0681 -- FIRE STOPPING

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Service penetration fire stopping systems.
 2. Control joint fire stopping systems.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. Appropriately sized samples of each type of fire stopping system.
 2. One of each type of fire collar.
 3. One fire pillow.

1.4 Sample Panels

- A. In accordance with Section 0171, provide the following sample panels:
1. Supply a sample panel of each fire-stopping assembly, on representative substrates. If built into the works, identify by marking it as a control sample.
 2. Size: 500mm run for junction seals and 500mm x 500mm area for penetration seals.

1.5 Mock-Ups

- A. Not required.

1.6 Prototypes

- A. Not required.

1.7 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171:
1. First installed of each specified type in locations to be agreed.

1.8 Witness Points

- A. Arrange to inspect the following with the Superintendent, together with the accredited third party testing representative (a minimum of two working days notice shall be given):
1. Service penetrations completed and ready for fire-stopping.
 2. Finished fire-stopping, before being concealed.

1.9 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.10 Warranties

- A. Refer to Annexure part K of the contract for required warranty periods.

1.11 Testing

- A. Submit type test certificates for each combination of fire-stopping system, application, type of service, substrate, penetration orientation and drawings of tested details. Include for:
1. Service penetration fire-stopping systems: Fire resistance tested to AS 1530.4.
 2. Conformance with AS 4072.1, NCC Clause C3.15 and Specification C3.15.
 3. Fire stop mortars: Resistance to explosive spalling to AS 1774.36.
 4. Control joint fire-stopping systems: Fire resistance tested to AS 1530.4.

- B. Provide full test reports from an independent NATA accredited testing laboratory demonstrating that the proposed fire stopping systems have been tested using an appropriate testing prototype and that the systems will provide an FRL (fire resistance level) equal to the element within which they are being installed.

1.12 Certification

- A. Submit evidence of conformance with the recommendations of AS 4072.1 Appendix B.
- B. Submit a completed certification list and schedule for installed fire-stopped penetrations and control joints.
 1. List form: To AS 4072.1 Figure B1.
 2. Schedule form: To AS 4072.1 Figure B2.

2 PRODUCTS

2.1 Generally

- A. Ensure that materials used have not exceeded their shelf life.
- B. Materials shall be free from asbestos and/ or lead and shall not require the use of toxic solvents. Furthermore, they shall not produce toxic by-products in the event of fire.
- C. Fire stopping of penetrations shall be according to the requirements of NCC clause C3.15.
- D. Construction joint fire protection to comply with NCC C3.16 and AS 1530.4.
- E. Fire resistance - Fire resistance and stability - Fire hazard properties: To NCC C1.10.
- F. Control joint fire-stopping systems shall comply with AS 4072.1.
- G. Fire and smoke control in buildings to comply with AS 1668.1.

2.2 Fire Stop Mortar

- A. Material: Hydraulic cement compound specially formulated for fire stopping of service penetrations and openings, requiring on-Site addition of water.
- B. Used for backfilling around cable and pipe penetrations in wall and floor openings where a specific FRL has to be maintained.

2.3 Formulated Compound of Incombustible Fibres

- A. Material: Formulated compound mixed with mineral fibres. Non-shrink, moisture resistant. Insoluble in water after setting.

2.4 Fibre Stuffing

- A. Material: Mineral fibre stuffing insulation. Dry and free of other contaminants.
- B. Standard: AS/NZS 4859.1 Section 7.

2.5 Fire Insulating Board

- A. Material: A low density, monolithic (non laminar) insulating board containing vermiculite and calcium silicate reinforced with cellulose fibres autoclave cured to provide high dimensional stability.

2.6 Fire Stop Sealant - Minor Joint Movement Capabilities

- A. Material: Acrylic (water-based) gun grade mastic with limited ($\pm 5\%$) joint movement capability for sealing internal joints and wall penetrations subject to minor movement.

2.7 Fire Stop Sealant - High Joint Movement Capabilities

- A. Material: One part fire rated low modulus polyurethane sealant with high joint movement ($\pm 50\%$) capability.
- B. Used for jointing of concrete, precast panels, block work and drywall systems as well as sealing around electrical cable and pipe penetrations.

2.8 Fire Stop Foams

- A. Material: Single component compound of reactive foam ingredients. Non-shrink, moisture resistant. Insoluble in water after setting.

2.9 Fire Spray

- A. Material: Non-combustible insulation material developed for spray coating applications to elements of building structure requiring fire-resistance protection.
- B. Standard: To EN 13055.

2.10 Fire Stop Putty

- A. Material: An intumescent paste unaffected by water and moisture and is designed to expand under fire conditions to fill any gaps around services that penetrate fire barriers.
- B. Used around combustible services and insulation that pass through fire rated walls and floors.

2.11 Fire Stop Collars

- A. Material: Mechanical device with incombustible intumescent fillers covered with sheet steel jacket. Airtight and watertight.
- B. Used where plastic pipes and cables penetrate fire rated elements. The collar prevents the passage of smoke and fire through gaps otherwise caused by the collapse and/ or melting of combustible services in the event of a fire.

2.12 Fire Stop Pillows

- A. Material: Fire retardant fabric bags containing high temperature granulated rockwool.

2.13 Identification

- A. All fire proofing materials/ systems, where possible, shall be provided with a label that identifies:
 - 1. The material supplier.
 - 2. The date of installation.
 - 3. The Head Contractor's details.

3 EXECUTION

3.1 Generally

- A. Any imperfections of fit between building elements that are required to prevent the passage of fire and/ or smoke shall be completely sealed.
- B. Install work under the Contract in accordance with the manufacturer's instructions.

3.2 Fire Stops

- A. Schedule the installation of fire stopping after completion of work under the Contract that involves penetration items, but prior to covering, concealing or eliminating access openings.
- B. Install fire stops in accordance with the manufacturer's instructions. Securely attach device frames to the supporting construction. Assemble component parts to ensure proper contact and sealing of all gaps and openings around penetrating items.
- C. Maintain required separation of penetrating items from edges of openings and from each other.
- D. Install fire stop material in a manner, and to the depth required, to achieve a rating of not less than the fire resistance of the element being penetrated.
- E. Install fire stop material with sufficient pressure to maintain uniform density and texture, and to ensure proper filling and sealing of openings.
- F. Tool or trowel exposed surfaces to a smooth finish, flush with surrounding surfaces unless otherwise specified.
- G. Inspect and confirm that surfaces and conditions of openings have no defects that could interfere with the installation of fire stopping materials.
- H. The material shall not shrink, slump or otherwise consolidate when installed or any time thereafter.
- I. Ensure that the fire protection material does not become damp or wet prior to, during, or after installation in a way that may be detrimental to its performance. Any such material affected by water or dampness must be removed and replaced.
- J. Cutting of mineral fibre shall be in accordance with the manufacturer's recommendations and shall satisfy all health and safety requirements. This shall be strictly enforced.

3.3 Fire Sealants and Putties

- A. Apply fire sealants and/ or putties in accordance with the manufacturer's recommendations.
- B. Seal around all services where they pass through partitions and fire resistant elements of structure.
- C. Work under the Contract shall be carried out to the manufacturer's recommendations.
- D. Where pipe sleeves are used, the space between the sleeve and the service shall be filled with a proprietary product suitable for the purpose. Completely fill the space leaving no gaps and finish neatly.

- E. The manufacturer shall provide certification of suitability of the material used for the particular installation.

3.4 Floor Penetrations

- A. Service pipes and cable trays shall be sealed all round where they pass through floors, with an accepted material made for the purpose and tested.
- B. In load bearing floors, completely fill the space to a minimum depth of 100mm introducing mild steel support brackets and mesh to BS 8110: Part 2. Leave no gaps and finish neatly. The manufacturer shall provide certification of suitability of all materials used.
- C. In non load bearing floors, the space shall be completely filled leaving no gaps. Finish neatly.
- D. The manufacturer shall provide certification of suitability of all materials used.

3.5 Wall Penetrations

- A. Service pipes and cable trays that pass through walls shall be sealed all round with an accepted material made for the purpose.
- B. The space shall be completely filled leaving no gaps and finished neatly. The manufacturer shall provide certification of suitability of all materials used.

3.6 Sealing Pipe Services

- A. Pipe Sleeves:
 - 1. Pipe sleeves shall be installed where required. Sleeves shall extend for the full thickness of the fire resisting element. Sleeves shall be accurately positioned to give a minimum clearance around the service of 20mm or the diameter of the service, whichever is the smaller.
 - 2. Sleeves shall be made for the purpose, suit the pipe material and pipe size. Install following manufacturer's recommendations.
 - 3. Sleeves, whether built in or installed in preformed holes, shall be bedded into solid material.
 - 4. Annular space between service and sleeve shall be sealed with fire stop compound.
 - 5. Where exposed to view, bedding and sealing shall be finished neatly and to the acceptance of the Superintendent.
- B. Sealing around smaller pipes:
 - 1. Fire stop sealant or putty shall be used following manufacturer's recommendations.
 - 2. Where exposed to view, bedding and sealing shall be finished neatly and to the acceptance of the Superintendent.

3.7 Remedial Works

- A. Identify damaged or re-entered seals requiring repair or modification.
- B. If penetrating items are to be added, remove enough material to permit penetration by new elements, being careful not to damage the balance of the seal.
- C. Repair holes, cracks and damage in accordance with manufacturer's instructions to ensure a complete seal.
- D. The only materials that can be used for repair are those accepted by the manufacturer of the original seal.
- E. Replace insulating materials that have become displaced.
- F. Make good:
 - 1. To damaged fireproofing caused by other trades before final inspection of work under the Contract and prior to enclosure by other components.
 - 2. Areas where the average thickness of the material is less than the minimum indicated in the Detailed Design and at locations where the individual thickness is deficient by more than 25% of the required thickness.
 - 3. Areas where inspection cuts and tests have been made.

3.8 Labelling

- A. To the recommendations of AS 4072.1 Appendix B.
- B. Additional marking: Include the following text in addition to the above: CAUTION – FIRE BARRIER MUST REMAIN SEALED.

-
- C. Location: Attach labels to cables, conduits, pipes and ducts on both sides of and close to, the control joint or penetration. On large items, provide multiple labels.

3.9 Cleaning

- A. On completion remove overspray and fall out of materials from adjacent surfaces and clean exposed surfaces to remove evidence of soiling.

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SECTION 0691 -- LIFT FIT-OUT (ARCHITECTURAL REQUIREMENTS)**1 GENERAL****1.1 Related Documents**

- A. This work section shall be read in conjunction with Section 0171, other related sections of the Specification, the Vertical Transportation Engineer's documents and the Preliminaries.

1.2 Outline of Work

- A. This work section of the Specification, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. All internal finishes to the lift car including wall, floor and ceiling linings.
 2. Lift car door panel and frame finishes.
 3. Handrails.
 4. Lighting.
 5. Lift call buttons, indicators, etc.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. A 300mm x 300mm sample of each type of finish as specified.
 2. Call buttons and surrounds.

1.4 Mock-Ups

- A. Not required.

1.5 Prototypes

- A. Provide a prototype in accordance with Section 0171 of the Specification as follows:
1. Complete lift fit-out, including all specified finishes. Mechanical and electrical installation not required.

1.6 Quality Benchmarks

- A. Provide the following quality benchmarks in accordance with Section 0171 of the Specification:
1. The submitted Contract samples, when accepted by the Superintendent, will form the benchmark standard that is required to be achieved with regard to all finishes.

1.7 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.8 Shop Drawings

- A. In addition to requirements detailed in the Vertical Transportation Drawings and Specification submit Shop Drawings showing the following information:
1. All interior finishes and fixing method to the lift car structure.
 2. Control panels, lift indicators and all other system details.

1.9 Test Requirements

- A. Provide evidence/ testing data and reports to demonstrate that all materials/ products proposed have been tested to meet the standards specified herein.
- B. Where testing has not previously been carried out on products/ materials proposed, arrange for tests to be carried out to comply with the requirements of the Specification to the satisfaction of the Superintendent.
- C. The provision of testing data or the carrying out of tests does not relieve the Head Contractor of his responsibilities regarding the performance requirements, durability of service life requirements, etc.
- D. Submit certificates relating to the materials used in work under the Contract as confirmation of tests carried out in accordance with the relevant Australian standards, and/ or other national standards, as appropriate.

1.10 General Requirements

- A. Lifts shall be in accordance with the set of AS 1735 standards.

1.11 Staff Training

- A. The Head Contractor shall provide two training sessions in hand winding of lifts to a minimum of six of the Principal's staff. The training shall be conducted by trainers approved by the lift manufacturer and shall be in accordance with the Principal's specific procedures.

1.12 Slip Resistance of Floor Surfaces

- A. The top surface shall have a suitable slip resistance.
- B. Slip resistance shall comply with AS/NZS 3661.2 , AS 4586 and AS 4663.

1.13 Warranty

- A. Refer to Annexure part K of the contract for required warranty periods.

2 PRODUCTS**2.1 Lift Car Floor Finish**

- A. The floor finish shall be as nominated in the Finishes Schedule and the Design Drawings.
- B. Determine the adequate thickness of finishes to meet the performance requirements.

2.2 Lift Car Wall Finishes

- A. The wall finishes shall be as nominated in the Finishes Schedule and the Design Drawings.
- B. The setting out of the wall panels shall be as indicated on the Design Drawings and aligned with the floor joints and ceiling panels.
- C. Details of the wall panel construction and fixing are considered to be critical. All fixings shall be concealed.
- D. The Design Drawings indicate the material required for each lift type as follows.
- E. Determine the thickness of the panels and the requirements for supporting members.

2.3 Lift Shaft Cladding

- A. Cladding to the lift shafts: Refer to the Design Drawings.

2.4 Lift Car Ceiling

- A. The ceiling shall be as nominated in the Finishes Schedule and the Design Drawings.
- B. Determine the thickness of the panels and the requirements for supporting members to ensure compliance with the Specification.

2.5 Lift Door Panels and Frames

- A. Lift door panels and frames to each floor level shall be as nominated in the Finishes Schedule and the Design Drawings.
- B. Determine the thickness of the panels and the requirements for supporting members.
- C. Layout and dimensions to doors, frames, architraves and fixed panels shall be generally as indicated on the Design Drawings.
- D. Doors shall be full height internally.

2.6 Handrails and Protection Rails

- A. The protection rails shall comprise buffer rails.
- B. The handrails/ protection rails shall be set out around the walls, as shown on the Design Drawings, at a nominal height of 900mm, unless nominated otherwise.
- C. Tubular handrails shall receive a flat end cap of stainless steel as shown on the Design Drawings.

2.7 Lift Car Displays

- A. The lift car floor indicator display panel comprises LED dot matrix, digital indicator of high quality stainless steel finish.
- B. All fixings shall be concealed.
- C. The indicator display shall be recessed into the walls and finished flush.

