

TECHNICAL SPECIFICATION

of
works to be done and materials to be used in the

**ASN Co Building Bays 4 - 5
Base Building Works
For
Commercial Use**

at

ASN Co BUILDING
1 – 3 Hickson Road
THE ROCKS

For

PLACE MANAGEMENT – PROPERTY NSW

TANNER KIBBLE DENTON ARCHITECTS PTY LTD
Level 1, 19 Foster Street Surry Hills NSW 2010
Tel: (02) 9281 4399 Fax: (02) 9281 4337

TKDA Job No: 17 0056
February 2018

DOCUMENT STATUS

Issue	Date	Description	Written	Authorised
A	26/02/2018	Tender issue	JJ	JJ

This page has been intentionally left blank for double sided printing

SPECIFICATION

CONTENTS

CONTENTS

GENERAL

- 0171 General Requirements

COMMON REQUIREMENTS

- 0181 Adhesives, Sealants & Fasteners
- 0182 Fire Stopping
- 0183 Metals and Prefinishes
- 0184 Termite Management
- 0185 Timber Products, Finishes and Treatment

THE SCHEDULES

- SH01 Schedule of Contract Documents
- SH02 Schedule of Substrates and Finishes
- SH03 Schedule of Sanitaryware and Tapware

02 SITE

- 0202 Demolition
- 0222 Earthwork

03 STRUCTURE

- 0310 Concrete Combined
- 0315 Concrete Finishes
- 0335 Brick and Stone Masonry
- 0341 Structural Steel
- 0342 Light Steel Framing
- 0344 Steel – Hot-dip Galvanizing
- 0381 Structural Timber
- 0382 Light Timber Framing
- 0383 Sheet Flooring

04 ENCLOSURE

- 0411 Waterproofing – external
- 0421 Roofing
- 0453 Doors and Access Panels
- 0455 Door Hardware
- 0467 Glazing and Glass Components
- 0472 Acoustic Insulation

05 INTERIORS

- 0511 Lining
- 0525 Cubicle Systems
- 0531 Suspended Ceilings
- 0551 Joinery
- 0552 Metalwork
- 0573 Extinguishers and Blankets
- 0581 Signs and Displays

06 FINISH

- 0611 Rendering and Plastering
- 0612 Cementitious Toppings
- 0621 Waterproofing – internal
- 0631 Ceramic Tiling
- 0651 Resilient Finishes
- 0655 Timber Flooring
- 0656 Floor Sanding and Finishing
- 0671 Painting

SPECIFICATION

CONTENTS

07 SERVICES

Mechanical Services
Electrical Services
Hydraulic Services
Fire Services
Fire Services - Fire Safety Upgrade
Vertical Transportation Services

APPENDIX

- AP1 PRESNA 'SHFA Hazardous Materials Register' dated 22 June 2012.
- AP2 ASN Bay 5 Ground Floor Services Trench Extension – Review of Archaeological Implications dated 15 January 2018 prepared by Casey & Lowe.

SPECIFICATION

01 GENERAL

0171 General requirements

0171 GENERAL REQUIREMENTS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Structural: If required, provide structures, installations and components as follows:

- Fixed accessways: To AS 1657.
- Structural design actions: To the AS 1170 series.

Design

Design by contractor: If the contractor provides design, use only appropriately qualified persons and conform to all statutory requirements.

Conflict with the documents: If it is believed that a conflict exists between statutory requirements and the documents, notify the contract administrator immediately and provide a recommendation to resolve the conflict.

Noise levels

General: Install systems within the limits of the contract design and documented equipment performance and as documented.

1.2 PRECEDENCE

General

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of the worksections override conflicting requirements of their referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

Common requirements

Requirement: Conform to the following worksections:

- PRELIMINARIES, for Heritage Building requirements.
- 0181 ADHESIVES, SEALANTS AND FASTENERS.
- 0182 FIRE-STOPPING.
- 0183 METALS AND PREFINISHES.
- 0184 TERMITE MANAGEMENT
- 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT.

Related worksections

Refer to the following worksections:

- MECHANICAL SERVICES specification
- HYDRAULIC SERVICES specification
- ELECTRICAL SERVICES specification
- FIRE SERVICES specification
- VERTICAL TRANSPORTATION SERVICES specification

Cross referencing styles

Within the text:

01 GENERAL

0171 General requirements

- Worksection titles are indicated by UPPERCASE text.
- Subsection titles are indicated by **BOLD** text.
- Clause titles are indicated by **BOLD** text.
- Subclause titles are indicated by **Bold** text.

1.4 REFERENCED DOCUMENTS

Contractual relationships

General: Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in the documents referenced in this specification.

Current editions

General: Use referenced documents which are the editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

1.5 INTERPRETATION

Abbreviations

General: For the purposes of this specification the following abbreviations apply:

- AS: Australian Standard.
- BCA: National Construction Code Series Volume One: Building Code of Australia Class 2 to 9 Buildings and Volume Two: Building Code of Australia Class 1 and Class 10 Buildings.
- GRP: Glass Reinforced Plastic.
- IP: Ingress protection.
- NATA: National Association of Testing Authorities.
- NCC: National Construction Code.
- NZS: New Zealand Standard.
- PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.
- PVC: Polyvinyl Chloride.
- PVC-U: Unplasticised Polyvinyl Chloride. Also known as UPVC.
- SDS: Safety data sheets.
- SHFA: Sydney Harbour Foreshore Authority
- VOC: Volatile Organic Compound.
- WHS: Work Health and Safety.

Definitions

General: For the purposes of this specification, the following definitions apply:

- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Contract administrator: Contract administrator has the same meaning as architect or superintendent and is the person appointed by the owner or principal under the contract.
- Contractor: Contractor has the same meaning as builder and is the person or organisation bound to carry out and complete the work under the contract.
- Default: Specified value, product or installation method which is to be provided unless otherwise documented.
- 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.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.

SPECIFICATION

01 GENERAL

0171 General requirements

- 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.
- Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.
- Fire hazard properties: To BCA A2.4.
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.
- High level interface: Systems transfer information in a digital format using an open system interface.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 after fabrication with coating thickness and mass to AS/NZS 4680 Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529.
- Joints:
 - . Construction joint: A joint with continuous reinforcement provided to suit construction sequence.
 - . Contraction joint: An opening control joint with a bond breaking coating separating the joint surfaces to allow independent and controlled contraction of different parts or components, induced by shrinkage, temperature changes or other causes. It may include unbound dowels to assist vertical deflection control.
 - . Control joint: An unreinforced joint between or within discrete elements of construction which allows for relative movement of the elements.
 - . Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.
 - . Isolation joint: A joint between elements of a structure designed to isolate structural movement while permitting horizontal and/or vertical movement between abutting elements.
 - . Sealant joint: A joint filled with a flexible synthetic compound which adheres to surfaces within the joint to prevent the passage of dust, moisture and gases.
 - . Structural control joint: A control joints (contraction, expansion and isolation) in structural elements when used with applied material and finishes.
 - . Substrate joint: A joint in the substrate which includes construction joints and joints between different materials.
 - . Weakened plane joint: A contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a pre-moulded strip.
- Local (government) authority: A body established for the purposes of local government by or under a law applying in a state or territory.
- Low level interface: Systems transfer information via terminals and voltage free contacts.
- 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.
- Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:
 - . Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are base metal thicknesses.
 - . Ferrous open sections zinc coated by an in-line process: To AS/NZS 4791.
 - . Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792.

SPECIFICATION

01 GENERAL

0171 General requirements

- Network utility operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or external stormwater drainage system.
- Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the contract administrator.
- Pipe: Includes pipe and tube.
- Practical completion or Defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.
- Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.
- Professional engineer: As defined by the BCA.
- Proprietary: Proprietary means identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Prototype: A full size mock-up of components, systems or elements to demonstrate or test construction methods, junctions and finishes, and to define the level of quality.
- Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.
- Readily accessible: Capable of being reached quickly and without climbing over or removing obstructions, mounting upon a chair, or using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.
- Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.
- Registered testing authority:
 - . An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field; or
 - . An organisation outside Australia registered by an authority recognised by NATA through a mutual recognition agreement; or
 - . An organisation recognised as being a Registered Testing Authority under legislation at the time the test was undertaken.
- Required: Required by the documents, the local council or statutory authorities.
- If required: A conditional specification term for work which may be shown in the documents or is a legislative requirement.
- Sample: A physical example that illustrates products, workmanship, materials, or equipment and establish standards by which the work will be judged. It includes samples, prototypes and sample panels.
- Statutory authority: A public sector entity created by a specific law of the Commonwealth, State or Territory.
- Supply: Supply, furnish and similar expressions mean supply only.
- Tests - completion: 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 contract administrator may direct that completion tests be carried out after the date for practical completion.
- Tests - pre-completion: Tests carried out before completion tests, including:
 - . Production: Tests carried out on a purchased item, before delivery to the site.
 - . Progressive: Tests carried out during installation to demonstrate performance in according with this specification.
 - . Site: Tests carried out on the site.
 - . Type: Tests carried out on an item identical with a production item, before delivery to the site.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.

01 GENERAL

0171 General requirements

- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

1.6 CONTRACT DOCUMENTS

Services diagrammatic layouts

General: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- Obtain measurements and other necessary information.
- Coordinate the design and installation in conjunction with all trades.

Building drawings

General: The architectural drawings are based on base drawings provided by the Principal. The drawings are approximately to the scales as noted, however, the architect does not warrant these drawings as being measured drawings.

Warranty: No warranty is given as to the completeness or accuracy of drawings of the existing building and/or manuals and drawings of existing services.

Levels

General: Spot levels take precedence over contour lines and ground profile lines.

1.7 INSPECTION

Notice

Concealment: If notice of inspection is required in respect of parts of the works that are to be concealed, advise when the inspection can be made before concealment.

Tests: Give notice of the time and place of documented tests.

Minimum notice: As documented in the **Notices schedule**.

Light level requirements: to AS/NZS 1680.2.4.

Attendance

General: Provide attendance for documented inspections and tests.

1.8 SUBMISSIONS

General

Submit to: Superintendent.

Default timing: Make submissions at least 5 working days before ordering products or starting installation of the respective portion of the works.

Submission response times: Allow in the construction program for at least the following times:

- Shop drawings: 5 working days
- Samples and prototypes: 3 working days
- Manufacturers' or suppliers' recommendations: 3 working days
- Product data: 3 working days
- Product/design substitution or modification: 5 working days

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.

Identification: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification.

Non-compliance: Identify proposals for non-compliance with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

01 GENERAL

0171 General requirements

Errors: If a submission contains errors, make a new or amended submission as appropriate, indicating changes made since the previous submission.

Electronic copies file format: AutoCAD dwg.

Transmission medium: Email. Files sizes limited to 10MB

Hard copy quantity: 3 sets of paper prints and 1 USB or 1 CD.

- Loose documents larger than A3: One transparency on heavyweight plastic film the same size as the standard contract drawings.
- Loose documents up to and including A3: One copy.

Standard contract drawing size: A1

Authority approvals

Authorities' approvals: Submit documents showing approval by the authorities whose requirements apply to the work.

Correspondence: Submit copies of correspondence and notes of meetings with authorities whose requirements apply to the work.

Building penetrations

General: If it is proposed to penetrate or fix to the following, submit details of the methods proposed for approval to maintain the required structural, fire and other properties:

- Structural building elements including external walls, fire walls, fire doors and access panels, other tested and rated assemblies or elements, floor slabs and beams.
- Membrane elements including damp-proof courses, waterproofing membranes and roof coverings. If penetrating membranes, provide a waterproof seal between the membrane and the penetrating component.

Certification

General: Submit certification that the plant and equipment submitted meets all requirements of the contract documents.

Execution details

General: Before starting the installation of building services, submit the following:

- Embedded services: Proposed method for embedding services in concrete walls or floors or chasing into concrete or masonry walls.
- Fixing of services: Typical details of locations, types and methods of fixing services to the building structure.
- Inaccessible services: If services will be enclosed and not accessible after completion, submit proposals for location of service runs and fittings.

Marking and labelling

General: Before marking and labelling submit:

- Samples of the proposed labels.
- A schedule showing, for each item or type of item:
 - . A description of the item or type of item sufficient to identify it.
 - . The proposed text of the marking or label
 - . The proposed location of the marking or label.

Materials

Product certification: If products conformance to product certification schemes, submit evidence of conformance.

Product data: For proprietary equipment, submit the manufacturer's product data as follows:

- Technical specifications and drawings.
- Type-test reports.
- Performance and rating tables.
- Recommendations for installation and maintenance.

SPECIFICATION

01 GENERAL

0171 General requirements

Samples

Submission: Submit nominated samples.

Incorporation of samples: If it is intended to incorporate samples into the works, submit proposals. Incorporate samples in the works which have been endorsed for inclusion. Do not incorporate other samples.

Retention of samples: Keep endorsed samples in good condition on site, until the date of practical completion.

Shop drawings

General: Include dimensioned drawings showing details of the fabrication and installation of structural elements, building components, services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and submit dimensioned set-out drawings.

Record drawings: Submit all documented shop drawings amended to include changes made during the progress of the work and up to the end of the defects liability period.

Services coordination: Coordinate with other building and service elements. Show adjusted positions on the shop drawings.

Space requirements: Check space requirements of equipment and services indicated diagrammatically in the contract documents.

Submission medium: Email pdf.

Electronic or Hard copy. Nominate alternatives or include both.

Drawing size: A1

Checking: Make sure that the drawings have been checked before submission.

Building work drawings for building services: Submit detailed dimensioned drawings showing all:

- Set-out of new concrete slab beams for building into existing timber beam wall pockets.
- Set-out for duct shafts with services through existing timber and concrete floors and timber framed roof.
- Access doors and panels.
- Conduits to be cast in slabs.
- Holding down bolts and other anchorage and/or fixings required complete with loads to be imposed on the structure during installation and operation.
- Openings, penetrations and block-outs.
- Sleeves.
- Plinths, kerbs and bases.
- Required external openings.

Cross reference

The above list is not conclusive. Refer to the worksections in this specification including the MECHANICAL, ELECTRICAL, HYDRAULIC, VERTICAL TRANSPORTATION and FIRE SERVICES specificationS for project specific shop drawing requirements.

Tests

General: Submit an inspection and testing plan which is consistent with the construction program. Include particulars of test stages and procedures.

Test reports: Submit written reports on nominated tests.

SPECIFICATION

01 GENERAL

0171 General requirements

2 PRODUCTS

2.1 GENERAL

Manufacturers' or suppliers' recommendations

General: Provide and select, if no selection is given, transport, deliver, store, handle, protect, finish, adjust and prepare for use the manufactured items in conformance with the recommendations of the manufacturer or supplier.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate in conformance with the recommendations of the manufacturer or supplier.

Project modifications: Advise of activities that supplement, or are contrary to the recommendations of the manufacturers or supplier.

Sealed containers

General: If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

Sources policy

General: Preference for Australian and New Zealand products

Prohibited materials

General: Do not provide the following:

- Materials, exceeding the limits of those listed, in the Safe Work Australia Hazardous Substances Information System (HSIS).
- Materials that use chlorofluorocarbon (CFC) or hydro chlorofluorocarbon (HCFC) in the manufacturing process.

Substitutions

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties of the item.

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:

- Evidence that the performance is equal to or greater than that specified.
- Evidence of conformity to a cited standard – Australian / New Zealand standard.
- Samples.
- Essential technical information, in English.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.

Availability: If the documented products or systems are unavailable within the time constraints of the construction program, submit evidence.

Criteria: If the substitution is for any reason other than unavailability, submit evidence that the substitution:

- Is of net enhanced value to the principal.
- Is consistent with the contract documents and is as effective as the identified item, detail or method.

2.2 TESTS

Attendance

General: Provide attendance on tests.

01 GENERAL

0171 General requirements

Testing authorities

General: Except for site tests, have tests carried out by a Registered testing authority and submit test reports.

- Reports: Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and conformance or non-conformance with requirements.
- Site tests: Use instruments calibrated by authorities accredited by a Registered testing authority.

2.3 MATERIALS AND COMPONENTS

Consistency

General: For each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

Corrosion resistance

General: Conform to the following atmospheric corrosivity category as defined in AS/NZS 2312.

Atmospheric corrosivity category: Category C5-M: Marine in accordance with AS2312.1 (2014)

Galvanizing

Severe conditions: Galvanize mild steel components (including fasteners) to AS 1214 or AS/NZS 4680 as appropriate, if:

- Exposed to weather.
- Embedded in masonry.
- Exposed to or in air spaces behind the external leaf of masonry walls.
- In contact with chemically treated timber, other than copper chrome arsenate (CCA).

3 EXECUTION

3.1 OFF-SITE DISPOSAL

Removal of material

General: Dispose of building waste material off site to the requirements of the relevant authorities.

3.2 WALL CHASING

Requirement

Existing building fabric is of high heritage significance value and is not to be chased for concealing service pipes and conduits. Refer to the Heritage Requirements notes on the drawings.

Holes and chases

General: If holes and chases are required in new masonry walls, make sure structural integrity of the wall is maintained. Do not chase walls nominated as fire-resistant, acoustic rated or building fabric that is of high heritage significance (existing sandstone and brick walls).

Parallel chases or recesses on opposite faces of a wall: Not closer than 600 mm to each other.

3.3 FIXING

General

Suitability: If equipment is not suitable for fixing to non-structural building elements, fix directly to structure and trim around penetrations in non-structural elements.

Fasteners

General: Use proprietary fasteners capable of transmitting the loads imposed, and sufficient for the rigidity of the assembly.

01 GENERAL

0171 General requirements

3.4 SERVICES CONNECTIONS

Connections

General: Connect to network distributor services or service points. Excavate to locate and expose connection points. Reinstate the surfaces and facilities that have been disturbed.

Network distributors' requirements

General: If the network distributor elects to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the authorities.

3.5 SERVICES INSTALLATION

General

Fixing: If non-structural building elements are not suitable for fixing services to, fix directly to structure and trim around holes or penetrations in non-structural elements.

Installation: Install equipment and services plumb, fix securely and organise reticulated services neatly. Allow for movement in both structure and services.

Concealment: Conceal all cables and pipes in plant spaces, stores, ceiling spaces and riser cupboards unless detailed to be exposed. Refer to the Services specifications and drawings for cable trays and metal conduits for services which will be exposed where no ceilings are being installed. Existing exposed services are a reference to the installation of services

Lifting: Provide heavy items of equipment with permanent fixtures for lifting as recommended by the manufacturer.

Arrangement: Arrange services so that services running together are parallel with each other and with adjacent building elements.

Dissimilar metals

General: Join dissimilar metals with fittings of electrolytically compatible material.

Temporary capping

Pipe ends: During construction protect open ends of pipe with metal or plastic covers or caps.

Piping

General: Install piping in straight lines at uniform grades without sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Spacing: Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation.

Changes of direction: Provide long radius elbows or bends and sets where practicable, and swept branch connections. Provide elbows or short radius bends where pipes are led up or along walls and then through to fixtures. Do not provide mitred fittings.

Vibration: Arrange and support piping so that it remains free from vibration whilst permitting necessary movements. Minimise the number of joints.

Embedded pipes: Do not embed pipes that operate under pressure in concrete or surfacing material.

Valve groupings: If possible, locate valves in groups.

Pressure testing precautions: Isolate items not rated for the test pressure. Restrain pipes and equipment to prevent movement during pressure testing.

Differential movement

General: If the geotechnical site investigation report predicts differential movements between buildings and the ground in which pipes or conduits are buried, provide control joints in the pipes or conduits, as follows:

- Arrangement: Arrange pipes and conduits to minimise the number of control joints.
- Magnitude: Accommodate the predicted movements.

01 GENERAL

0171 General requirements

3.6 BUILDING PENETRATIONS

Penetrations

Fire-resisting rated building elements: Seal new and existing penetrations with a system conforming to AS 4072.1.

Non fire-resisting building elements: Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is acoustically rated, maintain the rating.

Sleeves

General: If piping or conduit penetrates building elements, provide metal or PVC-U sleeves formed from pipe sections as follows:

- Movement: Arrange to permit normal pipe or conduit movement.
- Diameter (for non-fire-resisting rated building elements): Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm.
- Prime paint ferrous surfaces.
- Terminations:
 - . If cover plates are fitted: Flush with the finished building surface.
 - . In fire-resisting and acoustic-rated building elements: 50 mm beyond finished building surface.
 - . In floors draining to floor wastes: 50 mm above finished floor unless documented otherwise.
 - . Elsewhere: 5 mm beyond finished building surface.
 - . Termite management: To AS 3660.1.
- Thickness:
 - . Metal: 1 mm or greater.
 - . PVC-U: 3 mm or greater.

Sleeves for cables: For penetrations of cables not enclosed in conduit through ground floor slabs, beams and walls provide sleeves formed from PVC-U pipe sections. No penetrations through external walls are to occur without approval from the superintendent and the principal's heritage architect.

3.7 SUPPORT AND STRUCTURE

General

Requirement: Provide incidental supports and structures to suit the services. Mechanical plant is not to be supported from the existing timber floor structures. Details for air-conditioning duct supports from the timber structure are to be submitted for approval. All support for new plant/ services is to be approved.

3.8 PIPE SUPPORTS

Support systems

General: Provide proprietary support systems of metallic-coated steel construction.

Vertical pipes: Provide anchors and guides to maintain long pipes in position, and supports to balance the mass of the pipe and its contents.

Saddles: Do not provide saddle type supports for pipes greater than DN 25.

Dissimilar metals: If pipe and support materials are dissimilar, provide industrial grade electrically non-conductive material securely bonded to the pipe to separate them. Provide fixings of electrolytically compatible material.

Uninsulated pipes: Clamp piping supports directly to pipes.

Insulated pipes:

- Spacers: Provide spacers at least as thick as the insulation between piping supports and pipes. Extend either side of the support by at least 20 mm.
- Spacer material: Rigid insulation material of sufficient strength to support the piping and suitable for the temperature application.

01 GENERAL

0171 General requirements

Support spacing

Cold and heated water pipes: To AS/NZS 3500.1 Table 5.2. Provide additional brackets, clips or hangers to prevent pipe movement caused by water pressure effects.

Sanitary plumbing: To AS/NZS 3500.2 Table 9.1.

Other pipes: To AS/NZS 3500.1 Table 5.2.

Hangers

Conform to the **Hanger size table**.

Hanger size table

Nominal pipe size (DN)	Minimum hanger diameter (mm) for single hangers
50 maximum	9.5
65 to 90	12.7
100 to 125	15.8
150 to 200	19.0

All pipe support fixings to heritage fabric require approval from the superintendent and the principal's heritage architect prior to an installations being carried out. Details and shop drawings are to be provided as part of the approval process.

3.9 PLANT AND EQUIPMENT

General

Location: Locate so that failure of plant and equipment (including leaks) does not create a hazard for the building occupants and causes a minimum or no damage to the building, its finishes and contents including water sensitive equipment or finishes.

3.10 ACCESS FOR MAINTENANCE

General

Standards: Conform to the relevant requirements of AS 1470, AS 1657, AS/NZS 1892.1, AS 2865 and AS/NZS 3666.1.

Work Health and Safety: Conform to the requirements of the applicable Work Health and Safety regulations.

Protection from injury: Protect personnel from injury caused by contact with objects including those that are sharp, hot or protrude at low level.

Plant room flooring surfaces: R10 Slip resistance classification to AS 4586.

Trip hazards: Do not run small services including drains and conduits across floors where they may be a trip hazard.

Manufacturer's standard equipment: Modify manufacturer's standard equipment when necessary to provide the plant access documented.

Clearances

Minimum clearances for access: Conform to the following:

- ≥ 2100 mm clear vertically above horizontal floors, ground and platforms.
- Preferably ≥ 750 mm clear, but in no case less than 600 mm horizontally between equipment or between equipment and building features including walls.
- If tools are required to operate, adjust or remove equipment, provide sufficient space so that the tools can be used in their normal manner and without requiring the user to employ undue or awkward force.
- If equipment components are hinged or removable, allow the space recommended by the manufacturer.

SPECIFICATION

01 GENERAL

0171 General requirements

- Within plant items: Conform to the preceding requirements, and in no case less than the clearances recommended in BS 8313.

Elevated services other than in occupied areas

Access classifications:

- Access class A: Readily accessible. Provide clear and immediate access to and around plant items. If plant or equipment is located more than 2.0 m above the ground, floor or platform, provide a platform with handrails accessible by a stair, all to AS 1657.
- Access class B: If the plant item requiring access is located more than 2.0 m above the ground, floor or platform, provide a platform with handrails accessible by a non-vertical ladder, all to AS 1657.
- Access class C: Locate plant so that temporary means of access conforming to Work health and Safety regulations can be provided.

Areas in which access is restricted to authorised maintenance personnel: Provide access as follows:

- Instruments, gauges and indicators (including warning and indicating lights) requiring inspection at any frequency: Readily accessible.
- Access required monthly or more frequently: Access class A.
- Access required between monthly and yearly: Access class A or B.
- Access required less frequently than yearly: Access class A, B or C.

Other areas: Provide access as follows:

- Locate to minimise inconvenience and disruption to building occupants or damage to the building structure or finishes.
- In suspended ceilings, locate items of equipment that require inspection and/or maintenance above tiled parts. If not possible, provide access panels where located above set plaster or other inaccessible ceilings. Arrange services and plant locations to reduce the number of access panels. Coordinate with other trades to use common access panels where feasible.
- Do not locate equipment requiring access above partitions.
- Instruments, gauges and other items requiring inspection at any frequency: Readily accessible.
- Access required monthly or more frequently: Readily accessible. Provide clear and immediate access to and around plant items, located less than 2 m above the ground or floor.
- Access required less frequently than monthly: Allow space and locate for safe temporary access.
- Labelling: If equipment is concealed in ceilings, provide marking to **MARKING AND LABELLING, Equipment concealed in ceilings**.

Facilities for equipment removal and replacement

Requirement: Provide facilities to permit removal from the building and replacement of plant and equipment, including space large enough to accommodate it and any required lifting and/or transportation equipment. Arrange plant so that large and/or heavy items can be moved with the minimum of changes of direction.

Removal of components: Allow sufficient space for removal and replacement of equipment components including air filters, tubes of shell and tube heat exchangers, removable heat exchanger bundles, coils and fan shafts. Provide access panels or doors large enough to permit the safe removal and replacement of components within air handling units.

Facilities for access

Equipment behind hinged doors: Provide doors opening at least 150°.

Equipment behind removable panels: Provide panels with quick release fasteners or captive metal thread screws.

Removable panels: Provide handles to permit easy and safe removal and replacement.

Insulated plant and services: If insulation must be removed to access plant and services provide access for maintenance, arranged so it can be repeatedly removed and replaced without damage.

Piping

Conform to the following:

SPECIFICATION

01 GENERAL

0171 General requirements

- Provide access and clearance at fittings which require maintenance, inspection or servicing, including control valves and joints intended to permit pipe removal.
- Arrange piping so that it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.
- Preferably run piping, conduits, cable trays and ducts at high level and drop vertically to equipment.
- All fixings to be approved by the superintendent.

Electrical and controls

Electrical equipment: Provide clearances and access space to AS/NZS 3000.

Switchboards and electrical control equipment: Locate near the main entrance to plant space. Arrange plant so that, to the greatest extent possible, switchboards are visible from the plant being operated.

Control panels: Locate near and visible from the plant controlled.

3.11 VIBRATION SUPPRESSION

General

Requirement: Minimise the transmission of vibration from rotating or reciprocating equipment to other building elements.

Standard

Rotating and reciprocating machinery noise and vibration: Vibration severity in Zone A to AS 2625.1 and AS 2625.4.

Speeds

General: If no maximum speed is prescribed do not exceed 1500 r/min for direct driven equipment.

Connections

General: Provide flexible connections to rotating machinery and assemblies containing rotating machinery. Isolate pipes by incorporating sufficient flexibility into the pipework or by use of proprietary flexible pipe connections installed so that no stress is placed on pipes due to end reaction.

Inertia bases

General: If necessary to achieve the required level of vibration isolation, provide inertia bases having appropriate mass and conforming as follows:

- Construction: Steel or steel-framed reinforced concrete. Position foundation bolts for equipment before pouring concrete.
- Supports: Support on vibration isolation mountings using height saving support brackets.

Vibration isolation mountings

General: Except for external equipment that is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

- For static deflections < 15 mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment.
- For static deflections ≥ 15 mm: Spring mountings.

Selection: Provide mountings selected to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

Installation: Set and adjust vibration isolation mounting supports to give clearance for free movement of the supports.

Spring mountings: Provide freestanding laterally stable springs as follows:

- Clearances: ≥ 12 mm between springs and other members such as bolts and housing.
- High frequency isolation: 5 mm neoprene acoustic isolation pads between baseplate and support.
- Levelling: Provide bolts and lock nuts.
- Minimum travel to solid: ≥ 150% of the designated minimum static deflection.
- Ratio of mean coil diameter to compressed length at the designated minimum static deflection: ≥ 0.8:1.
- Snubbing: Snub the springs to prevent bounce at start-up.

01 GENERAL

0171 General requirements

- Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection and which remain out of contact during normal operation.

3.12 SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS

General

Requirement: Seismic restraint to AS 1170.4: Section 8 (design of parts and components)
Earthquake design category: 2

3.13 FINISHES TO BUILDING SERVICES

General

Requirement: If exposed to view (including in plant rooms), paint new building services and equipment. Surfaces painted or finished off-site: Conform to the METALS AND PREFINISHES worksection.

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.

Standard: Conform to the recommendations of AS/NZS 2311 Sections 3, 6 and 7 or AS/NZS 2312 Sections 5, 8 and 10, as applicable unless instructed otherwise.

Powder coating

Standard:

- Aluminium for architectural applications: To AS 3715.
- Other metals: To AS 4506.

Painting systems

New unpainted interior surfaces: To AS/NZS 2311 Table 5.1.

New unpainted exterior surfaces: To AS/NZS 2311 Table 5.2.

Paint application

Coats: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Make sure each coat of paint or clear finish is uniform in colour, gloss, thickness and texture and free of runs, sags, blisters or other discontinuities.

Combinations: Do not combine paints from different manufacturers in a paint system.

Protection: Remove fixtures before starting to paint and refix in position undamaged when painting is complete.

Underground metal piping

Corrosion protection: Provide corrosion protection for the following:

- Underground ferrous piping.
- Underground non-ferrous metal piping in corrosive environments.

Protection methods: Select from the following:

- Cathodic protection: Sacrificial anodes or impressed current. Incorporate a facility for periodic testing. Conform to the recommendations of AS 2832.1.
- Continuous wrapping using proprietary petroleum taping material.
- Impermeable flexible plastic coating.
- Sealed polyethylene sleeve.

Low VOC emitting paints

Paint types: To the recommendations of AS/NZS 2311 Table 4.2.

01 GENERAL

0171 General requirements

3.14 MARKING AND LABELLING

General

Requirement: Mark and label services and equipment for identification purposes as follows:

- Locations exposed to weather: Provide durable materials.
- Pipes, conduits and ducts: To AS 1345 throughout its length, including in concealed spaces.
- Cables: Label to indicate the origin and destination of the cable.

Consistency: Label and mark equipment using a consistent scheme across all services elements of the project.

Electrical accessories

General: Label isolating switches and outlets to identify circuit origin.

Equipment concealed in / above ceilings

Location: Provide a label on the ceiling, indicating the location of each concealed item requiring access for routine inspection, maintenance and/or operation. In tiled ceilings, locate the label on the ceiling grid closest to the item access point. In flush ceilings, locate adjacent to closest access panel. Items to be labelled include but are not limited to:

- Fan coil units and terminal equipment (e.g. VAV terminals).
- Fire and smoke dampers.
- Isolating valves not directly connected to items otherwise labelled.
- Motorised dampers.
- Wall and structure mounted equipment in occupied areas where approved for mounting: Provide labels to items in occupied areas including the following:
 - . Services control switches.
 - . Temperature and humidity sensors.

Points lists

Automatic control points: Provide plasticised, fade-free points lists for each automatic control panel. Store in a pocket on the door of the panel. Lists to include terminal numbers, point addresses, short and long descriptors.

Pressure vessels

General: Mount manufacturer's certificates in glazed frames on a wall next to the vessel.

Valves and pumps

General: Label to associate pumps with their starters and valves. Screw fix labels to body or attach label to valve handwheels with a key ring.

Underground services

Survey: Accurately record the routes of underground cables and pipes before backfilling. Include on the record drawings.

Records: Provide digital photographic records of underground cable and pipe routes before backfilling. Include in operation and maintenance manual.

Location marking: Accurately mark the location of underground cables and pipes with route markers consisting of a marker plate set flush in a concrete base, engraved to show the direction of the line and the name of the service.

Markers: Place markers at ground level at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

Marker bases: 200 mm diameter x 200 mm deep, minimum concrete.

Direction marking: Show the direction of the cable and pipe run by means of direction arrows on the marker plate. Indicate distance to the next marker.

Plates: Brass, aluminium or stainless steel with black filled engraved lettering, minimum size 75 x 75 x 1 mm thick.

Plate fixing: Waterproof adhesive and 4 brass or stainless steel countersunk screws.

Marker height: Set the marker plate flush with paved surfaces, and 25 mm above other surfaces.

SPECIFICATION

01 GENERAL

0171 General requirements

Marker tape: Where electric bricks or covers are not provided over underground wiring, provide a 150 mm wide yellow or orange marker tape bearing the words WARNING – electric cable buried below, laid in the trench 150 mm below ground level.

Labels and notices

Materials: Select from the following:

- Cast metal.
- For indoor applications only, engraved two-colour laminated plastic.
- Proprietary pre-printed self-adhesive flexible plastic labels with machine printed black lettering.
- Stainless steel or brass minimum 1 mm thick with black filled engraved lettering.

Emergency functions: To AS 1319.

Colours: Generally to AS 1345 as appropriate, otherwise black lettering on white background except as follows:

- Danger, warning labels: White lettering on red background.
- Main switch and caution labels: Red lettering on white background.

Edges: If labels exceed 1.5 mm thickness, radius or bevel the edges.

Fixing: Fix labels securely using screws, rivets, proprietary self-adhesive labels or double-sided adhesive tape and as follows:

- If labels are mounted in extruded aluminium sections, use rivets or countersunk screws to fix the extrusions.
- Use aluminium or monel rivets for aluminium labels.

Label locations: Locate labels so that they are easily seen and are either attached to, below or next to the item being marked.

Labelling text and marking: To correspond to terminology and identifying number of the respective item as shown on the record drawings and documents and in operating and maintenance manuals.

Lettering heights:

- Danger, warning and caution notices: Minimum 10 mm for main heading, minimum 5 mm for remainder.
- Equipment labels within cabinets: Minimum 3.5 mm.
- Equipment nameplates: Minimum 40 mm.
- Identifying labels on outside of cabinets: Minimum 5 mm.
- Isolating switches: Minimum 5 mm.
- Switchboards, main assembly designation: Minimum 25 mm.
- Switchboards, outgoing functional units: Minimum 8 mm.
- Switchboards, sub assembly designations: Minimum 15 mm.
- Valves: Minimum 20 mm.
- Self-adhesive flexible plastic labels:
 - . Labels less than 2000 mm above floor: 3 mm on 6 mm wide tape.
 - . Labels minimum 2000 mm above floor: 8 mm on 12 mm wide tape.
 - . Other locations: Minimum 3 mm.

Operable devices: Mark to provide a ready means of identification. Include the following:

- Controls.
- Indicators, gauges, meters.
- Isolating switches.

Vapour barriers: Do not penetrate vapour barriers.

01 GENERAL

0171 General requirements

3.15 SOFTWARE

General

Requirement: Provide the software required for the operation and management of building services systems and equipment.

3.16 WARRANTIES

General

Requirement: If a warranty is documented, name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Warranty period: Start warranty periods at acceptance of installation.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

Cross reference

Refer to **Selections** in this worksection.

3.17 RECORD DRAWINGS

General

Requirement: Submit record drawings showing the following:

- Installed locations of building elements, services, plant and equipment.
- Off-the-grid dimensions and depth if applicable.
- Any provisions for the future.

Recording, format and submission

Progress recording: Keep one set of drawings on site at all times, expressly for the purpose of marking changes made during the progress of the works.

Drawing layout: Use the same borders and title block as the contract drawings.

Quantity and format: Conform to **SUBMISSIONS**.

Endorsement: Sign and date all record drawings.

Accuracy: If errors in, or omissions from, the record drawings are found, amend the drawings and re-issue in the quantity and format documented for **RECORD DRAWINGS**.

Date for submission: Not later than 2 weeks after the date for practical completion.

Services record drawings

General: Submit record drawings of services to **General** and **Recording, format and submission** and the following:

- Extensions and/or changes to existing: If a drawing shows extensions and/or alterations to existing installations, include sufficient of the existing installation to make the drawing comprehensible without reference to drawings of the original installation.
- Detention: If on-site detention tanks or pondage are provided, include the volume required on the drawing and the permitted flow rate to the connected system.
- Domestic cold water or fire mains: Show the pressure available at the initial connection point and the pressure available at the most disadvantaged location on each major section of the works.
- Stormwater: If storm water pipes are shown, include the pipe size and pipe grade together with the maximum acceptable flow and the actual design flow.

Diagrams: Provide diagrammatic drawings of each system including the following:

- Controls.
- Piping including all valves and valve identification tags.
- Principal items of equipment.

01 GENERAL

0171 General requirements

- Single line wiring diagrams.
- Acoustic and thermal insulation.
- Access provisions and space allowances.
- Fixings.
- Fixtures.
- Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications.
- Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Issue of CAD base drawings electronically: CAD base drawings can be provided by the Architect and consultants to Superintendent for issue to the Contractor. Where the Architect has made available electronic copies of drawings in digital format the drawings are to be used for information only. The Architect does not warrant the use of electronic drawings for building setout, shop drawings or as-built drawings by contractors, or to provide the basis for accurate area or dimensional calculations by other consultants.

Subsurface services: Record information on underground or submerged services to the documented quality level, conforming to AS 5488.

3.18 OPERATION AND MAINTENANCE MANUALS

General

Requirement: Submit operation and maintenance manuals for the whole of the work.

Authors and compilers: Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Referenced documents: If referenced documents or technical worksections require that manuals be submitted, include corresponding material in the operation and maintenance manuals.

Subdivision: By installation or system, depending on project size.

Contents

Requirement: Include the following:

- Table of contents: For each volume. Title to match cover.
- Directory: Names, addresses, and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.
- Record drawings: Complete set of record drawings, full size.
- Drawings and technical data: As necessary for the efficient operation and maintenance of the installation. Include:
 - . Switchgear and controlgear assembly circuit schedules including electrical service characteristics, controls and communications.
 - . Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- Installation description: General description of the installation.
- Systems descriptions and performance: Technical description of the systems installed and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, and limiting conditions.
- Systems performance: Technical description of the mode of operation of the systems installed.
- Baseline data: To AS 1851.
- Documentation to AS 1851 including the schedule of essential functionality and performance requirements.
- Equipment descriptions:
 - . Name, address, email address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.

SPECIFICATION

01 GENERAL

0171 General requirements

- . Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed.
- . Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
- . Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
- Certificates:
 - . Certificates from authorities.
 - . Copies of manufacturers' warranties.
 - . Product certification.
 - . Test certificates for each service installation and all equipment.
 - . Test reports
 - . Test, balancing and commissioning reports.
 - . Control system testing and commissioning results.
- 7 day record of all trends at commissioning.
- Operation procedures:
 - . Manufacturers' technical literature as appropriate.
 - . Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
 - . Control sequences and flow diagrams for systems installed.
 - . Legend for colour-codes services.
 - . Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- Maintenance procedures:
 - . Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work including frequency and manufacturers' recommended tests.
 - . Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
 - . Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step sequence of instructions for each procedure.
 - . Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
 - . Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.
 - . Schedules for recording recommissioning data so that changes in the system over time can be identified.
 - . Instructions for use of tools and testing equipment.
 - . Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
 - . Safety data sheets (SDS).
 - . Instructions and schedules conforming to current standards AS 1851, AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4.
- Maintenance records:
 - . Prototype service records conforming to AS 1851 prepared to include project specific details.

SPECIFICATION

01 GENERAL

0171 General requirements

- . Prototype periodic maintenance records and report to AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4 as appropriate, prepared to include project specific details.
- . Submit, in binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the time of practical completion.
- . Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.

Format – electronic copies

Printing: Except for drawings required in the **RECORD DRAWINGS** clause provide material that can be legibly printed on A4 size paper.

Scope: Provide the same material as documented for hardcopy in electronic format.

Quantity and format: Conform to **Submissions – electronic copies**.

Format – hard copy

General: A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled. Include the following features:

- Cover: Identify each binder with typed or printed title *OPERATION AND MAINTENANCE MANUAL*, to spine. Identify title of project, volume number, volume subject matter, and date of issue.
- Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.
- Drawings: Fold drawings to A4 size with title visible, insert in plastic sleeves (one per drawing) and accommodate them in the binders.
- Pagination: Number pages.
- Ring size: 50 mm maximum, with compressor bars.
- Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.

Number of copies: 3.

Date for submission

Date for draft submission: The earlier of the following:

- 2 weeks before the date for practical completion.
- Commencement of training on services equipment.

Date for final submission: Within 2 weeks after practical completion.

3.19 TOOLS AND SPARE PARTS

Spare parts

General: Provide spare parts listed in the appropriate worksections.

Tools and spare parts schedule

General: At least 8 weeks before the date for practical completion, submit a schedule of tools, portable instruments and spare parts necessary for maintenance of the installation. For each item state the recommended quantity and the manufacturer's current price. Include the following in the prices:

- Checking receipt, marking and numbering in conformance with the spare parts schedule.
- Packaging and delivery to site.
- Painting, greasing and packing to prevent deterioration during storage.
- Referencing equipment schedules in the operation and maintenance manuals.
- Suitable means of identifying, storing and securing the tools and instruments. Include instructions for use.

Replacement: Replace spare parts used during the maintenance period.

01 GENERAL

0171 General requirements

3.20 COMPLETION TESTS

Reports

General: Submit reports indicating observations and results of tests and compliance or non-compliance with requirements.

Notice

Inspection: Give sufficient notice for inspection to be made of the commissioning and completion testing of the installation.

Controls

General: Calibrate, set and adjust control instruments, control systems and safety controls.

Samples

General: Remove unincorporated samples on completion.

Circuit protection

General: Confirm that circuit protective devices are sized and adjusted to protect installed circuits.

Completion tests

General: Test the works under the contract to demonstrate compliance with the documented performance requirements of the installation.

Functional checks: Carry out functional and operational checks on energised equipment and circuits and make final adjustments for the correct operation of safety devices and control functions.

Proprietary equipment: Submit type test reports confirming compliance of proprietary equipment.

Sound pressure level measurements: Conform to the following:

- Correction for background noise: To AS/NZS 2107 Table B1.
- External: To AS 1055.1.
- Internal: To AS/NZS 2107.
- Measurement positions: If a test position is designated only by reference to a room or space, do not take measurements less than 1 m from the floor, ground or walls.
- Sound pressure level analysis: Measure the sound pressure level and the background sound pressure level over the full range of octave band centre frequencies from 31.5 Hz to 8 kHz at the designated positions.
- Sound pressure levels: Measure the A-weighted sound pressure levels and the A-weighted background sound pressure levels at the designated positions.

Test instruments: Use instruments calibrated by a Registered testing authority.

Certification

General: On satisfactory completion of the installation and before the date of practical completion, submit certificates stating that each installation is operating correctly.

3.21 TRAINING

General

Duration: Instruction to be available for the whole of the commissioning and running-in periods.

Format: Conduct training at agreed times, at system or equipment location. Also provide seminar instruction to cover all major components.

Operation and maintenance manuals: Use items and procedures listed in the final draft operation and maintenance manuals as the basis for instruction. Review contents in detail with the principal's staff.

Certification: Provide written certification of attendance and participation in training for each attendee. Provide register of certificates issued.

Demonstrators

General: Use only qualified manufacturer's representatives who are knowledgeable about the installations.

01 GENERAL

0171 General requirements

Maintenance

General: Explain and demonstrate to the principal's staff the purpose, function and maintenance of the installations.

Operation

General: Explain and demonstrate to the principal's staff the purpose, function and operation of the installations.

Seasonal operation

General: For equipment requiring seasonal operation, demonstrate during the appropriate season and within 6 months.

3.22 CLEANING

Final cleaning

General: Before the date for practical completion, clean throughout, including all exterior and interior surfaces except those totally and permanently concealed from view.

Labels: Remove all labels not required for maintenance.

3.23 PERIODIC MAINTENANCE OF SERVICES

General

Requirement: During the maintenance period, carry out periodic inspections and maintenance work as recommended by manufacturers of supplied equipment, and promptly rectify faults.

Emergencies: Attend emergency calls promptly.

Annual maintenance: Carry out recommended annual maintenance procedures before the end of the maintenance period.

Maintenance period: The greater of the defects liability period and the period documented in the **Maintenance requirements schedule**.

Maintenance program

General: Submit details of maintenance procedures and program, relating to installed plant and equipment, 6 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

Maintenance records

General: Record in binders provided with the Operation and maintenance manuals.

Referenced documents: If referenced documents or technical worksections require that log books or records be submitted, include this material in the maintenance records.

Service visits: Record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. On completion of the visit, obtain the signature of the principal's designated representative on the record of the work undertaken.

Site control

General: Report to the principal's designated representative on arriving at and before leaving the site.

3.24 POST- CONSTRUCTION MANDATORY INSPECTIONS AND MAINTENANCE

General

Requirement: For the duration of the defects liability period, provide inspections and maintenance of safety measures required by the following:

- AS 1851.
- Other statutory requirements applicable to the work.

Records: Provide mandatory records.

Certification: Certify that mandatory inspections and maintenance have been carried out and that the respective items conform to statutory requirements. Submit certification.

SPECIFICATION

01 GENERAL

0171 General requirements

Annual inspection: Provide an annual inspection and maintenance immediately prior to the end of the defects liability period.

4 SELECTIONS

4.1 SCHEDULES

Noise level schedule

Property	A
Upper limit of noise caused by services	- Refer to the MECHANICAL SERVICES specification - Not to exceed the Maximum Noise Level Criteria NR38

Warranty schedule

Trade / Material	Warranty for	Warranty to	Warranty Period To commence with the Date of Practical Completion
Door Hardware	Manufacturer / Installer	Principal	5 years
Fire Door Frames	Manufacturer / Installer	Principal	10 years
Glazing	Manufacturer / Installer	Principal	10 years
Frameless glazing system	Manufacturer / Installer	Principal	1 year
Internal & External Paints	Manufacturer	Principal	2 years
Vinyl Sheet Flooring	Manufacturer / Installer	Proprietor	5 years
Tiling - Walls	Manufacturer / Installer	Principal	10 years
Tiling - Floors	Manufacturer / Installer	Principal	10 years
Door Hardware	Materials	Principal	1 year
Door Hardware	Installation	Principal	1 year
Toilet Partitions	Manufacturer / Installer	Principal	5 years
Waterproof Membrane - internal	Supplier interlocked with Applicator and sheet flooring	Principal	20 years
Waterproof Membrane – External	Supplier interlocked with Applicator	Principal	20 years
Roof Access Hatch	Manufacturer / Installer	Principal	5 years
Dulux Polyester Powdercoat – Duratec - colour and film integrity to AAMA 2604.98	Manufacturer / applicator	Principal	10 years
Dulux Powdercoat Fluoroset	Manufacturer / applicator	Principal	30 years
Paints and painting	Materials and application with accredited painter	Principal	5 years
Hydraulic Services Refer to HYDRAULIC SERVICES specification and as follows:			
Plant, equipment and materials	Manufacturer / Installer	Principal	1 year minimum or Manufacturer's warranty period
Wiring Systems	Manufacturer / Installer	Principal	5 years
Fire Services - Refer to FIRE SERVICES specification and as follows:			
Plant, equipment and materials	Manufacturer / Installer	Principal	1 year minimum or Manufacturer's warranty

01 GENERAL

0171 General requirements

			period
Mechanical Services – Refer to MECHANICAL SERVICES specification and as follows:			
All plant and equipment	Manufacturer / Installer	Principal	1 year minimum or Manufacturer's warranty period
Piping and wiring systems	Manufacturer / Supplier	Principal	1 year
Electrical Services - Refer to ELECTRICAL SERVICES specification and as follows:			
Services and Equipment	Manufacturer / Installer	Principal	1 year minimum or Manufacturer's warranty period
Wiring systems	Manufacturer / Installer	Principal	5 years
Vertical Transportation Services – Refer to VERTICAL TRANSPORTATION SERVICES specification and as follows			
All plant and equipment	Manufacturer / Installer	Principal	1 year minimum or Manufacturer's warranty period. Refer to the VERTICAL TRANSPORTATION SERVICES specification
Other			
Sanitary fittings	Manufacture / materials	Principal	2 years
Tapware	Manufacturer / Installer	Principal	2 years 10 years – ceramic discs
Metal finishes (internal)	Manufacturer / Installer	Principal	10 years
Metal finishes (external)	Manufacturer / Installer	Principal	20 years

Notices schedule

Item	Minimum notice
Hold Points	3 working days
Inspections	3 working days
Samples approval	3 working days
Where no period is provided in worksections	3 working days

4.2 MAINTENANCE

Maintenance requirements schedule

Provision	Maintenance period (months)	Requirement
Maintenance of mechanical Services	12 months as per the contract.	As documented, conform to Mechanical services Maintenance. Refer to MECHANICAL SERVICES specification.
Maintenance of electrical service	12 months as per the contract.	As documented, conform to electrical services Maintenance. Refer to ELECTRICAL SERVICES specification.

SPECIFICATION

01 GENERAL

0171 General requirements

Provision	Maintenance period (months)	Requirement
Maintenance of Hydraulic services	12 months as per the contract.	As documented, conform to Hydraulic services Maintenance. Refer to HYDRAULIC SERVICES specification.
Maintenance of Fire services	12 months as per the contract.	As documented, conform to Fire services Maintenance. Refer to FIRE SERVICES specification.
Maintenance of Vertical Transportation services	12 months as per the contract.	As documented, conform to Fire services Maintenance. Refer to VERTICAL TRANSPORTATION SERVICES specification.

01 GENERAL

0181 Adhesives, sealants and fasteners

0181 ADHESIVES, SEALANTS AND FASTENERS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide adhesives, sealants and fasteners, as documented and as follows:

- Fitness for purpose: Capable of transmitting imposed loads, sufficient to make sure the rigidity of the assembly, or integrity of the joint.
- Finished surface: That will not cause discolouration.
- Compatibility: Compatible with the products to which they are applied.
- Sealant replacement: Capable of safe removal without compromising the application of the replacement sealant for future refurbishment.
- Movement: If an adhered or sealed joint is subject to movement, select a system certified to accommodate the projected movement under the conditions of service.
- Fasteners: Accredited for the particular use, capable of transmitting imposed loads and maintaining the rigidity of the assembly.

1.2 PRECEDENCE

General

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of this worksection override conflicting requirements of its referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Associated Worksections

Refer to the following related worksections:

- 0551 JOINERY
- MECHANICAL SERVICES specification
- ELECTRICAL SERVICES specification
- HYDRAULIC SERVICES specification
- FIRE SERVICES specification
- VERTICAL TRANSPORTATION SERVICES specification

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of prepared joints and penetrations for each sealant application.

01 GENERAL

0181 Adhesives, sealants and fasteners

1.5 SUBMISSIONS

Samples

Visible joint sealants: Submit colour samples.

Technical data

Sealants: Submit technical data sheets.

Warranties

Manufacturer's warranty: Submit the manufacturer's published product warranties.

2 PRODUCTS

2.1 ADHESIVES

Standards

Mastic adhesive: To AS 2329.

Polymer emulsion adhesive for timber: To AS 2754.2, not inferior to Type 3.

High strength adhesive tape

General description: A foam of cross linked polyethylene or closed cell acrylic coated both sides with a high performance acrylic adhesive system, encased in release liners of paper or polyester.

Product classification: Select tape to suit substrate as follows:

- Firm high strength foam tapes: For high energy surfaces including most bare metals such as stainless steel and aluminium.
- Conformable high strength foam: For the following:
 - . Medium energy surfaces including many plastics and paints, and bare metals.
 - . Lower energy surfaces including many plastics, most paints and powder coatings, and bare metals.

Thickness: Select the tape to make sure a mismatch between surfaces does not exceed half the tape thickness under the applied lamination pressure.

2.2 SEALANTS

Standards

General: To ISO 11600.

Masonry joints

General: Provide sealant and bond breaking materials which are non-staining to masonry and removable where detailed. Do not use bituminous materials with absorbent masonry units.

Bond breaking backing:

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: Closed-cell or impregnated, not water-absorbing.

Fire-resisting control joints

General: Provide sealant materials that maintain the nominated fire-resistance level (FRL).

- Fire-stopping: To AS 4072.1.

Lightweight building element joints

Joints subject to rapid changes of movement: Provide sealants that accommodate the movement of the contact materials.

Floor control joints

General: Provide trafficable sealants.

Bond breaking backing:

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.

01 GENERAL

0181 Adhesives, sealants and fasteners

- Foamed materials: Closed-cell or impregnated, not water-absorbing.

2.3 FASTENERS

General

Masonry anchors: Proprietary expansion type anchors refer to 0355 BRICK AND STONE MASONRY.

Plain washers: To AS 1237.1.

- Provide washers to the heads and nuts of bolts, and the nuts of coach bolts.

Plugs: Proprietary purpose-made plastic or timber wedges in masonry joints.

Powder-actuated fasteners: To AS/NZS 1873.4.

Stainless steel fasteners: To ASTM A240/A240M.

Steel nails: To AS 2334.

- 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 10 mm thick.

Unified hexagon bolts, screws and nuts: To AS/NZS 2465.

Fasteners in CCA treated timber: Epoxy coated or stainless steel.

Bolts

Coach bolts: To AS/NZS 1390.

Hexagon bolts Grades A and B: To AS 1110.1.

Hexagon bolts Grade C: To AS 1111.1.

Corrosion resistance

Atmospheric corrosivity category: To the 0171 GENERAL REQUIREMENTS worksection.

Steel products: Conform to the **Corrosion-resistance table** or provide proprietary products with metallic and/or organic coatings of equivalent corrosion-resistance.

Corrosion-resistance table – Atmospheric corrosivity categories D and F to AS/NZS 2312

Situation	Material	Threaded fasteners and anchors		Powder actuated fasteners
		Minimum local metallic coating thickness (µm)	Minimum local metallic coating thickness (µm)	Material type
Internal		Electroplated zinc or Hot-dip galvanized	30	Stainless steel 316
External		Stainless steel 316	-	Stainless steel 316

Finishes

Electroplating:

- Metric thread: To AS 1897.
- Imperial thread: To AS 4397.

Galvanizing:

- Threaded fasteners: To AS 1214.
- Other fasteners: To AS/NZS 4680.

Mild steel fasteners: Galvanize if:

- Embedded in masonry.
- In external timbers.
- In contact with chemically treated timber other than CCA treated timber.

Epoxy coated:

- CCA Treated timber.

01 GENERAL

0181 Adhesives, sealants and fasteners

Nuts

Hexagon chamfered thin nuts Grades A and B: To AS 1112.4.

Hexagon nuts Grade C: To AS 1112.3.

Hexagon nuts Style 1 Grades A and B: To AS 1112.1.

Hexagon nuts Style 2 Grades A and B: To AS 1112.2.

Screws

Coach screws: To AS/NZS 1393.

Hexagon screws Grades A and B: To AS 1110.2.

Hexagon screws Grade C: To AS 1111.2.

Hexagon socket screws: To AS 1420 and AS/NZS 1421.

Machine screws: To AS/NZS 1427.

Self-drilling screws: To AS 3566.1.

Self-tapping screws:

- Crossed recessed countersunk (flat – common head style): To AS/NZS 4407.
- Crossed recessed pan: To AS/NZS 4406.
- Crossed recessed raised countersunk (oval): To AS/NZS 4408.
- Hexagon: To AS/NZS 4402.
- Hexagon flange: To AS/NZS 4410.
- Hexagon washer: To AS/NZS 4409.
- Slotted countersunk (flat – common head style): To AS/NZS 4404.
- Slotted pan: To AS/NZS 4403.
- Slotted raised countersunk (oval – common head style): To AS/NZS 4405.

Blind rivets

Description: Expanding end type with snap mandrel.

Type: Closed end for external application, open end for internal application.

End material:

- Aluminium base alloy for metallic-coated or prepainted steel.
- Stainless steel for stainless steel sheet.
- Copper for copper sheet.

Size:

- For sheet metal to sheet metal: 3 mm.
- For sheet metal to supports, brackets and rolled steel angles: 4.8 mm.

Performance

Loads: Provide fasteners capable of transmitting the loads imposed, and sufficient to make sure the rigidity of the assembly.

3 EXECUTION

3.1 ADHESIVES

Preparation

Substrates: Conform to the following:

- Remove any deposit or finish which may impair adhesion.
- If framed or discontinuous, provide support members in full lengths without splicing.
- If solid or continuous, remove excessive projections.
- If previously painted, remove cracked or flaking paint and lightly sand the surface.

01 GENERAL

0181 Adhesives, sealants and fasteners

Contact adhesive

Precautions: Do not use contact adhesive if:

- A substrate is polystyrene foam.
- A PVC substrate may allow plasticiser migration.
- The adhesive solvent can discolour the finished surface.
- Dispersal of the adhesive solvent is impaired.

Two-way method: Immediately after application, press firmly to transfer adhesive and then pull both surfaces apart. Allow to tack off and then reposition and press firmly together. Tap areas in contact with a hammer and padded block.

One-way method: Immediately after application, bring substrates together and maintain maximum surface contact for 24 hours by clamps, nails or screws as appropriate. If highly stressed, employ permanent mechanical fasteners.

High strength adhesive tape

Preparation:

- Non-porous surfaces: Clean with surface cleaning solvents such as isopropyl alcohol/water, wash down and allow to dry.
- Porous surfaces: Prime the surface with a contact adhesive compatible with the tape adhesive system.

Follow the recommendations of the manufacturer for application to the following: Copper, brass, plasticised vinyl and hydrophilic surfaces such as glass and ceramics in a high humidity environment.

Applied lamination pressure: Make sure the tape experiences 100 kPa.

Application temperature: Generally above 10°C, consult the manufacturer.

Completion: Do not apply loads to the assembly for 72 hours at 21°C.

3.2 JOINT SEALING

Joint preparation

Cleaning: Cut flush joint surface protrusions and rectify if required. Mechanically clean joint surfaces free of any deposit or finish which may impair adhesion of the sealant. Immediately before sealant application, remove loose particles from the joint, using oil-free compressed air.

Bond breaking: Install bond breaking backing material.

Taping: Protect the surface on each side of the joint using 50 mm wide masking tape or equivalent means. On completion of sealant application, remove the tape and remove any stains or marks from adjacent surfaces.

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

Sealant joint proportions

General weatherproofing joints (width:depth):

- 1:1 for joint widths less than 12 mm.
- 2:1 for joint widths greater than 12 mm.

Sealant application

General: Apply the sealant to dry joint surfaces using a pneumatic applicator gun. Make sure the sealant completely fills the joint to the required depth, provides good contact with the full depth of the sides of the joint and traps no air in the joint. Do not apply the sealant outside the recommended working time for the material or the primer.

Weather conditions

Two pack polyurethanes: Do not apply the sealant if ambient conditions are outside the following:

- Temperature: Less than 5°C or greater than 40°C.
- Humidity: To the manufacturer's recommendations.

01 GENERAL

0181 Adhesives, sealants and fasteners

Joint finish

General: Force the sealant into the joint and finish with a smooth, slightly concave surface using a tool designed for the purpose.

Excess sealant: Remove from adjoining surfaces using cleaning material nominated by the sealant manufacturer.

Protection

General: Protect the joint from inclement weather during the setting or curing period of the material.

Rectification

General: Cut out and remove damaged portion of joint sealant and reinstall so repaired area is indistinguishable from undamaged portion.

3.3 FASTENERS

General

Requirement: Install to the manufacturer's recommendations.

Fastening to wood and steel

Timber substrates: To AS 1720.1 Section 4.

Self drilling screws: To AS 3566.1 for timber and steel substrates.

Masonry anchors

Installation: To the manufacturer's recommendations.

4 SELECTIONS

4.1 ADHESIVES

Application schedule

Application	Product	Relevant worksections
Drywall lining / wall panels	High strength contact adhesive	0511 LINING
Timber joinery; trims, mouldings, skirtings and architraves	High strength contact adhesive	0551 JOINERY
Metal flashings and sealing non-porous substrates	Silicone neutral cure	0552 METALWORK
Mechanical services	Refer MECHANICAL SERVICES specification	
Hydraulic services	Refer HYDRAULIC SERVICES specification	
Fire services	Refer FIRE SERVICES specification	

4.2 SEALING, POINTING AND BEDDING

Application schedule

Application	Product	Relevant worksections
Window and external doors	1 part elastomeric polyurethane.	0467 GLAZING AND GLASS COMPONENTS; 0453 DOORS AND ACCESS PANELS,
Metal flashings and rainwater goods	Refer to 0421 ROOFING specification	
Mechanical services	Refer to MECHANICAL SERVICES specification	

01 GENERAL

0181 Adhesives, sealants and fasteners

Application	Product	Relevant worksections
Hydraulic services	Refer to HYDRAULIC SERVICES specification and to specification on the drawings	

Adhesives, sealants and fasteners combined function schedule

Application	Product	Relevant worksections
Control joints, tile adhesives and wet area sealants	Refer to 0631 CERAMIC TILING	
Wet area sealants and lightweight detail items	Refer to 0525 CUBICLE SYSTEMS	

4.3 FIRE-RESISTING SEALANTS

Application schedule

Application	Sealant type	Bond breaking	Sealant colour	Fire-resistance level to AS 1530.4 (FRL)	Relevant worksection
Pointing and stopping (including acoustic applications)	Masonry: intumescent 1 part polyurethane; Pointing and stopping: Intumescent acrylic.	Closed cell polythene for compatibility with sealant	Grey	Fire rating to AS1530.4	0182 FIRE-STOPPING

Fire collars: Refer to HYDRAULIC SERVICES specification and drawings

01 GENERAL

0182 Fire-stopping

0182 FIRE-STOPPING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide fire-stopping, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- GENERAL REQUIREMENTS.

Associated worksections

Refer to the following related worksections:

- 0511 LINING, for fire-rated sealants to fire-rated plasterboard linings in Bay 4 Lobby to meet BCA requirements. Refer to the BCA Compliance Report.
- 0310 CONCRETE – COMBINED, for infill to voids in existing concrete slabs left where services are removed and in the former Lift Motor Room.

ELECTRICAL SERVICES, for sealing of timber floors where there are holes and where existing electrical services cables and cable trays to the existing EDB services and cable trays pass through the floors or are removed; fire sealing to new services floor penetrations.

- MECHANICAL SERVICES, for fire dampers.
- HYDRAULIC SERVICES, for fire collars for hydraulic services

1.3 PRECEDENCE

General

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of this worksection override conflicting requirements of its referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.4 STANDARDS

General

Service penetration fire-stopping systems: To BCA C3.15.

Control joint fire-stopping systems: To AS 4072.1.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Service penetrations completed and ready for fire-stopping.
- Finished fire-stopping, before being concealed.

01 GENERAL

0182 Fire-stopping

1.6 SUBMISSIONS

Certification

General: Submit evidence of conformance with the recommendations of AS 4072.1 Appendix B.

Certification: Submit a completed certification list and schedule for installed fire-stopped penetrations and control joints.

- List form: To AS 4072.1 Figure B1.
- Schedule form: To AS 4072.1 Figure B2.

Execution

General: Give notice, if substrates or penetrants or both are not suitable for fire-stopping.

Manual

General: For fire-stopping systems which are intended to be modified in service, submit a user manual.

Manufacturers' information

General: If fire-stopping is documented without reference to brand, submit the following:

- Evidence that systems conform to documented requirements.
- Copies of relevant manufacturers' instructions.
- Safety data sheets (SDS).

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

Tests

Type tests: 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:

- Service penetration fire-stopping systems: Fire resistance tested to AS 1530.4.
- Fire stop mortars: Resistance to explosive spalling to AS 1774.36.
- Control joint fire-stopping systems: Fire resistance tested to AS 1530.4.

2 PRODUCTS

2.1 MATERIALS

General

Shelf life: Use materials that have not exceeded their shelf life.

Toxic materials: Free of asbestos and lead and free of, nor requiring the use of, toxic solvents.

Toxicity in fire: Non-toxic.

Fire-stop mortars

Type: Re-enterable cement-based compound, mixed with water. Non-shrinking, moisture resistant. Insoluble in water, after setting.

Formulated compound of incombustible fibres

Material: Formulated compound mixed with mineral fibres, non-shrinking, moisture resistant. Insoluble in water after setting.

Fibre stuffing

Material: Mineral fibre stuffing insulation, dry and free of other contaminants.

Standard: AS/NZS 4859.1 Section 8.

Mineral Wool Insulation

Sealant: Light weight low density, PVC-U based non asbestos setting compound formulated to mix easily with water.