2.8 Lift Car Controls

- A. The lift car controls shall be located integrally within the lift fascia panel and access by persons with a disability to the call point in fascia panel is required.
- B. Provide for a fully collective lift car operation returning to a specific floor when not in use. For technical requirements, see the Services Engineer's Specification.

- C. The naming of floor levels shall be determined by the Superintendent.

2.9 Call Buttons

- A. Call buttons shall be to the lift manufacturer's standard range within a non-standard panel as shown on the Design Drawings.
- B. Car operating panels:
1. The car operating panel shall be stainless steel to match the panelling, suitably backed.
 2. The call buttons shall be located by a 2.5mm thick stainless steel surround ring.
 3. All fixings shall be concealed.
 4. Buttons shall comprise a full set of vandal-resisting illuminating push buttons of high quality stainless steel finish.
 5. The indication numbers and letters shall be raised tactile digits on buttons in Helvetica typeface, unless nominated otherwise.
- C. Landing call panel buttons:
1. The call buttons shall match those inside the lift cars.
 2. Buttons shall be fixed on to a circular stainless steel flush surround as indicated on the Design Drawings.
 3. Buttons shall illuminate to confirm call registration.
 4. Goods lift shall have send and call buttons and "gate open" buzzer.

2.10 Other Controls

- A. Lift car intercom speaker/ receiver shall be set in the control panel.
- B. Other controls shall include the following:
1. Alarm horn button.
 2. Door open button.
 3. Door close button.
 4. Key switch operated car override control engraved "car preference".
 5. Key operated fan switch.
 6. Provision for future fitting of security card reader control functions.

2.11 Light Fittings

- A. Light fittings shall comprise low voltage downlights. The light level inside the lift car shall meet code requirements. Emergency lights shall be provided as required by statutory codes and regulations. Refer to the Electrical Services and Vertical Transportation documents.
- B. Each lift shaft shall be provided with permanent lighting and socket outlet.

2.12 Ventilation

- A. Ventilation shall be provided at high and low level supplied via gaps between the walls, floor and ceiling panels, where shown on the Design Drawings. Natural ventilation/ an extractor fan shall be provided above the lift car ceiling.

2.13 Landing Level Indicator Displays

- A. Electronic digital landing position indicator, of high quality stainless steel mounted in a stainless steel faceplate with pre-announcing direction arrows and electronic arrival gongs at all floor levels.

2.14 Security Controls

- A. Provide security key control to prevent unauthorised use of the lifts.
- B. Lift or stations shall be controlled by card swipe system as follows:
1. Proximity Key Reader:
 - a) The security access system (SAS) reader shall be recess mounted on the lift panel with a stainless steel case sealed to IP 65.
 - b) The card reader shall be retrofit installed by others who shall be responsible for terminating all cable supplied for connection to SAS equipment.
 2. Lift call station interface: The reader supplied shall provide a volt-free contact to be used to wire in series to the lift call station buttons.

3. Anti-tamper requirements: The lift control panel shall be secured with secret fixings to prevent tampering to override the SAS control of the lift call buttons.

2.15 Glazed Lift Shafts and Cars

- A. Glazing to lift shafts and lift cars shall be constructed from laminated glass to meet the requirements of BS EN 81: Parts 1 and 2.

3 EXECUTION

3.1 Floors

- A. Floor shall have a flatness criterion of 3:1000 over any length (ie the permitted deviation from the true panels shall not be in excess of 3mm either way in 1000mm and shall be non-cumulative).

3.2 Walls

- A. Panels shall have a flatness criterion of 1:1000 over any length (ie the permitted deviation from the true panel shall not exceed 1mm either way in any 1000mm and shall be non-cumulative).
- B. The panels shall be resistant to impacts from known and specified loads.
- C. All external and internal angles shall be 90°.
- D. Set out the panels as detailed on the Design Drawings, with joints matching floor and ceiling panel layouts.
- E. All fixing of the panels shall be concealed.
- F. Any shadow gaps between panels shall be as shown on the Design Drawings. They shall not deviate by more than ± 1 mm. All shadow gaps shall be backed with stainless steel.

3.3 Ceilings

- A. The panels shall be set out as detailed on the Design Drawings, with joints matching floor and wall panel layouts.
- B. Fixing of the panels shall be concealed.
- C. Where panels are opening, the hinges shall be concealed.
- D. Any shadow gaps between panels shall be as shown on the Design Drawings. They shall not deviate by more than ± 1 mm.
- E. Panels shall have a flatness criterion of 1:1000.
- F. Panels shall be resistant to impacts from known and specified loads.

3.4 Landing Doors

- A. Panels shall have a flatness criterion of 1:1000 over any length (ie the permitted deviation from the true panel shall not exceed 1mm either way in any 1000mm and shall be non-cumulative).

3.5 Handrails

- A. Handrails shall be fabricated such that they may be assembled inside the lift car on Site, and can be removed for maintenance.
- B. Handrails shall run horizontally and have concealed fixings.

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SECTION 0742 -- BARRIERS

1 GENERAL

1.1 Related Documents

- A. This work section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Outline of Work

- A. This work section, when read in conjunction with the Design Drawings, provides particular requirements with respect to the following:
1. Gates.
 2. Car park boom gates and pay station.
 3. Wheel stops.
- B. Ensure that all interfaces are fully coordinated prior to commencement.

1.3 Contract Samples

- A. In accordance with Section 0171, provide Contract samples of the following:
1. 1000mm length of barrier of each type.
 2. Minimum 1000mm of full height gate.
 3. All fixings.

1.4 Mock-Ups

- A. A mock-up shall be provided in accordance with Section 0171 as follows:
1. Typical works interface with surrounding structure including all fixing details.

1.5 Prototypes

- A. Not required.

1.6 Quality Benchmarks

- A. The following quality benchmarks shall be provided in accordance with Section 0171:
1. First installed of each type in location to be agreed.

1.7 Witness Points

- A. Arrange to inspect the following with the Superintendent (a minimum of two working days' notice shall be given):
1. Boundary survey location if applicable.
 2. Setout before construction.
 3. Foundation conditions before placing concrete in footings.

1.8 Subcontractors

- A. Submit names and contact details of proposed suppliers and Subcontractors.

1.9 Test Requirements

- A. Supply evidence/ testing data and reports to the Superintendent to demonstrate that all materials/ products proposed have been tested to meet the standards specified herein.
- B. Where testing has not previously been carried out on products/ materials proposed, arrange for tests to be carried out to comply with the Specification to the satisfaction of the Superintendent.
- C. The provision of testing data or the carrying out of tests does not relieve the Head Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

1.10 Warranty

1.11 Refer to Annexure part K of the contract for required warranty periods.

2 PRODUCTS

2.1 Barriers Generally

- A. Refer to the Master Schedule and the Design Drawings for product selection and details.

2.2 Chain Wire Fence

- A. To AS 1725.
- B. Chain wire fence:
 - 1. Steel frame and chainwire fencing.
 - 2. Finish: Galvanised in accordance with Section 0814.
- C. Chain wire gates:
 - 1. Fully welded tubular steel frame with infill chainwire mesh double tied to the frame. Lockable.
 - 2. Finish: Galvanised in accordance with Section 0814.
- D. Refer to the Design Drawings for extent and locations.

2.3 Boom Gate

- A. Automatic folding arm metal boom gate with card reader.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Product code: As scheduled.
 - 2. Boom arm type: As scheduled.
- C. System Components:
 - 1. Housing: 2mm zinc plated sheet, unless detailed otherwise.
 - 2. Finish: White powder coat plus bright red reflective tape strips, unless nominated otherwise.
 - 3. Provide exit in road induction loop cut into the concrete or asphalt.
 - 4. Housing Plinth: Concrete plinth, to Structural Engineer's details.

2.4 Car Park Height Restriction Bar

- A. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Finish: White powder coat with black lettering, unless nominated otherwise.
- B. Installation: Suspended.

2.5 Rubber Wheel Stops

- A. Moulded, tough recycled rubber compound, finished with a highly visible hazard pattern.
- B. Manufacturer/ reference: Refer to the Master Schedule.
 - 1. Size: 1650mm (L) x 159mm (W) x 100mm (H), unless nominated otherwise.
 - 2. Colour: Black base black with yellow or blue chevrons, as nominated by the Superintendent.

2.6 Metalwork

- A. Material thicknesses shown on the Design Drawings shall be maintained within tolerances as specified in the relevant Australian standards for manufacture.
- B. All materials and components shall be durable and to the minimum standards set out in the Specification, together with the relevant Australian standards.
- C. For each material or component, the total quantity shall be obtained from the same supplier or manufacturer unless otherwise agreed with the Superintendent.
- D. All inaccessible steel shall be properly protected against corrosion.
- E. The quality of finish and corrosion protection shall be maintained until completion of work under the Contract.
- F. Steel tubes
 - 1. Posts, rails, stays and pickets: To AS/NZS 1163.
 - 2. Grade: C350L0.

2.7 Welding

- A. Surfaces to be joined shall be cleaned and fit using clamps and jigs where practicable. Tack welds shall only be used for temporary attachment.

- B. Joints with parent and filler metal shall be bonded with no inclusions, holes, porosity or cracks and weld spatter shall be prevented from falling on surfaces of materials that are self-finished and visible in the completed work under the Contract. All traces of flux residue, slag and weld spatter shall be removed.
- C. Brazing shall be carried out in accordance with AS/NZS 1167.
- D. Finishing welded/ brazed joints: Butt joints or fillets that are visible in the completed work shall be smooth and flush with adjacent surfaces.

2.8 Fixings

- A. Fixings shall be fit for their intended purpose.
- B. All bolts, screws, nuts and anchors shall be of adequate strength for their intended purpose and be manufactured from the specified grade of material. Refer to Section 0813.
- C. All necessary fixings shall be installed for the work under the Contract.
- D. All fixings shall conform to all statutory requirements in respect of strength and type.
- E. Adequate measures shall be taken to prevent bimetallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces.
- F. Direct contact between aluminium or aluminium alloys and treated timber shall be avoided, unless with the prior acceptance of the Superintendent.
- G. Visible fixings shall comprise round-headed bolts.
- H. Unless otherwise specified, the following basic requirements shall be adhered to:
 - 1. Rigidity: Only fixings that are suited to the likely stresses, movements and vibrations in use without allowing any wobble, creaks or deflection of any fixtures or fittings shall be used.
 - 2. Removability: Items that require accessibility or removal shall be fixed with bolts.

2.9 Fabrication Tolerances

- A. In addition to the general requirements of the Specification:
 - 1. Employ a high degree of accuracy in the fabrication of work under the Contract and support structures.
 - 2. Work under the Contract and support structures shall be manufactured to tolerances sufficient to achieve the installation tolerances specified.
 - 3. Provide a detailed list of tolerances to which the components shall be fabricated, within the requirements of the Specification and overall design requirements. All tolerances shall be submitted for review by the Superintendent. As a minimum, the statement of tolerances shall include the following:
 - a) Thicknesses of components.
 - b) Straightness/ verticality/ horizontality normal to plane.
 - c) Eccentricity tolerances.

2.10 Finishes

- A. Galvanised finished to be in accordance with Section 0814.
- B. Metal finishes generally to be in accordance with Section 0813.
- C. Minor scratches and blemishes shall be repairable with the application of the manufacturer's recommended product and system, matching the original finish for colour, texture and gloss. Repair coatings shall adhere to and match the original finish.
- D. All finishes shall be within the limits of the agreed samples and without irregularities or distortions.
- E. No fixings shall be visible unless shown on the Shop Drawings. Where fixings or stiffeners are visible, treat so that there is no discontinuity in the finished surface appearance.
- F. Samples of all finishes shall be reviewed by the Superintendent prior to commencement of production/ manufacture. Colour and finish uniformity shall be established on the basis of reference samples.

2.11 Joints

- A. Movement joints shall be as shown on the Design Drawings.
- B. Work under the Contract shall accommodate all movement of joints in a manner that does not compromise their integrity or appearance.

3 EXECUTION

3.1 General

- A. Work under the Contract shall be installed in the correct position, within tolerance, and in the correct relationship to the building structure.
- B. All fixing bolts shall be installed in accordance with the manufacturer's recommended procedures.
- C. Protection shall remain in place until all work under the Contract is complete. All protective measures shall be replaced following any Superintendent inspections.
- D. Acceptance shall be received from the Superintendent before drilling or cutting parts of the structure, other than where shown on the Shop Drawings.
- E. Isolating tape, plastic washers, or other suitable means to prevent bimetallic corrosion shall be provided between dissimilar metals, or between preservation treated timber and metal.
- F. Work under the Contract shall be square, regular to line, level and plane, with all junctions fitting to the stated tolerances.
- G. At the time of completion, the visual requirements of work under the Contract are such that, within any planning grid area, the allowable tolerances shall be equally distributed to ensure that:
 - 1. The barriers/ balustrades are vertical.
 - 2. The vertical joints are of equal size and at equal centres.
 - 3. The support mullions are vertical and at even centres.
 - 4. Supports for work under the Contract have straight lines and flat planes.
 - 5. The horizontal joints are of equal size and in line between adjacent panels.
 - 6. The gap between the panels and structure posts is constant.

3.2 Car Park Wheel Stops

- A. Fix into concrete floor slab with masonry anchors to positions as shown on the Design Drawings.

3.3 Damage to Finished Surfaces

- A. Touch up any minor damage, including on fastenings and fittings, using low melting point zinc alloy repair rods or powders made for this purpose or at least two coats of zinc-rich paint to AS/NZS 3750. Apply sufficient material to provide a zinc coating at least equal in thickness to the original layer.
- B. Touch up paintwork shall be according to the finishing manufacturer's recommendations, and shall equal the finished surface in terms of appearance and durability.

3.4 Bad Weather

- A. Do not cast foundations, lay units, place haunching or make joints if the temperature is below 3°C on a falling thermometer or 1°C on a rising thermometer. Foundations, bedding and haunching shall be adequately protected against rapid drying by sun and wind.

3.5 Installation Tolerances

- A. Work under the Contract shall be erected in proper alignment in relation to established lines and grids shown on the Design Drawings.
- B. Joints: The width of any joint shall not deviate from the nominal width by more than ± 1 mm. Any variation shall be equally distributed with no sudden changes.
- C. Work under the Contract shall be erected such that no joint is more than 1.5mm from a vertical plane. The cumulative slope between the same locations on any vertical plane shall not exceed 1 in 1000. The vertical plane of work under the Contract shall be within ± 1.5 mm of the theoretical position.
- D. Alignment: Adjacent elements of barriers/ balustrades shall not deviate from either their intended horizontal or vertical alignment by more than ± 2 mm.
- E. Squareness: Any diagonal length across the panel shall not deviate by more than the lesser of ± 3 mm or 0.075% of design dimension.
- F. Bow: The centre section of the element shall not bow by more than the lesser of 3mm or 0.075% of the length of the element measured from a straight line between the ends of the element.
- G. Straightness: Any surface of edge shall not deviate by more than ± 2 mm from a 2000mm straightedge placed against it in a direction parallel to the long axis of the element.

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- H. Flatness: Any surface shall not deviate by more than $\pm 2\text{mm}$ from a 2000mm straightedge placed against it in any direction.
 - I. Twist: No section of the element may be twisted by more than 1° from the section at either end of the element.

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SECTION 0811 -- ADHESIVES, SEALANTS AND FASTENERS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Performance Criteria

- A. Provide adhesives and sealants capable of transmitting imposed loads, sufficient to ensure the rigidity of the assembly, or integrity of the joint and which will not cause discoloration or deterioration of finished surfaces or materials.

1.3 Fire Resistance

- A. Where sealants occur in a location where fire resistance levels are required, use only those sealant types installed in such a way so the required fire resistance levels will be achieved when tested to AS 1530.
- B. Provide test results from an independent NATA accredited testing laboratory confirming that sealants have been adequately tested to meet the required fire resistance levels.
- C. Refer to the Design Drawings, this Specification and/ or the Fire Engineering Report for the required fire resistance levels.

2 PRODUCTS

2.1 Fixing Generally

- A. Fixings shall be of sufficient strength, appropriate to their location, and in such locations so as to ensure the performance of the elements being attached. The fixings shall be suitable and used solely for the purposes intended by the manufacturer in order to satisfy the requirements of the Specification.
- B. Unless otherwise specified, observe the following requirements:
1. Fixings shall be selected such that adequate protection against any corrosion likely to occur is provided for the service life specified.
 2. Use fixings that are suited to the likely stresses, movements and vibrations in use.
 3. Where fixings are visible they shall match or suit the items being fixed.
- C. Supply all necessary and appropriate fasteners, fixings, bearings, brackets, etc, necessary for the safe and proper installation, plus associated flashings and closures.
- D. All fixings shall conform to all statutory requirements in respect of strength and type.
- E. Take adequate measures to prevent bi-metallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces. To this end attention is drawn to publication PD 6484, Commentary on Corrosion at bi-metallic Contacts and its Alleviation.
- F. Generally, fixings within aluminium framing components shall be non visible, with the exception of capping pieces fixed to vertical mullions.

2.2 Total Volatile Organic Compounds (TVOC's) in Paints, adhesives and sealants

- A. At least 95% of paints, adhesives and sealants applied on-site, including both exposed and concealed applications, are to be selected that comply with the TVOC limits as summarised below. The following items are excluded:
1. Glazing film, tapes, and plumbing pipe cements;
 2. Products used in car parks;
 3. Paints, adhesives and sealants used off-site, for example applied to furniture items in a manufacturing site and later installed in the fitout; and
 4. Adhesives and mastics used for temporary formwork and other temporary installations.
- B. Total VOC values must reflect the final ready to use product, inclusive of tints (in the case of paints) and given in grams of VOC per litre (g/L) of ready to use product.

Table 1 - Maximum TVOC Content Limits for Paints, Adhesives and Sealants

PRODUCT TYPE/ SUB-CATEGORY	MAX TVOC CONTENT (G/L OF READY-TOUSE PRODUCT)

General purpose adhesives	50
Interior wall and ceiling paint, all sheen levels	16
Interior wall and ceiling paint, all sheen levels (for the purposes of targeting innovation point for ultra-low VOC paints)	5
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

2.3 Adhesives and Sealants

- A. Types and classes of sealants: To ISO 11600.
- B. Mastic adhesive: To AS 2329.
- C. Non-structural adhesive for timber: To AS 2754.3 (WITHDRAWN).
- D. Structural sealant (silicone): To ASTM C1184.
- E. Polymer emulsion adhesive for timber: To AS 2754.2, not inferior to Type 3 if required to be water resistant.
- F. Sealing compound (polyurethane, polysulphide, acrylic):
 - 1. Single component: To ASTM C920.
- G. Sealing compound (silicone):
 - 1. Single component: To TT S 001543.
- H. Where caulking is required to perimeters of, or penetrations in, acoustic-attenuated elements use only 100% polyurethane mastic.
- I. Where visible or exposed in finished work, sealants shall match the colour of the material(s) being joined or sealed, whether natural or coated, unless specified otherwise. Where the colours of the materials to be sealed vary, obtain the instructions of the Superintendent as to which colour is to be matched.
- J. Where sealant occurs in floors or paved areas, use only trafficable grade.
- K. Where sealant is nominated as anti-bacterial it shall achieve a rating of 0 for fungal growth when assessed in accordance with AS 1157.1.

2.4 Fasteners

- A. Masonry anchors: To be proprietary expansion or chemical types.
- B. Plain washers: To AS 1237.1.
 - 1. Provide washers to the heads and nuts of bolts, and the nuts of coach bolts.
- C. Plugs: To be proprietary purpose-made plastic.
- D. Powder-actuated fasteners: To AS/NZS 1873.4.
- E. Stainless steel fasteners: To ASTM A240/A240M.
- F. Metric screw threads for fasteners: AS 1275.
- G. Steel nails:
 - 1. To AS 2334.
 - 2. Length: At least 2.5 times the thickness of the member being secured, and at least 4 times the thickness if the member is plywood or building board less than 10mm thick.
 - 3. Do not use masonry nails unless accepted in advance by the Superintendent.
- H. Bolts:
 - 1. Unified hexagon bolts, screws and nuts: To AS/NZS 2465.

2. Fasteners in CCA treated timber: Epoxy coated or stainless steel.
 3. Coach bolts: To AS/NZS 1390.
 4. Hexagon bolts Grades A and B: To AS 1110.1.
 5. Hexagon bolts Grade C: To AS 1111.1.
- I. Screw fixings:
1. Coach screws: To AS/NZS 1393.
 2. Hexagon screws Grades A and B: To AS 1110.2.
 3. Hexagon screws: Grade C To AS 1111.2.
 4. Hexagon socket screws: To AS 1420 and AS/NZS 1421.
 5. Machine screws: To AS/NZS 1427.
 6. Self-drilling screws: To AS 3566.1 and DR AS/NZS 3566.2.
 7. Tapping screws:
 - a) Crossed recessed countersunk (flat - common head style): To AS/NZS 4407.
 - b) Crossed recessed pan: To AS/NZS 4406.
 - c) Crossed recessed raised countersunk (oval): To AS/NZS 4408.
 - d) Hexagon: To AS/NZS 4402.
 - e) Hexagon flange: To AS/NZS 4410.
 - f) Hexagon washer: To AS/NZS 4409.
 - g) Slotted countersunk (flat - common head style): To AS/NZS 4404.
 - h) Slotted pan: To AS/NZS 4403.
 - i) Slotted raised countersunk (oval - common head style): To AS/NZS 4405.
 8. Washers and screw cups shall be of the same material as the screw.
- J. Nuts:
1. Hexagon chamfered thin nuts Grades A and B: To AS 1112.4.
 2. Hexagon nuts Grade C: To AS 1112.3.
 3. Hexagon nuts Style 1 Grades A and B: To AS 1112.1.
 4. Hexagon nuts Style 2 Grades A and B: To AS 1112.2.
- K. Packings generally:
1. Provide suitable, tight packings at fixing points to take up tolerances and prevent distortion.
 2. Use non-compressible, rot-proof, non-corrodible materials positioned adjacent to fixing points.
 3. All packings shall be concealed in the finished work.
- L. Plugs generally:
1. Use proprietary types selected to suit the background, loads to be supported and conditions expected in use.
- M. Corrosion resistance:
1. Atmospheric corrosivity category: Refer to Section 0171.
 2. Steel products: Conform to Table 2 below or provide proprietary products with metallic and/or organic coatings of equivalent corrosion-resistance.

<i>Table 2 - Corrosion-Resistance Table</i>			
Atmospheric corrosivity category to AS 4312.	Threaded fasteners and anchors		Powder actuated fasteners
	Material	Minimum local metallic coating thickness (µm)	Material
C1 and C2	Electroplated zinc or Hot-dip galvanised	30	Stainless steel 316
C3	Hot-dip galvanised	50	Stainless steel 316

C4 and T	Stainless steel 316	-	Stainless steel 316
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N. Finishes:

1. Electroplating:
 - a) Metric thread: To AS 1897.
 - b) Imperial thread: To AS 4397.
2. Galvanising:
 - a) Threaded fasteners: To AS 1214.
 - b) Other fasteners: To AS/NZS 4680.
3. Galvanise mild steel fasteners if:
 - a) Exposed to weather or dampness.
 - b) Embedded in masonry.
 - c) In external timbers such as weatherboards or decking.
 - d) In contact with chemically treated timber other than CCA treated timber.

3 EXECUTION

3.1 Adhesives

- A. Surfaces to receive adhesive shall be sound, unfrozen and free from dust, grease and any other contamination likely to affect bond. Where necessary, clean surfaces using methods and materials recommended by the adhesive manufacturer.
- B. Surfaces shall be sufficiently smooth and even to suit the gap-filling and bonding characteristics of the adhesive. Prepare as necessary.
- C. Observe the manufacturer's recommendations and statutory requirements for storage and safe usage of adhesives.
- D. Adhesives shall not be used in unsuitable environmental conditions or beyond the manufacturers' recommended maximum shelf life or open-pot time periods.
- E. Adhesives shall be applied using recommended spreaders/ applicators to ensure correct coverage. Bring surfaces together within the recommended time period and apply pressure evenly over the full area of contact surfaces to ensure full bonding.
- F. Remove surplus adhesive using methods and materials recommended by the adhesive manufacturers and without damage to affected surfaces.

3.2 Sealants

- A. Only polyurethane based sealants shall be incorporated into the works unless prior acceptance has been obtained from the Superintendent.
- B. Fire-resistance rated sealant: Non-hardening sealant, compatible with the materials to be sealed and having a fire-resistance rating equal to that of the building element it seals.
- C. Acoustic sealant: Non-hardening sealant compatible with the materials to be sealed.

3.3 Caulking

- A. Install and tool in such that all gaps and openings are completely filled, caulking is continuous and no air gaps remain.

3.4 Fixings

- A. Carry out all necessary preparation work such as drilling, plugging, screwing, bolting, cutting for anchor bolts or sockets to be cast-in and for making good, including grouting-in of anchor bolts and fixings where necessary.
- B. The method of fixing shall not damage any item being fixed or any item receiving fixings.
- C. Site welding is not permitted unless accepted by the Superintendent.
- D. Fasteners shall be installed with a coordinated purpose-designed tooling system that incorporates a mechanical depth locator to ensure consistent depth setting and which facilitates perpendicular installation. The fastener manufacturer shall be capable of providing on-Site instruction in the use of the fastener installation tooling system.
- E. All fixings are to comply with the NCC requirements.

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- F. Submit QA/ QC procedures for inspection of fixings to the Superintendent. This shall include, but not be limited to, the checking of each fixing for correct torques, mortice depths, alignment, etc.
 - G. Ensure that no lock-up stresses are generated.

3.5 Screw Fixings

- A. All screws shall have clearance holes. Pilot holes of approximately half the diameter of the shank shall be provided for screws of 8 gauge or more and for all screws into hardwood.
- B. Before using brass, aluminium or other soft metal wood screws, pre-cut the thread with a matching steel wood screw.
- C. Do not hammer screws unless specifically designed to be hammered.
- D. Unless specified otherwise, countersink screw heads not less than 2mm below timber surfaces that will be visible in the completed work.

3.6 Packings Generally

- A. Ensure that packings do not intrude into zones that are to be filled with sealants.

3.7 Nail Fixings

- A. In joints, use no fewer than two nails of opposed skew unless specified otherwise.
- B. Drive nails in fully without splitting or crushing the material being fixed.
- C. Punch nail heads below surfaces that will be visible in the completed work.
- D. Nails shall be punched with a punch narrower than the nail head.

3.8 Plugs Generally

- A. Locate plugs accurately in correctly sized holes in accordance with the manufacturer's recommendations.

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SECTION 0812 -- GLASS AND COATINGS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS

2.1 Glazing Generally

- A. All glass types shall be cut to accurate sizes with clean cut, arrised edges. Damage, such as shark teeth, serration hackle, sharp flare, flake chips, rough chips, feathered edges, shells or other imperfections is not acceptable if detrimental to the visual and performance criteria of the glass. Glass delivered to Site shall be of the required size. No cutting or nipping of glass is allowed on Site. Variations in manufacture and performance of the glass shall not affect its colour or appearance, while all glass of the same type shall be visually consistent in appearance and colour at all times, having due regard for the direction and angle of view within manufacturing tolerances and the agreed range of samples or observations of previous installations of the same type of glass.
- B. All glass shall be of the type specified in the relevant AS/ NZS series range, or other international standard as specified, while the glazing shall be carried out in accordance with the manufacturer's recommendations.
- C. Unless otherwise specified and accepted in advance by the Superintendent, all sheet glass shall be manufactured by the float process.
- D. All glass panes within frames shall be installed to give the necessary edge cover and clearance to ensure a permanent and safe installation. Glass panes with damaged edges, including shelling and impact markings, shall not be fixed into the building under any circumstances.
- E. Provide a warranty from the glass manufacturer, which states that the glazing systems comply with the manufacturer's requirements.
- F. Distortion shall be kept to an absolute minimum and local defects (such as tong marks) that produce irregular reflections are not allowed. All glass shall be manufactured and processed in accordance with quality control procedures to AS/NZS ISO 9001 and be independently maintained.
- G. Stresses in glazing: Ensure that no glass or glazing combination develops stresses that may lead to damage of glass, glazing materials, components and/ or framing systems:
1. Conduct a thermal stress analysis and make due allowance for any thermally treated or edge working of annealed glass which may be required.
 2. Take into account shading stresses that might occur from adjacent components, including solar shading devices.
- H. The method of glazing adopted shall take into account the manufacturing tolerances in the glass, thus minimising the effects of any distortion.
- I. The glass shall be replaceable without undue difficulty. Provide a method statement showing how to remove damaged glass and any associated metal framework, and how to install new components.
- J. A highly uniform, low reflection and durable quality is required of any surface coated glass. The glass shall have no unacceptable hue and be capable of reflecting or refracting light without chromatic aberration.
- K. Provide glass with a suitable colour rendering index (Ra), both for the transmittance and the reflected spectrum and provide detailed reflected and transmitted spectrum data for the purpose of identifying/ anticipating the possible problems with colour reflection. Demonstrate this by providing samples of each glass type, which shall be viewed under reproduction lighting conditions and accepted prior to material manufacture.
- L. Provide all glass from a single supplier unless agreed otherwise by the Superintendent, and provide certification proving the origin of the glass.
- M. Each type of coated glass shall be supplied from the same batch.
- N. Ensure that glass does not contain imperfections in excess of the tolerances stated in AS/NZS 4667.
- O. All exposed glass edges shall be ground and polished.