01 GENERAL

0182 Fire-stopping

Intumescent fire pillows

Product: For re-penetrations; sealed with intumescent.

Fire-stop sealants

Material: Elastomeric sealant. Soft, permanently flexible, non-sag, non-shrinking, moisture resistant. Capable of providing a smoke-tight, gas-tight and waterproof seal when properly installed. Insoluble in water after setting.

Fire-stop foams

Material: Single component compound of reactive foam ingredients, non-shrinking, moisture resistant. Insoluble in water after setting.

Fire-stop putty

Material: Single component, mouldable, permanently flexible, non-shrinking, moisture resistant, intumescent compound which conforms to the following:

- Expands on exposure to surface heat gain to form a high-volume thermally insulating char that closes gaps and voids.
- Resists the turbulence of a severe fire.
- Can be placed by hand to form an immediate fire seal.
- Insoluble in water after setting.

Product certification

Certification scheme: CERTIFIRE

Conformance: Address the following:

- Statutory and performance requirements.
- Adequacy of application/installation.

Appointment: In the joint names of the contractor and the principal.

2.2 COMPONENTS

Fire-stop collars

Material: Mechanical device with incombustible intumescent fillers covered with sheet steel jacket. Airtight and watertight. Refer to Hydraulic Services specification.

Fire-stop pillows

Material: Formed self-contained compressible flexible mineral fibre in cloth bags, rated to permit frequent changes in service.

Accessories

Primer: As recommended by manufacturer for substrates

Installation accessories: Provide clips, collars, fasteners, temporary stops and dams, and other devices required to position, support and contain fire-stopping and accessories.

Product certification

Certification scheme: CERTIFIRE

3 EXECUTION

3.1 INSTALLATION

General

Extent: Fire-stop and smoke-stop interruptions to fire-resistance rated assemblies, materials and components, including penetrations through fire-resisting elements, breaks within fire-resisting elements (e.g. expansion joints), and junctions between fire-resisting elements.

01 GENERAL

0182 Fire-stopping

Sequence: Fire-stop after services have been installed through penetrations and properly spaced and supported, after sleeving where appropriate, and after removal of temporary lines, but before restricting access to the penetrations, including before dry lining.

Installer qualifications: Minimum 5 years' experience.

Ventilation: Supply ventilation for non-aqueous solvent-cured materials.

Density: Apply fire-stopping material to a uniform density.

Fire-stopping exposed to view: Finish surfaces to a uniform and level condition.

Cable separation: Maintain cable separation.

Protection: Protect adjacent surfaces from damage arising through installation of fire-stopping. Protect completed fire-stopping from damage arising from other work.

Loose or damaged fire-stopping material: Remove and replace.

Penetrations by pipes and ducts: Allow for thermal movement of the pipes and ducts.

Preventing displacement: Reinforce or support fire-stopping materials with non-combustible materials when:

- The unsupported span of the fire-stopping materials is greater than 100 mm.
- The fire-stopping materials are non-rigid (unless shown to be satisfactory by test).

Large openings: Provide fire-stopping capable of supporting the same loads as the surrounding element or provide similar structural support around the opening.

Preparation

Cleaning: Clean substrates of dirt, dust, grease, oil, loose material, and other matter which may affect the bond of fire-stop material.

Primer: Clean and dry substrates for primers and sealants.

Restraint: Install backing and/or damming materials to arrest liquid material leakage. Remove temporary dams after material has cured.

3.2 SYSTEMS

Fire-stop mortars

Ambient conditions: Do not install below 5°C.

Formulated compound of incombustible fibres

Installation: Adapt manufacturer's recommendations to completely close openings.

Fibre stuffing

Installation: Compress to 40% of its uncompressed volume.

Fire-stop sealants

Ambient conditions: Do not store above 32°C. Do not install outside the temperature range recommended by the sealant manufacturer. Do not install when humidity exceeds that recommended by the sealant manufacturer for safe installation.

Fire-stop foams

Ambient conditions: Do not store above 32°C. Do not install below 15°C or above 32°C. Do not apply when temperature of substrate and air is below 15°C. Maintain this minimum temperature before, during and for 3 days after installation.

Installation: Test substrates for adhesion and prime if necessary. Place in layers for homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

Fire-stop putty

Ambient conditions: Do not install below 5°C. Do not allow the material to freeze.

Fire-stop collars

Installation: Refer to HYDRAULIC SERVICES.

01 GENERAL

0182 Fire-stopping

Fire-stop pillows

Ambient conditions: Do not install in conditions outside the manufacturer's recommendations.

Labelling

General: Label each fire-stopping installation with a permanently fixed tag or sticker containing the following information:

- Manufacturer's name.
- Name and address of installer.
- Date of installation.

3.3 COMPLETION

Cleaning

Requirement: Remove spilled and excess fire-stopping materials without damaging other work.

4 SELECTIONS

4.1 FIRE-STOPPING SYSTEMS

Fire-stopping systems schedule

Property	A	C
Substrate	Concrete / Brick	Timber floor
Penetrants	Metal pipes; ducts, electrical conduits	Electrical Services
Fire-stopping material or component	To AS 1530.4	To AS 1530.4
FRL (- / 120 / 120)	To BCA Requirements Refer to the BCA Compliance Report	To BCA Requirements Refer to the BCA Compliance Report
Resistance to the incipient spread of fire	To BCA C3.15	To BCA C3.15

Product data to be provided for all fire stopping systems and materials for approval before use.

01 GENERAL

0183 Metals and prefinishes

0183 METALS AND PREFINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirements: Provide metal and prefinishes as documented.

Performance

Requirement: Provide metals in sections of strength and stiffness suited to their required function, finish and method of fabrication.

1.2 PRECEDENCE

General

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of this worksection override conflicting requirements of its referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Associated worksections

Refer to the following related worksections:

- 0344 STEEL – HOT-DIP GALVANIZING, for galvanised finishes to steel.
- 0552 METALWORK, for finishes to architectural metalwork items – paint, anodizing and powder coating.
- 0455 DOOR HARDWARE, for finishes to proprietary door hardware.
- 0421 ROOFING, for powdercoat finish to external slatted screens to roof plant.
- 0671 PAINTING, for decorative and protective paint finishes to steel and metalwork.
- HYDRAULIC SERVICES, for finishes to metal hydraulic and fire service pipes, including tapware.
- MECHANICAL SERVICES, for finishes to metal ductwork and associated metalwork.
- ELECTRICAL SERVICES, for prefinishes to electrical items.
- FIRE SERVICES, for paint finishes to fire service pipes and equipment.

1.4 SUBMISSIONS

Samples

General: Submit samples of the following:

- Stainless steel: One sample of every documented surface finish.
- Anodising: One sample of every colour and finishing option.
- Powdercoat finishes: One sample of every colour and finishing option.

01 GENERAL

0183 Metals and prefinishes

2 PRODUCTS

2.1 METALS

Aluminium and aluminium alloys

Drawn pipe: To AS/NZS 1867.

Drawn rod, bar and strip: To AS/NZS 1865.

Extrusions: To AS/NZS 1866.

Plate and sheets: To AS/NZS 1734.

Coated steel

Electrogalvanized (zinc) coating on ferrous hollow and open sections: To AS 4750.

Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:

- Ferrous open sections by an in-line process: To AS/NZS 4791.
- Ferrous hollow sections by a continuous or specialised process: To AS/NZS 4792.
- Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are base metal thicknesses.

Steel wire: To AS/NZS 4534.

Copper and copper alloys

Casting: To AS 1565.

Plate, sheet and strip: To AS 1566.

Rods, bars and sections: To AS/NZS 1567.

Composition and designations: To AS 2738.

Stainless steel

Bars: To ASTM A276.

Plate, sheet and strip: To ASTM A240/A240M.

Welded pipe (plumbing applications): To AS 1769.

Welded pipe (round, square, rectangular): To ASTM A554.

Steel

Sheet: To AS/NZS 1595.

Structural bars and sections: To AS/NZS 3679.1.

Structural hollow section: AS/NZS 1163.

Steel for prefinishes

Cold rolled bar: To AS 1443 – Bright.

Cold rolled sheet: To AS/NZS 1595.

- Designation: CA2S-E.

Electric resistance welded tube: To AS 1450.

3 EXECUTION

3.1 GENERAL

Metal separation

Incompatible sheet metals: Provide separation by one of the following:

- Apply an anti-corrosion low moisture transmission coating such as alkyd zinc phosphate primer or aluminium pigmented bituminous paint to contact surfaces.
- Insert a concealed separation layer such as polyethylene film, adhesive tape, or bituminous felt.

Incompatible fixings: Do not use.

Incompatible service pipes: Install lagging or grommets. Do not use absorbent, fibrous or paper products.

01 GENERAL

0183 Metals and prefinishes

Brazing

General: Make sure brazed joints have sufficient lap to provide a mechanically sound joint.

Butt joints: Do not use butt jointing for joints subject to load. If butt joints are used, do not rely on the filler metal fillet only.

Filler metal: To AS/NZS 1167.1.

Finishing

Visible joints: Finish visible joints made by welding, brazing or soldering using methods appropriate to the class of work (including grinding or buffing) before further treatment such as painting, galvanizing or electroplating. Make sure self-finished metals are without surface colour variations after jointing.

Preparation

General: Before applying decorative or protective prefinishes to metal components, complete welding, cutting, drilling and other fabrication, and prepare the surface using a suitable method.

Standard: To AS 1627 series.

Priming steel surfaces: If site painting is documented to otherwise uncoated mild steel or similar surfaces, prime as follows:

- After fabrication and before delivery to the works.
- After installation, repair damaged priming and complete the coverage to unprimed surfaces.

Welding

Aluminium: To AS 1665.

Stainless steel: To AS/NZS 1554.6.

Steel: To AS/NZS 1554.1.

3.2 STAINLESS STEEL FINISHES

General

Requirement: Provide a surface finish to match the approved sample.

Sample identification: Refer to 0552 METALWORK and 0455 DOOR HARDWARE.

Pre-assembly

Mechanically polished and brushed finishes: Apply grit faced belts or fibre brushes that achieve uni-directional finishes with buffing, as required.

Post-assembly pre-treatment

Heat discolouration: Remove by pickling.

Welds: Grind excess material, brush, and polish to match the pre-assembly finish.

Post-assembly finish

Electropolish finish for external installations: Provide an electro-chemical process to stainless steel type 316.

Brushed electropolish finish: Conform to the following:

- Pre-assembly finish: No. 4 brushed finish.
- Post-assembly finish: Provide an electro-chemical processed finish to achieve a No. 7 to No. 8 brushed finish.

Mirror electropolish finish:

- Pre-assembly finish: Mill finish 2B or mirror polished finish.
- Post-assembly finish: Provide an electro-chemical processed finish to achieve a No. 8 mirror finish.

Completion

Cleaning: Clean and rinse to an acid free condition and allow to dry. Do not use carbon steel abrasives or materials containing chloride.

Protection: Secure packaging or strippable plastic sheet.

01 GENERAL

0183 Metals and prefinishes

3.3 ANODISING

General

Standard: To AS 1231.

Thickness grade: To AS 1231 Table H1.

Application: Aluminium slat screen and structure to external walls of the roof Plant Room. Prefinish all faces prior to installation with no cutting on site to damage the finish.

Description: Exterior - severe

Colour: Dulux Fluoraset Powdercoat.

Colour to be selected to match:

For the aluminium slatted screen around plant and the Store Room colour to be selected from:

- 'Xtreme Coin' 9647289S (R165 G170 B173 – LRV 44%) Satin Finish
- 'Xtreme Silver' 9647273Q (R165 G170 B173 – LRV 36%) Satin Finish

Refer to the sample schedule in 0552 METALWORK.

Warranty: 30 years durability warranty – to be supplied by a Dulux Registered Applicator.

Interior Powder coat finish: Dulux Duralloy to steel Stair 4 screen and to steel framed and aluminium mesh doors and mesh above amenities on all floors.

Sample

General: Provide a finish to match the sample in terms of colour and finishing options.

Sample identification: Aluminium slat – colour to match the dark slate roof.

3.4 PREPAINTING

Equipment paint system

Description: Brush or spray application using paint as follows:

- Full gloss enamel finish coats, oil and petrol resistant: To AS/NZS 3750.22, two coats.
- Prime coat to metal surfaces generally: To AS/NZS 3750.19 or AS/NZS 3750.20.
- Prime coat to zinc-coated steel: To AS 3730.15 or AS/NZS 3750.16.
- Undercoat: To AS/NZS 3750.21.

Prepainted metal products

Standard: To AS/NZS 2728.

Product type as noted in AS/NZS 2728 : Not lower than the type appropriate to the field of application.

3.5 COMPLETION

Damage

Damaged prefinishes: Remove and replace items, including damage caused by unauthorised site cutting or drilling.

Repair

Metallic-coated sheet: If repair is required to metallic-coated sheet or electrogalvanizing on inline galvanized steel products, clean the affected area and apply a two-pack organic primer to AS/NZS 3750.9.

01 GENERAL

0184 Termite management

0184 TERMITE MANAGEMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide termite management materials and systems, as documented.

Objective: To achieve building protection.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

This worksection includes but is not limited to the following:

- Termite treatment to new construction – Bay 5

Associated worksections

Refer to the following related worksections:

- 0342 LIGHT TIMBER FRAMING, for timber ceiling and floor framing.
- 0381 STRUCTURAL TIMBER, for reinstatement of original timbers and for new timber members for the reinstated structure.
- 0310 CONCRETE – COMBINED for new concrete slabs on ground in Bay 5.
- 0335 BRICK AND STONE MASONRY, for details of new masonry walls built off new and existing slab and for dwarf walls supporting timber and steel framed floors on the Ground Floor of Bay 5.
- HYDRAULIC SERVICES drawings and specification for in-ground services and for new drainage pipes installed through new concrete slabs.
- Architectural and Structural Engineering drawings for location of new concrete infill slabs and new masonry walls.

1.3 STANDARD

General

Termite management systems: To AS 3660.1.

1.4 INSPECTION

Notice

Inspection: Give sufficient notice so that inspection may be made of the completed termite management system.

1.5 SUBMISSIONS

Work Method Statement/shop drawings

General: Submit full details of termite management system to be used. Include project specific drawings, typical details and information on the materials to be used. Drawings are to resemble shop drawings quality, be of equal or similar scale and consider the aesthetic implications of integrating the termite management system.

01 GENERAL

0184 Termite management

The drawings are to be submitted for review and revision if so determined. Allow for design development of the proposed details to satisfy both architectural and termite protection parameters.

Warranty: Submit full details of the proposed warranty for review, including warranty length.

Compliance: Prior to commencement submit evidence that the termite management system complies with relevant Australian Standards and that the installer has appropriate experience.

Tests

Woven stainless steel management systems: Provide certification that stainless steel type 725 has been used to the manufacturer's recommendation.

Chemical soil management systems: Submit a Registered testing authority laboratory analysis certificate to AS 3660.1 Appendix E.

2 PRODUCTS

2.1 NON-CHEMICAL MANAGEMENT SYSTEMS

Concrete slab

Standard: To AS 3660.1 Section 4.

Termite cap and strip shields

Standard: To AS 3660.1 Section 5.

Material: galvanized steel

Woven stainless steel mesh

Standard: To AS 3660.1 Section 6.

Grade: 725 stainless steel.

Graded stone particles

Standard: To AS 3660.1 Section 7.

3 EXECUTION

3.1 NON-CHEMICAL MANAGEMENT SYSTEMS

Concrete slab

Standard: To AS 3660.1 Section 4.

Termite cap and strip shields

Standard: To AS 3660.1 Section 5.

Woven stainless steel mesh

Standard: To AS 3660.1 Section 6.

Graded stone particles

Standard: To AS 3660.1 Section 7.

3.2 COMPLETION

Termite management system notice

General: Provide a durable notice permanently fixed in a prominent location to BCA B1.4(i)(ii) or BCA 3.1.3.2(b) and AS 3660.1 Appendix A.

Waste materials

Progressive cleaning: Make sure no waste materials which could attract termites remain on the site.

Warranties

Type: Renewable.

01 GENERAL

0184 Termite management

Certificate of installation

General: To AS 3660.1 Appendix A.

Completion inspection

Report: At the end of the defects liability period, inspect the termite management systems and submit a report on their efficacy and status.

4 SELECTIONS

4.1 SCHEDULE

Termite management systems schedule

Property	TB1
Location	All locations on the Ground Floor of ASN Co Building Bay 5 requiring protection to the building.
Under slabs, slab penetrations, slab control joints	Woven stainless steel mesh barriers. Proprietary System: Termi-Mesh Termite Control System.

SPECIFICATION

01 GENERAL

0185 Timber products, finishes and treatment

0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide timber products with finishes and treatments as documented and as follows:

- For durability and fire-resistance.
- Carrying appropriate certification for the finishing applications.

1.2 PRECEDENCE

General

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of this worksection overrides conflicting requirements of its referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS

Associated worksections

Refer to the following related worksections:

- 0383 SHEET FLOORING, for plywood sheet flooring and particleboard flooring.
- 0453 DOORS AND ACCESS PANELS, for timber doors and panels to be painted or clear finished, repair and refinishing of existing timbers.
- 0551 JOINERY, for plywood balustrades, skirtings, joinery cupboards and timber trim.
- 0671 PAINTING, for preparations and paint finishes – clear and opaque to timber elements.
- 0467 GLAZING AND GLASS COMPONENTS, for timber handrail finish to glass balustrade.
- 0655 TIMBER FLOORING, for timber floor board repairs, new timber floor boards to match existing and for new timber stair treads.
- 0656 FLOOR SANDING AND FINISHING, for sanding and finishing of timber floor finishes.
- Architectural drawings and details for miscellaneous timber trim, battens and packers.

1.4 STANDARDS

General

Preservative treatment: To the AS 1604 series.

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS/NZS 4491 and the following apply:

SPECIFICATION

01 GENERAL

0185 Timber products, finishes and treatment

- Dry processed fibreboard: A panel manufactured by bonding lignocellulosic fibres (derived from wood or other materials) with a synthetic resin adhesive and curing under heat and/or pressure. The panels are manufactured with a forming moisture content of less than 20%.
- Groups of timbers: Terms employed for that purpose in relevant Australian standards.
- High pressure decorative laminates (HPDL):
 - Panels consisting of core layers impregnated with phenolic and/or aminoplastic resins and a surface layer(s) impregnated with aminoplastic resins (mainly melamine resins).
 - Sheets consisting of a decorative face and layers of fibrous sheet materials (e.g. paper) impregnated with thermosetting resins and bonded together under heat and pressure of at least 5 MPa.
- Particleboard: A panel manufactured under pressure and heat from wood particles and/or lignocellulosic material with the addition of an adhesive.
- Plywood types: To AS/NZS 4491.
- Softboard (Insulation board): Also known as Canite™, insulating board is available with a fine textured finish on one side or finished with 2 coats of matt white casein-kaolin paint. The reverse side is natural finish with a heavier texture.
- Standard trade common names: To AS/NZS 1148.
- Wet processed fibreboard (hardboard): A panel material manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and/or pressure, the bond of which is derived from felting of the fibres and the panels are manufactured with forming moisture content greater than 20%.

1.6 SUBMISSIONS

Products

Rainforest species: Submit source certification.

Pressure preservative treatment: For timber required to be pressure treated, submit a certificate or other evidence showing that the timber has been treated.

Technical data

Treated timber: Submit Safety data sheets for preservative treated timber.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Deliver timber products to site in unbroken wrapping or containers and store so that the moisture content is not adversely affected.

2.2 CERTIFICATION

Forest certification

Timber product application: All structural timbers

Timber source: The Forest Stewardship Council scheme.

Product labelling: AFS/PEFC (Australian Forestry Standard/ Program for the Endorsement of Forest Certification Schemes)

Chain of custody: Australian Forestry Standard AFS certification to AS4707

Preservative treatment branding

Requirement: Branding details of preservative treatment as follows:

- Treatment number.

SPECIFICATION

01 GENERAL

0185 Timber products, finishes and treatment

- Preservative code number.
- Hazard class.

Timber certification

Recognised product certification programs:

- Pine framing: Plantation Timber Certification.
- Hardwoods: Australian Timber Industry Certification (ATIC) Quality Scheme.
- Glued-laminated timber: Glued Laminated Timber Association of Australia (GLTAA) Product Certification System.
- Laminated veneer lumber: Engineered Wood Products Association of Australasia (EWPA) Quality Control and Product Certification Scheme.
- Finger jointed structural timber: Plantation Timber Certification.

Timber to be certified in lieu of branding: All timbers to be exposed and where branding will show through finish.

Inspection: If neither branding nor certification is adopted, have an independent inspecting authority inspect the timber.

- Inspection authority: Forests NSW Timber Inspection Service

Timber panel products

Certification program: Brand panels under the authority of a recognised certification program applicable to the product. Locate the brand on faces or edges which will be concealed in the works.

Certification programs:

- Plywood and block board: Engineered Wood Products Association of Australia (EWPA) Quality Control and Product Certification Scheme.
- Wet processed fibreboard, dry processed fibreboard, particle board and decorative overlay wood panels: Engineered Wood Products Association of Australia (EWPA) Quality Control and Product Certification Scheme.

Plywood formaldehyde emission class to AS/NZS 2270: E1 (1.0mg/L)

Reconstituted wood-based panel certified formaldehyde emission class to AS/NZS 1859 series: E1 (1.0mg/L)

2.3 FIRE-RESISTANCE

General

Standard: To AS 1720.4.

Fire resistance level (FRL) required: Refer to BCA Clause C1.10 and the BCA report.

2.4 DURABILITY

General

Requirement: Provide timbers with natural durability appropriate to the conditions of use, or preservative-treated timber of equivalent durability.

Natural durability class: To AS 5604.

Obtain durability: By chemical impregnation, natural durability or both.

Timber quality: Free of core wood (material within 50 mm of the tree's centre) and free of splits, checks, loose knots and cavities. Free of sapwood (lighter coloured wood found on the outer layer of the tree).

Lyctid susceptible timbers: Do not provide untreated timbers containing Lyctid susceptible sapwood.

Preservative treatment

Glued laminated timber products: To AS/NZS 1604.5 Table A1.

Laminated veneer lumber (LVL): To AS/NZS 1604.4 Table A1.

SPECIFICATION

01 GENERAL

0185 Timber products, finishes and treatment

Plywood: To AS/NZS 1604.3 Table A1.

Reconstituted wood-based products: To AS/NZS 1604.2 Table A1.

Sawn and round timber: To AS 1604.1 Table D1.

Moisture content

Moisture content: Seasoned timber $\leq 15\%$; unseasoned timber $\geq 15\%$

Test: Methods as follows:

- Timber: To AS/NZS 1080.1.
- Plywood: To AS/NZS 2098.1.
- Reconstructed wood-based products: AS/NZS 4266.3.

Protection: Protect timber and timber products stored on site from moisture and weather. For milled, prefinished, prefabricated and similar elements which are to be protected in the final structure, provide temporary weather protection until the permanent covering is in place.

Subfloor ventilation: To BCA F1.12 or BCA 3.4.1.2 as applicable.

Termite treatment

Requirement: To the 0184 TERMITE MANAGEMENT.

2.5 FINISHING

Surface finish

Hardwood: To AS 2796.1 Table B1.

Surface finish: Fine sawn

Edge detail: rounded (arrised)

Softwood: To AS 4785.1 Table B1.

Surface finish: natural - unpainted

Edge detail: rounded (arrised)

Surface coating

Painting: To the 0671 PAINTING worksection and as follows:

Application: To the manufacturer's specification.

2.6 RECYCLED TIMBER

General

Requirement: Use of recycled timbers is to be submitted for approval.

Type of species: Hardwood to match existing structure

Source: To be approved

Grit blasted or re-machined: Remove all nails and screws.

Classification: Visually graded.

3 EXECUTION

3.1 JOINTS

General

Joints and connections: Use hot-dipped galvanized or stainless steel fasteners, composite bolts, nails or nailed metal connectors.

Timber-to-timber interfaces: Provide a seal coating of preservative formulation and include inside bolt holes and the end grain of the timber.

Avoid: Details that may trap water such as housed, checked or birdsmouth joints.

01 GENERAL

0185 Timber products, finishes and treatment

Fasteners: Follow manufacturer's instructions to prevent chemical treatments reacting with fasteners.

3.2 SHRINKAGE RESTRAINT

General

Moisture content: Use finishes and end-grain sealants to minimise moisture content changes.

Fasteners: Align fasteners along member axis and use single fasteners at the joints.

Connections: Use connections that allow for movement.

Avoid shrinkage restraint: Use seasoned timber, especially if timber elements are integrated with steel and/or concrete construction.

Drill holes: 10% oversize in unseasoned timber.

Reduce movement and shrinkage: If timber is unseasoned, use species with similar shrinkage values.

Vertical movement: For unseasoned framing provide adequate clearance at the top of masonry veneer and face fixed members to reduce vertical movement.

3.3 FINISHING

Ploughing

General: Back plough boards liable to warp (e.g. if exposed externally on one face). Make the width, depth and distribution of ploughs appropriate to the dimensions of the board and degree of exposure.

Painting

Edges: Chamfer edges of work to receive paint or similar coatings.

Priming: For woodwork to be painted, prime hidden surfaces before assembly.

Working with treated timber

Safety: Handle preservative treated timber to NOHSC 2003 and the recommendations of NOHSC 3007.

4 SELECTIONS

4.1 PRODUCT SCHEDULES

Preservative treatment schedule

Timber product application	Hazard class	Species	Natural durability class	Preservative treatment
Ground Floor timbers – protected / internal	H2	Hardwood	Class 2 Durable	LOSP treated to AS5604

SPECIFICATION

SH.01 SCHEDULE OF CONTRACT DOCUMENTS

DOC / DWG NO	DOCUMENT TITLE	ISSUE
ARCHITECTURAL	DRAWINGS	
AR.TD.0000	Drawing List/Site Map	A
AR.TD.1001	Existing Floor & Roof Plans	A
AR.TD.1101	Demolition & Proposed Ground Floor & Level 1 Plans	A
AR.TD.1102	Demolition & Proposed Level 2 & 3 Plans	A
AR.TD.1103	Demolition & Proposed Level 4 & Roof Space Plans	A
AR.TD.1104	Demolition & Proposed Roof & Store Room Plans	A
AR.TD.1201	Demolition & Proposed – West Elevations	A
AR.TD.1202	Demolition & Proposed – East Elevations	A
AR.TD.2001	Ground Floor & Level 1 Reflected Ceiling Plans	A
AR.TD.2002	Level 2 & 3 Reflected Ceiling Plans	A
AR.TD.2003	Level 4 & Store Room Reflected Ceiling Plans	A
AR.TD.3001	Demolition & Proposed Section A-A	A
AR.TD.3002	Demolition & Proposed Section B-B	A
AR.TD.3003	Demolition & Proposed Section C-C	A
AR.TD.3004	Demolition & Proposed Section D-D	A
AR.TD.3005	Demolition & Proposed Section E-E	A
AR.TD.3006	Demolition & Proposed Section F-F	A
AR.TD.3007	Demolition & Proposed Section G-G	A
AR.TD.3008	Demolition & Proposed Section H-H	A
AR.TD.3009	Demolition & Proposed Section J-J	A
AR.TD.4001	Doors & Windows Schedule Bay 5	A
AR.TD.4002	Doors & Windows Schedule Bay 4	A
AR.TD.5101	Construction Details – Miscellaneous	A
AR.TD.5102	Construction Details – Store Room	A
AR.TD.5103	Construction Details – Link Sheet 1 of 2	A
AR.TD.5104	Construction Details – Link Sheet 2 of 2	A
AR.TD.5105	Construction Details – Amenities	A
AR.TD.5201	Construction Details – (N) Stair 3	A
AR.TD.5202	Construction Details – (N) Stair 4 Sheet 1 of 2	A
AR.TD.5203	Construction Details – (N) Stair 4 Sheet 2 of 2	A
AR.TD.5251	Construction Details – External Ramp	A
AR.TD.5252	Construction Details – Internal Ramp	A
AR.TD.5301	Construction Details – Doors & Windows Sheet 1 of 2	A
AR.TD.5302	Construction Details – Doors & Windows Sheet 2 of 2	A
AR.TD.6001	Wet Areas Ground Floor	A
AR.TD.6002	Wet Areas Levels 1-4	A
AR.TD.6003	Wet Areas Ground Floor	A
AR.TD-6101	Joinery	A
STRUCTURAL	DRAWINGS	
XX-0001	Cover Sheet & General Notes	0
XX-0002	General Notes Sheet 2	0
01-0010	Ground Floor Plan & Details	0
01-0020	Level 1 Plan & Details	0

SPECIFICATION

SH.01 SCHEDULE OF CONTRACT DOCUMENTS

02-0030	Level 2 Plan & Details	0
02-0031	New Stair 3 Plan, Elevation & Details	0
02-0032	New Stair 3 Sections & Details	0
03-0040	Level 3 Plan & Details	0
03-0041	New Stair 4 Plans, Elevation & Details	0
04-0050	Level 4 Plan & Details	0
XX-0060	Details Sheet 1	0
XX-0070	External Access Ramp Framing Plan	0
XX-0071	External Access Ramp Details	0
RP-0080	Roof Plan & Details	0
MECHANICAL	DRAWINGS	
ME-0000	Cover Sheet	E
ME-0001	Legend, Notes & Schedules	E
ME-0002	Details Sheet	E
ME-2000	Ground Floor & Level 1 Layouts	E
ME-2001	Level 2 & 3 Layouts	E
ME-2002	Level 4 & Roof Layouts	E
ME-2003	Roof Layout	E
ME-9000	Air Schematic	E
ELECTRICAL	DRAWINGS	
EL-0000	Cover Sheet	G
EL-0001	Legend, Notes & Details	H
EL-1001	Ground Floor & Level 1 – Lighting Layout	H
EL-1002	Level 2 & 3 – Lighting Layout	H
EL-1003	Level 4 – Lighting Layout	H
EL-2001	Ground Floor & Level 1 – Power & Communication Layout	G
EL-2002	Level 2 & 3 – Power & Communication Lighting Layout	G
EL-2003	Level 4 – Power & Communication Lighting Layout	G
EL-5000	Power & Communication Single Line Diagram	G
EL-6000	Details	E
HYDRAULIC	DRAWINGS	
HY-000	Cover Sheet	F
HY-001	Legend, Notes & Details	F
HY-200	Ground Floor Layout	G
HY-201	Level 1 Layout	F
HY-202	Level 2 Layout	C
HY-203	Level 3 Layout	C
HY-204	Level 4 Layout	F
HY-205	Roof Layouts	E
HY-900	Schematic	D

SPECIFICATION

SH.01 SCHEDULE OF CONTRACT DOCUMENTS

FIRE SERVICES	DRAWINGS	
FP-0000	Cover Sheet	C
FP-0001	Legend & Notes	C
FP-1001	Ground Floor	C
FP-1002	Level 1	B
FP-1003	Level 2	C
FP-1004	Level 3	C
FP-1005	Level 4	C
BUILDING FIRE SAFETY UPGRADE		
FP-000	Cover Sheet	B
FP-001	Legend & Notes	B
FP-100	Ground Floor	C
FP-101	Level 1	C
FP-102	Level 2	C
FP-103	Level 3	C
FP-104	Level 4	C
DOCUMENTS	DOCUMENT TITLE	ISSUE
TECHNICAL SPECIFICATIONS & SCHEDULES		
GENERAL		
0171	General Requirements	A
COMMON REQUIREMENTS		
0181	Adhesives, Sealants and Fasteners	A
0182	Fire Stopping	A
0183	Metals and Prefinishes	A
0184	Termite Management	A
0185	Timber Products, Finishes and Treatment	A
THE SCHEDULES		
SH01	Schedule of Contract Documents	A
SH02	Schedule of Substrates and Finishes	A
SH03	Schedule of Sanitaryware and Tapware	A
SITE		
0202	Demolition	A
0222	Earthwork	A
STRUCTURE		
0310	Concrete – Combined	A
0315	Concrete Finishes	A
0331	Brick, Block and Stone Masonry	A
0341	Structural Steel	A
0342	Light Steel Framing	A
0344	Steel – Hot-Dip Galvanizing	A