- P. Mirror glass is not acceptable, unless described as acceptable elsewhere in the Specification.
- Q. Where combinations of glass types are used in a unit, the least stringent criteria for viewing shall be used in accordance with the relevant standards.
- R. Prior to placing an order for any glazing materials, obtain all necessary confirmation and/ or calculations in writing from the glass manufacturer on all aspects of the glazing systems for review, including but not limited to the following:
1. Ventilating and draining provisions of the glazing rebates.
 2. Thickness of individual glass panes and of insulating glass units due to consideration of the wind loadings specified.
 3. Access loads for horizontal/ inclined glazing conditions with consideration of the wind loadings specified.
 4. Visible colour variations shall only be acceptable if within the tolerances established by accepted samples.
 5. Determination as to whether or not heat strengthening or toughening of glass will be required.
 6. Thickness and number of PVB interlayers (laminated glass).
 7. Thermal and shading performance of insulating glass units.
 8. Thermal safety of insulating glass units.
 9. Hardness, location, shape and dimensions of setting blocks and glazing gaskets.
 10. Depth and width of glazing rebates.
 11. Expansion, tolerances, glass bite and clearance shall meet all specified performance requirements.

2.2 Certification

- A. Provide supplier certification for all glazing installed into the Works showing the type, quantities and manufacturer's data sheets demonstrating all glazing properties and minimum visual transmittance levels.

2.3 Safety Glass

- A. Select safety glass categories for use in critical locations as defined and recommended in AS/NZS 2208, and as required to comply with the Building Code of Australia Regulations, Local Authority requirements and other relevant health and safety requirements. The glass type and thickness selected shall meet the performance requirements of the Specification and shall minimise the risk to persons both during construction and during the service life of the Works.
- B. Safety glass shall be tested in accordance with AS/NZS 2208. Submit evidence of conformance to AS/NZS 2208 Appendix A.

2.4 Annealed Glass

- A. The tolerances on thickness shall comply with AS 1288 and AS/NZS 4667.
- B. Visual quality testing of annealed glass for dimensional requirements and visual defects shall comply with AS 1288 and AS/NZS 4667.

2.5 Laminated Glass

- A. Laminated glass shall be Grade A in accordance with AS/NZS 2208.
- B. Laminated glass shall consist of a number of sheets of flat glass with polyvinyl butyral (PVB) with a thickness of not less than 0.375mm, or methyl metacrylate resin interleaving between each layer. The layers can be clear, translucent or coloured depending on the design intentions of the glazing. The glass may be annealed, heat strengthened, or heat soaked toughened, as required to meet the performance requirements of the Specification.
- C. The Design Drawings show the visual requirements of the Superintendent. Final selection of glass type and thickness of each layer, together with type, opacity, density and location of interlayer and coatings shall be accepted by the Superintendent prior to ordering materials.
- D. The bottom supported edges of laminated glass panes shall be cut flush over the width of the pane to provide even distribution of vertical load to the setting blocks.

2.6 Toughened Glass

- A. Justify the use of toughened glass by risk assessment and/ or calculations, with the general aim of minimising its use.

-
- B. All toughened glass to be heat soaked to EN 14179-1, paying particular attention to temperature and duration of treatment. Prior to heat soaking, provide a written report to demonstrate oven and thermocouple calibration and temperature tolerances. Demonstrate that, despite temperature tolerances, the air temperature in all parts of the oven was maintained at or above 280°C for eight hours. Provide detailed records of heat soaking for each batch prior to delivery to Site.
- C. Toughened glass shall be Grade A in accordance with AS/NZS 2208.
- D. The glass shall conform to the following requirements in the horizontal toughening process:
1. Maximum overall bow: 0.003mm per millimetre measured along the glass edge.
 2. Maximum local bow: The maximum deviation for flatness from peak to trough not to exceed 0.3mm per 300mm or 0.15mm at the edge or 0.08mm in the middle.
 3. Rollerwave: Glass shall be sized to provide for consistent and horizontal alignment of ripples. Provide proposals describing the control the extent of rollerwave, if any. Provide full-sized samples of all types of heat treated glass to demonstrate the range of rollerwave applicable to the Works, prior to commencing glass production.
 4. Edge dip: 0.25mm maximum.
- E. Exposed edge working shall be flat ground with small ground arris and have a frosted appearance. Small shells and/ or chips, exceeding a maximum diameter of 2mm, shall be ground out prior to toughening.
- F. The surface compressive stress shall be demonstrated by non-destructive testing, to be controlled at the Works at 69N/ mm².
- G. Cut all glass to accurate sizes and deliver to the Site in the required sizes. No on-Site cutting or nipping allowed. The glass shall be clearly marked to show its intended final position and orientation.
- H. Ensure that glass heat treatment requirements are satisfactory to meet wind, impact or thermal, or other loads anticipated in the Works. The manufacturer of the toughened glass shall be made aware of its intended use in the construction. Carry out any drilling and notching with the agreement of the manufacturer of the toughened glass and prior to the toughening being carried out. All toughened glass shall be tempered on a roller hearth furnace eliminating tong marks.
- I. Ensure that the toughening process does not produce iridescence, distortion, roll marks or ripples in the glass. Demonstrate such anticipated imperfections by the provision of samples prior to commencement of glass production. The Superintendent shall examine the samples provided and advise what is acceptable and what is unacceptable. All glass shall comply with the accepted samples.
- J. Prior to commencement of manufacture, advise the Superintendent of the glass supplier and the premises where fabrication and processing shall be carried out. The Superintendent shall be given the opportunity to visit the glass manufacturer's premises during fabrication and/ or processing.
- K. Prior to installation of toughened glass, demonstrate with documentary evidence that the glass has been heat soaked for the prescribed periods. Such evidence shall include, as a minimum, the following:
1. Source of supply and evidence of batching.
 2. Dates and records of toughening/ heat soaking of all glass.
 3. Certification that the glass meets the performance requirements of the Specification.
 4. Records shall include details of all units that failed during the heat soak test.
- L. The toughening process shall not create any stresses in the glass that are visible within the limits specified.
- M. Cooling jet marks shall not affect the visible appearance of the finished surface of toughened glass unless the variation is no greater than that established through accepted samples.
- N. Any discoloration or distortion caused by the toughening process is unacceptable outside of rollerwave distortion and glass bow as specified.
- O. If it is considered that the glass panel configuration within the completed installation is susceptible to anisotropy, when viewed in polarised light, notify the Superintendent and submit proposals to minimise this characteristic. Take all reasonable measures to control the toughening process so as to avoid the occurrence of anisotropy at the time of manufacture. Reject glass if it does not fall within the range of agreed samples.

- P. Demonstrate that all necessary control has been taken to ensure that the effect of anisotropy in the manufactured glass has been controlled and minimised taking into account the thickness of glass and its orientation on the façade of the building. Glass will be rejected if it does not fall within the range of agreed samples. Any coatings applied to the glass must not increase the tendency to show the effects of anisotropy.

2.7 Heat Strengthened Glass

- A. Unless otherwise specified, all heat strengthened glass shall comply with AS 1288 and AS/NZS 2208.
- B. Visual quality testing of heat strengthened glass for dimensional requirements and visual defects shall be in accordance with AS/NZS 4667.
- C. Heat strengthened glass shall not be considered a "safety" glass. If heat strengthened glass is proposed for use in situations that require a safety glazing material, it shall be laminated.

2.8 Wired Glass

- A. Wired safety glass shall comply with AS/NZS 2208.
- B. Glass shall be annealed.
- C. Glass shall have "Georgian" wire embedded within the glass thickness, unless specified otherwise.

2.9 Curved Glass

- A. The maximum variation in curved form shall be ± 4 mm from the theoretical form.
- B. The maximum variation in adjacent glass edges when installed shall be 1mm per 1000mm.
- C. The maximum difference between curved adjacent glass edges when installed shall be 3mm.
- D. All curved glass panels shall be continuously curved from edge to edge for the full radius with no straight returns.
- E. The maximum allowed deviation of the length and width of sheets shall be ± 4 mm for dimensions up to and including 2000mm and ± 4.5 mm for dimensions over 2000mm.
- F. The maximum allowed deviation of the diagonal dimension of any sheet shall be ± 7 mm for dimensions over 2000mm.
- G. The maximum allowed deviation of the top and bottom edges (ie the curved edges) measured on the face of the glass and perpendicularly to the curvature shall be ± 3 mm.

2.10 Coatings

- A. Glass coatings generally:
1. Submit to the Superintendent detailed proposals in respect of coatings.
 2. Surface coatings: A highly uniform, low reflection and durable quality is required of any surface modified glass. Such coatings shall be consistent in colour, durable and sufficiently hard on exposed surfaces to avoid damage.
 3. Body tinting:
 - a) Provide evidence from the glass manufacturer that the correct body tinting has been incorporated into the materials at the appropriate stage, when this has been specified on the Design Drawings.
 - b) Provide evidence that the correct surface modified tinting has been applied by the glass manufacturer, where this has been specified on the Design Drawings.
 4. Ceramic frit coatings:
 - a) Tolerances for positioning and sizes of prints shall comply with optical quality determined by viewing from a distance of 3000mm using daylight without direct sunlight or direct spotlight, perpendicularly to the glass, for no more than 10 seconds.
 - b) Apply smoothly and consistently over the whole, or part, of each glazed area as indicated on the Design Drawings.
 - c) Fuse into the surface of the glass, thus providing a permanent layer (with the exception of the exposed internal surface).
 - d) The coatings shall have similar sheen, chromaticity and luminosity, to give a non-discernible colour difference when viewed by eye and illuminated by a standard light source, and shall colour match. All ceramic fritting shall be opaque and to a colour to be agreed with the Superintendent.

B. High performance glass coatings:

1. Panes of glass with high performance coatings shall be examined for defects in accordance with BS EN 1096: Part 1, viewed from a distance of 3000mm from the outside face of the glazing, for both the main area and the edge area of the glass panes.
2. Soft coatings in double glazed units:
 - a) The glass shall be edge stripped on the coating side to a width corresponding to the width of the spacer bar (complete with butyl strip) such that when the panes are sealed together no discoloration to the coating by the butyl strip occurs around the perimeter of the double glazed unit. The occurrence of a red or blue line around the perimeter of the glass panes is unacceptable.
 - b) Up until the time of installation, all handling of glass shall be carried out using protective cotton or surgical gloves so as not to damage the surface of the coating with fingerprints. After protection is removed from the coated glass panes, the panes shall be installed into the double glazed units and sealed within the time period recommended by the coating manufacturer, to avoid any atmospheric deformation of the surface.

2.11 Unitised Systems**A. Double glazed units:**

1. Unless otherwise specified, double glazed units shall be hermetically sealed units complying with AS/NZS 4666.
2. System shall comprise spacers, to separate glass panes, filled with moisture absorbing desiccant and a mechanically applied primary polyisobutylene seal between glass and spacer, providing a continuous vapour-proof barrier, to a minimum width of 1mm, and a secondary two-part silicone seal to the perimeter of the units to carry wind loads.
3. Visual inspection by the Superintendent of the glass edges, edge seals and spacers shall be unhindered, prior to glazing.
4. Drainage of water along edge seals is not permitted.
5. All double glazed units shall be assembled in controlled temperature and humidity conditions. Breather tubes shall be used, if necessary, during manufacture and transportation. Remove and seal units prior to manufacture.
6. State the maximum concavity and convexity that will occur under the anticipated ambient climatic conditions and barometer pressure differentials.
7. The bottom supported edges of laminated glass panes within vertical double glazed units shall be ground flush over the width of the pane to provide even distribution of load to the setting blocks.

2.12 Structural Silicone Glazing**A. General:**

1. To AS 1288.
2. Be responsible for the final selection of materials, testing, fabrication, transportation and installation of the structural silicone glazing and submit samples for review by the Superintendent prior to manufacture.
3. The structural silicone glazing shall be carried out in such a manner that will not compromise the integrity of the double glazed units' edge seals and the specified warranties.
4. Structural silicone glazing application shall only be carried out in a strictly controlled working environment, in accordance with the manufacturer's instructions, to maintain temperature, humidity, dust and dirt-free conditions, etc, in the environment.

B. Materials:

1. Provide structural silicone adhesive, which shall be obtained from a single source manufacturer and applied strictly in accordance with the manufacturer's recommendations.
2. For marine or similar environments, the structural silicone shall be suitable for this purpose.
3. Proposals shall be submitted to the Superintendent for review and acceptance.

C. Installation/ fabrication:

1. Structural silicone glazing application shall not be carried out on Site unless agreed otherwise with the Superintendent.
2. Provide documentation of the sealant manufacturer's requirements for the particular substrate of the construction, including joint sizes, limitations and requirements for mixing, cleaning, surface preparation, priming and application.
3. Provide evidence that the sealant has been selected taking into account the sealant manufacturer's recommendation as to use and compatibility with the contact surfaces.
4. Joint design shall be in accordance with the sealant manufacturer's recommendations for glue-line and bite to glue-line ratio, taking into account the design wind pressures and panel sizes.
5. Provide details of tensometer and any other testing equipment as required.
6. Glazing procedures shall include frame assembly, cleaning, priming (if necessary), gunning, tooling and frame handling after glazing and curing. Sealant shall not be applied when the temperature is below 4°C and units shall not be moved until the silicone has achieved a level of cure recommended by the silicone supplier.
7. Adopt silicone batching logging procedures to record all batches used, including batch manufacture date and arrival date of each batch at the fabrication works. The location of each structural silicone glazed panel shall be individually located on As-Constructed Drawings of the building, recording date and batch of structural silicone, with details of tests carried out to ensure that the highest quality of silicone is being used.
8. The structural silicone glazing shall be recorded at the time of assembly and include identification marks of every panel by a unique number, readable from the inside of the building for the life of the building. Provide glazing records with information on each panel including silicone type, batch, date of application, glazier's name and temperature and humidity measured inside the factory on the day of assembly.
9. Recommend a periodical maintenance regimen for agreement with the Superintendent. This shall be incorporated in the Operation and Maintenance Manuals. Acceptance criteria shall be consistent with the requirements of the testing criteria, which as a minimum shall be:
 - a) A standard "peel test" on any broken panels that require replacement.
 - b) A close visual inspection shall be carried out externally from the cleaning apparatus, including application of hand pressure to verify continued adhesion. This exercise shall be carried out for 1% of the cladding, once a year for the first three years, then at a frequency of every five years. The panels shall be randomly selected around the elevations at varying heights.
 - c) The sealant supplier or other qualified body shall carry out tests.

2.13 Rooflights/ Skylight/ Horizontal and Inclined Glazing

- A. Rooflights/ skylights shall be designed to satisfy the requirements of the HSE's Health and Safety in Roof Work guidance booklet HS(G)33, Safe Work Australia regulations and be manufactured only by a company registered to AS/NZS ISO 9001 or carrying European Technical Approval (ETA).
- B. Overhead glazing shall be in accordance with AS 1288.
- C. Glazing shall be capable of withstanding the impact load of two persons falling on it during maintenance, cleaning and inspection operations. The glazing system shall maintain its structural integrity and the glass and edge covering shall have adequate thickness so that units do not "pop out" of the frame under such impact. If the outer layer of glass breaks, the inner sheet glass shall stay in place and support the operatives.

2.14 Mirror Glass

- A. To AS 1288.
- B. Type: Silver layer deposited on the glass or glazing plastic.

2.15 Product Identification

- A. Safety glazing materials: Identify each piece or panel in accordance with AS 1288.
- B. Heat soaked glass: Marked to EN 14179-1 or certified to AS 1288 clause 3.8.2 by the manufacturer.
- C. Noise reducing glazed assemblies: Label each panel with a legible non-permanent mark, self-destroying when removed, stating and certifying the Rw rating, and identifying the testing authority. Remove when directed.

3 EXECUTION

3.1 Glass Processing Generally

- A. Processing: Perform all required processes on glass, including cutting, obscuring, silvering and bending. Form necessary holes, including for fixings, equipment, access holes and speaking holes.

3.2 Installation Generally

- A. Install the glass so that:
1. Each piece is held firmly in place by permanent means which enable it to withstand the normal loadings and ambient conditions at its location without distortion or damage to glass and glazing materials.
 2. Building movements are not transferred to the glass.
 3. External glazing is watertight and airtight.
- B. Install to AS 1288.
- C. Temporary marking: Use a method which does not harm the glass. Remove marking on completion.
- D. Toughened glass: Do not cut, work, or permanently mark after toughening. Use installation methods which prevent the glass making direct contact with metals or other non-resilient materials.
- E. Heat absorbing glass: In locations exposed to direct sunlight, provide wheel cut edges free from damage or blemishes, with minimum feather.
1. Edge grinding or arising: Wet process, using grit no coarser than 120-180. Do not work across the edge from surface to surface.
 2. Temporary marking: Remove before installation.
- F. Frameless installations: Join the vertical edges of adjacent glass panels with silicone jointing compound.

3.3 Pre-glazing

- A. Window assemblies and glazed doors: Supply inclusive of glazing, shop pre-glazed unless pre-glazing is impracticable.

3.4 Glazing Method

- A. Vision panels shall be installed so they can be independently removed.

3.5 Fixing Mirrors

- A. Concealed fixing: Fully back glass on to 13mm thick waterproof particleboard sheet with all edges flush. Accurately provide an opening in the wall fully noggged so as to provide an even 3mm gap all around the mirror. Fit mirror into wall recess with packers as necessary so that the mirror finishes flush with the wall lining. Glue backing to wall framing with adhesive and seal joint around mirror with clear waterproof silicone. Ensure silicone does not contact silver coating.

3.6 Glazed Shower Screens

- A. Type: Proprietary frameless system or comprising frames, where detailed, of extruded aluminium, stainless steel, or PVC, assembled around safety glass to form fixed panels and sliding, hinged or pivoted doors.
- B. Water shedding: Provide an assembly which sheds water to the inside without retaining it on the frame surfaces. Seal the edge of the frame to adjoining surfaces with a resilient strip.
- C. Sliding assemblies:
1. Hanging: Hang the sliding sash on stainless steel or nylon sheaves on overhead channel track formed in the frame head, and fit nylon or equivalent bottom guides.
 2. Hardware: Pull handles on both sides of sash, or of leading sash in multiple sash arrangements.

3.7 Partition Glazing

- A. General: Assembly: Provide beads or snap-in beads and resilient (PVC, butyl or similar) glazing tapes, gaskets and inserts, so that the glass is held firmly without distortion and withstands the specified loadings.

-
- B. Frameless installations: Join the vertical edges of adjacent glass panels with a silicone jointing compound.

3.8 Completion

- A. Warranties:
1. General: Submit a warranty undertaking to repair or replace glass and glazing materials which, within the warranty period, become defective, provided that the manufacturer's recommendations for the maintenance of the material have been followed during the warranty period.
 2. Glass manufacturers' warranties: An undertaking, conditional only on compliance with the manufacturers' recommendations for installation and maintenance, to supply replacement glass units to the Site for replacement of defective units defined as follows:
 - a) IGU units: Units in which the hermetic seal has failed as evidenced by intrusion of foreign matter, or internal condensation at temperatures above 2°C.
 - b) Coated glass units (including coated SIG units): Units in which the metallic coating shows evidence of manufacturing defects, including but not necessarily limited to cracking or peeling, as determined in accordance with ASTM C1048.
 3. Toughened glass warranty: The manufacturer's warranty certifying that toughened glass supplied for use has been subjected to a heat soaking process which has converted at least 95% of the nickel sulphide content to the stable beta-phase.
- B. Maintenance manual: Submit manufacturers' published recommendations for service use.
- C. Cleaning: Replace damaged glass and leave the work clean, polished, free from defects, and in good condition.

SECTION END

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SECTION 0813 -- METALS AND PRE-FINISHES**1 GENERAL****1.1 Related Documents**

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.
- B. For requirements pertaining to structural steel, refer also to the Structural Engineer's documents.

2 PRODUCTS**2.1 Metals**

- A. Components:
 - 1. The material thicknesses and the dimensions shown on the Design Drawings shall be maintained within specified tolerances.
 - 2. All materials and components shall be durable and to the minimum requirements set out in the Specification and shall comply with the relevant Australian Standards.
 - 3. For each material or component, obtain the total quantity from the same supplier or manufacturer unless otherwise agreed with the Superintendent.
 - 4. Protect all inaccessible steel against corrosion.
 - 5. All support systems shall be of adequate thickness and strength to meet the structural requirements and eliminate risk of distortion in finished surfaces.
 - 6. Provide protection until Practical Completion to avoid any deterioration or damage to the finished elements.
 - 7. Finish exposed metalwork in accordance with the relevant Australian Standards. Unless otherwise specified, concealed items shall be mill finished in internal conditions only, or hot dip galvanised steel in accordance with AS/NZS 4680. Treat cut edges so that the specified level of protection is maintained.
- B. Mild Steel:
 - 1. All mild steelwork shall comply with AS 4100, unless stated otherwise.
 - 2. Fabrication of steelwork shall be in accordance with the requirements of the Specification.
 - 3. Check for accuracy of fit before and after making permanent connections in frames and other structural elements which are to be assembled before delivery to Site.
 - 4. Welding procedures shall be such that distortion is reduced to a minimum and local distortion rendered negligible in the final fabrication.
 - 5. No welds other than those shown on the Shop Drawings, even for temporary attachments or repairs, are acceptable unless agreed in advance by the Superintendent. If welded temporary connections are agreed upon, then the welding and removal of the connection shall be in accordance with AS/NZS 1554.
 - 6. Vent holes in hollow sections shall be sealed in a manner to prevent the ingress of moisture.
 - 7. External visible lines and depressions caused by the internal welding of hollow section steelwork shall be positioned so as to be non visible.
- C. Aluminium:
 - 1. Unless otherwise specified, fabricate all extruded aluminium alloy members from the appropriate grade of aluminium alloy complying with AS/NZS 1734, AS/NZS 1865, AS/NZS 1866 and AS/NZS 1867.
 - 2. Unless otherwise specified, aluminium sheeting shall be a minimum of 3mm thick.
 - 3. Use only appropriate grades, strengths and thicknesses of aluminium to ensure that all structural and finishing requirements of the Specification are met. The wall thicknesses of aluminium extrusions shall be sufficient to ensure their rigidity in the lengths required in the final installation.
 - 4. All aluminium fixing brackets and cleats shall be manufactured from the appropriate grade of alloy to the requirements of AS 2848.1. If visible, the finish shall match the metal panels and framing members.

5. Protect exposed aluminium with low tack adhesive film during construction and remove prior to Practical Completion.
6. Aluminium sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions or other visible deformation or irregularity.
7. Aluminium to aluminium welding to AS 1665.
8. Aluminium structures to AS/NZS 1664.1 or AS/NZS 1664.2.

D. Stainless Steel:

1. Unless otherwise specified, stainless steel shall be austenitic, non-magnetic, using either grade 304 or grade 316 to ASTM A240/A240M for plate, sheet and strip and grade 304 or grade 316 to ASTM A217/A217M for castings. Specific grade designations shall be either as specified in the relevant sections of the Specification or, where not identified specifically, selected to meet the performance criteria specified for the particular element or components.
2. Unless otherwise specified, welds to visible areas of stainless steel shall be ground smooth to achieve a seamless surface and to match the finish of the parent metal. Remove heat tints using light abrasives, pickling paste, wire brush or similar to achieve continuity with the specified finish. Areas difficult to access shall be manually finished if necessary.
3. When welding stainless steel minimise distortion due to thermal movement using jigs or other methods as appropriate during welding. Welding methods and consumables shall be chosen as most appropriate to the type, thickness, shape and location of joints to meet the performance levels required and have mechanical properties at least equal to the original base metal. In addition, consumables shall have an equal or superior corrosion resistance to the base metal being welded.
4. Stress corrosion or cracking will not be accepted. Undertake the necessary precautions in the fabrication and installation of stainless steel elements/ materials, avoiding the simultaneous presence of any of the following:
 - a) Tensile stresses.
 - b) Residual stresses after cold working or welding.
 - c) Aggressive local environmental conditions.
 - d) Metal temperatures that, in conjunction with the above, may induce stress corrosion cracking.
5. Stainless steel castings:
 - a) Shall be of austenitic stainless steel and the casting alloy shall be determined to meet the requirements of the Specification.
 - b) Shall be manufactured using the lost wax process or such other process as may be proposed and accepted by the Superintendent.
 - c) Exposed feeder ports and die lines will not be accepted in the finished castings.
 - d) The surface finish of the castings shall be determined by the submittal of samples for review and acceptance. Samples, once accepted, shall represent the required standard for all subsequent castings.
 - e) Make allowance for two post production finishing processes. The processes shall be agreed with the Superintendent and include blast finishes (including bead blasting) and electropolishing or acid pickling.
6. Stainless steel shall be protected where possible using appropriate adhesive film, to the film manufacturer's written recommendations.
7. If stainless steel has not been protected by adhesive film, thoroughly clean prior to presentation to the Superintendent for acceptance.

2.2 Powder Coating

- A. To AS 3715 and/ or AS 4506.
- B. Powder coat finish to metal substrates:
 1. Refer to the Specification work sections and/ or the schedules for further details including colours.
 2. Powder coating to aluminium and aluminium alloy for architectural applications to comply with AS 3715, AAMA 2603, AAMA 2604 and AAMA 2605.

3. For metal substrates other than aluminium, demonstrate compliance with the requirements of AS 4506 by providing a certificate from the coating applicator stating the atmospheric classification, substrate material and method of surface preparation.
4. Warranty:
 - a) Aluminium substrates in external applications: 20 years for colour retention (fading) and film integrity.
 - b) Aluminium substrates in internal applications: 10 years for colour retention (fading) and film integrity.
 - c) Steel: Not available.
- C. Powder coating shall be applied using only materials suitable for the purpose intended.
- D. Aluminium alloys shall be selected to ensure that the finished appearance of all components is consistent and identical. Aluminium shall be in a condition suitable for the application of the coating process. The sheet shall be of a suitable and agreed thickness and of suitable temper to withstand the stoving process.
- E. In conjunction with the Superintendent, ensure that the application complies with Section 0171 and the requirements of the NSW Department of Environment and Climate Change. The Head Contractor shall also comply with the NSW Department of Environment, Climate Change and Water document Spray Painting and Surface Coating.
- F. Colour shall be selected by the Superintendent from the full colour range of the manufacturer.
- G. Assure colour consistency from batch to batch.
- H. Limits for acceptable colour variations in production shall be established and accepted by the Superintendent from samples provided by the Head Contractor prior to production. When metallic colours are used, top and bottom limits of colour variation and appearance shall be established and agreed prior to coating commencement. All colour samples shall be submitted and coating shall not commence before acceptance by the Superintendent.
- I. Dry film thicknesses of powder coating shall be as recommended by the manufacturer to suit the corrosivity category of the Site as nominated in Section 0171.
- J. The minimum and maximum local dry film thickness on adjacent panels or elements shall not vary by more than 20%. If this is not achievable, submit samples to the Superintendent for review showing the maximum variation in coating thickness.
- K. Adhesive/ protective tapes/ films shall be a low tack type applied at room temperature, remaining in contact with the surface for a maximum period of six months. Should longer periods be required, the tape/ film shall be removed and replaced. Where adhesive/ protective tapes/ films are used, the colour shall be white or lighter in tone than the powder coating.

2.3 Product Tests to Powder Coating

- A. Demonstrate compliance with the test requirements outlined in AS 3715 and AS 4506.
- B. Product tests shall meet all the requirements of the Specification.
- C. Test pieces shall consist of finished panels or extrusions representative of product-coated aluminium. Test pieces shall be at least 150mm long and 75mm wide with a flat coated/ significant surface on which to conduct instrumental measurements. The Superintendent shall indicate exposed/ significant surfaces.
- D. Tests shall be performed on exposed/ significant surfaces and shall meet the requirements of the Specification.
- E. Test reports shall be produced at the time of coating and shall be made available to the Superintendent. These reports shall include:
 1. Date when tests were performed and date of issue of report.
 2. Identification of the powder coating/ system tested, including product supplier, colour reference, product code and batch reference.
 3. Statement indicating that the powder coating/ system tested passed all tests, or failed one or more.
 4. In the case of failure(s), state which test(s) and describe the failure(s).
 5. Statement that all tests were conducted in accordance with the Specification and the applicable standards.
 6. Name and address of the laboratory which conducted the tests and issued the reports.

7. The Superintendent shall commission an independent inspecting authority. The Head Contractor shall be responsible for all costs incurred. To gain acceptance of the finished products for use, carry out a minimum of three independent acceptance inspections, sampling procedures and plans as set out in AS 1199.1 for general inspection level 2. AQL (Acceptable Quality Level) = 1% on each colour and finish used in the Works. These inspections shall be carried out by an independent consultant or acceptance laboratory at the finishing plant prior to fabrication.
8. Where damage has occurred or a production test report is not supplied, the Superintendent shall carry out a Site inspection and commission an independent investigation of all finishes on site-fixed units at the Head Contractor's expense.
9. This investigation shall be carried out in accordance with the guidelines of AS 1199.2, LQ (Limited Quality) (Pa = 10%) = 5%. For the purpose of this inspection each section in the window curtain wall or other fabrication shall be taken as an individual component in assessing the overall batch number, to allow the acceptance inspection laboratory to certify that the Works comply with the Specification.
10. For units that are finished in fewer than three production runs, acceptance inspections shall also be made using AS 1199.2 to the same LQ. The acceptance inspection laboratory shall be approved by the Superintendent and instructed by the commissioning authority to submit all reports simultaneously to the Head Contractor and the Superintendent. These reports shall cover factory production materials and Site-fixed units.
11. Certificates of Practical Completion or any other document of authority accepting responsibility shall not be signed by the Superintendent until they have received these reports.