SPECIFICATION

SH.01 SCHEDULE OF CONTRACT DOCUMENTS

0381	Structural Timber	A
0382	Light Timber Framing	A
0383	Sheet Flooring	A
ENCLOSURE		
0411	Waterproofing – external	A
0421	Roofing	A
0453	Doors and Access Panels	A
0455	Door Hardware	A
0467	Glazing and Glass components	A
0472	Acoustic Insulation	A
INTERIORS		
0511	Lining	A
0525	Cubicle Systems	A
0531	Suspended Ceilings	A
0551	Joinery	A
0552	Metalwork	A
0573	Extinguishers and Blankets	A
0581	Signs and displays	A
FINISH		
0611	Rendering and Plastering	A
0612	Cementitious Toppings	A
0621	Waterproofing – internal	A
0631	Ceramic Tiling	A
0651	Resilient Finishes	A
0655	Timber Flooring	A
0656	Floor sanding and Finishing	A
0671	Painting	A
APPENDIX		
AP1	PRESNA 'SHFA Hazardous Materials Register' dated 22 June 2012	-
AP2	ASN Bay 5 - Ground Floor Services Trench Extension – Review of Archaeological Implications. Casey & Lowe 18 January 2018	-
SERVICES SPECIFICATIONS		
MECHANICAL SERVICES		04
ELECTRICAL SERVICES		003
HYDRAULIC SERVICES		A
FIRE SERVICES		03
FIRE SERVICES (FIRE SAFETY UPGRADE)		01
VERTICAL TRANSPORTATION SERVICES		B

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES****ABBREVIATIONS LEGEND**

A/C	AIR CONDITIONING	ETJ	EXISTING TIMBER JOIST	NTP	NEW TIMBER POST
AC	ACOUSTIC / SOUND RATED	ETP	EXISTING TIMBER POST	N/A	NOT APPLICABLE
AFFL	ABOVE FFL	EQ	EQUAL	NIC	NOT IN CONTRACT
AL	ALUMINIUM	EX	OUT OF	NTB	NEW TIMBER BEAM TME
AP	ACCESS PANEL - CEILING	F	FIXED	NTC	NEW TIMBER COLUMN TME
AP/FLR	ACCESS PANEL - FLOOR	FC	FIBRE CEMENT	NTJ	NEW TIMBER JOIST
AP/W	ACCESS PANEL - WALL	FCL	FINISHED CEILING LEVEL	NTP	NEW TIMBER POST
ACP	ACOUSTIC ACCESS PANEL - CEILING	FE	FIRE EXTINGUISHER	OA	OVERALL
BAL	BALUSTRADE	FD	FIRE DOOR	OD	OUTSIDE DIAMETER
BBW	BASE BUILDING WORKS	FFL	FINISHED FLOOR LEVEL	O/S	OUTSIDE
BBP	BASE BUILDING PLUS WORKS	FG	FIXED GLASS	PAV	PAVING
BHD	BULKHEAD	FH	FIRE HYDRANT	/P	PAINT/ PAINTED
BK	BRICKWORK	FHR	FIRE HOSE REEL	PBD	PLASTERBOARD
BK/F	BRICKWORK / FACE	FIP	FIRE INDICATOR PANEL	PBD/FR	PBD - FIRE RATED
BK/C	BRICKWORK- COMMON	FLR	FLOOR	PF	PRE-FINISHED
BK/FR	BRICKWORK – FIRE-RATED	FR	FIRE RATED	PLY	PLYWOOD
BL	BLOCKWORK CONCRETE	FRL	FIRE RESISTANCE LEVEL	PLY/F	PLYWOOD FLOOR
BSN	BASIN	FS	FINISHED SIZE	POL	POLISHED
C	CONCRETE	FVG	FLOOR VENTILATION GRILLE	PTB	PARTICLEBOARD
CAR	CARBORUNDUM	FW	FLOOR WASTE	R	ROOF
/CF	CLEAR FINISHED	G	GLASS	RC	REINFORCED CONCRETE
CFC	COMPRESSED FIBRE CEMENT	GAL	GALVANISED	RC/BR	RC- BROOM FINISH
CH	CEILING HEIGHT	GD	GRATED DRAIN	RC/ST	RC- STEEL TROWEL FINISH
CI	CAST IRON	HMR	HIGH MOISTURE RESISTANT	RC/WF	RC- WOOD FLOAT FINISH
CJ	CONTROL JOINT	HWU	HOT WATER UNIT	RCP	REFLECTED CEILING PLAN
COS	CONFIRM ON SITE	HRL	HANDRAIL	RETB	REINSTATED EXISTING TIMBER BEAM
COV	COVED	L	LAMINATE FINISH	RETC	REINSTATED EXISTING TIMBER COLUMN
CNJ	CONSTRUCTION JOINT	LS	LIGHT STEEL FRAME	RETJ	REINSTATED EXISTING TIMBER JOIST
/CR	CEMENT RENDER	LVR	LOUVRE	RETP	REINSTATED EXISTING TIMBER POST
CP	CHROME PLATED	M	MIRROR	RHS	RECTANGULAR HOLLOW SECTION
/CV	COVED	MAG	MAGNESITE FLOORING	RL	RELATIVE LEVEL
D	DOOR	MDF	MEDIUM DENSITY FIBREBOARD	RS	ROLLER SHUTTER
(E)	EXISTING	MR	MOISTURE RESISTANT	SAL	SALVAGE
EDB	ELECT DISTRIBUTION BOARD	MS	MILD STEEL	SHS	SQUARE HOLLOW SECTION
EF	EXHAUST FAN	(N)	NEW		
EJ	EXPANSION JOINT	NTB	NEW TIMBER BEAM		
ETB	EXISTING TIMBER BEAM	NTC	NEW TIMBER COLUMN		
ETC	EXISTING TIMBER COLUMN	NTJ	NEW TIMBER JOIST		

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

SIM	SIMILAR
SK/T1	TIMBER SKIRTING TYPE 1
SK/T2	TIMBER SKIRTING TYPE 2
SK/VS	VINYL SKIRTING
/SLD	SLIDING
SNK	SINK
SPR	SPRINKLER - FIRE
SS	STAINLESS STEEL
SL	SLATE
SSL	STRUCTURAL SLAB LEVEL
ST	SANDSTONE
STC	SOUND TRANSMISSION CLASS
T	TIMBER
TSI	TACTILE SURFACE INDICATOR
TF	TIMBER FLOOR BOARDS
TJ	TIMBER JOIST
TL/F	TILE – FLOOR
TL/W1	TILE – WALL – TYPE 1
TL/W2	TILE – WALL – TYPE 2
TME	TO MATCH EXISTING
TOP	TOPPING
TOP1	TOPPING – TYPE 1
TOP2	TOPPING – TYPE 2
TOP3	TOPPING – TYPE 3
TOP4	TOPPING – TYPE 4
TYP	TYPICAL
TZ	TERRAZZO
UNO	UNLESS NOTIFIED OTHERWISE
UR	URINAL
U/S	UNDERSIDE
V/S	VINYL SHEETING
VOS	VERIFY ON SITE
VP	VENT PIPE
W	WINDOW
WC	TOILET SUITE
WUC	WORKS UNDER THE CONTRACT
WP	WEATHERPROOF
WPM	WATERPROOF MEMBRANE
WR	WATER RESISTANT

WALL TYPES

Refer LIGHT TIMBER FRAMING Specification

GENERAL:

- Refer to Architectural, Structural and the Services drawings and specifications for the full extent of works on all floors, externally and on the roof.
- Refer to and coordinate this schedule with the Architectural drawings (demolition and proposed floor plans, reflected ceiling plans and details).
- Refer to 0202 DEMOLITION for all items to be salvaged and stored on site, returned to the Principal or reused in the works.
- Provide approved protection to existing timber and masonry structure, windows, joinery doors, existing finishes, surfaces and finishes in spaces where works are being undertaken and which are shown as remaining.
- Refer to Architectural and Services drawings for where access panels are required in ceilings and timber floors due to the installation of new services. Make allowance for the access panels shown on the drawings and for the extra over tender allowance to cover additional access panels not shown on the drawings as specified.
- Refer to the Mechanical, Electrical, Hydraulic and Fire Services documentation for works not described herein and for capping off / removal of existing services, diversions / extensions and modifications to existing services and for making good. Refer to Services specification for associated builder's work.
- Refer to the 0341 STRUCTURAL TIMBER specification for the list of new structural timbers and floor boards to be provided by the Principal and for the existing timbers off site at White Bay that have been assessed for reuse.
- Refer to the Structural Engineers' drawings with specification notes and the specifications bound in this Technical Specification for scope of structural works in this project. Refer to specifications on the Engineer's drawings for works to salvaged timber structure, cast iron collars and historic signs.
- Allow to make good all walls, ceilings and floors nominated for retention after removal of services, existing fittings and finishes.
- Refer Electrical Services for proposed conduit reticulation. Seek approval for proposed details, prior to installation, of any services on stone masonry and on the timber structure.
- Refer to the Services drawings for services penetrations which require fire dampers, collars or other fire sealing. Refer to 0182 FIRE STOPPING.
- Refer 0655 TIMBER FLOORING and architectural drawings for the extent of new timber floor boards.
- Where substrates and finishes are existing, they are notated with the prefix (E);
- Where substrates and finishes have no notation they are new materials or finishes. Where substrates and finishes have the prefix (N), they are new.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
BAY 5 GROUND FLOOR – INTERNAL								
5G.01	AREA A (Kitchenette and Bin store)	(E)C/ Heritage Asphalt; (N)PLY/T floor; AP/FLR x 3	(E)ST, (E)ST/P** (E)BK/P in arches ** (E)BK & (E)SM	JN01, sliding mesh doors; Mesh over; Joinery as detailed	(E)ST, (E)ST/P**	3/No.(E) W/T/ (N)P *	(E)T Structure.	- (E) Timber structure (ETC, ETB AND ETJ) to remain as existing. - Refer JOINERY for kitchenette cupboards and to drawings for details. * Replace obscure glass in (E)T windows 5GD/W4, 5GD/W5 and 5GD/W6 with clear glass. Glazing details to match existing. ** Existing paint to remain *** Refer PAINTING for removal of paint from masonry walls.
	STAIR 3	- New steel stair with timber treads and mesh steel risers to architectural and structural engineering details. Paint Finish - Stair to be supported on (N)C pads on WPM on (E)C which is concealed below the (N)PLY/T floor. - Refer to architectural drawings and to the Structural Engineer's drawings for fixings to the existing structure. - BAL/G to void to Stair 4 to architectural details as detailed.						
5G.02	AIRLOCK	TL/F /TOP4 * Wall tile is skirting SK/TL/W	TL/W2	TLW2	TLW2	TLW2	PBD/P AP	- Refer to the 1:50 wall elevations for tiling setout - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer MECHANICAL SERVICES for access panels * TL/F on TOP4 to falls on CFC on (N)TF raised above (E) heritage C

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5G.03	FEMALE WC	TL/F/TOP4 * FW Wall tile is skirting tile. SK/TL/W	FC/TL/W1 Toilet cubicle	FC/TL/W1	FC/TL/W1 D/T/P	FC/TL/W1 M	PBD/P	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer to MECHANICAL SERVICES for AP requirements and co-ordinate with RCP. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5G.04	MALE WC	TL/F/TOP4 * Wall tile is the skirting tile. SK/TL/W1	FC/TL/W1 Toilet cubicle	FC/TL/W1 M	FC/TL/W1	FC/TL/W1 to low wall to urinal NTC	PBD/P	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste. * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5G.05	PASSAGE 2	(N)PLY/T floor above (E) C; heritage asphalt ** (N)C to (N) trench * below PLY/T floor	(E)ST	-	PBD/P 1x double T/D/P 2x single T/D/P	-	(E) T structure	- Refer ELECTRICAL, MECHANICAL and FIRE SERVICES and RCP's * Refer to Archeological Report and EARTHWORKS specification for works required in opening up the slab to the new drainage connection. Refer to the notes on the architectural drawings; ** PLY/T step ramp 2 with non-slip finish
5G.06	CLEANER	CFC/V/S * SK/V/S/ COV	FC/P	FC/P	FC/TL/W1 to wall behind the cleaners sink ** HWU	FC/P	PBD/P	* CFC to be installed on top of (N)TF structure above (E)C. **HWU wall mounted at high level on brackets with safe tray as specified in HYDRAULIC SERVICES. - SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections.
5G.07	AREA B	(E)C; Heritage Asphalt; (N)PLY/T floor * AP/FLR as specified	(E)ST, Repair walls where toilet removed as specified (N) Ramp 2 *** FHR FE	(E)ST, (E)Steel doors / partition with (N)steel / glass 2x(E)W/T/ (N)P**	(E)ST	PBD/P	(E)T Structure.	- Refer Architectural drawings for demolition of existing toilet block. - Refer Architectural, Engineer's and Hydraulic drawings for the extent of concrete slabs removal to access trench for new connection to existing below ground drainage. * Timber joists on WPM in (E)C for PLY/T floor protection to (E) C - Re-glaze 5GD/W1 and 5GD/W3 with clear glass; ** Replace 2/no (E) louvres with (N)T glazed sashes ***Refer JOINERY for PLY balustrade to PLY Ramp 2 with non-slip finish.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5G.08	PASSAGE 1	(N)PLY/T steps and floor raised above the (E)C / heritage asphalt. Mesh gap to wall for ventilation	PBD/P D/T/P	-	(E)ST *	-	(E)T structure No ceiling.	- Refer to the architectural drawings for the T framed raised floor and steps built above the (E) C - Refer ELECTRICAL, MECHANICAL and FIRE SERVICES and RCP's
BAY 5 GROUND FLOOR – EXTERNAL								
5GX.01	ENTRY	(E)PAV/BK	(N)Steel & glass doors / partition /P	-	(N)Steel & glass partition/P ,	(N)Steel & glass partition with double doors /P	(E)	- External painting limited to new construction. - Existing external roller shutter to remain and be fixed up high and locked in the open position. - Refer architectural details for new steel and glass Entry steel and glass doors TME details and for fixing to (E) fabric. - Refer ELECTRICAL SERVICES for security to existing doors, exit signs internally
5GX.02	VOID	(E)C	-	-	-	-	-	-
BAY 4 GROUND FLOOR – INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4G.01	FIRE EXIT	(E)C (E) finish	BK/FR/CR/ P, FRL -/120/120 [20mm CR both sides] FD/P, FRL -/120/30	(E)Timber doors / (N)P; (E)SM	(E)FD/ (N)P (E)BK/CR /(N)P	BK/FR/ CR/P FRL -/120/120 [20mm CR both sides] FD/P FRL -/120/30	PBD/ FR/P * set square cornice.	- Refer DEMOLITION for removal of AL framed glass partitions and door; make good all finishes where partitions removed. * New fire rated ceiling below (E) joists FRL -/120/120 and all joists fire-sealed to BCA report. - Refer DOORS AND ACCESS PANELS and details for metal door frames to fire doors – grout filled. - Refer ELECTRICAL SERVICES for lighting and exit signs
4G.02	FIRE STAIR 1	(E)C (N) stair nosings	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	Existing C	- Refer ELECTRICAL SERVICES for new lighting to Fire Stair 1. - Upgrade (E) balustrade for fire stair BCA compliance. - Refer METALWORK for new non-slip nosings to the existing concrete stair treads.
4G.03	KITCHENETTE	(E)TZ	Existing	Existing	Existing	BK/FR/ CR/P FRL -/120/120 [20mm CR both sides] (N)FD/P	Existing	- All existing building fabric and finishes remain. - New walls and finishes as scheduled.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4G.04	AREA 4A	(E)C	Existing	Existing	BK/FR/ CR/P, FRL -/120/120 [20mm CR both sides]	Existing	Existing	- All existing building fabric and finishes remain with exception of removal of the glass partition. - New walls and finishes as scheduled.
4G.05	AIRLOCK	(E)TZ/ (N)TOP1	BK/CR/P, D/P	(E)BK/CR / (N)P, BK/CR/P, ETC	BK/CR/P, D/P	BK/CR/P, D/P	PBD/P AP*	- Refer Architectural details for demolition extent and for new Toilets; extent of wall tiling and for floor finishes. - Carefully remove (E) toppings back to TZ substrate before preparing / laying new toppings * Confirm access panel requirements - Refer SIGNS AND DISPLAYS for signage.
4G.06	MALE WC	(E)TOP – remove for (N)TOP 1 NOTE: Wall tile is the skirting tile. SK/TLW1	(E)BK/CR/ (N)TLW	(E)BK/FC/ (N)TLW * M	BK/CR/ TLW	BK/CR/ TLW	PBD/P AP**	- Refer Architectural details for demolition extent and for new Toilets; extent of wall tiling and for floor finishes. * FC on 25mm on channels on BK instead of CR. ** Confirm access panel requirements. - Carefully remove (E) toppings back to TZ substrate before preparing / laying new toppings - SH.04 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer MECHANICAL SERVICES for mechanical exhaust system modifications for new amenities.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4G.07	FEMALE WC	(E)TOP – remove for (N)TOP 1 NOTE: Wall tile is the skirting tile. SK/TL/W1	(E)BK/CR/ (N)TL/W	(E)BK/FC/ (N)TL/W * M	BK/CR/ TL/W	BK/CR/ TL/W	PBD/P AP**	- Refer Architectural details for demolition extent and for new Toilets; extent of wall tiling and for floor finishes. * FC on 25mm on channels on BK instead of CR. ** Confirm access panel requirements. - Carefully remove (E) toppings back to TZ substrate before preparing / laying new toppings - SH.04 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer MECHANICAL SERVICES for mechanical exhaust system modifications for new amenities.
4G.08	ACCESS (AMBULANT WC)	(E)TOP – remove for (N)TOP 1 NOTE: Wall tile is the skirting tile. SK/TL/W1	BK/CR/ TL/W	(E)BK/CR / (N)TL/W * M	(E)SM/FC / (N)TL/W *	(E)BK/FC/ (N)TL/W *	PBD/P AP**	- Refer Architectural details for demolition extent and for new Toilets; extent of wall tiling and for floor finishes. - Carefully remove (E) toppings back to TZ substrate before preparing / laying new toppings. *FC on 25mm on channels on BK instead of CR. **Access panel for AAV. Refer HYDRAULIC SERVICES. - SH.04 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer METALWORK schedule for grab rails - Refer MECHANICAL SERVICES for mechanical exhaust system modifications for new amenities.
4G.09	LIFT LOBBY	(E)TZ	Existing	Existing	(E)C/CR/ (N)P * new signs	Existing	(E)T structure; No ceiling	- VERTICAL TRANSPORTATION SERVICES - for replacement of the existing lift cars and plant. New landing / hall buttons. - Existing lift landing doors / frames retained. * New painted lift signage to match existing.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4G.10	LINK 0	(E)C/TOP3 *, (E)TZ	-	(N)BK/C to holes in wall TME. (N)P	FD FRL -/120/30	(N)BK/C to holes in wall TME, (N)P (E) FD/(N)P	(E)T structure; No ceiling	- Remove (E)EDB and cupboard. * Scabble back (E)C 30mm for TOP3 to finish flush with a straight line to existing Terrazzo - Refer ELECTRICAL SERVICES for services to be removed and for services to remain on walls. - Refer architectural details for new opening for new fire door and for finishes around the door. - Refer structural details for lintels to opening.
4G.11	FIRE STAIR 2	(E)TZ	Existing New signage	Existing	(N)SM where FD removed	BAL/G to window on mid landing.	Existing	- Refer architectural details for removal of (E)fire door and for infill to opening with salvaged SM - New Fire Hydrant. Repair Terrazzo at base where required. - New signage for egress in Stair 2 . Refer SIGNAGE AND DISPLAYS.
BAY 4 GROUND FLOOR – EXTERNAL								
4G.X.01	VOID	(E)C	-	-	-	* (E) services	-	NOTE: Protect (E) services fixed to west wall. Relocate electrical conduit/cables at top of wall as required for ramp construction to approval. - Confirm principal's building lighting proposals. CI stormwater pipe to be retained. Refer architectural drawings.
BAY 5 FIRST FLOOR - INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L1.01	AREA A (Kitchenette and Bin Store)	(E)C/(N) POL * (E) SK/T1/P to existing masonry walls and (N) SK/T1/P to stud walls	(E)BK/CR/ (N)P (N)Opening in wall for FD as detailed; FD/P	JN02 *** Sliding mesh doors to detail Demolish (E) cinema walls and services	** BK/CR/P; (E)BK/CR /(N)P Remove timber shelving BK/CR/) to where stud wall in opening removed	(E)BK/CR / (N)P (E)W/T(N) P (N) W/T(N)P ETC/ETB structure to remain. Remove (E)BAL to 5L1/W5; (N)BAL/G Repair CR/P where stair removed	(E)C/(N)P	- Demolish toilets and concrete stair from Level 1 to Level 2; repair walls where concrete beams /slabs removed with (N)BK/TME and CR/P; reinstate brick projection on north and south walls for (N) T structure. - Demolish toilets and remove services; demolish BK in former window and prepare for (N)W/T. - New steel Stair 3 as detailed. - New skirtings to match existing details; * Remove (E) carpets /adhesives and polish concrete ** Remove (E) stud infill to former opening in south wall; (N) BK infill; FRL -/120/120 BK + CR/P; finish flush with (E)CR. - Remove (E) ceiling and hangers; (E) services and patch (E) concrete soffit as needed. - Retain existing timber structure, ETC,ETB and ETJ; * Refer CONCRETE and CONCRETE FINISHES for work to existing concrete. ** Refer JOINERY and details for sliding mesh door details to kitchenette and bin store. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage *** Repair cargo landing door at entry and paint; **** Refer Structural Engineer's drawings for base fixing of (E) and (N) timber columns to be fixed to existing concrete floor slab.
	STAIR 3	- New steel stair with timber treads and mesh steel risers to architectural and structural engineering details. Paint Finish - Refer to architectural drawings and to the Structural Engineer's drawings for fixings to the existing structure. - BAL/G to void to Stair 4 to architectural details as detailed.						

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L1.02	AIRLOCK	TL/F /TOP4 * Wall tile is skirting SK/TL/W	TL/W2	TL/W2	TL/W2 (E)BK/CR / (N)P	TL/W2	PBD/P	- Refer to the 1:50 wall elevations for tiling setout - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. Refer to ELECTRICAL SERVICES for strip lighting. * TL/F on TOP4 to falls on CFC on (N)TF
5L1.03	FEMALE WC	TL/F/TOP4 FW * Wall tile is skirting tile. SK/TL/W	FC/TL/W1 RFL Shaft Wall to duct AP/W/FR with TLW1 finish Toilet cubicle	FC/TL/W1 D/T/P M	FC/TL/W1	FC/TL/W	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer to MECHANICAL SERVICES for AP requirements and co-ordinate with RCP. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L1.04	ACCESS WC	TL/F/ TOP4 Wall tile is skirting tile. SK/TL/W1 FW	FC/TL/W1	FC/TL/W1	FC/TL/W1 D/T/P NTC	FC/TL/W M	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L1.05	MALE WC	TL/F/TOP4 Wall tile is the skirting tile. SK/TL/W1	FC/TL/W1 Toilet cubicles	FC/TL/W1 M NTC	FC/TL/W1	FC/TL/W1 to low wall to urinal	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L1.06	PASSAGE 2	(E) C / (N)POL ** SK/T1/P to masonry walls and SK/T2/P to stud walls	(E)BK/CR/ (N)P * FHR FE	-	PBD/P 2x double T/D/P 1x single T/D/P NTC	-	Rein-stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. ** Recess (E) slab for NTC and ETC for reinstating concrete structure. Refer ELECTRICAL SERVICES and RCP's
5L1.07	CLEANER	CFC/V/S * SK/V/S/ COV	FC/P	FC/P	FC/TL/W1 to wall behind the cleaners sink ** HWU	FC/P	PBD/P	* CFC to be installed on top of (E)C. Provide splayed T section at threshold at change of level. **HWU wall mounted at high level on brackets with safe tray as specified in HYDRAULIC SERVICES. - SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L1.08	AREA B	(E)C/POL * (N)SK/T1/P to masonry walls and (N)SK/T2/P to stud walls	** (E)BK/CR/(N)P and (E)BK/ (N)P (E)FD/(N)P	** (E)BK/CR/(N)P and (E)BK/ (N)P; BAL/G to low window sills	** (E)BK/CR/(N)P and (E)BK/CR/(N)P (N)BK/CR/P to infill where louvres removed.	PBD/P	(N)T structure, NTC, NTB, NTJ	* Remove (E) cinema walls, seating fitout and finishes; remove (E) services to services drawings; Fire seal holes in slab where services removed. Cut chemsets level with floor and grind smooth ** Retain (E) rendered and un-rendered walls and paint; to existing cracked render, allow to repair/re-render 75% of east wall after brick repairs. - Remove stud walls to face of east windows and cargo doors; refurbish doors as specified in DOORS AND ACCESS PANELS - New plumbing, electrical , fire and mechanical services. ***Refer ELECTRICAL. MECHANICAL and FIRE SERVICES and RCP's
5L1.09	PASSAGE 1	(N)T/F to walkways and floor raised above the reinstated (N)T/F and (E)C SK/T1/P to masonry walls and SK/T2/P to stud walls	PBD/P	-	(E)BK/CR / (N)P *	-	Rein-stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer to the architectural drawings for the walkways built above the reinstated timber structure with (N) timber floor boards. - Refer ELECTRICAL, MECHANICAL and FIRE SERVICES and RCP's
BAY 4 FIRST FLOOR – INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L1.01	FIRE STAIR 1	(E)C (N)stair nosings	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P	* repair C slab after removal of services	* Refer MECHANICAL SERVICES for removal of stair smoke exhaust / pressurization; - Refer ELECTRICAL SERVICES for new stair lighting and exit signs. - Upgrade (E) balustrade for fire stair BCA compliance. - Refer METALWORK for new stair nosings. - Refer SIGNS & DISPLAYS for signage
4L1.02	LIFT LOBBY	(E)TF/MAG	Existing steel / glass doors and partitions	Existing	(E)C/CR/ (N)P – TME * New signs. (N)FD/P to FIRE STAIR 2.	Existing	(E)T structure; No ceiling	- VERTICAL TRANSPORTATION SERVICES - for replacement of the existing lift cars and plant. New landing / hall buttons. - Existing landing doors / frames retained. * New painted lift signage to match existing.
4L1.03	LINK 1	(N) checker plate ramp on T/MAG/ timber structure. Non slip paint finish	-	(N)BK/C to holes in wall TME. (N)P	FD/P FRL -/120/30 Remove stud infill to wall **	(N)BK/CR /P infill where FD removed * (N)BK/C to holes in wall TME, (N)P.	(E)T structure; No ceiling	* Remove existing fire door and frame to Stair 2. ***after removal of stud infill enlarge opening with new lintels as detailed - Remove (E)EDB cupboard and refer to ELECTRICAL SERVICES for services to be removed and for services to stay on walls and be enclosed. - Refer architectural details for new opening for new fire door and for finishes around the door. - Refer structural details for lintels to opening and architectural details.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L1.04	FIRE STAIR 2	(E)TZ	(E)CR/(E) P and (N)CR/P (N)FD/P in new opening	(N)BK/CR /P where FD removed FH	Existing	BAL/G to window on mid landing		- Refer architectural drawing for (N)FD in north wall and for removal for (E)FD in east wall. - New FH Fire Hydrant; repair terrazzo as required.
BAY 5 SECOND FLOOR - INTERNAL								

SPECIFICATION
SH02 : SCHEDULE OF SUBSTRATES AND FINISHES

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L2.01	FOYER (Stair 4 & Kitchenette)	*(E)C/(N) POL RC/TOP2/ POL ****Form recesses in (E) slab for 2 x STC (E)SK/T1/ (N)P SK/T1/P	(E)BK/CR/ (N)P (N)Opening for FD as detailed; FD/P	JN03 ** Sliding mesh doors to detail	(E)BK/CR / (N)P BK/CR/P for repairs after demolition	(E)BK/CR / (N)P (E)W/ (N)P (N)glass sliding auto doors x 2 *** NTC/NTB and ETC/ETB reinstated structure. Remove (E)BAL to 5L2/W4; (N)BAL/G Repair CR/P	(N) reinstated T structure over.	- Demolish 2 concrete stairs up to L3 and 1 concrete stair from Level 1 to Level 2; repair walls where concrete beams /slabs removed with (N)BK/TME and CR/P; reinstate brick projection on north and south walls for (N) T structure. - New steel Stair 4 as detailed. Steel screen to stair as detailed; - New skirtings to match existing details; - Retain existing timber structure, ETS,ETB and ETJ; Reinstate original timbers for new timber structure for Bays V-D. Refer structural drawings. - Refer DOORS AND ACCESS PANELS for work to (E) timber doors. * Refer CONCRETE and CONCRETE FINISHES for work to new and existing concrete. ** Refer JOINERY and details for sliding mesh door details to kitchenette and bin store. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage *** Repair cargo landing door at entry and paint; **** Refer Structural Engineer's drawings for base fixing of (E) and (N) timber columns to be fixed to existing concrete floor slab. Refer STRUCTURAL TIMBER and DEMOLITION for removal and reinstatement of (E) timber structure for (N) structural connections.
	STAIR 4	- New steel stair with timber treads and mesh steel risers to architectural and structural engineering details. Paint Finish - Refer to architectural drawings and to the Structural Engineer's drawings for fixings to the existing structure. - Steel screen to west side of Stair 4 to architectural details as detailed.						

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L2.02	AIRLOCK	TL/F / CFC/TOP4 * Wall tile is skirting SK/TL/W	TL/W2	TL/W2	TL/W2 (E)BK/CR / (N)P	TL/W2	PBD/P	- Refer to the 1:50 wall elevations for tiling setout - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. Refer to ELECTRICAL SERVICES for strip lighting. * TL/F on TOP4 to falls on CFC on (N)TF
5L2.03	FEMALE WC	TL/F/CFC/ TOP4 FW * Wall tile is skirting tile. SK/TL/W	FC/TL/W1 RFL Shaft Wall to duct AP/W/FR with TLW1 finish Toilet cubicle	FC/TL/W1 D/T/P M	FC/TL/W1	FC/TL/W	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer to MECHANICAL SERVICES for AP requirements and co-ordinate with RCP. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L2.04	ACCESS WC	TL/F/CFC/ TOP4 Wall tile is skirting tile. SK/TL/W1 FW	FC/TL/W1	FC/TL/W1	FC/TL/W1 D/T/P	FC/TL/W M	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L2.05	MALE WC	TL/F/CFC/ TOP4 Wall tile is the skirting tile. SK/TL/W1	FC/TL/W1 Toilet cubicles	FC/TL/W1 M	FC/TL/W1	FC/TL/W1 to low wall to urinal	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L2.06	PASSAGE 2	(N)T/F and (E) C / (N)POL Movement joint SK/T1/P to masonry walls and SK/T2/P to stud walls	(E)BK/CR/ (N)P * FHR FE	-	PBD/P T/D/P	-	Rein- stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. Refer ELECTRICAL SERVICES and RCP's
5L2.07	CLEANER	CFC/V/S * SK/V/S/ COV	FC/P	FC/P	FC/TL/W1 to wall behind the cleaners sink ** HWU	FC/P	PBD/P	* CFC to be installed on top of new T/F boards. Provide splayed T section at threshold at change of level. **HWU wall mounted at high level on brackets with safe tray as specified in HYDRAULIC SERVICES. - SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L2.08	AREA A	(N)TF on (N) T structure (N) SK/T1/P to masonry walls; (N) SK/T2/P to stud walls;	(E)BK/CR/ (N)P * FD/P **	(E)BK/CR / (N)P* (E)Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	(E)BK/CR /(N)P *	PBD/P	(E) C/P (N)P Repair holes in concrete structure after services / fixtures removed	- Refer conc floor where chemset fixings are cut off and ground smooth with slab. ** Form new opening in brick party wall for FD; install (N) lintels to Structural Engineers and architectural details. * Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer DOORS AND ACCESS HATCHES for repair works to sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.
5L2.09	PASSAGE 1	(N)T/F to walkways and floor raised above the reinstated (N)T/F and (E)C SK/T1/P to masonry walls and SK/T2/P to stud walls	PBD/P	-	(E)BK/CR / (N)P *	-	Rein- stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer to the architectural drawings for the walkways built above the reinstated timber structure with (N) timber floor boards. - Refer ELECTRICAL SERVICES and RCP's
BAY 5 – SECOND FLOOR - EXTERNAL								
-	STEPS 1	- Scabble back to removed cracked toppings to concrete steps. New granolithic non-slip topping TOP3 with aggregate TME (to approved samples) with inset non-slip strips to treads. Refer CEMENTITIOUS TOPPINGS and METALWORK. - Replace existing handrails to compliant height and weld fix to match existing. Refer METALWORK and architectural details. - Refer to Ramp details for work to existing balustrades, handrails and for painting refer PAINTING.						