3 EXECUTION

3.1 Fabrication Generally

- A. Fabricate components carefully and accurately to ensure compliance with the Detailed Design and the Specification.
- B. Do not permit contact between dissimilar metals in components that are to be fixed where moisture may be present or may occur.
- C. Finished components shall be rigid and free from distortion, cracks, burrs and sharp edges or arrises. Moving parts shall move freely and without binding.
- D. Unless specified otherwise, mitre corner junctions of identical sections.

3.2 Cold Formed Work

- A. Use brake presses or cold rolling to produce accurate profiles with straight arrises.

3.3 Stainless Steel Fabrication

- A. Fabrication shall only take place in workshops dedicated to stainless steel and using dedicated tools and equipment.

3.4 Metal Separation

- A. Incompatible sheet metals: Prevent direct contact between incompatible metals. Provide separation by one of the following:
 1. Apply an anti-corrosion low moisture transmission coating such as alkyd zinc phosphate primer or aluminium pigmented bituminous paint to contact surfaces.
 2. Insert a concealed non-metallic separation layer such as polyethylene film, adhesive tape, neoprene, nylon or bituminous felt.
- B. Incompatible fixings: Do not use.

3.5 Adhesive Bonding

- A. Prepare surfaces of metals to receive adhesives by degreasing and abrading mechanically or chemically.
- B. Use adhesives to manufacturers' written recommendations.
- C. Form bond under pressure.

3.6 Thermal Cutting of Steel

- A. After cutting, grind off material that is liable to corrode.

3.7 Welding/ Brazing Generally

-
- A. Thoroughly clean surfaces to be joined.
 - B. Ensure accurate fit using clamps and jigs where practicable. Use tack welds only for temporary attachment.
 - C. Make joints with parent and filler metal fully bonded throughout with no inclusions, holes, porosity or cracks.
 - D. Prevent weld spatter falling on surfaces of materials that will be self-finished and visible in the completed work.
 - E. Remove all traces of flux residue, slag and weld spatter.

3.8 Brazing

- A. Brazing shall be in accordance with AS/NZS 1167.

3.9 Finishing Welded/ Brazed Joints

- A. Visible butt joints in the completed work shall be smooth and flush with adjacent surfaces.
- B. Visible fillet joints in the completed work shall be executed neatly and ground smooth to be flush with adjacent surfaces.

3.10 Preparation for Coating

- A. Metal preparation and pre-treatment of metal is to be in accordance with the AS 1627 series. Preparation methods will be determined according to metal type, required coating and the degree of preparation required.

3.11 Applying Coatings

- A. Unless specified otherwise, apply coatings after fabrication is complete and all fixing holes have been drilled.
- B. Before applying coatings, remove all paint, grease, flux, rust, burrs and sharp arrises.
- C. Make good all defects that would show after application of coating and ensure surface finishes are smooth.

3.12 Applying Powder Coatings

- A. Powder coating application and stoving shall be carried out in accordance with AS 3715 and/ or AS 4506. Only one coating plant shall be used and one batch of powder, unless otherwise accepted by the Superintendent.
- B. Warranties: Make available to the Superintendent, fully documented and signed copies of the coating warranties. Warranties shall cover:
 - 1. Colour retention (fading).
 - 2. Film integrity and adhesion.
 - 3. Surface finish retention (powdering).
- C. Cleaning Frequency: The normal cleaning frequency associated with the warranty for powder coat finishes shall be 12 months, unless agreed otherwise by the Superintendent.
- D. Damage shall be repaired immediately. Site rectification of damage is not generally acceptable and shall only be permitted with the Superintendent's agreement. If so agreed, a guarantee for the powder coat adhesion and colour and gloss retention equivalent to the remaining period of the guarantee shall apply.

SECTION END

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SECTION 0814 -- GALVANISED COATINGS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS

2.1 Materials

- A. Appearance:
1. All finishes shall be stable, fade resistant and not affected by ultraviolet light. Provide data and samples for review by the Superintendent.
 2. All finishes shall be durable, of uniform texture and colour and shall be resilient to all known and/or specified environmental and pollution effects. This shall include scratching and cigarette smoke and burns, etc. Submit data and samples for review by the Superintendent.
 3. Minor scratches and blemishes shall be repaired using the coating manufacturer's recommended products and system, matching original finish for colour, texture and gloss. Repaired coatings shall be visually acceptable to the Superintendent. Provide confirmation that repairs to the damaged finish comply in all respects to the requirements of the Specification. Guarantee in writing repairs to the damaged or defective coatings. Employ an independent finishing consultant to carry out an inspection and any necessary tests and supply a full report to the Superintendent.
 4. All finishes shall be within the limits of the agreed samples and without irregularities or distortions. Fixings, stiffeners, etc, not intended to be visible shall be treated so there is no discontinuity in the finished surface appearance.
- B. Surface preparation of steelwork:
1. Surface preparation shall remove all rust, scale and surface contamination to leave a clean surface to AS 1627.1. Achieve this by acid pickling, to AS 1627.5, except where the presence of paint, oil, grease, welding slag, etc, renders this ineffective, and in all weld areas the steel shall be locally blast cleaned to AS 1627.4.

2.2 Finishes

- A. Liquid organic coating:
1. Aluminium alloy components shall comply with AS 1231.
- B. Plating of surfaces:
1. Cadmium/ zinc plating of iron and steel surfaces shall comply with AS 1789.
 2. Chromium plating shall comply with AS 1192.
- C. Galvanising generally:
1. To AS/NZS 4680.
 2. Where galvanising is visible, the final finish shall be smooth, continuous, consistent and free from flux staining and other forms of staining. Coating weight shall be consistent maintaining a uniform appearance throughout the service life of the Works.
- D. Galvanised self finish surface:
1. Galvanised steelwork shall not be painted.
 2. Blast cleaning shall comply with AS 1627.4.
 3. Preparation: Edge grind, remove all grease, oil and varnish and any other surface contaminants, ensure that any oil or silicon based anti-weld spatter is removed, remove weld spatter, grind welds as required and fill pits and other surface imperfections that may cause the premature failure of the coating system.
 4. Galvanising: The steelwork shall be supplied to the galvaniser in a suitable condition to be acid pickled in dilute hydrochloric acid, passivated and then hot dip galvanised in accordance with AS/NZS 4680.
 5. Uniformity: Carry out galvanising in such a way as to maximise the smoothness and uniformity of the deposited coating. Use only double dipping where no alternative exists.

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6. Touching-up is not allowed unless agreed by the Superintendent. If touching-up is carried out it must be according to the following:
 - a) Surface preparation shall comply with AS 1627.2 and AS 1627.9.
 - b) Where acceptance is given, use the Zilt-Stick system in accordance with the manufacturer's recommendations. Zilt-Stick is a self-fluxing and galvanising system applied by hand. The stick is made up from a galvanising compound with a "foil" wrapping, which is rubbed over the affected area until completely covered. The black flux residue shall be removed using a damp cloth.
 - c) The maximum size of an area of touch-up shall be determined by locating the point on the damaged surface that is furthest from an intact galvanised coating. If the distance from this point to the galvanising is in excess of 10mm, the member shall be re- galvanised or rejected.
 7. Refer to the recommendations of the Galvanizers Association of Australia (GAA) for galvanising and zinc metal-spraying.
 8. Immersion process shall be discussed and agreed with the Superintendent and submitted for formal comment. This is to ensure that during the galvanising process drips are not allowed to run off fair-faced surfaces and thus disfiguring them. Fair-faced surfaces are all those surfaces that will be visible in the completed Works. Agree location of all fair-faced surfaces with the Superintendent before application.
 9. Breathing holes: Locate in unobtrusive places. Agree the location of these holes with the Superintendent and mark clearly on the Shop Drawings.
 10. Distortion: Ensure that no distortion of fabricated elements occurs during galvanising.
 11. Advise the Superintendent on the possibility for distortion of the steelwork elements during the galvanising process to enable design modifications of components to be made before fabrication of these components.
 12. Maintenance/ corrosion protection:
 - a) The interval to first maintenance shall be not less than 20 years from completion of the Works.
 - b) Refer to AS 1247.
 - c) Average coating thickness shall be a minimum of 85 microns.
- E. Galvanised steelwork to be painted:
1. The minimum average coating thickness shall meet the requirements of AS/NZS 4680 and AS/NZS 2312.

3 EXECUTION

- A. Not used.

SECTION END

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SECTION 0815 -- TIMBER AND WOOD BASED PRODUCTS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS

2.1 Timber

- A. Hardwood:
1. Milled products: To AS 2796.1.
 2. Grade description: To AS 2796.2.
 3. Timber for furniture components: To AS 2796.3.
- B. Softwood:
1. Milled products: To AS 4785.1.
 2. Milled products (Cyprus Pine): To AS 1810 Grade 1, unless nominated otherwise.
 3. Grade description: To AS 4785.2.
 - a) Timber for furniture components: To AS 4785.3.
- C. Recycled timber:
1. Standard: To FWPA PN06.1039.
 2. Grading: To Section 5, as specified.
- D. Dressed timbers: Unless otherwise noted, use the following:
1. Timbers for transparent finish: The highest grade in the standard.
 2. Timbers for opaque finish: Select grade for hardwood, standard grade for softwood.
- E. Framing shall comply with AS 1684 Parts 1, 2, 3 or 4 as appropriate.
- F. The design of timber structures shall comply with AS 1720.1.
- G. Do not use damaged, rotten or discoloured materials.
- H. Materials shall be relatively knot free, free from distortion, cracks or other blemishes.
- I. Select all timber for its final use.
- J. All timber to be treated for leaching prior to installation.
- K. Moisture content of timber:
1. Timber shall be naturally seasoned for one year per 25mm thickness of board or kiln dried in accordance with BRE's Timber Drying Manual.
 2. The moisture content of all timbers nominated as 'kiln dried' shall not exceed 15% at time of delivery.
 3. For external use or in other high moisture content areas, timber shall be graded and marked "WET". Such timber shall not be used internally.
 4. Moisture content at the time of erection shall not exceed:
 - a) Under cover in generally non-conditioned spaces: 24%.
 - b) Under cover in generally conditioned spaces: 20%.
 - c) Internal spaces: 20%.
 5. Moisture content shall be determined in accordance with AS/NZS 1080.1.
 - a) Plywood: To AS/NZS 2098.1.
 - b) Reconstructed wood-based products: AS/NZS 4266.1.
- L. Structural timber members which are cut from larger graded sections shall be regraded for acceptance by the Superintendent and then appropriately marked according to the new grade.

2.2 Engineered Wood Products

- A. Engineered wood products include particleboard, plywood, timber veneer, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), glulam timber, High Pressure Laminates, (HPL), compact laminates and decorative overlaid wood panels. Timber veneers are excluded. Where only part of a product is composed of an engineered wood product, the limits apply only to that portion of the product, not the entire item.
- B. Formwork, car park applications and non-engineered wood products such as timber are excluded. All engineered wood products (including both 'raw' unfinished and unfinished products) used in the project (except excluded applications) must meet the relevant limits specified in Table 1 as per the specified test protocol, or have product specific evidence that it contains no formaldehyde.

<i>Table 1 - Formaldehyde emission limit values of engineered wood products</i>	
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	< 1.0 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	< 1.0 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	< 1.0 mg/L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	< 1.0 mg/L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A 5905:2003 – MDF, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A1901 (not applicable to Plywood)	< 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 (may also be represented as 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.	

2.3 Sustainable Sources of Timber

- A. Ensure 95% (by cost) of all timber and timber based products used in the building and construction works have been sourced from one and/ or other of the following:
1. Certified by a forest certification scheme, in accordance with 20.2A;
 2. Or
 3. From a reused source, in accordance with 20.2B.
 4. Tropical hardwoods or timber based products (including but not limited to veneers, edgings and manufactured board) of unknown origin are prohibited from use.
- B. A combination of both initiatives may be used to achieve 95% compliance.
- C. This requirement applies to all timber applications within the building and construction works. No distinction is made between temperate, tropical, hardwood and softwood timbers and engineered wood products.
- D. Typical timber uses include, but are not limited to:

1. Formwork and other temporary installations of timber (e.g. hoardings);
 2. Structural and non-structural timber, including internal walls, floors and roof structures;
 3. External and internal cladding;
 4. Flooring, wall, and ceiling finishes;
 5. Internal and external joinery, windows, doors, and other specialist uses of timber, such as installed furnishings or balustrades; and
 6. Furniture items made from timber or including timber components.
- E. Where the cost of timber in the project is less than 0.1% of the Project Contract Value, this criterion is made 'Not Applicable'.
- F. 20.2A Certified Timber
1. Timber must be sourced from forests that have been certified by forest certification schemes that are deemed to satisfy the minimum requirements of the GBCA's 'Essential Criteria' for forest certification.
 2. Timber and timber products sourced from certified forests must be accompanied by a relevant Chain of Custody (CoC) in order to be recognised as certified timber. Currently in Australia, FSC International and PEFC-accredited forest certification schemes both meet the GBCA's 'Essential' criteria.
- G. 20.2B Reused Timber
1. Timber that is reused includes timber that is pre-existing in a building and timber that is procured from a second-hand source.

2.4 Formaldehyde and Formaldehyde Based Products

- A. Formaldehyde composite wood products shall only be used if it can be demonstrated that:
1. Emissions are less than (<) 0.041 ±0.0005 mg/ m²/ hr when measured in accordance with ASTM D5116 or BS EN ISO 16000 parts 9, 10 and 11 and defined as E0 grade, or
 2. Plywood: emissions are less than (<) 0.5mg/ l (E0 grade) in accordance with the testing procedure outlined in AS/NZS 2098.11 method 11.
 3. Particleboard: emissions are less than (<) 0.5mg/ l (E0 grade) in accordance with the testing procedure outlined in AS/NZS 4266.16 method 16.
 4. MDF: emissions are less than (<) 0.5mg/ l (E0 grade) in accordance with the testing procedure outlined in AS/NZS 4266.16 method 16.
- B. Obtain the approval of the Superintendent before substituting any engineered wood products.
- C. The supplier shall provide confirmation of the type and quantity of each product supplied to the project.
- D. Provide confirmation:
1. Describing the application, amount, type and supplier of engineered wood products used throughout the project.
 2. Demonstrating that compliant low-formaldehyde products were used wherever specified.
- E. The manufacturer/ supplier shall provide a formaldehyde emissions report:
1. Quoting the formaldehyde emission level of each engineered wood product used in the project.
 2. Highlighting the compliant emission values in the test results for clarity of submittal purposes.

2.5 Plywood

- A. Generally plywood shall comply with AS/NZS 1604.3 with Hazard Classification to Table 1 and AS/NZS 4491.
- B. WBP grade plywood, EWPA certified, shall satisfy the requirements of:
1. Interior use: To AS/NZS 2270. Bond type C.
 2. Exterior use: To AS/NZS 2271. Bond type A.
 3. Marine plywood: To AS/NZS 2272. Bond type A.
 4. Minimum bond quality: To AS/NZS 2754.1, with thickness to suit the design requirements.