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
BAY 4 SECOND FLOOR - INTERNAL								
4L2.01	ENTRY	(E)TZ Remove (E) strip drain at entry and infill with (N) topping. TOP3 to STEPS 2	(N)steel / glass partition /P	(N)steel / glass partitions and double doors/P	(N)steel / glass partition/P	* (E)T/(N)P Clean (E) render.	(E)T structure; No ceiling	*Remove / salvage timber doors – refer DEMOLITION. Retain timber fanlight and door frame. Refer DOORS AND ACCESS PANELS for work to frames. - Refer architectural details for the new steel and glass Entry walls and doors TME details and for fixing to (E) fabric.
4L2.02	FOYER	(E)TZ (E)TF/MAG	Existing	(E)Steel / glass partition & doors. Remove (E) steel / glass doors. Salvage D handles	Existing. ETC FIP on wall to approved location near retained notice board	(E)BK. (E)BK/CR /P (N)BAL/G to low window sill (N)Steel glass doors partitions	(E)T structure; No ceiling	- Protect existing finishes to be retained. - Refer architectural drawings for steel glass partitions to be removed and partitions to remain - Repair wall finish and P where partitions removed. - Refer architectural details for the new steel and glass entry with double doors.
4L2.03	LINK 2	(E)TF/MAG (N)TF/ (N)MAG TOP 3 to door threshold	-	(N)BK/C to holes in wall TME. (N)P	FD/P FRL -/120/30	(E)BK/CR /P (N)BK/C to holes in wall TME, (N)P	(E)T structure; No ceiling	- Remove (E)EDB and cupboard. - Refer ELECTRICAL SERVICES for services to be removed and for services to stay on walls. - Refer architectural details for new opening for new fire door and for finishes around the door. - Refer structural details for lintels to opening.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L2.04	LIFT LOBBY	(E)TF/MAG	Existing	Existing	(E)C/CR/ (N)P * new signs	Remove (E) steel / glass doors. Salvage D handles	(E)T structure; No ceiling	- Protect existing finishes to be retained. - VERTICAL TRANSPORTATION SERVICES - for replacement of the existing lift cars and plant. New landing / hall buttons. - Existing landing doors / frames retained. * New painted lift signage to match existing.
4L2.05	FIRE STAIR 1	(E)C (N) TOP3 step ramp at door for level change. (N)stair nosings	Existing (E)HRL/ (N)P FD/P * Repair wall TME where door opening cut in & lintels installation	Existing (E)HRL/ (N)P	Existing (E)HRL/ (N)P (N)FD/P	Existing (E)HRL/ (N)P	(E)C	- Refer ELECTRICAL SERVICES for new stair lighting and exit signs. *Form new opening in brick dividing wall for new FD; install lintels as detailed. Refer architectural details. - Upgrade (E)balustrade for fire stair BCA compliance. - Refer METALWORK for new stair nosings. - Refer SIGNS & DISPLAYS for signage
4L2.06	FIRE STAIR 2	(E)TZ	Existing	Existing (N)FH	Existing	BAL/G to window on mid landing	-	- New FH Fire Hydrant. - Repair terrazzo as required.
BAY 4 – SECOND FLOOR – EXTERNAL								
-	(N) RAMP	- Refer to Structural Engineer’s and architectural details for the new steel ramp, balustrades and handrails.						
-	STEPS 2	- Scabble back to removed cracked toppings to concrete steps. New granolithic non-slip topping TOP3 with aggregate TME (to approved sample) with inset non-slip strips to treads. Refer CEMENTITIOUS TOPPINGS and METALWORK. - Refer to Ramp Details for work to existing balustrades, new balustrades and handrails.						
-	FAÇADE AT ENTRY	- No changes are being made to the existing façade. Existing unpainted render around the Entry to remain. - Clean the render by washing and hand brushing to remove urban grime and dirt.						
BAY 5 - THIRD FLOOR - INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L3.01	AREA A	(N)T/F (N) SK/T1/P	BAL/G to VOID NTP	Steel screen /PC to Stair 4	(E)BK/CR /(N)P *	(E)BK/CR / (N)P* (E)Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	Rein- stated T structure with (N) and (E) timbers. No ceiling.	- New timber floor on reinstated timber structure with joists in reformed joist recesses in west wall. - Refer TIMBER FLOORING for finishing * Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer DOORS AND ACCESS HATCHES for repair works to reinstate sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.
5L3.02	AREA B	(N)T/F (N)SK/T1/P	(E)BK/CR/ (N)P * (N)FD/P	Steel screen /PC to Stair 4	BAL/G to VOID NTP	(E)BK/CR / (N)P* (E) Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	Rein- stated T structure with (N) and (E) timbers. No ceiling.	- New timber floor on reinstated timber structure with joists in reformed joist recesses in west wall. - Refer TIMBER FLOORING for finishing * Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer DOORS AND ACCESS HATCHES for repair works to reinstate sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L3.03	BREAKOUT (Kitchenette)	(N)T/F (N)SK/T1/P To BK/CR/P walls	(E)BK/CR/ (N)P * (N)FD/P	JN05 ** Sliding mesh doors to detail	(E) BK/CR/ (N)P *	Steel Stair 4; BAL/G to Stair 4; Steel screen /PC to Stair 4	Rein- stated T structure with (N) and (E) timbers. No ceiling.	- New timber floor on reinstated timber structure. - Refer TIMBER FLOORING for finishing - Demolish ceiling below U/S trusses and cinema services and retain existing steel bracing. * Repair / make good render where cinema and associated services are removed; prepare and repaint. ** Refer JOINERY and details for sliding mesh door details to kitchenette and bin store. -Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
	STAIR 4	- New steel stair with timber treads and mesh steel risers to architectural and structural engineering details. Paint Finish - Refer to architectural drawings - Steel screen to west side of Stair 4 to architectural details; BAL/G with timber top rail to east side of stair – all as detailed.						
5L3.04	AIRLOCK	TL/F / CFC/TOP4 * Wall tile is skirting SK/TL/W	TL/W2	TL/W2	TL/W2 (E)BK/CR / (N)P	TL/W2	PBD/P	- Refer to the 1:50 wall elevations for tiling setout - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. Refer to ELECTRICAL SERVICES for strip lighting. * TL/F on TOP4 to falls on CFC on (N)TF

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L3.05	FEMALE WC	TL/F/CFC/ TOP4 FW * Wall tile is skirting tile. SK/TL/W	FC/TL/W1 RFL Shaft Wall to duct AP/W/FR with TLW1 finish Toilet cubicle	FC/TL/W1 D/T/P M	FC/TL/W1	FC/TL/W	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer to MECHANICAL SERVICES for AP requirements and co-ordinate with RCP. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L3.06	ACCESS WC	TL/F/CFC/ TOP4 Wall tile is skirting tile. SK/TL/W FW	FC/TL/W1	FC/TL/W1	FC/TL/W1 D/T/P	FC/TL/W M	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L3.07	MALE WC	TL/F/CFC/ TOP4 Wall tile is the skirting tile. SK/TL/W1	FC/TL/W1 Toilet cubicles	FC/TL/W1 M	FC/TL/W1	FC/TL/W1 to low wall to urinal	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L3.08	PASSAGE 2	(N)T/F and (E) C / (N)POL Movement Joint SK/T1/P to masonry walls and SK/T2/P to stud walls	(E)BK/CR/ (N)P * Brick infill early wall opening to maintain FRL . Finish BK/F FHR / FE	-	PBD/P 2 x (N) double doors and 1 x (N) single door /P NTC	-	Rein- stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render to walls where cinema and associated services are removed; prepare and repaint. - Refer ELECTRICAL SERVICES and MECHANICAL SERVICES and RCP's - Tefer to notes on the floor plans and to details
5L3.09	CLEANER	CFC/V/S * SK/V/S/ COV	FC/P	FC/P	FC/TL/W1 to wall behind the cleaners sink ** HWU	FC/P	PBD/P	* CFC to be installed on top of new T/F boards. Provide splayed T section at threshold at change of level. **HWU wall mounted at high level on brackets with safe tray as specified in HYDRAULIC SERVICES. - SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L3.10	AREA C	(E) C / (N)POL ** (N) SK/T1/P to masonry walls; (N) SK/T2/P to stud walls;	(E)BK/CR/ (N)P * (E)FD/(N)P	(E)BK/CR / (N)P* (E)Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	(E)BK/CR /(N)P * 	PBD/P	Rein- stated T structure with (N) and (E) timbers. No ceiling.	- New timber columns (recessed into (E)C slab) with new beams and joists in reformed joist recesses in east wall. * Repair / make good render where cinema and associated services are removed; prepare and repaint. ** Repair slab as spec chemsets to removed cinema seat structure - Refer DOORS AND ACCESS HATCHES for repair works to sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.
5L3.11	PASSAGE 1	(N)T/F to walkways and floor raised above the reinstated (N)T/F SK/T1/P to masonry walls and SK/T2/P to stud walls	PBD/P NTC	-	(E)BK/CR / (N)P * NTC	-	Rein- stated T structure with (N) and (E) timbers. No ceiling.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer to the architectural drawings for the walkways built above the reinstated timber structure with (N) timber floor boards. - Refer ELECTRICAL SERVICES and RCP's Refer STRUCTURAL TIMBER for reuse of (E) and (N) T columns, beams and joists with (N) T floor boards
BAY 4 – THIRD FLOOR – INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L3.01	LINK 3	(N)Grano topping – TOP3 to threshold.	-	(E)BK/CR/P (N)BK/C to holes in wall TME. (N)P	FD/P FRL -/120/30	(E) BK/CR/P (N)BK/C to holes in wall TME, (N)P	(E)T structure; No ceiling	- Remove €EDB and cupboard. Relocate electrical / comms services. - Refer ELECTRICAL SERVICES for services to be removed and for services to stay on walls. - Refer architectural details for new opening for new fire door and for finishes around the door. - Refer structural details for lintels to opening.
4L3. 02	FIRE STAIR 2	(E)TZ	Existing	Existing FH	Existing	BAL/G to window on mid landing	Existing	- New Fire Hydrant - Repair terrazzo as required where FH installed.
4L3. 03	LIFT LOBBY	(E)T/F/ MAG	(N) Steel/glass partitions and doors / P	Existing	(E) C/CR/ (N)P * new signs.	(N) Steel/ glass partitions and doors / P	(E)T structure; No ceiling	- VERTICAL TRANSPORTATION SERVICES – for replacement of the existing lift cars and plant. New landing / hall buttons. - Existing landing doors & frames retained. * New painted lift signage to match existing. - (N) steel/glass partition with doors to form the lift lobby separation to tenancy. Refer Door and Window Schedule. Details TME ground floor and as detailed on architectural drawings.
4L3. 04	STORE	-	-	-	-	-	-	-
4L3. 05	FIRE STAIR 1	(E)C (N) stair nosings	Existing C (E)HRL/ (N)P	Existing C (E) HRL/ (N)P	Existing C (E)HRL/ (N)P	Existing C (E)HRL/ (N)P (E)FD/ (N)P	Existing C	- Refer ELECTRICAL SERVICES for new stair lighting and exit signs. - Upgrade (E) balustrades for fire stair BCA compliance. - Refer METALWORK for new stair nosings - Refer SIGNS & DISPLAYS for signage
BAY 5 – FOURTH FLOOR – INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L4. 01	AREA A	(N)T/F (N) SK/T1/P	BAL/G to VOID NTP	Steel screen /PC to Stair 4	(E) BK/CR/ (N) P *	(E) BK/CR/ (N)P* €Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	Existing T roof trusses and structure. P to Existing steel bracing	- New timber floor on reinstated timber structure with joists in reformed joist recesses in west wall. - Refer TIMBER FLOORING for finishing - Demolish ceiling below U/S trusses and cinema services and retain existing steel bracing. * Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer DOORS AND ACCESS HATCHES for repair works to reinstate sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.
5L4. 02	AREA B	(N)T/F (N)SK/T1/P	(E)BK/CR/ (N)P * (N)FD/P	Steel screen /PC to Stair 4	BAL/G to VOID NTP	(E) BK/CR/ (N)P* (E) Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	Existing T roof trusses and structure. P to Existing steel bracing	- New timber floor on reinstated timber structure with joists in reformed joist recesses in west wall. - Refer TIMBER FLOORING for finishing - Demolish ceiling below U/S trusses and cinema services and retain existing steel bracing. * Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer DOORS AND ACCESS HATCHES for repair works to reinstate sliding cargo landing doors. - Refer architectural details for the glass screen; rehanging of the cargo landing doors and glass balustrades to low window sills.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L4. 03	BREAKOUT (Kitchenette)	(N)T/F (N)SK/T1/P To BK/CR/P walls	(E)BK/CR/ (N)P * (N)FD/P	JN05 ** Sliding mesh doors to detail	(E) BK/CR/ (N)P *	Steel Stair 4; BAL/G to Stair 4; Steel screen /PC to Stair 4	Existing T roof trusses and structure.	- New timber floor on reinstated timber structure. - Refer TIMBER FLOORING for finishing - Demolish ceiling below U/S trusses and cinema services and retain existing steel bracing. * Repair / make good render where cinema and associated services are removed; prepare and repaint. ** Refer JOINERY and details for sliding mesh door details to kitchenette and bin store. -Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
	STAIR 4	- New steel stair with timber treads and mesh steel risers to architectural and structural engineering details. Paint Finish - Refer to architectural details. - Steel screen to west side of Stair 4 to architectural details; BAL/G with timber top rail to east side of stair – all as detailed.						
5L4. 04	AIRLOCK	TL/F / CFC/TOP4 * Wall tile is skirting SK/TL/W	TL/W2	TL/W2	TL/W2 (E)BK/CR / (N)P	TL/W2	PBD/P	- Refer to the 1:50 wall elevations for tiling setout - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. Refer to ELECTRICAL SERVICES for strip lighting. * TL/F on TOP4 to falls on CFC on (N)TF

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L4. 05	FEMALE WC	TL/F/CFC/ TOP4 FW * Wall tile is skirting tile. SK/TL/W	FC/TL/W1 RFL Shaft Wall to duct AP/W with TL/W1 finish Toilet cubicle	FC/TL/W1 D/T/P M	FC/TL/W1	FC/TL/W	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer to LIGHT TIMBER FRAMING for timber stud wall types and sound insulation. - Refer to ELECTRICAL SERVICES for strip lighting. - Refer to MECHANICAL SERVICES for AP requirements and co-ordinate with RCP. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls * TL/F on TOP4 to falls on CFC on (N)TF. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L4. 06	ACCESS WC	TL/F/CFC/ TOP4 FW * Wall tile is skirting tile. SK/TL/W	FC/TL/W1	FC/TL/W1	FC/TL/W1 D/T/P	FC/TL/W M	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L4. 07	MALE WC	TL/F/CFC/ TOP4 Wall tile is the skirting tile. SK/TL/W1	FC/TL/W1 Toilet cubicles	FC/TL/W1 M	FC/TL/W1	FC/TL/W1 ; FC/TL/W1 to low wall to urinal	PBD/P AP	- SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections. - Refer architectural details for tile pattern to walls; for basin and mirror setouts; and for floor toppings for falls to floor waste.. - Refer to CUBICLE SYSTEMS for toilet cubicles. - Refer METALWORK for grab rails and accessories. - Refer services drawings for fire sprinklers, lighting and power; hot / cold water and drainage
5L4. 08	PASSAGE 2	(N)T/F SK/T1/P to masonry walls and SK/T2/P to stud walls	(E)BK/CR/(N)P *	-	PBD/P T/D/P Ladder on wall for access to plant platform over	-	Existing to U/S roof structure.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. Refer ELECTRICAL SERVICES and RCP's
5L4. 09	CLEANER	CFC/V/S * SK/V/S/ COV	FC/P	FC/P	FC/TL/W1 to wall behind the cleaners sink ** HWU	FC/P	PBD/P	* CFC to be installed on top of new T/F boards. Provide splayed T section at threshold at change of level. **HWU wall mounted at high level on brackets with safe tray as specified in HYDRAULIC SERVICES. - SH.03 SCHEDULE OF SANITARYWARE AND TAPWARE refer to for selections.

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
5L4. 10	AREA C	(N)T/F (N) SK/T1/P to masonry walls; (N) SK/T2/P to stud walls;	(E)BK/CR/ (N)P * FD/P **	(E)BK/CR / (N)P* (E)Timber cargo doors & (N) glass screen. BAL/G to windows with low sills	(E)BK/CR /(N)P *	PBD/P	Existing T roof trusses and structure. P to Existing steel bracing	- New timber floor on reinstated timber structure with joists in reformed joist recesses in east wall. - Refer TIMBER FLOORING for finishing - Demolish ceiling below U/S trusses and cinema services and retain existing steel bracing. * Repair / make good render where cinema and associated services are removed; prepare and repaint. ** Form new opening in brick party wall for FD; install (N) lintels to Structural Engineers and architectural details - Refer DOORS AND ACCESS HATCHES for repair works to sliding cargo landing doors. - Refer architectural details for the glass screen; rehang of the cargo landing doors and glass balustrades to low window sills.
5L4.11	PASSAGE 1	(N)T/F to walkways and floor raised above the reinstated (N)T/F SK/T1/P to masonry walls and SK/T2/P to stud walls	PBD/P	-	(E)BK/CR / (N)P *	-	Existing to U/S roof structure.	* Repair / make good render where cinema and associated services are removed; prepare and repaint. - Refer to the architectural drawings for the walkways built above the reinstated timber structure with (N) timber floor boards. - Refer ELECTRICAL SERVICES and RCP's
BAY 4 - FOURTH FLOOR AND ROOF - INTERNAL								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L4. 01	LINK 4	TOP3 to threshold. (E)T/F and (N)MAG to marry up to existing	-	(E)BK/CR /P (N)BK/C to holes in wall TME. (N)P *	FD/P FRL -/120/30	(E)BK/CR /P (N)BK/C to holes in wall TME, (N)P *	(E)T structure; No ceiling	- Remove (E)EDB and cupboard. Relocate electrical / comms services. * Refer ELECTRICAL SERVICES for services to be removed and for services to stay on walls and to be enclosed. - Refer architectural details for new opening for new fire door and for finishes around the door. - Refer structural details for lintels to opening.
4L4. 02	LIFT LOBBY	(E)MAG	(N) Steel/glass partitions and double doors / P	Existing	(E)C/CR/ (N)P where new lift control boxes installed in C wall * new signs	(N) Steel/ glass partitions and doors /P	(E)T structure; No ceiling	- VERTICAL TRANSPORTATION SERVICES - for replacement of the existing lift cars and plant. New landing / hall buttons. - (N) steel/glass partition with doors to form the lift lobby separation to tenancy. Refer Door and Window Schedule. Details TME Ground Floor and Level 1 Lift Lobby partitions. Refer to details on architectural drawings. - Existing landing door frames retained. * New painted lift signage to match existing.
4L4. 03	KITCHENETTE	(E)V/S Allow for (N)V/S TME where cupboard removed TME	Existing	Existing	FD/P * Repair wall TME where door opening cut in & lintels for install	Existing	(E)T structure; No ceiling	*Form new opening in brick dividing wall for new FD; install lintels as detailed. Refer architectural details. - Cut back kitchenette cupboard to facilitate (N)FD. Confirm work on site in consultation with the tenant.
4L4. 04	FIRE STAIR 2	(E)TZ	Existing	Existing	Existing	BAL/G to window on mid landing	-	- New Fire Hydrant - Repair terrazzo as required where hydrant installed.
ROOF – LEVEL 5								

SPECIFICATION**SH02 : SCHEDULE OF SUBSTRATES AND FINISHES**

Room No.	Room Name	Floor/ Skirting	Walls				Ceiling/ Cornice	Comments
			North	East	South	West		
4L5. 01	STORE ROOM (FORMER LMR)	(E)C/(N)C * *4 holes in floor with steel plates to be removed and openings infilled with concrete after lifts installed.	(E)C (E)D/FR/ (N)P	(E)C Remove louvres and fan and brick up opening (N)D/T/P in new opening;	(E)C Remove redundant services;	(E)C/P Remove redundant services; Replace (E)LVR with(N)AL / LVR/PF in existing opening;	(E)C/P (N)Light fittings Retain (E) steel beams below C roof for new lift install	- VERTICAL TRANSPORTATION SERVICES, refer to for removal of existing lift plant, controls / services in the Store Room (Former LMR); - Refer Architectural drawings for removal of steel plates to floor penetrations, existing wall fan and window and for forming of new door opening. - Refer Electrical and mechanical services for retained / reused switch board and for new Mechanical switchboard. * Refer Engineer's Drawings for details of new infill concrete slabs to floor penetrations to be carried out.
ROOF - EXTERNAL								
-	ROOF PLANT PLATFORM	- Refer to Architectural drawings for the extent of the existing steel roof A/C services platform and for the new extension including handrails. - Refer to MECHANICAL SERVICES for removal of existing redundant mechanical plant off the roof platform and for the new mechanical plant to be installed on the platform. Refer to Architectural drawings for the new metal screen to conceal new external services against the south wall of the Store Room; for waterproofing of the Plant Room roof; for safe roof access ladder; for new door opening from the Plant Room onto the roof platform, windows to be removed and bricked up and all other works required externally. Refer to Structural drawings for the repair of existing steel framing support to roof platform, new steel members and for the platform extension. Refer to 0421 ROOFING for works to the slate roof including removal of nominated roof access hatches, new roof hatch and for slate roof repair where hatches removed or new openings provided.						

SPECIFICATION

THE SCHEDULES

SH.03 Schedule of Sanitaryware and tapware

Schedule of Sanitaryware and Tapware

CODE	ITEM	DESCRIPTION	LOCATION	IMAGE	SUPPLIER / CONTACT
BSN1	Wall Mounted Basin	Caroma Cube Extension Wall Basin with Right Hand Shelf and 1 Taphole – Centre Option Code: 864115W Size: 570x395mm Waste: Vandal Resistant Covered Chrome Plug and Waste suitable for a 40mm Trap Connection Code: 687143 Fixings: D.200 Basin Fixing Kit incl. with Basin Bottle Trap: Refer to BT2	Male, Female and Access WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
BSN2	Wall Mounted Basin	Caroma Liano Hand Wall Basin with 1 Taphole Code: 649715W Size: 460x280mm Waste: Vandal Resistant Covered Chrome Plug and Waste suitable for a 40mm Trap Connection Code: 687141C Fixings: D.200 Basin Fixing Kit incl. with Basin Bottle Trap: Refer to BT1	Male and Female WCs BAY 4: 4G.06 4G.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
BSN3	Wall Mounted Basin	Caroma Opal 720 Wall Basin with Right Hand Shelf with 1 Taphole Centre Option Code: 632210 Size: 720x450mm Waste: Vandal Resistant Flush Fitting Chrome Waste Code: 687141 Fixing: D.200 Basin Fixing Kit incl. with Basin Bottle Trap: TBC Shroud: Opal Shroud Code: 632601W	Access WCs BAY 4: 4G.08 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187

SPECIFICATION

THE SCHEDULES

SH.03 Schedule of Sanitaryware and tapware

CODE	ITEM	DESCRIPTION	LOCATION	IMAGE	SUPPLIER / CONTACT
BT1	Bottle Trap	Argent Bottle Trap S-Trap to suit 40mm Waste with Stand Pipe to Floor Code: 28923 Finish: SCP Accessories: – Waste Adapter to suit 40mm plug and waste as required to BSN1, BSN2 and BSN3 Code: 28921	Male and Female WCs BAY 4: 4G.06 4G.07 4G.08 Refer Architectural Drawings.		Argent Contact: Jamelle Moussa P: 1300 364 748 M: 0409 459 003
BT2	Bottle Trap	Argent Bottle Trap P-Trap to suit 40mm Waste Code: 28922 Finish: SCP Accessories: – Extension Sleeve (If Required) Code: 28924EXT – Waste Adapter to suite 40mm plug and waste as required to BSN1, BSN2 and BSN3 Code: 28921	Male, Female and Access WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer Architectural Drawings.		Argent Contact: Jamelle Moussa P: 1300 364 748 M: 0409 459 003
CL/SNK	Cleaner's Sink	Caroma Cleaners Sink with Rubber Rest Pad Code: 811592W Size: 575x435mm Fixing: 1521 Bracket – White Powder Coated Code: 811594 Fittings: Hinged Grating – Heavy Chrome Plated Brass Code: 811593	Cleaner BAY 5: 5G.06 5L1.07 5L2.07 5L3.09 5L4.09 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
CL/TP	Cleaner's Sink Tapware	Enware ½ Turn Ceramic Disc CS Recess Set with SP110 Swivel Aerated Spout Code: CSH315 Finish: Polished Chrome Water Efficiency Rating: WELS 3 Star (8lpm)	Cleaner BAY 5: 5G.06 5L1.07 5L2.07 5L3.09 5L4.09 Refer Architectural Drawings.		Enware Contact: Jordi Skelton P: 02 8536 4029 M: 0432 807 568

SPECIFICATION

THE SCHEDULES

SH.03 Schedule of Sanitaryware and tapware

CODE	ITEM	DESCRIPTION	LOCATION	IMAGE	SUPPLIER / CONTACT
FW	Floor Waste	Floor Drain - Round 100mm Chrome Plated Brass Code No: FDCBR100	Male, Female and Access WCs BAY 4: 4G.06 4G.07 4G.08 BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer Architectural Drawings.		DTA Australia Contact: P: 1800 505 045
SNK	Kitchen Sink	Clark Quatro Single End Bowl Stainless Steel Sink with Drainer and Basket Waste (incl.) (handed to suit – refer documentation) plus stainless steel draining basket.	Kitchenettes – JN01 JN02 JN03 JN04 JN05		Clark / GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
TP1	Basin Mixer Tap	Caroma Liano Basin Mixer Code: 96142C5A Finish: Chrome Water Efficiency Rating: WELS 5 Star (5lpm)	Male and Female WCs BAY 4: 4G.06 4G.07 BAY 5: 5G.03 5G.04 5L1.03 5L1.05 5L2.03 5L2.05 5L3.05 5L3.07 5L4.05 5L4.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187

SPECIFICATION

THE SHEDULES

SH.03 Schedule of Sanitaryware and tapware

CODE	ITEM	DESCRIPTION	LOCATION	IMAGE	SUPPLIER / CONTACT
TP2	Basin Mixer Tap	Caroma Pin Lever Care Basin Mixer Code: 872563C5A Finish: Chrome	Access WCs BAY 4: 4G.08 BAY 5: 5L1.04 5L2.04 5L3.06 5L4.06 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
TP3	Kitchen Mixer	Caroma Liano single lever mixer tap. Finish: chrome Water Efficiency Rating: WELS 5 Star (6lpm) Code: 96135C5A	Kitchenettes – JN01 JN02 JN03 JN04 JN05		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
UR1	Urinal	Caroma Cube 0.8L Electronic Urinal Suite Code: 678800 Installation: P Trap Grate: Vandal Resistant Grate Code: 687396 Water Efficiency Rating: WELS 6 Star Note: – Supply Voltage to the System is 240V AC 50Hz – Flush Valve Located in Ceiling Allow Access for Servicing	Male WCs BAY 5: 5G.04 5L1.05 5L2.05 5L3.07 5L4.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
WC1	Toilet Suite	Caroma Cube Wall Faced Close Coupled Wall Faced Back Entry Soft Close Toilet Suite Code: 824615W Installation: TBC Seat: Cube Soft Close Toilet Seat Water Efficiency Rating: WELS 4 Star (4.5/3L Flush)	Male and Female WCs BAY 4: 4G.06 4G.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187

SPECIFICATION

THE SHEDULES

SH.03 Schedule of Sanitaryware and tapware

CODE	ITEM	DESCRIPTION	LOCATION	IMAGE	SUPPLIER / CONTACT
WC2	Ambulant Compliant Toilet Suite	Caroma Urbane Dual Flush Wall Faced Close-Coupled Toilet Suite RH Bottom Inlet Internal Overflow Code: 744500 Installation: TBC Seat: Arc Soft Close Seat Water Efficiency Rating: WELS 4 Star (4.5/3L Flush)	Male and Female WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.05 5L2.03 5L2.05 5L3.05 5L3.07 5L4.05 5L4.07 Refer Architectural Drawings.		GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
WC3	Access Compliant Toilet Suite	Caroma Care 800 Cleanflush Wall Faced Toilet Suite with Backrest – Pedigree II Care SF AG Code: 901900BAG Seat: Pedigree II Care Single Flap Seat in Anthracite Grey Installation: TBC Water Efficiency Rating: WELS 4 Star (4.5/3L Flush)	Access WCs BAY 4: 4G.08 BAY 5: 5L1.04 5L2.04 5L3.06 5L4.06 Refer Architectural Drawings.	 Note: Anthracite Grey (AG) Seat	GWA Group Contact: Anthony Carulli P: 13 14 16 M: 0418 180 187
ZIP	Boiling / Chilled water outlet	Zip Hydrotap BC 100/75 Boiling and Chilled 1-20 people. Finish: chrome Code: HT1764 Capacity: 100 Boiling cups and 75 Chilled Glasses per hour Unit Size: 280 W x 455 D x 333 H. Include ZIP Hydrotap G4 Vent Tray Kit. Code: 93540. Contractor to specify model once water pressure is confirmed. Vented model required if there is no direct hot water supply.	Kitchenettes – JN01 JN02 JN03 JN04 JN05		Zip Industries Contact: Leanne Martz P: 1800 638 633 M: 0451 633 412

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

0202 DEMOLITION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Carry out demolition, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- PRELIMINARIES
- 0171 GENERAL REQUIREMENTS
- 0184 TERMITE MANAGEMENT

Specified in this worksection

This worksection includes but is not limited to the works in the Schedules to this worksection and the demolition and associated work as required and as shown on the architectural, structural and services drawings and as follows:

- Classes for demolished material;
- Methodology for demolition works;
- Temporary support during demolition;
- Ownership of demolished materials;
- Recording of materials insitu prior to removal where specified;
- Complete removal of the 2 cinemas – the fitouts, screens, carpets, seating steps and seats, electrical services, mechanical services and fire services; masonry and light weight walls; fire-rated ceilings and all associated cinema construction including lighting structures; capping off and making good where services are removed;
- Demolition of the Level 1 toilets and associated services;
- Demolition of concrete stairs from Level 1 to 2 and stairs from Level 2 to Level 3;
- Select areas of demolition of concrete slabs and beams;
- Salvaging of scheduled items, storage on site and reinstallation as detailed and as specified or for removal off site for storage by the Principal;
- Salvaging of materials from demolition for reuse in the works;
- Salvaging of materials from demolition to be used as samples to match for new construction;
- Protection of original fire sprinkler pipes and heads;
- Protection of the existing timber structure, walls, floors windows and doors;
- Protection of existing walls, internal and external of sandstone and brick masonry;
- Protection of existing concrete and bitumen floors in Bay 5 – Ground Floor;
- Protection of recently completed maintenance painting works to the building exterior;
- Maintaining the building is sound structural condition throughout the work;
- Protection of uncovered joinery, skirtings, timber windows and doors and door hardware.
- Removal of waste building materials off site for disposal and recycling to authorities approval;
- All protection to existing fabric during demolition and when demolition waste is being removed.

Refer to the architectural drawings and schedules for demolition scope and refer to the services and structural engineering drawings;

Demolition is restricted to the area of the works as shown on the drawings.

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Refer to PRELIMINARIES for those parts of the building that will continue to be occupied during the Works.

Protection generally

Provision of protection for the duration of the works to protect building occupants in other Bays of the building and site users.

- Protection of all existing finishes and building fabric throughout the works;
- Maintaining weather protection to the building interior at all times.

Associated worksections

Refer to the following related worksections:

- PRELIMINARIES for heritage site inductions; project scope; heritage construction management plan; occupied building; site access; site area; site restrictions; maintaining safe egress in and around the building; for contractor's areas, noise restrictions, site services; general administrative requirements, protection of existing building fabric, Dilapidation Report, WH&S Management, Environmental Management and Construction Management Plan.
- APPENDIX for the PRESNA 'SHFA Hazardous Materials Register' dated 22 June 2012;
- 0335 BRICK AND STONE MASONRY, for forming of new openings in masonry dividing / party wall between Bays 4 and 5; for salvaging of bricks from demolition for reuse in repair works; for coring brick walls for removal of chemical and steel anchors and for infilling holes; for salvaging of sandstone blocks from forming the new opening and for using salvaged sandstone for enclosing an existing opening in sandstone walls; for repairs and new brickwork to areas of the internal brick walls required after removal of the concrete floor structures and stairs; brick wall repairs where the concrete slabs with fire-spray protected steel angle slab supports and fixings are removed on the south wall on Levels 1 and 3 and all other works as documented;
- 0612 CEMENTITIOUS TOPPINGS for the stripping off of existing clear finishes to existing concrete slabs prior to polishing and for new toppings; for removal of existing concrete toppings to Steps 1 and 2.
- 0310 CONCRETE - COMBINED, for concrete repairs to exposed concrete slabs edges where the concrete stairs are removed and general making good works; for infill slabs to Store Room floor penetrations after lift machinery / plant is removed and for cutting new door opening into the Store Room; for cutting chemical anchors to the top of the concrete and grinding smooth with the concrete finish and for all works as documented;
- 0381 STRUCTURAL TIMBER and structural engineer's drawings for works to the existing retained timber structure in Bay 5; for reinstatement of original timbers stored off site and for new structural timbers required for the complete reinstatement of the timber structure where documented after the demolition of the cinemas;
- 0467 GLAZING AND GLASS COMPONENTS for removal of obscure glass and installing new clear glass to existing timber windows in Bay 5 with new putty;
- 0421 ROOFING, for all roof works required in the forming and flashing of new openings for exhaust and supply air ducts and for the reuse of the salvaged slate or use of new slate from these works for reinstatement of the roof structure and slate roofing where the existing roof access hatches are removed from the Bay 4 and Bay 5 roofs;
- MECHANICAL, ELECTRICAL HYDRAULIC and FIRE SERVICES drawings and specifications for the removal of redundant services, capping of existing services and for modifications to existing services and new services.
- VERTICAL TRANSPORTATION SERVICES for the removal of the 2 existing lifts – lift cars and lift motor room plant and equipment and for the preparation for the installation of 2 new lifts with existing lift landing door openings and all works associated with the new lift installation including staging and programming for tenants in the building.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES and the architectural drawings for making good works after demolition.