5. Ensure that fastenings do not protrude above the surface of the sheet. Fastenings shall be of a type recommended for the purpose by the fastenings manufacturer.

- C. Finish shall be suitable for its location, sanded:
 1. Visible surfaces with clear finish: Veneer quality A.
 2. Other visible surfaces: Veneer quality B.

2.6 Particleboard

- A. Particleboard shall comply with AS/NZS 1859.1.
- B. Use paint quality veneered moisture resistant particleboard for surfaces to be painted or plastic laminate faced.

2.7 Medium Density Fibreboard (MDF)

- A. To AS/NZS 1859.2.
- B. MDF shall not be cut, trimmed, planed or sanded on Site. MDF joinery requiring alteration shall be removed from Site for alteration and returned to Site ready for installation.

2.8 Timber Veneers

- A. To AS/NZS 2097 and AS/NZS 2098.

2.9 Terminology

- A. Standard: To AS/NZS 4491.
- B. Individual timbers: Standard trade common names to AS/NZS 1148.
- C. Group of timbers: Terms employed for that purpose in relevant Australian Standards.

2.10 Drying Quality

- A. Make milled or dressed timber products from timber dried to Quality Class B as specified in AS/NZS 4787 for target moisture content, residual drying stress, checking and discoloration caused by drying.
- B. The specified drying quality of timber shall be protected during the manufacturing process using appropriate storage and handling facilities and quality management procedures.
- C. The target moisture content for dried timber shall be the equilibrium moisture content appropriate for the species of timber, the geographic location and the particular environment and conditions of use.
- D. Compliance shall be established by sampling and testing in accordance with AS/NZS 4787.
- E. Submit documentary evidence if requested.
- F. If unseasoned timber is used, or if variations in moisture content are likely to occur in service, swelling, shrinkage and differential movement shall be accommodated in the design and construction of the product.

2.11 Durability

- A. General: Provide timbers having natural durability appropriate to the conditions of use, or preservative-treated timber of equivalent durability.
- B. Natural durability classification: To AS 5604.
- C. Do not provide timbers containing Lyctus susceptible sapwood.
- D. Naturally termite-resistant timbers: To AS 3660.1.
- E. Preservative treatment:
 1. Sawn and round timber: To AS 1604.1.
 2. Reconstituted wood-based products: To AS/NZS 1604.2.
 3. Plywood: To AS/NZS 1604.3.
 4. Laminated veneer lumber (LVL): To AS/NZS 1604.4.
 5. Glue laminated products: To AS/NZS 1604.5.
 6. Hazard classification: To AS 1604.1.

2.12 Visible Work

- A. Where timber is required to have a clear or stained finish, keep all visible faces, edges and corners clean and free from blemishes, marks and bruises.
- B. All exposed timber is to include a UV inhibitor and will not discolour.

2.13 Dimensions

- A. Framing timbers: Tolerances to AS 1684.
- B. Finished sizes: Use dressed or milled timbers with actual dimensions which are not less than the stated dimensions, except for dimensions qualified by a term such as "nominal" or "out of" or equivalent, to which a machining tolerance of -4mm per dressed face applies.

2.14 Stress Grading of Timber

- A. Hardwood: To AS 2082.
- B. Softwood: To AS 2858.
- C. Mechanical stress grading: To AS/NZS 1748.
- D. Machine proof-grading: To AS 3519.
- E. Timber with a basic thickness of less than 150mm and not specified for wet exposure shall be stress graded at a moisture content not exceeding 20%, and clearly marked "DRY" or "KD" (kiln dried).

2.15 Identification

- A. Identify timber using branding, certification or both.
- B. Brand structural timber under the authority of a recognised product certification programme applicable to the product. Locate the brand mark on faces ensuring they are concealed in the finished works. Include the following data:
 - 1. Stress grade.
 - 2. Method of grading.
 - 3. "Seasoned" or "s".
 - 4. The certification mark of the product certification programme.
 - 5. The applicable standard.
- C. Recognised product certification programmes:
 - 1. Pine framing: Plantation Timber Certification.
 - 2. Finger jointed structural timber: Plantation Timber Certification.
 - 3. Plywood: Engineered Wood Products Association of Australasia (EWPAA) Quality Control and Product Certification scheme.
 - 4. Blockboard: Engineered Wood Products Association of Australasia (EWPAA) Quality Control and Product Certification scheme.
- D. If neither branding nor certification is adopted, no timber shall be used unless it has been inspected and certified by an independent inspecting authority.

3 EXECUTION**3.1 Workmanship Generally**

- A. Timber members that are damaged, crushed or split beyond the limits of their grading shall not be used.
- B. The cross section dimensions of timber shown on the Design Drawings shall be considered the minimum sizes permitted.
- C. The warping limits set down in AS 2082 and AS 2858 for the amount of bow, spring, twist and cup in a piece of timber shall not be exceeded.
- D. Scarf joints, finger joints or splice plates shall not be used without the acceptance of the Superintendent.
- E. Notches and holes shall be positioned in relation to knots and other defects so that the strength of members is not reduced.
- F. When processing treated timber, ensure that as much cutting and machining as possible is carried out before treatment.
- G. Treat exposed surfaces with two coats of a solution recommended by the manufacturer.
- H. Treated timber which is sawn along its length, ploughed, thickness planed or otherwise extensively processed shall be retreated with the original treatment.
- I. Minor cuts and drill holes that reveal untreated timber shall be treated with a solution recommended for the purpose.

-
- J. When instructed by the Superintendent, timber sections shall be tested with an approved electrical moisture meter which shall be used in accordance with the manufacturer's recommendation.
1. 5% of material but not less than ten lengths of each cross section shall be tested. Testing shall occur at the centre of the length.
 2. 90% of values given shall be within the specified range. All results shall be provided to the Superintendent in writing.

3.2 Protection Generally

- A. Timber shall be kept dry and shall not be subjected to overstress, distortion or disfigurement of sections or components during transit, storage, lifting, erection or fixing.
- B. All timber for external use shall be kept so that its moisture content does not change significantly from when it was graded "WET".
- C. Timber and components shall be stored under cover, clear of the ground and with good ventilation. Level bearers on a dry firm base shall provide support at regular intervals. Packs shall be opened to ensure free movement of air through the stack.
- D. The sequence of construction shall be arranged so that the timber is protected prior to use in the construction, while it is being mounted in the construction and subsequently maintained.
- E. Minimise end splitting of timber sections by sealing the ends with EndCheck or Carbatec End Sealer, clear sealing emulsion, or acceptable equivalent, before delivery to the Site. Reapply sealing emulsion to all ends of timbers where cut on Site.
- F. Painted Finishes: Structural timber that is to be painted shall be primed according to the paint manufacturer's recommendations, prior to delivery to Site.
- G. Provide temporary protection for all materials both before and after erection until permanent coverings are in place.

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SECTION 0816 -- ANODISING

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS

2.1 Aluminium Anodising

- A. Materials
1. Unless otherwise specified anodising shall comply with AS 1231 and a certificate shall be provided to that effect for each batch.
 2. The colour anodising process shall be agreed with the Superintendent. Colouring of the anodic film shall be achieved using a two-stage electrolytic process using cobalt or nickel as the colouring metal or by using a single stage integral process. On no account use tin electrolytes for anodic film colouring. Any proposal for using an alternative colouring technique will be considered only if the anodiser confirms in writing that the alternative process meets all the visual, physical and documentary requirements detailed in the Specification. Satisfactory independent evidence and samples shall be required to prove that an alternative colouring process will provide an equal or superior standard of performance and life expectancy.
 3. Colour control limits shall be submitted as samples with the Tender for review and comment by the Superintendent. The anodic finish shall be within these limits agreed and held by the Superintendent.
 4. All aluminium alloys shall be selected to ensure that the finished visual appearance of all components is identical. The alloy for extrusions shall be grade 6063, or acceptable equivalent, and for sheet material grade J57S, or acceptable equivalent. Obtain a certificate from the material supplier stating the grade of the material being supplied.
 5. Base metal batching shall be controlled so that areas match. Critical visible areas shall be from a single batch. Agree base metal batching with the Superintendent prior to production.

3 EXECUTION

3.1 General

- A. Anodic oxidation coating shall be carried out at a single place of manufacture. All critical visible areas shall be anodised in a single batch.
- B. Wherever possible anodising shall commence after fabrication/ machining is complete.
- C. Any fabrication of pre-finished lengths shall be previously agreed with the Superintendent. Uncoated edges in assemblies shall be non visible and not exposed to the atmosphere. Fabricated pieces shall meet the thickness requirements of AS 1231.
- D. The processes adopted shall be compatible, offering weather resistance, abrasion resistance, impact resistance and protection against chemical attacks as follows:
1. Corrosion resistance shall be equal to or greater than that of an anodised aluminium finish thickness of minimum average 25 microns and sealing in accordance with AS 1231 and the Specification.
 2. For production control the abrasion resistance of the anodising shall be determined in accordance with AS 1231. Films that continue to be scratched by glass coated abrasive paper when tested by this method are deemed not to conform to the Specification.
 3. For production control the sealing value of the anodising shall be determined in accordance with AS 1231.
 4. For production control the film thickness of the anodising shall be determined in accordance with AS 1231.
 5. Anodic oxidation coating shall be carried out by the sulphuric acid bath process. The temperatures of the anodising bath and chemical content shall be set and maintained to achieve good quality control of the finished product in accordance with AS 1231.
 6. Notwithstanding AS 1231 visible surfaces shall be free from coating or metallurgical defects when viewed from 100cm.

- E. A quality control system for cleaning extrusion dies shall be adopted such that no lines appear on the face of the extrusions. As a minimum check every fifth extrusion.
- F. Rejected anodised extrusions shall only be reprocessed once.
- G. Anodised finishes shall be within the control limits (established from range samples) or standards accepted by the Superintendent.
- H. The finish shall be agreed with the Superintendent from the range of samples provided.
- I. The finish shall be sealed in accordance with AS 1231.
- J. Finishes shall be tested to AS 1231.
- K. Warranties: Make available to the Superintendent, fully documented and signed copies of the manufacturer's/ applicator's warranties. Unless otherwise agreed in advance with the Superintendent, the duration of the warranties shall be:
 - 1. Internal applications: 15 years.
 - 2. External applications: 25 years.
- L. Variation of final surface finish shall be limited to tolerances agreed with the Superintendent prior to commencement. If such variation occurs, the components that, in the opinion of the Superintendent, fail to achieve a uniform final surface finish shall be replaced.
- M. Lines produced at the location of die connection points shall only occur on non-visible surfaces in the installed work under the Contract. The contact marks on sections resulting from electrical connection shall not be on visible surfaces of the installed work under the Contract.
- N. Cleaning Frequency: The normal cleaning frequency associated with the warranty for anodised finishes shall be 12 months, unless agreed otherwise by the Superintendent.
- O. Repair of damage: Surface areas likely to be damaged during handling, fixing or by other building trades shall be fully protected until completion of all other work in the area of the installation. If during fixing or glazing any damage occurs, it shall be rectified immediately. Site rectification of damage shall only be carried out with the Superintendent's acceptance and shall carry a 25-year guarantee for colour retention, avoidance of discoloration and corrosion resistance.

3.2 Testing

- A. Carry out a minimum of three independent acceptance inspections, sampling procedures and plans, as set out in AS 1199.1, for general inspection level 2. Acceptable Quality Level (AQL) shall be 1% on each colour and finish used in the Works. These inspections shall be carried out at the finishing plant prior to fabrication, by a competent independent inspector from an approved laboratory.
- B. Where there is damage or the production test reports have not been provided, the Superintendent may commission an independent investigation of all finishes on Site-fixed units. The Head Contractor shall be responsible for all costs in connection with such Site inspections. This investigation shall be carried out within the guidelines of AS 1199.2, LQ (Limited Quality) (Pa = 10%) = 5%. For the purpose of this inspection each section shall be taken as an individual component in assessing the overall batch number to allow certification and compliance with the Specification. For units that are finished in fewer than three production runs, acceptance inspections shall also be made using AS 1199.2 to the same LQ.
- C. Certificates of Practical Completion, or any other document of authority accepting responsibility, may not be signed by the Superintendent until testing reports have been received.

SECTION END

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SECTION 0819 -- INSULATION AND BARRIERS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

1.2 Definitions

- A. Thermal insulation terminology: To AS/NZS 4859.1 and AS/NZS 4859.2.
- B. Bio-soluble: A product that dissolves in bodily fluids and is quickly cleared from the lungs.
- C. Fire hazard properties: Terminology to NCC A5.5.
- D. Pliable building membrane: To AS/NZS 4200.1 and equivalent to sarking-type materials as defined in the NCC.
- E. Vapour permeable (breathable) membrane: A flexible membrane material, normally used for secondary waterproofing that allows for the transmission of water vapour.

1.3 Testing

- A. Provide testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification, AS/NZS 4859.1 and AS/NZS 4859.2.
- B. The provision of testing data or the carrying out of tests does not relieve the Head Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

2 PRODUCTS

2.1 Insulation Generally

- A. Insulation shall be inert, durable, rot-proof, vermin-proof, and not be degraded by action of moisture, extreme climate temperature or water and water vapour. Insulation shall be CFC, HCFC and HFC free in its makeup and during the manufacturing process.
- B. Insulation shall have a zero ozone depletion potential (ODP) in its manufacture and composition, be CFC and HFC free in its manufacture and composition and have a global warming potential (GWP) of less than five. Provide material safety data sheets (MSDS) or other such evidence from the manufacturer demonstrating compliance.
- C. Insulation to satisfy the performance requirements nominated in the particular work sections of the Specification, including fire, acoustic and thermal.
- D. The selected material and its method of attachment to the supporting components shall eliminate the risk of bulging, sagging, delamination or detachment.

2.2 Fire Hazard Properties

- A. All components incorporated in external walls, common walls, internal non-load bearing fire-resisting walls and shaft walls are to comply with Deemed-To-Satisfy provisions of Clause C1.9 of the NCC, with a compliant spread of flame index and are to be non-combustible in accordance with AS 1530.1.
- B. Exposed insulation/linings: Group number to AS 5637.1.
- C. Insulation and barriers, as part of facade assemblies, are to comply with AS 5113.
- D. Insulation: Fire hazard indices for all materials when tested to AS/NZS 1530.3:
 1. Spread-of-Flame Index: 9.
 2. Smoke-Developed Index: 8 if Spread-of-Flame Index > 5.
 3. Materials with reflective facing: Test to AS/NZS 1530.3 and the recommendations of Appendix A6.
- E. Pliable membranes:
 1. Flammability Index when tested to AS 1530.2: 5.