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

- Architectural, Structural and HYDRAULIC SERVICES drawings for the extent of removal of existing concrete slabs on the ground floor of Bay 5 to open up for new installation of new in-ground services and for connections to existing services.
- Architectural drawings for the extent of demolition works.

1.3 STANDARD

General

Demolition: To AS 2601.

1.4 INTERPRETATION

Definitions

For the purposes of this worksection, the following definitions apply:

- Demolition: The complete or partial dismantling of a building or structure, by pre-planned and controlled methods or procedures.
- Dilapidation record: The photographic or video and written record made before commencement of demolition work of the condition of the portion of the existing building being retained, adjacent Bay 4 and areas of Bays 2 to 4 that relate to these works, the adjacent buildings, and other relevant structures or facilities. A detailed record is to include the exterior steps, the public footpaths, painted steel balustrades and handrails into and in front of Bays 4 and 5 to Hickson Road and Circular Quay West. Refer to PRELIMINARIES.
- Dismantle: The reduction of an item to its components in a manner to allow re-assembly.
- Recover: The disconnection and removal of an item in a manner to allow re-installation.

1.5 HERITAGE BUILDING

Heritage building requirements

The ASN Co Building at 1-5 Hickson Road, The Rocks, is of State heritage significance for its historical and scientific cultural values and are also of State heritage significance for their contribution to The Rocks area which is of State Heritage significance in its own right. These base building works alterations to remove the cinemas and the new works are required to be in accordance with the policies established in the Former ASN Co Building, 1-3 Hickson Road The Rocks Conservation Management Plan 2009 prepared by City Plan Heritage.

Care must be taken to ensure the works have no negative impact on the building fabric. A Heritage Architect has been appointed by the Principal to monitor the works.

The Contractor must:

- Make all subcontractors and workmen aware that the Principal's property is old and of exceptional heritage significance;
- Exercise care throughout the execution of the demolition works to ensure existing building fabric to remain is protected and to avoid any damage; and
- Rectify any damage sustained to the existing building during the works, including damage sustained by the building as the unavoidable consequence of the performance of the work under the contract. All repairs shall be as directed and approved by the Heritage Architect.

Salvaged Material

Salvaged materials, including fossils, relics or valuable minerals, uncovered or disclosed by the Works shall remain the property of the Principal and shall not be removed from the site unless instructed by the Superintendent to do so. Contact the Superintendent when relics or valuable materials are uncovered during the works.

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Ground Works: Discovery of Relics or Aboriginal Objects

Where a relic, Aboriginal object or item of heritage significance is found during site works, works are to cease in the area until the Heritage Council of NSW (for relics) and the Office of Environmental and Heritage (for Aboriginal objects) and the landowner have been notified. Works are only to re-commence after all required approvals have been granted and/ or protection measures have been implemented and as directed by the land owner/ consent authority. Potential relics may include: broken ceramics, animal bones glass or building materials and human remains. Aboriginal objects can include: any deposit, object or material evidence relating to the Aboriginal habitation of the area including stone tools and human remains.

Cross reference

APPENDIX AP2: ASN Bay 5 Ground Floor Services Trench Extension – Review of Archaeological Implications dated 15 January 2018 prepared by Casey & Lowe

1.6 RECORDING PRIOR TO REMOVAL

Items to be recorded

Requirement: The following items are to be recorded insitu prior to removal:

- External: Existing section of steel balustrade and wall brackets to the Hickson Road Void to be removed for the new access ramp, is to be retained for fabrication and detail purposes for the new balustrade to the new ramp. After recording they are to be removed and handed to the principal for storage off site;
- Bay 4 Level 2: Timber and glass entry doors to Bay 4 Level 2 documented for removal are to be photographically recorded in situ and removed for storage on site in the Store Room (former LMR) to allow for future reinstatement;
- Bay 4 Level 2: Steel and glass doors and associated partition in the Foyer of Bay 4 on Level 2 to be removed are to be retained for use as templates for the new steel and glass Lift Lobby doors and partitions on Levels 3 and 4. Brass pull hands from these doors are to be removed, stored on site and reused as the pull handles on the new steel and glass entry doors G4L2/XD1.
- Bay 5 Levels 2 , 3 and 4 – west side: Existing structural timbers in situ are to be fully recorded and tagged to approved methods prior to removal and reinstatement with new structural connections and timber members to ensure the timber columns and beams are returned to their original locations. Methodology for recording, removal and reinstatement to be submitted for approval. Refer to the structural engineers drawings and 0381 STRUCTURAL TIMBER.

Records of the recording to be provided to the Superintendent and / or Principal's heritage architect prior to commencement of the demolition works.

1.7 CONTRACTOR'S WORK ASSOCIATED WITH SERVICES

Work associated with services installation

Cross Reference: Refer to the following services specifications for the scope extent for demolition of services and the architectural drawings and details for demolition and retention of existing services; and for the contractors work associated with services:

- MECHANICAL SERVICES specification for the removal of existing mechanical services in Bay 5 and to the architectural and mechanical services drawings for existing plant removal from the roof platform and for new roof platform plant.
- ELECTRICAL SERVICES specification and drawings for extent of work to existing services.
- HYDRAULIC SERVICES specification and drawings for extent of work to existing hydraulic services.
- FIRE SERVICES specification and drawings for extent of work to existing fire services, in particular the retention of heritage sprinkler pipes and heads that are to be retained insitu.
- VERTICAL TRANSPORTATION SERVICES specification for extent of work in the removal of the existing lift cars, redundant lift motor room plant and associated services.

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

1.8 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Protection in place.
- Services before disconnection or diversion.
- Contents of building before commencement of demolition.
- Internal masonry walls after the removal of the concrete slabs and beams; concrete beams and slabs to be demolished that are built into the existing masonry walls are to be removed;
- Site after removal of demolished concrete and materials.
- Services after reconnection or diversion.

Hold points

- Rendered masonry piers where concrete beams and slabs are to be removed.
- Cargo landing doors internal support on east wall in Bay 5 when cinema walls are fully removed.
- Timber windows and rendered brickwork on the east wall in Bay 5 when the cinema stud walls are fully removed.
- Uncovering of the timber beam threshold at the entry doors into Bay 4 on Level 2;
- Uncovering of the original joist recesses in the brick walls in the east and west wall on Levels 3 and 4 where the timber floors were removed and where they will be reinstated with new timber beams;
- Dimensional check for the location of the existing concrete beams relative to the new service shafts.

Notice required: 2 working days.

1.9 SUBMISSIONS

Authority approvals

Evidence of compliance: Before commencing demolition, submit evidence of the following:

- Requirements of authorities relating to the work under the contract have been ascertained.
- A permit to demolish has been obtained from the appropriate authority.
- Certification that each person having access to the construction site has completed a WHS induction training procedure which is site-specific.
- Precautions necessary for protection of persons and property have been taken and suitable protective and safety devices provided to the approval of the relevant authority.
- Treatment for rodent infestation has been carried out and a certificate has been obtained from the appropriate authority.
- Fees and other costs have been paid.

Hazardous materials

Cross reference: Refer APPENDIX AP1 Hazardous Materials Register.

Audit: Prepare a Hazardous substances management plan to AS 2601 clause 1.6. Include the following:

- Asbestos or material containing asbestos.
- Flammable or explosive liquids or gases.
- Toxic, infective or contaminated materials.
- Radiation or radioactive materials.
- Noxious or explosive chemicals.
- Tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances.

Investigation and work plan

Work plan: Submit the work plan before demolition or stripping work. Include the check list items appropriate to the project from AS 2601 Appendix A, and the following information:

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

- The method of protection and support of adjacent property and bays of the ASN Co Building;
- The method of removal of construction waste from the Bays 4 and 5;
- The method of maintaining safe access for the building's tenants and visitors from the Level 2 Hickson Road entry to the lifts and to all levels of the building during the works; maintaining access out of the Fire Stairs and Bay 4 Entry on Level 2 to open space for occupants in other bays of the building;
- The method of protection of the existing timber structure including timber columns, beams, joists and strutting, timber trusses and roof structure prior to commencement of demolition;
- The method of protection uncovered timber windows, doors and door tracks / guides on the east side on each floor of Bay 5.
- Confirmation of the sequence of the demolition works for the removal of nominated areas of concrete slabs and concrete stairs in Bay 5. The existing concrete topped timber floors on Level 1 are not to be loaded with demolition debris and materials. Demolition material is to be removed as quickly as possible after demolition.
- The method of maintaining the building safe and in a structurally stable condition at all times.
- Maintaining essential services active to the remainder of the ASN Building during the works.
- Locations and details of necessary service deviations and terminations.
- Requirements of AS 2601 Section 2 Planning and execution.
- If the demolition program results in components temporarily cantilevered, provide a certificate from a professional engineer.
- Proposals for the safe use of suspended structural members including provisions for the protection of lower floors in the event of structural failure.

Off-site disposal

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from the site.

Records

Dilapidation record: Submit a copy of the dilapidation record for inspection.

Recycling

Delivery location: Submit the name and address of the proposed recycling facility.

2 PRODUCTS

2.1 DEMOLISHED MATERIALS

Demolished materials

Ownership: Ownership of demolished materials is described in the **Demolished material classes table**.

Demolished material classes

Ownership and implementation: Comply with the **Demolished material classes table**.

Demolished material classes table

Class	Requirement	Ownership
Recovered items for re-use in the works	Recover without damage items identified in the Recovered items for re-use in the works in existing or new locations schedule	Principal
Recovered items for delivery to the principal	Recover without damage items identified in the Recovered items for delivery to the principal schedule	Principal
Dismantle for relocation as part of the works	Dismantle without damage and store items identified in the Dismantle for relocation schedule	Principal
Demolished material for	Demolish and deliver for recycling material identified in the	Contractor

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Class	Requirement	Ownership
recycling off site	Demolished material for recycling off-site schedule	
Demolished for removal	Remove from the site demolished materials identified in the Demolish for removal schedule . Do not burn or bury on site Transit: Prevent spillage of demolishing materials in transit	Contractor

3 EXECUTION

3.1 SUPPORT

Temporary support

General: If temporary support is required, certification for its design and installation is required from a professional engineer engaged by the contractor.

Existing buildings: Until permanent support is provided, provide temporary support for sections of existing buildings which are to be altered and which normally rely for support on work to be demolished.

Ground support: Support excavations for demolition of underground structures.

Adjacent structures: Provide supports to adjacent structures where necessary, sufficient to prevent damage resulting from the works.

- Lateral supports: Provide lateral support equal to that given by the structure to be demolished.
- Vertical supports: Provide vertical support equal to that given by the structure to be demolished.

Permanent supports

General: If permanent supports for adjacent structures are necessary and are not documented, give notice and obtain instructions.

3.2 PROTECTION

Protection generally

Refer to **Cross references** in this worksection, the drawings and as follows:

East wall and openings

Site access for waste removal and materials access: Details of protection materials and installation are to be submitted for approval where the cargo landing door openings and windows are proposed to be used for the removal of demolition and construction waste and for delivery of new materials and items into the building. Protection materials and installation are to have no adverse impacts on the existing building fabric.

Concrete slabs and beams removal

The beams supporting the concrete slabs nominated for demolition have been built into the existing brick engaged piers and brick walls or built off steel shelf angles bolted to the brick walls. The demolition in these areas is to be carefully undertaken to ensure retention and protection of original building fabric. All bolts in the concrete are to be removed. The shelf angles have been fire-spray protected and this is to be safely removed.

Bay 5 Ground Floor concrete and asphalt finish

Protection: The ground floor concrete slab and finish are of high heritage significance and are to be protected during the works prior to the installation of the new sheet flooring. Submit protection details for approval.

Encroachment

General: Prevent the encroachment of demolished materials onto adjoining property, including public places.

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Dust protection

General: Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

Security

General: If a wall or roof is opened for alterations and additions, provide security against unauthorised entry to the building.

Temporary screens

General: Fill the whole of designated temporary openings or other spaces using dustproof and weatherproof temporary screens, fixed securely to the existing structure, and installed to shed water to avoid damage to retained existing elements or adjacent structures and contents.

Type: Timber framed screens sheeted with fibre cement and painted. Seal the junctions between the screens and the openings.

Designated openings: Openings in the dividing wall between Bays 4 and 5 and as required for the demolition works.

Temporary access

General: If required, provide a substantial temporary doorset fitted with a rim deadlock, and remove on completion of demolition.

Exposed surfaces

General: Where necessary, protect and weatherproof the surfaces of adjacent structures exposed by demolition.

Existing services

Location: Before commencing demolition, locate and mark existing underground services in the areas which will be affected by the demolition operations. Refer to HYDRAULIC SERVICES drawings and specification. Refer to the Archaeologist's Report.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not excavate by machine within 1 m of existing underground services.

Fixed items

Individual protection: Protect the following items in their existing positions:

- Existing timber columns and posts, beams, joists and flooring.
- Existing timber boarded cargo landing doors – swing and sliding.
- Existing timber windows.
- Masonry walls – brick and sandstone, render and paint finishes.
- Ground floor concrete slab with asphalt finish;
- Level 2 terrazzo entry floor
- Existing fire doors and frames to fire stairs to be retained.
- Existing heritage fire services to be retained. Refer to FIRE SERVICES.

3.3 DEMOLITION – BUILDING WORKS

Dilapidation record

Purpose: Use the dilapidation record to assess the damage and rectification work arising out of demolition work.

Availability: Keep the records of the investigations on site and available for inspection until the date of practical completion of the contract.

Concrete slabs

General: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face existing concrete slabs to be partially demolished or penetrated.

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Bay 5 Cinema stepped seating structure removal

ChemSet masonry anchor fixings: Where ChemSets have been used to fix the timber cinema structure to the concrete slabs, they are to be ground flush for the concrete floor slabs.

Explosives

General: Do not use explosives.

3.4 DEMOLITION – BUILDING SERVICES

General

General: Decommission, isolate, demolish and remove from the site all existing redundant equipment including associated components that become redundant as a result of the demolition.

Breaking down: Disassemble or cut up equipment where necessary to allow removal.

Recovered materials: Recover all components associated with the listed items. Minimise damage during removal and deliver to the locations scheduled.

Refrigeration systems

General: Undertake demolition work on refrigeration systems in conformance with:

- AS/NZS 1677.2 Appendix F.
- The recommendations of SAA HB 40.1 and SAA HB 40.2.

Re-used components

General: Clean re-used components and test for compliance with current Australian Standards before returning to service. Provide results of compliance tests.

3.5 HAZARDOUS MATERIALS

Identified hazardous materials

Register: Hazardous materials have been identified as present on site and a Hazardous materials register has been prepared.

Availability: Refer to the APPENDIX in this specification.

Requirement: Contractor to undertake their own assessment of the presence of Hazardous Materials in the area of the works.

Hazardous materials removal

Standard: To AS 2601 clause 1.6.2.

Procedure for asbestos removal: Refer to How to safely remove asbestos by Work Safe Australia.

3.6 COMPLETION

Notice of completion

General: Give at least 7 working days' notice of completion of demolition so that adjacent structures may be inspected following completion of demolition.

Rectification: Repair any damage arising out of demolition work. Obtain written acceptance from the owner of each adjoining property of the completeness and standard of the rectification work.

Temporary support

General: Clear away at completion of demolition.

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

4 SELECTIONS

4.1 DEMOLITION

Recovered items for re-use in the works in existing or new locations schedule

Item	Location for re-use
Existing 'heritage' (non-active) fire sprinkler services – pipes and heads of High heritage significance.	Existing locations to be maintained. Modifications to existing active services as documented in FIRE SERVICES. Items are to be protected during the works include old fire sprinkler pipes and heads that are not active but which are to be retained insitu due to their heritage significance.
Existing fire extinguishers	Bays 4 and 5 – locate where directed if approved. Refer HYDRAULIC SERVICES. Existing fire extinguishers are to be checked for suitability for re-use. New extinguishers are to be allowed for by tenderer in their tender price.
Bay 5 – existing timber structure – columns, beams and joists	Bay 5 – original timber structure – columns, beams and joists are to retained insitu and to be protected. Refer to Recording Prior to Removal in this worksection for recording prior to removal, protection and reinstatement in original locations. Refer to Structural Engineer's drawings.
First Floor Timber Floor – timber floor boards from where the new service shaft will be cut through the timber floor and concrete topping	Bay 5 First Floor – reuse where boards require replacement after removal of plumbing and other service pipes. To the direction of the Superintendent Refer 0655 TIMBER FLOORING
Bay 5 Timber skirtings from walls to be demolished	Bay 5 – existing and new walls. Refer 0551 JOINERY
All other timber skirtings found on existing walls in Bay 5 are to remain in situ.	Existing locations to be maintained. Items are to be protected during the works.
Bay 4 – brass handles from double steel and glass doors to be removed.	Bay 4 – reuse on new steel and glass door to new building Entry. Refer 0453 DOORS AND ACCESS PANELS; 0455 DOOR HARDWARE.
Bay 4 – steel and glass partition and doors - steel sections for doors and partitions.	For use a samples for steel sections to be used in the new steel glass partitions and doors to the new steel and glass Entry into Bay 4 and to the Lift Lobby on Level 3. Refer 0453 DOORS AND ACCESS PANELS.
Timber windows, timber cargo landing doors and all associated door hardware – door tracks, rollers, hangers, pull handles, hasp and staples etc.	Existing locations to remain insitu unless specified to be removed and handed over to the Principal for storage. Items are to be protected during the works
All external timbers, joinery including fanlights, threshold beams, beams to the cargo bay openings; ground floor Bay 5 concrete and asphalt.	Existing locations to be maintained. Items are to be protected during the works
Timber beams / thresholds at entries into Bay	To remain is existing location. Fully protect during the

SPECIFICATION

02 SITE, URBAN AND OPEN SPACES

0202 Demolition

Item	Location for re-use
5 and Bay 4 Level 2	works prior to repair
Sandstone blocks and bricks	Refer to 0355 BRICK AND STONE MASONRY
Roof slates from the forming of new openings for mechanical exhaust and supply air ducts in the roof	For reinstatement of slate roof where roof hatch is removed. Refer to 0421 ROOFING and MECHANICAL SERVICES drawings
Roof – timber boards from above rafters where new openings are being formed	For reinstatement of support substrate to slate roof to match existing details where roof hatches are removed. Refer to 0421 ROOFING and MECHANICAL SERVICES drawings

Demolished material for recycling off-site schedule

Material
Concrete and steel reinforcement
Brick and block internal walls and their finishes from the cinemas and toilets
Plasterboard and fibre cement sheet linings, doors and door frames
Steel studs and furring channels
Cinema seats and timber framed support structure
Cinema screens and support structures
Glass from glass balustrades in Bay 5 entry
Carpets and other flooring coverings
All other materials not included above that are being removed and which can be recycled.
Existing mechanical and electrical services including redundant internal services, lighting and plant. Refer MECHANICAL SERVICES and ELECTRICAL SERVICES.
Refer to HYDRAULICS SERVICES and FIRE SERVICES for removal of existing services now redundant and for maintaining active fire services during the construction works.

Demolish for removal schedule

Item
All demolished materials not scheduled for salvaged for reuse on site
The construction and complete contents of 2 cinemas including plasterboard steel framed walls, doors and door frames, timber framed stepped floors, carpets, cinema screens and framing, light fittings and all other materials required to fully strip out the 2 cinemas from Bay 5 including all internal stud and masonry walls within Bay 5 as shown on the drawings.

Recovered items for delivery to the principal schedule

Item	Location for re-use
Double timber glazed entry doors 4L2/SD1 to Bay 4 on Level 2.	Carefully remove and hand over to the Principal, Property NSW. Refer to Recording prior to removal . Move to the Store Room (former LMR).
Steel balustrade removed from the Hickson Road boundary for the new ramp construction.	Carefully remove and hand over to the Principal, Property NSW. Refer to Recording prior to removal . Move to nominated location as directed in the Sydney CBD.

SPECIFICATION

02 SITE URBAN AND OPEN SPACES

222 Earthwork

222 EARTHWORK

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide earthworks, excavations to the dimensions and tolerances, as documented.

Design

Geotechnical and environmental reports provided: Nil

Design of depths: For underpinning of existing masonry walls, refer to the structural drawings.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- Archaeological survey requirements - Refer to the Property NSW's Heritage for archaeological survey requirements for excavation within the building and report the finding of any relics and building remains discovered in the excavation to the superintendent. No further excavation work is to proceed without approval if historic items are uncovered during the works. Refer Clause 1.5 **Archaeology** in this worksection.

Specified in this worksection

- Excavation, backfilling and compaction

Associated worksections

Refer to the following related worksections:

- APPENDIX AP2 - ASN Bay 5 Ground Floor Services Trench Extension – Review of Archaeological Implications by Casey & Lowe;
- HYDRAULIC SERVICES, for service excavations, backfilling and compaction and for in-ground services.
- 0310 CONCRETE - COMBINED, for reinforced concrete slabs to be laid on compacted filled excavations where existing trench is opened up for new services installations.
- 0315 CONCRETE FINISHES, for finishes to new concrete slabs after services installation.
Structural Engineer's drawings for details of the excavation, backfilling and concrete slab to excavation once complete.

1.3 STANDARDS

General

Earthworks: Conform to the recommendations of those parts of AS 3798 which are referenced in this worksection.

1.4 INTERPRETATION

Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- GITA: Geotechnical inspection and testing authority.
- GTA: Geotechnical testing authority.

SPECIFICATION

02 SITE URBAN AND OPEN SPACES

222 Earthwork

Definitions

General: For the purposes of this worksection the definitions given in AS 1348, AS 3798 and the following apply:

- Description and classification of soils: To AS 1726.
- Site classification: To BCA 3.2.4.
- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:
 - . The nature or quantity of the material to be excavated or placed.
 - . Existing site levels.
 - . Services or other obstructions beneath the site surface.
- Rock: Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up by rippers or percussion tools.
- Subbase: The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.
- Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed. Generally taken to relate to the upper line of the formation.
- Zone of influence: A foundation zone bounded by planes extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.

1.5 ARCHAEOLOGY

Salvaged Material

Salvaged materials, including fossils, relics or valuable minerals, uncovered or disclosed by the Works shall remain the property of the Principal and shall not be removed from the site unless instructed by the Superintendent to do so. Contact the Superintendent when relics or valuable materials are uncovered during the works.

Ground Works: Discovery of Relics or Aboriginal Objects

Where a relic, Aboriginal object or item of heritage significance is found during site works, works are to cease in the area until the Heritage Council of NSW (for relics) and the Office of Environmental and Heritage (for Aboriginal objects) and the landowner have been notified. Works are only to re-commence after all required approvals have been granted and/ or protection measures have been implemented and as directed by the land owner/ consent authority. Potential relics may include: broken ceramics, animal bones glass or building materials and human remains. Aboriginal objects can include: any deposit, object or material evidence relating to the Aboriginal habitation of the area including stone tools and human remains.

1.6 TOLERANCES

General

Finish: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: + 0, - 25 mm.

02 SITE URBAN AND OPEN SPACES

222 Earthwork

1.7 SUBMISSIONS

Execution details

Report: Submit a time based schedule noting the methods and equipment proposed for the earthworks, including the following:

- Dewatering and groundwater control and disposal of surface water.
- Excavation methods, stages, clearances, batters and temporary supports.

Geotechnical site investigations: Carry out a test pit where directed to establish the nature and depth of the existing wall footings and ground conditions necessary for design the any necessary underpinning. Submit to the superintendent for approval.

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from site.

Temporary shoring: Submit a proposal for any temporary shoring or underpinning required including the progressive removal.

Certified records of measurement: Submit a certified copy of the agreed records of measurement.

Construction records: Submit the following to AS 3798 clause 3.4 and Appendix B:

- Test pit results
- Underpinning records

Materials

Imported fill: Submit certification or test results by a GTA registered laboratory which establish the compliance of imported fill with the contract including the source.

Tests

Compaction: Submit certification and/or test results in conformance with the specified level of responsibility to AS 3798.

1.8 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Service trench opening up to be inspected by the superintendent and the archaeologist.
- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Excavation completed for new services installation to founding material.
- Filling completed to contract levels prior to concrete slab finishing.

2 PRODUCTS

2.1 FILL MATERIALS

General

Suitable material: To AS 3798 clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use unsuitable material for fill in conformance with AS 3798 clause 4.3.

Sulphur content: Do not provide filling with sulphur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material in conformance with AS 3798 clause 4.4.

Stockpiles: No stockpiles are permitted outside the building.

Disposal: If stockpiling is not permitted under the contract, dispose of excavated material off-site to AS 3798 clause 6.1.8.

SPECIFICATION

02 SITE URBAN AND OPEN SPACES

222 Earthwork

2.2 IMPORTED FILL

General

Imported material: Only when no suitable excavated material is available.

- Suitable material: To AS 3798 clause 4.4.

3 EXECUTION

3.1 GEOTECHNICAL

As found site conditions

General: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies.
- Springs, seepages.

Inspection and testing

Inspection and testing: Conform to the following:

- Level 2 GTA required to AS 3798 clause 8.3.

3.2 RECORDS OF MEASUREMENT

Excavation and backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: By registered surveyor unless otherwise agreed.

Rock

Level and class: If rock is measured for payment purposes, whether as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined.

3.3 EXCAVATION

Extent

Footings: Excavate for footings, and below ground structures walls, to the required sizes and depths. Confirm that the foundation conditions meet the design bearing capacity.

Rock

General: Do not use explosives.

Existing footings

Requirement: If excavation is required within the zone of influence of an existing footing, use methods including (temporary) shoring or underpinning that maintain the support of the footing and make sure that the structure and finishes supported by the footing are not damaged.

Existing services

Location: Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

02 SITE URBAN AND OPEN SPACES

222 Earthwork

Excavation: Do not excavate by machine within 1 m of existing underground services.

Disposal of excess excavated material

General: Remove excess excavated material from site not required or unsuitable for fill.

- Standard: To AS 3798 clause 6.1.8.

3.4 SUBGRADES AFFECTED BY MOISTURE

General

Requirement: If the subgrade is unable to support construction equipment, or it is not possible to compact the overlying pavement only because of a high moisture content, perform one or more of the following:

- Allow the subgrade to dry until it will support equipment and allow compaction.
- Excavate the wet material and remove to spoil, and backfill excavated areas.

3.5 BEARING SURFACES

General

Requirement: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

Deterioration

General: If the bearing surface deteriorates because of water or other cause, excavate further to a sound surface before placing the loadbearing element.

3.6 REINSTATEMENT OF EXCAVATION

General

Fill adjacent structures and trenches: To AS 3798 clause 6.2.6.

Zone of influence: Within the zone of influence of footings, beams, or other structural elements, use concrete of strength equal to the structural element, minimum 15 MPa. Make sure that remedial concrete does not create differential bearing conditions.

Below slabs: Provide selected fill compacted to the specified density.

Cut subgrades: Where the over excavation is less than 100 mm, do not backfill. Rectify by increasing the thickness of the layer above.

Rock depressions and subsoil drains: Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter.

3.7 SUPPORTING EXCAVATIONS

Removal of supports

General: Remove temporary supports progressively as backfilling proceeds.

Voids

General: Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

3.8 ADJACENT STRUCTURES

Temporary supports

General: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

SPECIFICATION

02 SITE URBAN AND OPEN SPACES

222 Earthwork

Permanent supports

General: If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

Encroachments

General: If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

Zone of influence

Angle from horizontal: 30deg

3.9 PREPARATION FOR FILLING

Preparation

Stripping: Prepare the ground surface before placing fill, ground slabs or load bearing elements to AS 3798 clause 6.1.5. Remove materials which will inhibit or prevent satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS 3798 clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation to the minimum relative compaction in AS 3798 Table 5.1.

Compaction: Use an approved minimal vibration method for inside the existing building

Under slabs

Compact the ground: To AS 3798 Table 5.1.

3.10 PLACING FILL

General

Layers: Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area.

Extent: Place and compact fill to the designated dimensions, levels, grades, and cross sections so that the surface is always self-draining.

Edges: At junctions of fill and existing surfaces, do not feather the edges.

Mix: Place fill in a uniform mixture.

Previous fill: Before placing subsequent fill layers, make sure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

Protective covering: Do not disturb or damage the protective covering of membranes during backfilling.

Placing at structures

General: Place and compact fill in layers simultaneously on both sides of structures and pipelines to avoid differential loading. Carefully place first layers of fill over the top of structures.

3.11 FILL MOISTURE CONTROL

General

Moisture content: Adjust the moisture content of fill during compaction within the range of 85 to 115% of the optimum moisture content determined by AS 1289.5.1.1 or AS 1289.5.2.1, as appropriate, to achieve the required density.

SPECIFICATION

02 SITE URBAN AND OPEN SPACES

222 Earthwork

3.12 COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE

Density

Excavated and stripped ground surface: After excavation and/or stripping, compact these surfaces to a minimum depth of 150 mm.

Maximum rock and lump size in layer after compaction: To AS 3798 clause 6.2.2.

Fill batter faces: Either compact separately, or overfill and cut back. Form roughened surfaces to the faces.

Minimum relative compaction: To AS 3798 Table 5.1.

Compaction control tests

Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.

Compaction control test frequency

Standard: To AS 3798 Table 8.1.

Confined operations: 1 test per 2 layers per 50 m².

3.13 COMPLETION

Grading

External areas: Grade to give falls away from buildings, minimum 1:100.

Site restoration

Requirement: Where variation of existing ground surfaces is not required as part of the works, restore surfaces to the condition existing at the commencement of the contract to match adjoining finishes.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

0310 CONCRETE – COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide cast concrete, as documented and as follows:

- Conforming to the design details and performance criteria.
- Satisfying quality and inspection requirements.
- Compatible with documented finishes.

Design

Designer: Mott MacDonald Australia Pty Ltd

Formwork: The design of formwork, other than profiled steel sheeting composite formwork, is the contractor's responsibility. Allow for dimensional changes, deflections and cambers resulting from the following:

- Imposed actions.
- Concrete shrinkage and creep.
- Temperature changes.
- The application of prestressing forces (if any).

Structural design: To AS 3600.

Post-tensioning: To AS 3600.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

- Formwork
- Reinforcement
- Materials for concrete
- Waterproof membranes
- Concrete infill repair to existing Void wall where fixtures (tenant sign posts and balustrade) are removed.

Related worksections

Refer to the following related worksections:

- 0202 DEMOLITION, for the partial removal of existing concrete slabs, beam and concrete stairs;
- 0184 TERMITE MANAGEMENT, for termite protection to new construction and services;
- 0335 BRICK AND STONE MASONRY, for precast fire-rated concrete lintels to new openings in existing brick walls; for damp proof membrane to brick walls, piers and timber joists built off existing concrete slabs on ground.
- 0315 CONCRETE FINISHES, for stripping off existing coatings from existing concrete slabs to expose concrete colour; for coloured concrete topping to new concrete slabs to match existing colour;
- Structural Engineers drawings and details for all new reinforced concrete construction and for connections of new to existing concrete construction.
- Architectural drawings for the extent of removal of existing concrete structures - slabs with beams and for concrete stairs and for repairs to existing masonry walls and floor after removal.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

1.3 STANDARDS

General

Formwork design and construction, formed surfaces: To AS 3610 and AS 3610.1.

Plywood formwork: To AS 6669.

Profiled steel sheeting, including shear connectors: To AS 2327.1.

Specification and supply of concrete: To AS 1379.

Reinforced concrete construction: To AS 3600.

Residential ground slabs and footings: To AS 2870.

Concrete structures for retaining liquids: To AS 3735.