2.3 EPS, PU and PIR Insulation

- A. Shall comply with specification and AS/NZS 4859.1 section 8.

- B. Use of extruded or expanded polystyrene (EPS), rigid foam polyurethane (PU) and/ or polyisocyanurate (PIR) insulation products other than those specified are not acceptable unless formally accepted by the building owner's insurance underwriters.

2.4 Pliable Building Membranes

- A. Pliable building membranes shall comply with the requirements of AS/NZS 4200.1.

2.5 Rigid Cellular Plastic Sheet Insulation

- A. Rigid cellular polystyrene insulation (extruded and moulded) in the form of sheets, board blocks and cut shapes to comply with AS 1366.3 and AS 1366.4.
- B. Rigid cellular polyurethane insulation in the form of sheets, board blocks and cut shapes to comply with AS 1366.1.
- C. Rigid cellular polyisocyanurate insulation in the form of sheets, board blocks and cut shapes.

2.6 Insulation Batts and Blankets

- A. Biosoluble glasswool and rockwool insulation with or without facings.
- B. Polyester insulation.
- C. Comply with AS/NZS 1530.3.

2.7 Reflective Insulation

- A. Insulation that incorporates a reflective metallic surface in the form of either a rolled metallic foil or a metallic deposit.
- B. Shall meet the requirements of the Specification, NCC Part J1 and AS/NZS 4859.1, Section 9.

2.8 Vapour Barriers

- A. Shall meet the requirements of the Specification.
- B. Shall effectively prevent the passage of water vapour into the system.
- C. Vapour barriers shall be installed as a fully sealed and airtight assembly without holes or tears.

2.9 Breather Membranes

- A. Proprietary breathable (vapour permeable) membrane: A flexible membrane material normally used for secondary waterproofing that adequately allows for the transmission of water vapour and has a vapour resistance not more than 0.5 MNs/g.
- B. Breather membranes shall meet the requirements of the Specification and AS/NZS 4200.1 and installed in accordance with AS/NZS 4200.2.
- C. The breather membrane shall permit the passage of air through the system without giving rise to the risk of interstitial condensation.
- D. Application: Provide a vapour permeable membrane behind external facing material which does not provide permanent weatherproofing or which may be subject to condensation forming on the internal face.

2.10 Polyester Insulation

- A. Shall comply with the Specification and AS/NZS 4859.1, Section 6.

2.11 Mineral Wool Insulation

- A. Shall comply with the Specification and AS/NZS 4859.1, Section 7.

2.12 Sarking

- A. Installed under the outer roofing surface of tiled or metal roofs as water or weatherproofing material.
- B. Shall comply with AS/NZS 4200.1, AS/NZS 4200.2 and AS 1530.1.

2.13 Fasteners and Supports

- A. Galvanised steel.

2.14 Mesh Support to Roof Insulation

- A. Provide support to the following:
1. Sarking, vapour barrier or reflective thermal insulation membranes laid over roof framing members which are spaced at more than 900mm centres.
 2. Blanket type thermal insulation laid over roof framing members as sound insulation to metal roofing.

- B. Welded safety mesh to comply with AS/NZS 4389.

2.15 Thermal Break Strips

- A. Provide thermal break strip to steel framing supporting metal sheet roof cladding.
- B. R-Value: 0.2.

2.16 Packaging and Labelling

- A. Packaging and labelling shall comply with AS/NZS 4859.1.
- B. Mineral wool packaging shall be labelled FBS-1 Bio-soluble Insulation and not listed as a hazardous material in the Safe Work Australia Hazardous Chemical Information System (HCIS).

3 EXECUTION

3.1 Installation of Mineral Wool Insulation

- A. Comply with the AMWU/ CFMEU/ CEPU/ ICANZ Industry Code of Practice for the Safe Use of Glasswool and Rockwool Insulation.
- B. Marking: Deliver mineral wool products to site in packaging labelled FBS-1 BIOSOLUBLE INSULATION.

3.2 Insulation

- A. Installation of bulk insulation shall comply with AS 3999.
- B. All components shall be stored on Site such that they are not damaged, distorted or weathered unevenly. Keep dry at all times.
- C. Before installation, holes shall be sealed and all debris removed.
- D. Material shall fit tightly with closely butted joints fittings and abutments and no gaps shall be left.
- E. Eaves ventilation shall be left unobstructed and electric cables shall not be covered (unless they have been sized accordingly).
- F. Insulation shall not be installed beneath water cistern platforms.

3.3 Vapour Barriers/ Breather Membranes

- A. Before fixing, the moisture content of timber shall be checked and vapour barrier shall only be installed if moisture content is below 20%.
- B. Material shall be fixed carefully and neatly to provide a fully sealed barrier free from tears, punctures, open seams and sagging.
- C. Staples shall be used for fixing at not more than 250mm centres along all supports. Sheets shall be lapped only at supports and laps shall not be less than 150mm. Material shall lap over and be fixed to reveals of openings.
- D. All joints and edges, including around pipes, ducts, etc, shall be sealed with adhesive tape recommended by the vapour barrier manufacturer.
- E. Immediately before covering over, membranes shall be checked for perforations and any found shall be repaired or replaced to the satisfaction of the Superintendent.
- F. Installation: Run the vapour permeable membrane horizontally on the outer face of external wall framing, over the flashing, from the bottom plate up. Pull taught over the framing and fix to framing members. Seal across the wall cavity at the top.
- G. Openings: Run the vapour permeable membrane over the openings and leave covered until windows and doors are installed. Cut the membrane on a 45° diagonal from each corner of the opening, fold the flaps inside and fix to the inside frame of the opening. If the membrane is used to provide a continuous air tight layer, seal all joints with pressure sensitive adhesive tape.
- H. Fixing: Install as follows:
 1. Steel or aluminium frames: Hex head screws, with either 20mm diameter washers or through hardboard strips.
 2. Adhesive tape: In accordance with the manufacturer's written instructions and to comply with the NCC.

3.4 Cavity Barrier

- A. Material shall be cut to fit tightly and shall be securely fixed along all edges. All joints shall be wired or stapled together to provide a complete barrier to smoke and flame.
- B. There shall be no gaps.
- C. Sleeved fibre small cavity barriers:

-
1. Fix securely with staples at not more than 150mm centres. Fix vertical barriers by both flanges, horizontal barriers by upper flange only.
 2. Closely butt at joints and intersections and ensure that the barriers are compressed along their full length to give a complete seal.

D. Wired fibre small cavity barriers:

1. Fix securely with staples, folding if necessary to ensure a tight fit. Closely butt at joints and intersections, leaving no gaps.

3.5 Pliable Building Membranes

- A. Installation shall comply with AS/NZS 4200.2 and NCC J1.2 or NCC 3.12.1.1, as appropriate.

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SECTION 0820 -- GASKETS

1 GENERAL

1.1 Related Documents

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS

2.1 Materials

- A. Gaskets shall accommodate the maximum movements anticipated in the particular application.
- B. All gasket to gasket joints shall be butt jointed and heat sealed. The bonding of gaskets using other materials is not acceptable. The gaskets shall perform and appear as a single continuous material.
- C. The gasket system shall comprise both extruded and moulded elements. These shall perform and appear as a single element.
- D. All gaskets shall be fabricated to the most appropriate grade and hardness. Design and select all gaskets so that:
1. The most appropriate solution is chosen for the particular application.
 2. Glass retention and weatherproofing requirements are maintained.
 3. They retain their shape and function and do not permanently distort over their working life.
- E. Gaskets shall be kept free from contact with materials that have stain characteristics and shall be compatible with all substrates, sealants and any other materials used in the Works.
- F. Provide written confirmation from the gasket manufacturer that the gasket material and designs are suitable for their specific use in all parts of the Works and that they are compatible with all other materials and sealants used within the installation and at interfaces with other materials/ components.
- G. The colour of all gaskets shall be black unless specified otherwise.
- H. Gaskets shall not shrink, warp or deteriorate during the periods nominated in the Head Contractor's stated times for replacement.
- I. Gasket corners in frames shall be preformed and factory vulcanised in layers.
- J. The choice of seals and gaskets shall not compromise sound insulation performance.
- K. Gaskets and seals used to achieve the required airtightness shall be selected to accommodate fully the range of dimensional tolerances and movements associated with the design, fabrication and installation of the Works. Gaskets shall be formed from materials capable of maintaining their elastic qualities and dimensions and shall be resistant to physical and chemical attack.
- L. Be responsible for ensuring that the glazing framework is effectively sealed to the building structure to such an extent that the acoustic performance of the installation is equivalent to that measured under the test conditions detailed in the Specification.

3 EXECUTION

- A. Not Used.

SECTION END

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SECTION 0821 -- MORTAR**1 GENERAL****1.1 Related Documents**

- A. This section shall be read in conjunction with Section 0171, other related sections of this Specification and the Preliminaries.

2 PRODUCTS**2.1 Materials**

- A. Mortar class: To AS 3700 Table 5.1.
- B. Sand for mortar:
1. Shall be fine aggregate with a low clay content and free from efflorescing salts, selected for colour and grading.
 2. Shall be from one source to ensure consistency of colour and texture, unless specified otherwise.
 3. Shall be well graded from 2mm maximum.
 4. Where a mix range is specified (eg 1:1:5-6) the lower proportion for grade 'g' sands and higher proportion for grade 's' sands shall be used.
 5. Marine sand shall not be used with sulphate resisting or super sulphated cement.
 6. All sand used in face work shall be thoroughly washed to remove all contaminants and shall be guaranteed not to contain any efflorescing salts.
 7. Submit samples of sand proposed in accordance with the requirements of the Specification and identify:
 - a) Name of supplier.
 - b) The pit of origin.
 - c) Sieve analysis.
- C. Cement:
1. Portland cement shall comply with AS 3972.
 2. Masonry cement shall comply with AS 1316.
 3. White cement shall have iron salts content less than 1%.
- D. Water shall be clean and free from any deleterious material.
- E. Mortar class shall comply with AS 3700.
- F. Unless otherwise stated, Portland cement shall be Type GP and be delivered in the original sealed bags of the manufacturer or in acceptable bulk containers.
- G. All cement used shall be obtained from a supplier capable of complying with the requirements of the Specification.
- H. Lime shall comply with AS 1672.1.
- I. No mortar plasticiser or other additive shall be used unless the Superintendent has given prior acceptance. Additives shall be used in the proportions recommended by the manufacturer. Alter mortar mixes in accordance with the manufacturer's recommendations. The suitability of the mixture for use in any particular mortar shall be demonstrated.
- J. Admixtures shall not be used in mortar unless specified or agreed in writing. If used they shall comply with the following:
1. Air-entraining agents shall comply with AS 1478.1.
 2. Methyl cellulose water thickeners shall be designed for use in blockwork.
 3. Plasticisers or workability agents shall be designed for use in blockwork.
- K. Pigments shall comply with BS EN 12878, and as follows:
1. Quantity: Less than 10% of the mass of cement in the mix.
 2. For light colours: Use off white cement in the mix.
- L. Calcium chloride, or any admixtures containing calcium chloride, shall not be used.

- M. Ready-mixed mortar may be used, subject to prior acceptance by the Superintendent.
- N. Proportions: As documented in the Masonry cement mortar mix table and Cement (GP/GB) mortar mix table.

2.2 Masonry Cement Mortar Mix Table: Cement, Lime, Sand Ratios (by Volume)

<i>Table 1 - Masonry cement mortar mix table: Cement, lime, sand ratios (by volume)</i>				
Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M3	1:0:4	1:0:4	n/a	Yes
M4	1:0:3	n/a	n/a	Yes

2.3 Cement (GP/GB) Mortar Mix Table: Cement, Lime, Sand Ratios (by Volume)

<i>Table 2 - Cement (GP/GB) mortar mix table: Cement, lime, sand ratios (by volume)</i>				
Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M2	1:2:9	n/a	n/a	No
M3	1:1:6	1:1:6	n/a	Optional
M3	1:0:5	1:0:5	1:0:5	Yes
M4	1:0.5:4.5	1:0.5:4.5	n/a	Optional
M4	1:0:4	1:0:4	1:0:4	Yes
M4	1:0-0.25:3	1:0-0.25:3	n/a	Optional

3 EXECUTION

3.1 Workmanship

- A. Mixing plant, tools and banker boards shall be kept clean at all times.
- B. Materials shall be measured accurately by volume using clean gauge boxes. Proportions of mixes shall be for dry sand, making allowance for bulking if damp.
- C. Ingredients shall be mixed thoroughly to a consistency suitable for the work and free from lumps. Mortars containing air-entraining admixtures shall be mixed by machine, but not overmixed.
- D. Mortar shall be used within two hours of mixing, at normal temperatures. Retarded mortar shall be used within the time recommended in writing by the manufacturer, taking into account any extreme temperatures that may be experienced on Site. Mortar may be retempered to restore workability, but only within manufacturer's time limits and without the introduction of additional water.
- E. Determine the minimum amount of water required to achieve a workable mix.
- F. If pre-mixed mortars are used, the characteristics, product data, and testing criteria shall be submitted to the Superintendent for review.

3.2 Testing

- A. Mortar Testing:
1. Tests:
 - a) Testing of mortars shall be carried out in accordance with AS/NZS 2350 and AS 2701, or to equal standards acceptable to the Superintendent.
 - b) All testing shall be carried out by a NATA accredited laboratory.
 - c) Specimens for preliminary tests of the mortars shall be prepared at least six weeks in advance of any walling commencing.
 - d) All material sources shall be identified to the Superintendent for acceptance prior to commencement of preliminary tests.

-
- e) Samples shall be taken at the point of mixing or use.
 - f) Additional tests and sampling shall be performed if the mortar does not comply with the Specification.
 - g) Subject to the test results, the specified nominal mix proportions shall be adjusted and tested.
 - h) Half the samples shall be tested at seven days, the remainder at 28 days. The 28-day crushing strength of the cubes shall not be less than 3.6N/ mm² for the preliminary test and 2.5N/ mm² for the work test.
2. Testing apparatus:
 - a) Ensure that on-Site apparatus is maintained in good repair.
 - b) Maximum and minimum thermometers as required.
 - c) Soil thermometers as required for measuring the mortar and ground temperatures.
 - d) Syphon can apparatus for measuring the moisture content of aggregate.
 3. Frequency of testing: Cubes shall be prepared for each type of mortar and for each type of block walling or for every storey, whichever is the more frequent.
 4. Failure of mortars: Masonry walling containing mortar that does not comply with the requirements of the Specification shall be demolished, debris removed from the Site, and rebuilt.

3.3 Transportation, Handling and Storage of Materials

A. Storage of Materials:

1. Cements and lime shall be stored off the ground, under cover, away from damp and in such a manner as to enable them to be used in order of delivery.
2. Sands shall be stored separately, according to type, on clean, hard, dry standings and be protected from contamination.
3. Pre-mix mortars, if used, shall be stored in accordance with the manufacturer's instructions.

SECTION END