Strand, bar and wire: To AS/NZS 4672.1.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Anti-burst reinforcement: Reinforcement cage surrounding anchorages to control the tensile bursting stresses.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.
- Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.
- Concrete class:
 - . Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise conforming to AS 1379 clause 1.5.3.
 - . Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise conforming to AS 1379 clause 1.5.4.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Formwork:
 - . Jump formwork: Incrementally moved formwork.
 - . Lost formwork: Sacrificial formwork left in place.
 - . Slip formwork: Continuously slipped or moving formwork.
 - . Table forms: Prefabricated and re-usable formwork systems for slabs and beams.
- Green concrete: Concrete which has set but not appreciably hardened.
- Production assessment: An assessment procedure for concrete specified by strength grade, carried out by the supplier on concrete produced by a specific supplying plant and based on the statistical assessment of standard compressive strength tests on concrete.
- Project assessment: An assessment procedure for concrete specified by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples, prototypes and sample panels.
- Specimen: A portion of a sample which is submitted for testing.
- Weather:
 - . Cold: Ambient shade temperature less than 10°C.
 - . Hot: Ambient shade temperature greater than 30°C.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade; or on the existing ground floor slabs before new concrete pads are laid for new steel stairs.
- Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place.
- Used formwork, after cleaning and before re-use.
- Concealed surfaces or elements before covering.
- Commencement of concrete placing.
- Stripping single storey suspended work, if conformance with AS 3610.1 is not possible.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

1.6 TOLERANCES

Formwork

Plumb of elements > 8 m high: 1:1000.

Plumb of elements ≤ 8 m high: To AS 3610.1.

Position: Construct formwork so that finished concrete conforms to AS 3600 clause 17.5 and as documented.

Reinforcement

Fabrication and fixing: To AS 3600 clause 17.2.

Reinforcement and tendon position: To AS 3600 clause 17.5.3.

Finishes

Formed surfaces quality of surface finish: To AS 3610.1 Table 3.3.2.

Unformed surfaces flatness: To the **Flatness tolerance class table**, for the documented class of finish, using a straightedge placed anywhere on the surface in any direction.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2 m straightedge	4
B	3 m straightedge	6
C	600 mm straightedge	6

1.7 SUBMISSIONS

Calculations

Formwork calculations: Submit calculations by a professional engineer experienced in formwork design to show that allowable concrete stresses will not be exceeded and formwork capability will be maintained for the following:

- Proposed formwork procedures or loadings which differ from those documented.
- Props above a floor that do not coincide with the props below.
- Undocumented formwork shoring or stripping procedures or allowable loadings from stacked materials.

Certification

Formwork design certification: For other than profiled steel sheeting composite formwork, submit certification by a professional engineer experienced in formwork design verifying conformance of the design.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Formwork execution certification: Submit certification by a professional engineer experienced in formwork design and construction verifying conformance of the completed formwork, including the suitability of the formwork for the documented surface finish class.

Existing concrete and stone retaining wall: before the new steel ramp is installed, certification is to be provided for the new loads from the new ramp on the existing wall.

Design

Loading: Submit details of proposed construction systems, loads and procedures, including propping and re-shoring.

Execution details

Moveable formwork: Provide the following details on the formwork drawings:

- Table, slip and jump forms: Proposed method and sequence of moving the formwork to provide concrete of the documented quality and surface finish.
- Slip forms: The average rate of movement.

Re-shoring: Submit details of any proposed re-shoring.

Surface repair method: Submit details of any proposed surface repair method before starting repairs.

Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Changes to the concrete mix.
- Curing and protection methods.
- Curing period for low-pressure steam curing.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Placing under water.
- Sequence and times for concrete placement, and construction joint locations and relocations.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.
- Sequence of concrete placement: Submit details of any proposed If sequential placement of slab segments.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 Section 8.
- Mechanical bar splices: Details and test certificates for each size and type of bar to be spliced.
- Provision for concrete placement: Details of spacing or cover to reinforcement that does not conform to AS 3600.
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379, and the following:

- For special class performance concrete: Documented performance and type of cement binder.
- For special class prescription concrete: Details of mix, additives, and type of cement binder.
- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Materials

Product conformity: Submit current assessments of conformity, as appropriate, as follows:

- Certificate of conformity by a JAS-ANZ accredited third party.
- Report by a NATA accredited laboratory describing tests and giving results which demonstrate that the product conforms.

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Submit details of any proposed liquid membrane-forming curing compound, including the following:

- Certified test results for water retention to AS 3799 Appendix B.
- Evidence of compatibility with concrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.
- For visually important surfaces, evidence that an acceptable final surface colour will be obtained.

Admixtures: Submit details of any proposed admixtures, including the following:

- Brand name.
- Place of manufacture.
- Basic chemical composition.

Reinforcement strength and ductility: Submit type-test reports to verify conformance to AS 3600 Table 3.2.1 for each reinforcement type.

Samples

Coloured concrete: Submit sample blocks of coloured concrete produced using the proposed mix and method before casting final concrete as follows:

- Number: 4.
- Size (nominal): 300 x 300 x 50 mm.

Shop drawings

Cores, fixings and embedded items: Submit the proposed locations, clearances and cover and show any proposed repositioning of reinforcement.

Formwork: Submit shop drawings including details of proposed linings, bolt positions, facings, release agents and, where applicable, re-use of formwork.

Subcontractors

Pre-mixed supply: Submit names and contact details of proposed pre-mixed concrete suppliers and alternative source of supply in the event of breakdown of pre-mixed or site mixed supply.

Tests

Other tests: Submit results, as follows:

- Site slip resistance test of completed installation to AS 4663.
- Concrete compressive strength test results to AS 1012.9.

2 PRODUCTS

2.1 MATERIALS

General

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Aggregates

Standard: To AS 2758.1.

Aggregate properties: As documented in the **Aggregate property schedule**.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

03 STRUCTURE

0310 Concrete – combined

Storage: Store cement bags under cover and above ground.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Polymeric film underlay

Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

Chemical admixtures

Standard: To AS 1478.1.

Curing compounds

Curing compounds: To AS 3799.

Concrete and reinforcement repair

Refer to the Structural drawings for the repair to cut concrete edges where steel reinforcement is exposed and requires sealing and cover.

2.2 CONCRETE

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
 - . Properties: As documented.
- Special-class: To AS 1379 clause 1.5.4.
 - . Properties: As documented.

Coloured concrete

Standard: To AS 3610.1.

2.3 TESTING

General

Test authority: Concrete supplier or NATA registered laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results

Standard: To AS 1379.

Method of assessment: Project assessment.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table**.

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Other elements / day
1	1
2-5	2
6-10	3

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Number of batches for each type and grade of concrete per day	Minimum number of samples: Other elements / day
11-20	4
each additional 10	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size:

- Aggregate size $\leq$ 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size $>$ 20 mm: Nominally 300 x 150 mm diameter.

Test methods

General : To the relevant parts of the AS 1012 series.

Acceptance criteria:

- General: As documented.
- Early age compressive strength: As documented.

Slump tests: Assess slump for every batch. Perform slump test on each strength sample.

Drying shrinkage at 56 days: To AS 1012.13.

Embedded pressure pipes

General: Complete leak tests before embedding pipes.

Liquid retaining structures

Testing for liquid tightness: To AS 3735.

2.4 FORMWORK

General

Form linings, facings and release agents: Compatible with finishes applied to concrete.

Lost formwork: Free of timber or chlorides, and not to impair the structural performance of the concrete members.

Void formers: Material capable of maintaining rigidity and shape until the concrete has set, capable of withstanding construction loads and non-collapsible on absorption of moisture.

Plywood formwork

Material: Plywood sheeting to AS 6669.

Grade: Use appropriate grade for the documented design dimensions, loading and surface quality.

Joints: Seal the joints consistent with the documented surface finish class.

Tolerances: To AS 3610.1 Section 3.

2.5 REINFORCEMENT

Fibre reinforcement

Standard: To CIA CPN35.

Steel reinforcement

Standard: To AS/NZS 4671.

Shape: Deformed ribbed bar U.N.O

Ductility class: Normal

Strength grade: 500MPa U.N.O.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material which would reduce the bond between the reinforcement and concrete.

03 STRUCTURE

0310 Concrete – combined

Protective coating

Standard: To AS 3600 clause 17.2.1.2.

General: For concrete elements containing protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals with a suitable coating.

Epoxy coating: High build, high solids, chemically resistant coating.

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanising and coat cut ends.
- Zinc-coating (minimum): 600 g/m².

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

2.6 MISCELLANEOUS

Surface hardeners, sealants and protectors

Supply: If documented, provide proprietary products conforming to the manufacturer's recommendations.

Slip resistance treatment

Slip resistance classification: To AS 4586.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location

General: Under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Under new materials (concrete, brick and timber) constructed above the existing concrete Ground Floor slab for protection of the existing fabric.

Base preparation

General: Conforming to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and loose material.
- Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Lightly wet the sand just before laying the underlay.

Installation

Standard: To AS 2870 clause 5.3.3.

General: Lay underlay over the base as follows:

- Lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape.
- Face the laps away from the direction of concrete pour.
- Continue up vertical faces past the damp-proof course where applicable, and tape fix at the top.
- Patch or seal punctures or tears before placing concrete.
- Cut back as required after concrete has gained strength and formwork has been removed.

3.2 FORMWORK

General

Requirement: As documented.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Preparation

Cleaning: Before placing concrete, remove free water, dust, debris and stains from the formwork and the formed space.

Bolt holes

Removable bolts: Remove tie bolts without damaging the concrete.

Formwork tie bolts left in the concrete: Position more than 50 mm from the finished surface.

Bolt hole filling: Provide material with durability and colour matching the concrete – internal and external; services holes in concrete soffits after demolition.

Recessed filling: Fill or plug the hole to 6 mm below the finished surface.

Corners

Work above ground: Chamfer at re-entrant angles, and fillet at corners.

Face of bevel 25 mm.

Embedments

Fixing: Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

Openings

Inspection: In vertical formwork provide openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams.

Access: For thin walls and columns, provide access panels for placing concrete.

Release agents

Application: Before placing reinforcement, apply a release agent to linings and facings.

Slip formwork

Provision for inspection: Provide access below the moveable formwork for surface treatment and inspection.

Steel linings

Rust: Clean off any rust and apply rust inhibiting agent before re-use.

Visually important surfaces

Surface finish classes 1, 2 or 3: Set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

3.3 REINFORCEMENT

Dowels

Fixing: If a dowel has an unpainted half, embed in the concrete placed first.

Tolerances:

- Alignment: 1:150.
- Location: $\pm$ half the diameter of the dowel.

Grade: 250 N.

Cover

Concrete cover generally: To AS 3600 clause 4.10.

Concrete cover for structures for retaining liquids: To AS 3735.

Concrete cover for residential ground slabs and footings: To AS 2870.

Supports

Proprietary concrete, metal or plastic supports: Provide chairs, spacers, stools, hangers and ties, as follows:

- Able to withstand construction and traffic loads.
- With a protective coating if they are ferrous metal, located within the concrete cover zone, or are used with galvanized or zinc-coated reinforcement.

Spacing:

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

- Bars: ≤ 60 diameters.
- Mesh: ≤ 800 mm.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate, place a metal or plastic plate under each support.

Projecting reinforcement

Protection: If starter or other bars extend beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is cast into later work.

Tying

General: Secure the reinforcement against displacement at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of formwork or unformed faces to prevent the ties projecting into the concrete cover.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Bundled bars: Tie bundled bars in closest possible contact. Provide tie wire of at least 2.5 mm diameter and spaced not more than 24 times the diameter of the smallest bar in the bundle.

Columns: Secure longitudinal column reinforcement to all ties at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

3.4 CONCRETE

General

Conformance: As documented.

Elapsed delivery time

General: Make sure the elapsed time between the wetting of the mix and the discharge of the mix at the site conforms to the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
10 – 24	120
24 – 27	90
27 – 30	60
30 – 32	45

Pre-mixed supply

Addition of water: To AS 1379 clause 4.2.3.

Transport method: Prevent segregation, loss of material and contamination of the environment, and do not adversely affect placing or compaction.

Site mixed supply

Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in a plant located on the construction site.

3.5 CORES, FIXINGS AND EMBEDDED ITEMS

Adjoining elements

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

Existing concrete: provide all recesses in existing concrete for timber column plate fixings and for new Stair 4 fixings. Care to be taken with cutting penetrations into the existing concrete and not to overcut the area as the existing concrete is not being covered with another finish.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and the documented surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

Structural integrity

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete providing minimum cover to reinforcement.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS 4100.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.6 CONCRETE WORKING BASE

Finish

Membrane support: Wood float finish or equivalent.

Installation

General: Lay over the base or subgrade and screed to the required level.

Surface tolerance

Deviation: Flatness tolerance Class B.

3.7 PLACING AND COMPACTION

Placing

Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Horizontal elements: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

Placing records

Log book : Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

Protection : During placement and before setting, protect the surface from damage.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Time between adjacent placements

General: As documented.

Vertical elements

Placement : Limit the free fall of concrete to maximum of 2000 mm.

Placing in cold weather

Cement: Do not use high alumina cement.

Placing concrete: Maintain temperature of the freshly mixed concrete at 5°C or more.

Formwork and reinforcement: Before and during placing maintain temperature at 5°C or more.

Severe weather: If severe weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is within the documented limits.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any formwork, materials, and equipment coming in contact with the concrete.

Maximum temperature of water: 60°C when placed in the mixer.

Freezing : Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete conforming to the **Elapsed delivery time table**.

Placing concrete: Maintain the temperature of the freshly mixed concrete conforming to the **Hot weather placing table**.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Formwork and reinforcement: Before and during placing, maintain temperature at 35°C or less.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Hot weather placing table

Concrete element	Temperature limit
Normal concrete in footings, beams, columns, walls and slabs	35°C
Concrete in sections 1 m or more in all dimensions except for concrete of strength 40 MPa or more, in sections exceeding 600 mm in thickness	27°C

Placing under water

General: Do not place under water unless conditions prevent dewatering.

Minimum cement content for the mix: Increase by 25%.

3.8 CURING

General

Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

- . Fully enclosed internal surfaces/Early age concrete: 3 days.
- . Other concrete surfaces: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.
- Curing method: As follows:
 - . Keep surfaces continuously wet for three days then
 - . Prevent moisture loss for the next four days using polythene sheeting or wet hessian protected from wind and traffic and then allow gradual drying out.
 - . Curing compounds may be used provided that they comply with AS3799 and they do not affect floor finishes.
 - . PVA-based curing compounds are not acceptable.

Curing compounds

Application: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken at least for the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Curing compounds: If curing compounds are proposed, provide details.

Protection: Select a protection method from the following:

- If the concrete temperature is more than 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant.
- If ambient shade temperature is more than 35°C, protect from wind and sun using an evaporative retarder until curing is commenced.
- Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

3.9 JOINTS

Construction joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

SPECIFICATION

03 STRUCTURE

0310 Concrete – combined

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Slip joints

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

3.10 SURFACE MODIFIERS

General

Application: Apply to clean surfaces to the manufacturer's recommendations.

3.11 FORMED SURFACES

General

Surface finish: Provide formed concrete finishes as documented.

Damage: Do not damage concrete works through premature removal of formwork.

Curing

General: If formwork is stripped before the minimum curing period, for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

General: If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

Surface repairs

Method: If surface repairs are required, submit proposals.

Finishing methods

Details : If soffits of concrete elements or faces of concrete beams are to have a finish other than an off-form finish, provide finishes as documented.

Exposed aggregate finish: Remove the vertical face formwork while the concrete is green. Wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Floated finishes:

- Sand floated finish: Remove the vertical face formwork while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
- Grout floated finish: Remove the vertical face formwork while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: Remove the vertical face forms while the concrete is green. Wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

Cross reference

Refer to 0351 CONCRETE FINISHES for polishing of existing and new concrete and for sealing concrete.

3.12 UNFORMED SURFACES

General

Surface finish: As documented.

03 STRUCTURE

0310 Concrete – combined

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Surface repairs

Method: If surface repairs are required, submit proposals.

Finishing methods – primary finish

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating finish, as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Finishing methods – supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

3.13 COMPLETION

Formwork removal

Extent: Remove formwork, other than profiled steel sheeting composite formwork and lost formwork, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete is hardened enough to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 where it is more stringent than AS 3610.1.
- Vertical formwork: To AS 3610.1 Appendix B Table B1.
- Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.

Protection

General: Protect the concrete from damage due to construction loads, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

SPECIFICATION

03 STRUCTURE

0315 Concrete finishes

0315 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide finishes to formed and unformed concrete surfaces, as documented and as follows:

- Compatible with documented finishes.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

This worksection includes but is not limited to the concrete finishing works as required and as shown on the architectural and structural drawings and as follows:

- Cutting back and grinding smooth chemical anchors in concrete floors after cinema fitouts removed;
- Finishing to new concrete infill floor toppings to new structural slabs.
- Stripping carpet adhesives and existing finishes off existing concrete floor slabs for refinishing.
- Refinishing to existing concrete floor slabs.
- Polishing of new and existing concrete.
- Polishing of new toppings laid over new concrete structural slab where stairs are removed.
- Control / construction joints
- Samples for coloured concrete toppings to match existing concrete colour
- Samples of concrete polishing – new and existing concrete
- Placing toppings to new concrete slabs
- Sealing new and existing concrete floor finishes.

Associated worksections:

Refer to the following related worksections:

- 0310 CONCRETE – COMBINED, for concrete, formwork and reinforcement for new concrete slabs and beams;
- 0612 CEMENTITIOUS TOPPINGS, for cement based topping to masonry substrates, for repairs to existing external steps and for new thresholds in new wall openings, carborundum non-slip inserts to existing steps in new toppings and to treads in existing stairs; for bedding to finishes to be laid to falls.
- 0552 METALWORK, for non-slip nosings to existing concrete stairs, timber treads to new steel stairs and to existing external concrete steps.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for the location of concrete finishes.
- Architectural drawings for extent of new and existing concrete slabs.
- Structural engineers drawings for set down of new reinforced concrete slab to take coloured concrete topping and for the extent of new concrete floor slabs and details.

1.3 STANDARDS

General

Formed surfaces: To AS 3610.1.

SPECIFICATION

03 STRUCTURE

0315 Concrete finishes

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definition applies:

- Green concrete: Concrete which has set but not appreciably hardened.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Evaluation of the off-form finishes.
- Evaluation of surface finish.

1.6 TOLERANCES

Formed surfaces

Quality of the surface finish: Class 3 to AS 3610.1 Table 3.3.1.

Unformed surfaces

Flatness: To AS3610.1 Table 3.4.2

1.7 SUBMISSIONS

Information

Submit the following:

- Confirmation of the concrete mix for review prior to ordering.
- Details of any admixtures or curing products proposed and not herein specified.
- Method Statement methodology to be used in achieving the required polished finish to the topping, and protection measures to be taken for the remainder of the works to ensure the topping remains free of damage.

Samples

General: Submit samples of the following products:

- Colouring products.
- Movement control joint products
- Slip sheet material.
- Surface treatment – sealant products.

Prototypes

General: Prepare prototypes of polished existing and new concrete slabs and topping slabs as follows:

- Number: Allow for 3/off prototypes minimum.
- Type: Machine float with buff finish
- Size: Area approximately 3m x 3m.

Location: Level 2 Bay 5 or as agreed with the Superintendent. Location to be confirmed.

Features: Prototypes to include jointing against wall and typical control joint complete with strip insert. Undertake working, full curing and application of penetrating sealer to accurately reflect final installation.

Requirement: Programme prototypes to allow for full curing, review and replacement if so required.

Time will be required to evidence any cracking or crazing which may develop. If initial prototype is not approved remove in full and prepare again in the same location until approval is achieved. Approved prototype may remain built into the works.

Quality control: Approved prototype is to serve as the measure of quality for the remainder of the installation. Ensure protection for damage.

SPECIFICATION

03 STRUCTURE

0315 Concrete finishes

Tests

Slip resistance: Submit test results, as follows:

- Site slip resistance test of completed installation to AS 4663.

2 PRODUCTS

2.1 MATERIALS

Surface hardeners, sealants and protectors

Supply: If documented, provide proprietary products to the manufacturer's recommendations.

Slip resistance treatment

Slip resistance classification: To AS 4586.

3 EXECUTION

3.1 SURFACE MODIFIERS

General

Application: Apply to clean surfaces to the manufacturer's recommendations.

3.2 FORMED SURFACES

General

Surface finish: Provide formed concrete finishes as documented in the **Formed surface finishes schedule**.

Damage: Do not damage concrete works through premature removal of formwork.

Curing

General: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

General: If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

Surface repairs

Method: If surface repairs are required, submit proposals.

3.3 UNFORMED SURFACES

General

Surface finish: As documented in the **Unformed surface finishes schedule**.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Surface repairs

Method: If surface repairs are required to new and existing concrete, submit proposals.

Former Cinema concrete floors: Where the seating steps structure is removed, grind smooth the chemical anchors flush with the slab. Do not attempt to remove. Where masonry walls and stud walls are removed, allow for removal of mortar and for fixings into the slabs and for mortar patch repairs if needed, colour to match existing concrete and prepare for polishing.

Where carpets are removed, allow for the removal of all adhesives in preparation for polishing.

For other surface repairs to existing concrete, refer to the structural engineer's details.

Finishing methods – primary finish

Machine float finish:

SPECIFICATION

03 STRUCTURE

0315 Concrete finishes

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating finish, as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Finishing methods – supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

New concrete toppings TOP2

Location: Foyer Bay 5 Level 2 where the 2 concrete stairs are removed and where a new reinforced concrete slabs are being placed 30mm below the level of the existing floor slabs.

New toppings are to match the colour of the stripped and polished existing concrete slabs.

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's recommendations and trowel to achieve the required appearance.

Product: Boral Coloured Concrete mix

Colour: To be confirmed on site after the stripping of the existing concrete for the new concrete finish to match the existing colour.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

- Method: steel trowelled and polished to match the polish on the existing Bay 5 Level 2 Foyer slab.
- Colour: Selected to match the existing stripped and polished existing concrete
- Sealing: required: Refer to **Selections**

Sealing: to new toppings to new slabs and for existing concrete slabs. Refer to **Selections**

4 SELECTIONS

4.1 SCHEDULES

Formed surface finishes schedule

Property	A.
Location	All
Surface finish class to AS 3610.1	3
Formwork lining type	To meet the standard
Colour control	Lightest grey possible with concrete mix – provide samples
Bolt hole filling	N/A
Surface finish type	To AS 3610.1. Concrete will not be painted.

Unformed surface finishes schedule

Property	A.
Location	All
Flatness tolerance class	2

SPECIFICATION

03 STRUCTURE

0315 Concrete finishes

Property	A.
Primary finish	Machine floated
Supplementary finish	N/A
Slip resistance treatment	Refer to Sealer Selection
Slip resistance classification	To AS/NZ 4586 Slip resistance classification of new pedestrian surface finishes
Slip resistance site test of completed installation	Required
Sealant	As specified in Selections

Sealer: Potassium silicate sealer - Clear

Substrate	Proprietary paint system
Concrete: conduct a water absorption test prior to application.	International Building Supply 20 Sir Joseph Banks Street Botany NSW 2019. T. (02) 8338 0000 www.poishedconcrete.net.au
Polishing of concrete – all areas – new concrete and existing concrete	Anti-microbial Tough-Grip Non-slip internal and external; clear surface sealer Slip Resistance R11

03 STRUCTURE

0335 Brick and stone masonry

0335 BRICK AND STONE MASONRY

1 GENERAL

1.1 RESPONSIBILITIES

Responsibilities

Requirement: Provide brick and stone construction, as documented.

Requirement: Provide stone masonry elements, as documented and as follows:

- Of uniform quality within any grade.
- Selected for the optimum matching of visual properties such as colour and pattern for facework.
- Sound and free from defects liable to affect its strength, appearance and durability under the intended conditions of use.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

This worksection includes but is not limited to the works in the Schedules to this worksection and the associated work as required and as shown on the architectural and structural drawings and as follows:

- Brick masonry construction using bricks to match existing where metal louvres are removed from the external wall of Bay 5 on Levels 1 and 3;
- Masonry construction using common dry pressed bricks for new internal dwarf brick walls on the ground floor;
- Masonry construction for new non-load bearing fire-rated brick walls where scheduled;
- Making good existing brickwork to match existing where new openings are formed in existing walls and internally using salvaged bricks from the opening up works; and for where lightweight construction is removed and is documented to be bricked up;
- Repairs and making good existing brick walls to match existing details with dry pressed bricks where the concrete stairs, beams and slabs that were embedded in the concrete are demolished;
- General repairs to make good the masonry walls after removal of cinema walls, the fitouts and associated services to prepare walls for new floors;
- Coring out of chemical anchors and epoxy steel out of brick walls after demolition and for filling the hole remaining with mortar and brick dust.
- Repairs and re-bedding of bricks in the existing brick east and west walls where joist pockets are to be reinstated for new joists and where the brickwork is loose, missing or in poor condition.
- Repairs to the brick and stone piers where the timber beam pockets are to be reformed to take new timber beams in the reinstatement of the timber floor structure.
- Reinstatement of brick corbels on the south and north walls where new timber floors are being reinstated to match existing details.
- Repair to the south wall on Levels 1 and 3 where the fire-rated steel angles and bolt fixings are removed with the demolition of the concrete slabs to the cinema plant rooms.
- Repairs to existing rendered masonry walls where concrete stairs and beams are removed to restore walls to match existing.
- Bricking up of internal openings to match existing masonry in salvaged or second hand bricks to match existing; making good to reveals to new openings formed in existing brickwork.

03 STRUCTURE

0335 Brick and stone masonry

- Stone construction using sandstone salvaged from forming new openings internally and new sandstone to match existing where required to complete the work. Making good stonework where brick walls abutting sandstone walls have been removed;
- Allowance for stone indents on the Ground Floor where the toilet is removed in bay 5 after removal of deteriorated stone;
- external indent stone repairs to restore the Ground Floor wall of Bay 5 where redundant pipes recessed into the stone are removed;
- Lintels;
- Mortar used in masonry construction;
- Masonry joints including sealant to joints;
- Accessories such as wall ties, lintels, seals, flashings and the like.
- The necessary operations of laying, building-in, and the like.
- Provision of samples.
- All brick and stone masonry work required to complete the works as documented and as specified.

Associated worksections

Refer to the following related worksections:

- 0203 DEMOLITION, for protection, for the removal of existing masonry walls in the forming of new openings; for the removal of metals louvres in external walls that are to be bricked up.
- 0182 FIRE STOPPING, for fire-rated sealants in masonry wall joints required to be fire sealed.
- 0453 DOORS AND ACCESS PANELS, for door frames to be installed into prepared openings and in new openings cut into existing brick walls as detailed.
- 0611 RENDERING AND PLASTERING, for cement render to new and existing walls and for repairs to existing render finishes to match existing.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of brick and stone walls existing and new in the areas for the contract works.
- Architectural Drawings for new brick walls, stone and brick in existing walls; for location of bricking-up of openings after removal of louvres; for making good to where new openings are formed in existing brick and stone walls and where concrete slabs and stairs have been removed; for external stone repairs after redundant service pipes are removed.
- Structural Engineers drawings and details of junction of new concrete slabs where concrete stairs are removed and where repairs are required and for concrete fire-rated lintels for new openings.

1.3 STANDARDS

General

Materials and construction: To AS 3700 – 2018 Masonry Structures.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions in AS 3700 clause 1.5.2, AS/NZS 4455.1 and the following apply:

- Facework: Masonry intended to be exposed in a wall.

1.5 TOLERANCES

Dimension stone units

Maximum deviation from required dimensions:

- Loadbearing stone: ± 2 mm.
- Other stone: ± 10 mm.

03 STRUCTURE

0335 Brick and stone masonry

Masonry construction

Conformance: Conform to AS 3700 Table 12.1.

1.6 SUBMISSIONS

Samples

Face units: Submit face units of each type of brick illustrating the range of variation available, including pigmented colour, texture, surface irregularities, defective arrises, and shape.

- Number of each brick and block type: 6 - 10 minimum until an acceptable match is approved.
- Number of sandstone blocks: 3 @ 400 cube for each of internal and external finishes to match existing.
- Stone mortar mix and colour to match existing for both the internal and the external stone work.

Sand: Submit a 2 kg sample of each type of sand required to be of a particular colour, grade or source.

Wall ties: Submit sample of stainless steel wall ties.

Refer to **Selections**

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Face bricks selected to match existing in colour and texture.
- Set-out for internal masonry walls.
- Control joints, ready for insertion of joint filler.
- Damp-proof membrane courses, in position.
- Propping of masonry walls for lintel installation.
- Control joints, ready for insertion of joint filler.
- Lintels in position before covering up.
- Proposed stone including quarry, storage yard for new sandstone.
- Prepared stone sample range for both internal and external work to match existing features.
- Stone laid out before fixing.
- Substrate prepared to receive the specified stonework.

2 PRODUCTS

2.1 DURABILITY

General

Exposure environment: marine

Exposure locations: To AS 3700 (2018) clause 5.4.

2.2 MATERIALS – BRICK AND BLOCK MASONRY

Brick and block units

Selections: As documented in the **Brick and block construction schedule**.

Standard: To AS/NZS 4455.1 and AS/NZS 4455.3.

Salt attack resistance grade: To AS 3700 Table 5.1.

Minimum age of clay bricks: 7 days.

03 STRUCTURE

0335 Brick and stone masonry

Mortar materials

Mortar class: To AS 3700 Table 5.1.

Cement: To AS 3972.

- Type: GP.

White cement: With $\leq 1\%$ iron salts content.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content and free from efflorescing salts, selected for colour and grading.

Water: Clean and free from any deleterious matter.

Admixtures: To AS 3700 clause 11.4.2.4.

Pigment: To BS EN 12878, and as follows:

- Integral pigment mix proportion: $\leq 10\%$ by weight of cement. Colour to match existing mortar colour.

Mix proportions: As documented in the **Masonry cement mortar mix proportions table** and **Cement (GP/GB) mortar mix proportions table**.

Masonry cement mortar mix proportions table: (cement : lime : sand), by volume

Mortar class to AS 3700	Clay	Concrete	Water thickener
M3	1:0:4	1:0:4	Yes
M4	1:0:3	n/a	Yes

Cement (GP/GB)mortar mix proportions table (cement : lime : sand), by volume

Mortar class to AS 3700	Clay	Concrete	Water thickener
M3	1:1:6	1:1:6	Optional
M3	1:0:6	1:0:5	Yes
M4	1:0:5:4:5	1:0.5:4.5	Optional
M4	1:0:4	1:0:4	Yes
M4	1:0-0.25:3	1:0-0.25:3	Optional

2.3 MATERIALS – NATURAL STONE

Stone types

Sandstone selection: 'Quarry run' free from defects including clay balls, shale inclusions or obvious bedding planes to approved sample. Only 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.

Stone selection

General: new sandstone where required:

- Internally to finish existing openings to match existing detail and where the salvaged sandstone needs to be supplemented with new stone.
- For indents in external façade after redundant services pipes are removed.

Conform to the accepted samples and prototypes as documented in the **Stone masonry schedule**.

Grading: Select stone of the designated quality grade to match the existing stone.

Matching: Select stone for the optimum matching of visual properties such as colour and pattern.

Finish: Internal: Broad convict pick finish to match existing interior finish.

Finish: External: 'Rusticated' finish to match existing.

Source of stone supply

Nominated source: Gosford Quarries T. 02 8585 8282

03 STRUCTURE

0335 Brick and stone masonry

Mortar materials

Cement type to AS 3972: GP.

White cement: Iron salts content $\leq$ 1%.

Masonry cement: To AS 1316.

Lime: To AS 1672.1.

Sand: Fine aggregate with no clay content, free from efflorescing salts and selected for colour and grading.

Crushed stone: Fine aggregate consisting partly or wholly of crushed stone, made from material of the same type as the stone facing.

Sand for facework:

- Colour: to match existing to an approved sample

Admixtures: Do not provide admixtures.

Water

General: Clean and free from any deleterious matter.

Mortar mix

Batching: Batch by weight and machine mix.

Mix compressive strength: Not more than compressive strength of the stone bedded on it.

Mix permeability: More than stone permeability.

Preparing lime putty:

Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency. Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.

- Mix proportions: Traditional 1 part lime to 3 parts sand (M1 to AS 3700)
- AS 3700 Clause 11.4.1

2.4 BUILT-IN COMPONENTS

General

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

Steel lintels

Angles and flats: To AS/NZS 3679.1.

Cold formed proprietary lintels: Designed to AS/NZS 4600.

Corrosion protection: To AS/NZS 2699.3.

Galvanizing: Do not cut after galvanizing.

Prestressed Precast Concrete lintels

Selection: Ultralintels from Ultrafloor T. 02 9868 4805

Size: 100mm x 170mm Standard Ultralintel with FRL 120 minutes

Location: Refer to the structural engineers drawings and architectural details.

Wall ties – brick masonry

Standard: To AS/NZS 2699.1.

Type: Type A

Corrosion protection: To AS/NZS 2699.1.

Duty classification rating:

- Cavities > 60 mm and < 200 mm wide: Heavy duty stainless steel

Connectors and accessories

Corrosion protection: To AS/NZS 2699.2.

Flashings and damp-proof courses

Standard: To AS/NZS 2904.

03 STRUCTURE

0335 Brick and stone masonry

Slip joints

Standard: To AS 3700 clause 4.13.

Material: As shown on the drawings.

3 EXECUTION

3.1 GENERAL

Mortar mixing

General: Measure volumes accurately to the documented proportions. Machine mix for at least six minutes.

Protection from contamination

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

Bond - bricks

Type – Single skin: Stretcher bond

Type – 230mm walls: English Bond to match existing bond, coursing and joint depth.

Building in

Embedded items: Build in wall ties and accessories as the construction proceeds. If it is not practicable to obtain the required embedment wholly in the mortar joint in cored brickwork, fill appropriate cores with grout or mortar.

Steel door frames: Fill the backs of jambs and heads solid with mortar as the work proceeds.

Construction at different rates or times

Monolithic structural action: If two or more adjoining sections of masonry, including intersecting walls, are constructed at different rates or times, rake back or tie the intersections between those sections so that monolithic structural action is obtained in the completed work.

Joining to existing – brick and stone

General: Tooth new masonry into existing work as detailed where openings are removed and infilled to match existing wall.

Mortar joints

Solid units: Lay on a full bed of mortar. Fill perpends solid. Cut mortar flush.

Face-shell bedded hollow units: Fill perpends solid. Cut mortar flush.

Finish: Conform to the following:

- Externally: Tool to give a dense water-shedding finish and to match the existing joints.
- Internally: If wall is to be plastered, do not rake more than 10 mm to give a key.
- Thickness: 10 mm.

Cutting: Set out masonry with joints of uniform width and minimum cutting of masonry units.

Monolithic structural action

Header units: Except in stretcher bond facework, provide brick header units, to AS 3700 clause 4.11.2.

Spacing: 600 mm maximum.

Location: Provide header units in the following locations:

- Between leaves in solid masonry construction.

Rate of construction

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

Set out – block and brick masonry

Rods: Construct masonry to the following rods, or in existing face brick walls to match existing:

- 75 mm high units: 7 courses to 600 mm.
- 90 mm high units: 6 courses to 600 mm.
- Set out – brick masonry

03 STRUCTURE

0335 Brick and stone masonry

Set out – stone masonry

Rods: Construct sandstone in existing face sandstone walls to match existing coursing.

Protection

General: Cover the top surface of brickwork to prevent the entry of rainwater and contaminants.

Single leaf and solid walls: Moisture protection to AS 3700 clause 4.7.4.

Temporary support

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

3.2 FACEWORK – BRICK MASONRY

Cleaning

General: Clean progressively as the work proceeds to remove mortar smears, stains and discolouration. Do not erode joints if using pressure spraying.

Acid solution: Do not use.

Colour mixing

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

Perpends

General: If other than vertically aligned perpends in alternate courses are proposed, provide details.

3.3 SUBFLOOR WORK – BRICK MASONRY

Underpinning

Requirement: Install underpinning while maintaining the building undamaged.

Grouting: Pack dry mix M4 mortar between underpinning and existing structure at the completion of each panel of underpinning.

Concrete: Underpinning where detailed 25mpa concrete from underside of footing to rock.

Refer Structural drawings for excavation for grease arrestor close to the wall between Bays 4 and 5.

3.4 CAVITY WORK – BRICK MASONRY

Cavity clearance

General: Keep cavities clear at all times.

Cavity fill

General: Fill the cavity to 1 course above adjacent finished (ground) level with mortar. Face the top surface towards the outer leaf.

Cavity width

General: Provide minimum cavity widths in conformance with the following:

- Brick walls: 50 mm. refer to details for the new cavity wall to where a louvre has been removed.

Openings

Care: Do not close the cavity at the jambs of external openings.

Wall ties connectors and accessories

Protection: Install to prevent water passing across the cavity.

3.5 DAMP-PROOF COURSES – BRICK MASONRY

Location

General: Provide damp-proof course or waterproof membranes as follows:

- On existing concrete slab below new brick dwarf walls to new amenities on the ground floor.

03 STRUCTURE

0335 Brick and stone masonry

Installation

General: Lay in long lengths. Lap full width at angles and intersections. Sandwich brick mortar onto the damp-proof course.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

3.6 FLASHINGS

Location

General: Provide flashings as follows:

- Internal walls built of existing floor slabs: Full width of the brick wall at the slab junction, cut to size. Required for protection of the existing heritage significant substrate and for removing in the future without damage to the existing substrate.

Installation

General: Sandwich flashings between mortar except on lintels. Bed flashings in one operation to maximise adhesion.

Laps: If required, lap full width at angles and intersections and at least 150 mm at joints.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

Pointing: Point up joints around flashings, filling voids.

3.7 WALL TIES

Location

General: Space wall ties in conformance with AS 3700 clause 4.10 or AS 4773.2, as appropriate, and at the following locations:

- Not more than 600 mm in each direction.
- Adjacent to vertical lateral supports.
- Adjacent to control joints.
- Around openings.

Installation

Embedment: At least 50 mm into mortar making sure that mortar cover is 15 mm minimum to the outside face of the mortar.

3.8 CONTROL JOINTS

General: Location and spacing: Provide control joints to AS 3700 clause 4.8.

Control joint filling

Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining to brickwork. Do not use bituminous materials with absorbent masonry units.

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: Closed-cell or impregnated, not water-absorbing.

Installation: Clean the joints thoroughly and insert an easily compressible backing material before sealing.

Sealant depth: Fill the joints with a gun-applied flexible sealant for a depth of at least two-thirds the joint width.

Fire-resistance rated control joints

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.

Fire stopping: To AS 4072.1.

03 STRUCTURE

0335 Brick and stone masonry

Joints between new brick walls and existing masonry walls

General: New walls are to be separated from existing walls with a removable non-staining compressed foam and removable sealant. Joint width 20-30mm.

3.9 BRICKWORK BED JOINT REINFORCEMENT

Location

General: Locate as follows:

- In 2 bed joints below and above head to openings.
- In third bed joint above bottom of wall.
- In second bed joint below top of wall.

Maximum vertical intervals: 500 mm.

Installation

General: Lap 450 mm at splices. Fold and bend at corners so that the longitudinal wires are continuous. Stop 50 mm short of control joints. Extend 450 mm beyond each side of openings.

Reinforcement

Material: Galvanized welded wire mesh.

Width: Equal to the width of the leaf, less 15 mm cover from each exposed surface of the mortar joint.

3.10 LINTELS

Location

General: Provide 1 lintel to each wall leaf as documented in the **Lintel schedule**.

Installation

General: Do not cut on site. Keep lintels 10 mm clear of heads of frames.

Steel lintels: Pack mortar between the vertical component and supported masonry units. For angles install the long leg vertical.

Minimum bearing each end:

- Span $\leq$ 1000 mm: 100 mm.
- Span $>$ 1000 mm $\leq$ 3000 mm: 150 mm.
- Span $>$ 3000 mm: To structural drawings.

Propping: Provide temporary props to lintels to prevent deflection or rotation.

- Minimum propping period: 7 days.

Fire-rated prestressed concrete lintels: Ultralintels from Ultra Floor [T.1800 858 723] as documented in the **Lintel Schedule** and as detailed.

Installation prestressed concrete lintels

General:

- Lintels must be placed with the rough side facing up in order to provide a proper key into the mortar above.
- Lintels must be propped at intervals not exceeding 1500mm until the mortar has matured.
- The minimum bearing onto the brickwork / masonry is 150mm based on the assumption of a minimum brick crushing strength of 20 MPa.

Refer to the manufacturer's instructions for installation procedures.

Refer to the architectural drawings for the number of lintels per new internal opening and for the finishing and linings to lintels.

03 STRUCTURE

0335 Brick and stone masonry

3.11 CONNECTORS AND ACCESSORIES

Slip joints

General: Provide slip joints to top of all unreinforced masonry walls supporting concrete slabs and other concrete elements.

Protection: Keep the slip joints in place and protect from displacement.

3.12 TESTS

Mortar

Durability: Scratch index test to AS 3700 Appendix E.

Compressive strength: To AS 3700 Appendix C.

Flexural strength: To AS 3700 Appendix D.

Special masonry

Sampling and testing: To AS 3700 clause 12.7.

4 SELECTIONS

4.1 SCHEDULES

Brick construction schedule

Property	A	B	C
Bricks and block: Name or type	Face bricks: Bowral Bricks Select from a blend of 'Gertrudis Brown', 'Capitol Red' and 'Bowral Brown' dry pressed bricks – to approved samples to match existing bricks.	Bricks: Commons Dry pressed (for internal concealed brick masonry)	Fire-rated bricks: Common Cored (core % < 30) Weight/unit 2.8kg
Location	External South wall where louvres are removed	For repairs and internal masonry that will be concealed by cement render and for rebuilding to openings in the party wall between Bays 4 and 5	To new masonry walls on the Ground Floor of Bay 4 Fire Exit 4G.01
Bricks: Fire resistance level (FRL)	-	-	FRL120 with insulation – 20mm cement render both sides
Bricks: Work size (mm) W x H x L	110 x 76 x 230	110 x 76 x 230	110 x 76 x 230
Bricks: Category	Solid to match existing	Solid to match existing	Solid
Bricks: Salt attack resistance category	Exposure	Protected	Protected
Bricks: Characteristic unconfined compressive strength (MPa)	Load bearing	Load bearing and non-load bearing	Load bearing support fire-rated plasterboard ceiling
Mortar: Cement	GP	GP	GP
Mortar: Colour	To match existing	To match existing	To approved sample

SPECIFICATION

03 STRUCTURE

0335 Brick and stone masonry

Property	A	B	C
Mortar: Proportions or mortar class	As specified	As specified	As specified
Mortar: Sand	To approved sample to match existing	To approved sample to match existing	To approved sample
Unit mortar joints: Bond	To match existing	Stretcher Bond unless detailed otherwise	Stretcher Bond
Unit mortar joints: Depth (mm)	To match existing	10mm	10mm
Unit mortar joints: Shape or profile	To match existing	Raked where rendered. Flush where un-rendered	Raked for rendering both sides
Built-in components: Wall ties / bed reinforcement	Stainless steel	Stainless steel	Stainless steel

Stone Masonry Schedule

Sandstone – select from:

- Gosford Quarries Mt White “quarry run” sandstone with a ‘broad convict pick finish’ to match existing for internal stone finish.
- Gosford Quarries sandstone with rusticated finish to match existing.

Alternatives: Alternatives can be provided for approval with samples and the quarry source and storage yard confirmed.

Lintel schedule A

Opening dimensions (mm)	Lintel type	Minimum end bearing	Fire rating
New openings in stone and brick walls. Refer to the Engineers drawings and Lintel schedule	Standard Ultralintel 100mmW x 170mmD FRL120 minutes. Refer to the Engineers drawings for number of lintels per opening.	150mm	FRL – 120 minutes

Lintel schedule B

Lintels to be stainless steel. Refer to the Engineer's drawings and schedules

Steel Lintel Table		
Maximum Span(mm)	Lintel Dimensions (mm)	Bearing each end (mm)
1050	90 x 10 Plate	150
1500	100 x 100 x 8 Angle	150
1800	100 x 100 x 10 Angle	150

5 EXTERNAL STONE REPAIRS

5.1 BAY 5 REPAIRS

Requirement

Bay 5 ground floor external façade repairs are as follows:

- Remove redundant services pipes as documented on the architectural drawings and Hydraulic Services drawings.

03 STRUCTURE

0335 Brick and stone masonry

- Stone 1: At base of wall, remove the stone where there was a pipe penetration and the smaller adjoining stone to the north and replace with 1/no stone indent minimum 200mm thick with face to match the rusticated stones above.
- Stones 2, 3, 4 and 5: After removal of the pipes, inspect with the superintendent and heritage architect and allow all costs for the following:
 1. Mortar patch to pipe hole in Stone 2; clean stones in recesses below in Stones 3, 4 and 5 where pipes or
 2. Remove 300mm wide section of stone centered on location of the removed pipes, and insert indent stones 300mm wide x min 200mm deep finished to match existing stones.

The Heritage Architect will direct the repair option to be followed with the costs for either repair being included in the tendered sum.

6 COMPLETION

6.1 COMPLETION OF STONEMWORK

Operation and maintenance manual

Requirement: Provide a manual of maintenance procedures for the care and maintenance of the stonework, including the following:

- Particulars of stone source, type of stone, and jointing materials.
- A program for regular maintenance cycles at not more than five-year intervals
- Stonework cleaning.
- Desalination.
- Inspection and repair of joints and flashings.
- Inspection of rainwater goods for blockages and breakdown.
- Detection of potential failures arising from movement or other causes.

Cleaning

Requirement: Leave the stonework clean on completion.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

0341 STRUCTURAL STEEL

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide structural steelwork, as documented and provide for the fixing of adjoining building elements that are to be connected to or supported on the structural steel.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Structural steel includes but is not limited to the following:

- New steel connections to existing cast iron collars to timber beam and column connectors to join the existing and new beams and columns
- Extensions to the existing roof plant platform to support condensers to match existing details;
- Repairs and new steel beams to the existing plant platform steelwork;
- New internal steel Stair 3 and Stair 4 with cut steel stringers, tread supports, balustrades and fixings to structure;
- Structural steel wall framing and bracing for service riser shafts;
- Structural steel beams for automatic opening glass sliding doors;
- External steel ramp structure, framing and balustrades;
- Steel framing and floor for plant access floor between trusses on Level 4;
- Steel framing to support aluminium screens to services at roof level.
- All other structural steelwork documented and as required to complete the works as detailed and as shown on the structural engineers and architectural drawings.

Associated worksections

Refer to the following related worksections: The General requirements worksection contains umbrella requirements for all building and services worksections.

- 0344 STEEL – HOT-DIP GALVANIZED COATINGS, for galvanised finishes to steel.
- 0310 CONCRETE – COMBINED, for steel reinforcement in concrete beams and slabs;
- 0381 STRUCTURAL TIMBER, for reinstatement of salvaged and new timber floor structures requiring new steel plates, angles, bolts and other steelwork for installation.
- 0342 LIGHT STEEL FRAMING, for steel wall framing to the fire-rated services shaft and for miscellaneous steel framing;
- 0552 METALWORK, for floor gratings and handrails to the extended roof plant platform; access ladders and safe roof access system;
- 0671 PAINTING, for preparation and execution of finishes to internal and external steel;
- VERTICAL TRANSPORTATION SERVICES, for certification of the existing steel lifting beams in the Store (existing LMR)
- Architectural drawings and details for the new external ramp structure and ramp components including balustrades and floor grating; new steel Stairs 3 and 4 details; service shaft.
- Structural Engineers drawings and specifications for the new connections for the structural timber , new Stair 4 and Stair 4, for repair to existing roof plant platform steel and for the extension to the existing platform and other steel as detailed.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

1.3 STANDARDS

General

Materials, construction, fabrication and erection: To AS 4100.

Cold-formed steel: To AS/NZS 4600.

1.4 INTERPRETATION

Abbreviations

AESS: Architecturally Exposed Structural Steel.

ILAC: International Laboratory Accreditation Cooperation.

1.5 INSPECTION

Notice – off site

Inspection: Give notice so that inspection may be made of the following:

- Materials including welding consumables before fabrication.
- Submission of the proposed welding procedure to prevent distortion and non-ductile welds in tension zones.
- Testing of welding procedures and welder qualification tests.
- Commencement of shop fabrication.
- Commencement of welding.
- Before placement of root runs of complete penetration butt welds.
- Completion of fabrication before surface preparation.
- Surface preparation before shop painting.
- Completion of protective coating before delivery to site.

Notice – on site

Inspection: Give notice so that inspection may be made of the following:

- Custom steel floor framing to raised floors prior to covering up with sheet linings
- Steelwork on site before erection.
- Anchor bolts in position before casting in.
- Tensioning of bolts in categories 8.8/TB and 8.8/TF.
- Reinforcement and formwork in place before any encasement.

1.6 SUBMISSIONS

Anchors

Concrete or masonry anchors: If masonry anchors other than as shown on the drawings are required or proposed for the support or fixing of structural steel, submit evidence of the anchor capacity to carry the load.

Bolts

Compliance: Submit a manufacturer's compliance/test certificate from an ILAC accredited testing organisation confirming conformance with AS/NZS 1252.

Independent certification: Provide a local NATA-accredited laboratory independent compliance certificate based on appropriate testing and verification.

Execution

Anchor bolts: If anchor bolts do not meet specified location tolerances, submit proposals that will allow steel erection to proceed.

Splicing: If splicing of structural members is intended, submit proposals.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

Welding procedures: Submit details of proposed welding procedures, using the WPS form in Appendix C of AS/NZS 1554.1.

Identification marks: If members and/or connections are to be exposed to view submit details of proposed marking.

Distortions: Submit proposals for preventing or minimising distortion of galvanized components, welded components or welded and galvanized components; and proposals for restoration to design shape.

Record drawings

General: Supply as-built structural and shop drawings.

Samples

AESS: Submit samples of AESS as documented.

Special finishes: Submit samples of finished steel as documented.

Minimum sample sizes: 0.1 m².

Shop drawings

General: Submit shop drawings showing the following information:

- Relevant details of each assembly, component and connection.
- Information relative to fabrication, surface treatment, transport and for erection on site. Refer to site for existing available access requirements.

Specific requirements: Include the following information:

- Erection procedures for the new steel Stair 3 and Stair 4 in long lengths as detailed.
- Marking plans.
- Identification.
- Steel type and grade.
- Dimensions of items.
- Required camber, where applicable.
- Fabrication methods including, where applicable, hot or cold forming and post weld heat treatment.
- Location, type and size of welds and/or bolts and bolt holes.
- Weld categories and bolting categories.
- Orientation of members.
- Surface preparation methods and coating system if shop applied.
- Best practice details in relation to application of protective coatings.
- Breather holes for hollow sections (with seal plates) being hot-dip galvanized.
- Procedures necessary for shop and site assembly, and erection.
- Location of and preparation for site welds.
- Temporary works such as lifting lugs, support points, temporary cleats and bracing which are required for transport and erection of the structural steelwork, and the procedure for final removal.
- Required fixings for adjoining building elements.

Substitution: If alternative sections or connections are proposed, provide details.

Splices: If variations to documented splice locations or additional splices are proposed, submit details.

Subcontractors

General: Submit names and contact details of proposed fabricator and installer.

Tests

Steel properties: Submit evidence that the steel used in the work conforms to the cited material standards.

Bars and sections: Submit results of all non-destructive tests.

Plates: Submit results of all ultrasonic tests.

Welds: Submit results of all non-destructive examinations.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

2 PRODUCTS

2.1 STEEL TYPE AND GRADE

Material

Steel members and sections: Conform to the **Steel grade (minimum) table**.

Steel grade (minimum) table

Type of steel	Grade
Universal beams and columns, parallel flange channels, large angles to AS/NZS 3679.1	300
Flat, small angles, taper flange beams and columns to AS/NZS 3679.1	250
Welded sections to AS/NZS 3679.2	300
Hot rolled plates, floor plates and slabs to AS/NZS 3678	250
Hollow sections to AS/NZS 1163: Circular sections less than 165 mm nominal outside diameter	C250
Hollow sections to AS/NZS 1163: Sections other than the above	C350
Cold formed purlins and girts to AS 1397	G450 Z350 or Z450

Steel certification

Acceptable evidence: Certified mill test reports, or test certificates issued by the mill in conformance with AS/NZS 1163 clause 13.2.2 for cold formed hollow sections, AS/NZS 3679.1 clause 11.2.2 for hot rolled bars or sections or AS/NZS 3679.2 clause 10.2.3 for welded I sections.

Alternative: Have the steel tested by an independent NATA or ILAC accredited testing authority for compliance with the chemical composition and mechanical test requirements of the cited material standard.

Testing

Requirement: As documented.

2.2 BOLTS

Bolts, nuts and washers

Finish: Hot-dip galvanized, corrosion-free, coated in oil and in serviceable condition.

3 EXECUTION

3.1 FABRICATION AND ERECTION

General

Care: Provide structural members in single lengths. Shop detail and fabricate members so that they can be properly erected.

Substitution: If substitution of members is proposed, provide details.

Beam camber

General: If beam members have a natural camber within the straightness tolerance, fabricate and erect them with the camber up.

Straightening

Care: If correcting distorted members, conform to the submitted procedures and avoid damage.

Site work

General: Other than work shown on the shop drawings as site work, do not fabricate, modify or weld structural steel on site.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

Identification marks

General: Provide marks or other means of identifying each member compatible with the finish, for the setting out, location, erection and connection of the steelwork in conformance with the marking plans.

High strength bolting: If the work includes more than one bolting category, mark high-strength structural bolted connections with a 75 mm wide flash of colour, clear of holes.

Cold formed members: Clearly mark material thickness.

Tolerances

Measurement: Check tolerances by measurement after fabrication and application of corrosion protection.

Conformance: To AS 4100 clause 14.4.

3.2 WELDING

General

Standard: To AS/NZS 1554.1.

Weld category

Weld categories not shown on the drawings: Category GP.

Weld type

Weld type not shown on the drawings: Submit proposals for weld type and electrodes.

Non-destructive weld examination

Standard: To AS/NZS 1554.1.

Methods: Refer to documentation.

Radiographic and ultrasonic examination: By an independent testing authority.

Repairs: Repair welds revealed as faulty by non-destructive examination and repeat the examination.

Non-destructive weld examination (NDE) table

Type of weld and category	Examination method	Extent (% of total length of weld type)
Shop fillet welds	Visual means	100
Site fillet welds	Visual means	100
Butt welds, GP	Visual means	100
Butt welds, SP	Visual means	100
Fillet and butt welds, SP	Radiographic or ultrasonic examination	10

3.3 BOLTING

General

Standards: To AS 1110.1, AS 1111.1 and AS/NZS 1252.

Bolting category

General: As documented.

Connections

Connection type: For connections not documented, submit proposals.

Bolting category 8.8/TF contact surfaces: Clean, as rolled and free from applied finishes.

Anchor bolts

General: Provide each anchor bolt with 2 nuts and 2 oversize washers and provide sufficient thread to permit the levelling nut and washer to be set below the base plate.

Galvanizing: Galvanize all components.

Hexagonal bolts: To AS 1111.1.

Hexagonal nuts: To AS 1112.3.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

Plain washers: To AS 1237.1.

Set out: Set out bolt groups using templates and subject to survey check.

Lock nuts

General: Provide lock nuts for bolts in moving parts or parts subject to vibration and for vertical bolts in tension.

Tensioning of bolting categories 8.8/TB and 8.8/TF

Method: Use part-turn-of-nut or load indicating washers.

Permanent bolting

Completion: Bolt only when correct alignment and preset or camber has been achieved.

3.4 ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

General

Requirement: Provide AESS as documented

Standard: Conform to the requirements of ASI/SCNZ AESS E - AESS Sample specification.

Fabrication

Requirement: Conform to the requirements of ASI AESS F - AESS Code of practice.

Welds: Make intermittent welds appear continuous, either with additional welding, caulking or filler.

Corners and edges: Grind fair those corners and edges, which are sharp, marred, or roughened.

Rough surfaces: Deburr and ground smooth.

3.5 SURFACE PREPARATION AND TREATMENT

General

General: To AS 1627.

Requirements: As shown on structural drawings

Site connections: After completing the connection, prepare the surface of the connection, adjacent unprimed surfaces and surfaces damaged during erection.

Steel surfaces generally: Remove loose millscale, loose rust, oil, grease, dirt, globules of weld metal, weld slag and other foreign matter. Ensure surfaces are dry.

Abrasive blast cleaning

Do not use silica abrasive for dry blasting. Use phosphate inhibitors when wet blasting.

Marking

On the contact surfaces of friction type joints, confine the use of marking ink to the minimum necessary for marking hole positions.

3.6 ERECTION

General

Standard: To AS 3828.

Execution: Make sure that every part of the structure has sufficient design capacity and is stable under construction loads produced by the construction procedure or as a result of construction loads, which are applied.

Calculations: If required to justify the adequacy of the structure to sustain any loads and/or procedures, which may be imposed, provide calculations.

Temporary work

General: Provide all necessary temporary bracing or propping.

Temporary connections: If required cleats are not shown on shop drawings, submit details.

Temporary members: If temporary members are required, fix so as not to weaken or deface permanent steelwork.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

Hand cutting

General: If hand cutting of bolt holes appears to be necessary, submit a report and proposed alternative options.

Cold-formed purlins

Trimming members: Provide to support edges of roof sheeting along hips, valleys and roof penetrations.

Movements

General: Allow for thermal movements during erection.

Site welds

Completion: Weld only when correct alignment and preset or camber have been achieved.

Overhead welding: If overhead welding is required, submit proposals.

Clearances

End clearances at connections (mm): 10mm maximum

Anchor bolts

General: For each group of anchor bolts, provide a template with setting out lines clearly marked for positioning the bolts when casting in.

Grouting at supports

Preparation: Before grouting steelwork to be supported by concrete or masonry, set steelwork on packing or wedges.

- Permanent packing or wedges: Form with solid steel or grout of similar strength to the permanent grout.
- Temporary packing or wedges: Remove before completion of grouting.

Timing: Grout at supports before the construction of any supported floors, walls, roofing, wall cladding or precast.

Temperature: Do not grout if the temperature of the base plate or the footing surface exceeds 35°C.

Method: Dry pack with stiff cement mortar.

Type: 1 cement: 2 sand, or use an approved proprietary brand.

Minimum compressive strength (MPa): 25

Minimum thickness (mm): 20mm

Maximum thickness (mm): 60mm

Handling

Care: Handle members or components without overstressing or deforming them.

Protection: Wrap or otherwise protect members or components to prevent damage to surface finishes during handling and erection.

Drifting

Limitation: Use drifting only to bring members into position, without enlarging holes or distorting components.

3.7 REPAIRS

General

General: Repair finishes to restore the full integrity of each phase and each coating.

3.8 COMPLETION

Tolerances

Conformance: After erection is complete confirm conformance with AS 4100 clause 15.3.

Temporary connections

General: Remove temporary cleats on completion and restore the surface.

SPECIFICATION

03 STRUCTURE

0341 Structural steel

Cross references

Refer to structural engineers drawing specification and to 0671 PAINTING for finishes to steelwork and to reinstated metal timber collars.

4 SELECTIONS

Refer to Structural Engineer's documentation for structural steel and to the architectural details.

STRUCTURE

0342 Light steel framing

0342 LIGHT STEEL FRAMING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide light steel wall framing, as documented and as follows:

- Suitable for having linings fixed to it.
- In conformance with the documented performance criteria.
- Independently designed and documented.
- Independently certified by a professional engineer for the design and the erected framing.

Alternative

Light steel framing is an alternative to the preferred timber stud framing for general non-fire-rated walls only where heritage approval is given for its use. Refer to 0382 LIGHT TIMBER FRAMING

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Light steel framing includes but is not limited to the following:

- Light steel framing for service shafts and ducts.
- Miscellaneous steel framing as required to complete the works as documented.

Associated worksections

Refer to the related following worksections:

- 0382 LIGHT TIMBER FRAMING, for timber studs to new stud walls as documented
- 0341 STRUCTURAL STEEL, for steel structure for the extensions to the existing steel roof plant platform structure; for repairs to existing roof plant platform steel; for wall framing to the services shaft; for new steel stairs, external ramp and for balustrades;
- 0552 METALWORK, for the steel roof platform extension including floor grating and handrails, steel stair balustrades and miscellaneous metalwork and for metal accessories;
- 0344 STEEL – HOT-DIP GALVANIZED COATINGS, for galvanized finishes to steel.
- 0511 LINING, for fire rated and non-fire-rated plasterboard linings to walls and ceilings; for fibre cement sheet linings fixed to timber wall framing; for fire-rated board linings to fire-rated service riser shaft, for wall types – structure and finishes.
- 0551 JOINERY, for kitchenettes, for timber skirtings and trim; for plywood balustrades to ramps;
- 0453 DOORS AND ACCESS PANELS, for steel door and access door frames.
- 0531 SUSPENDED CEILINGS, for metal suspension systems for ceilings IN Bay 4 Ground Floor
- 0471 ACOUSTIC INSULATION, for acoustic insulation in stud walls to amenities.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, and architectural drawings for wall types and locations.
- Structural Drawings, for structural steelwork details.

STRUCTURE

0342 Light steel framing

1.3 STANDARDS

General

Design, materials and protection: To AS/NZS 4600.

Residential and low-rise steel framing: To NASH-1 (National Association of Steel Housing) and NASH-2.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in the NASH-1 and NASH-2. Standards apply.

1.5 TOLERANCES

General

Manufacturing, assembly and installation tolerances: To NASH-1 Appendix D and NASH-2 Appendix A.

1.6 SUBMISSIONS

Alternatives

Light steel framing is an alternative to timber stud wall framing and is to be approved before use.

Design

General: Where the structural drawings define performance criteria, submit independent design, documentation and certification from a professional engineer including certification for the erected work.

Reactions: Submit the location and magnitude of reactions that are to be accommodated by the support structure.

Floor and wall frame member sizes: where approved, submit a schedule of proposed member sizes, certified as meeting stated project, and AS/NZS 4600 requirements for span, spacing and loadings.

Samples

Submit samples of the following for approval:

- Technical data and compliance with AS 4674-2004 Construction and fit out of food premises.

Shop drawings

General: Submit shop drawings, to a scale that best describes the detail, certified by a professional engineer stating that the design has been carried out in accordance with documented project, and AS/NZS 4600, requirements for the documented configurations and loadings for the following:

Service Shafts

- Structural framing for light steel intermediate framing as detailed in the Structural Engineering drawings.

Wall frames: If pre-fabricated wall framing is approved for use, submit drawings to show:

- Plan: Wall layout.
- Elevation: Arrangement of members, and size and section type of each member.
- Method of assembly, connection, holding down and bracing.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

STRUCTURE

0342 Light steel framing

- Sample fixings to existing fabric (floors, existing timber structure reinstated and existing in place) for approval before proceeding.
- Steel framing erected on site before lining.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Requirement: Transport all components to site and store if required in a manner so as not to damage or distort the components.

2.2 COMPONENTS

Cold-formed steel framing

General: Cold-form sections from steel, metallic-coated to AS 1397.

Corrosion protection: To BCA 3.4.2.2.

Framing members

Cold-formed steel framing: For proprietary systems, comply with NASH-1 and NASH-2.

Steel wall frame type: refer to **The Schedules**

Steel floor frame type: Refer to DOORS AND ACCESS PANELS

2.3 LIGHT STEEL FRAME ALTERNATIVE

General

Requirement: Timber stud wall framing is specified and is to be priced in this project. Approval is to be provided for steel studs.

Provide wall framing as complete proprietary systems, each fabricated by one manufacturer and installed by a specialist installer of demonstrated capacity.

Wall framing

General: Proprietary framing systems of folded steel strip lipped studs with corresponding channel section top tracks, bottom tracks and noggings.

Finish: Hot-dip zinc coating to AS 1397. Minimum zinc coating Z275.

Proprietary item

Rondo steel stud and tracks systems by Rondo Building Services Pty Ltd.

Metal stud framing

Material: Coated steel

Coating class: Z275 unless noted otherwise on structural drawings.

3 EXECUTION

3.1 GENERAL

Fabrication

Length: Cut members accurately to length so that they fit firmly against abutting members.

Service holes: Form holes by drilling or punching.

Bushes: Provide plastic bushes or grommets to site cut holes.

Swarf: Immediately remove swarf and other debris from cold-formed steel framing.

STRUCTURE

0342 Light steel framing

Fastening

Type: Select from the following:

- Bolting.
- Self-drilling, self-tapping screws.
- Blind rivets.
- Proprietary clinching system.
- Structural adhesives.
- Welding. On-site welded connections are not permitted.

Explosive driven-fastenings are not to be used.

Tracks

General:

- Fix bottom tracks to floor substrate to approved sample and details
- Fix deflection head tracks to the floor structure or slab soffit.

Fixing to existing masonry:

Provide masonry anchors suitable for hollow core or grout filled blockwork or brickwork for tracks and studs. Do not provide explosive-driven fastenings.

Track fixing: ≤ 600 mm centres, and 100 mm from ends. Splice plates at ends to maintain continuity and alignment.

Welding

Burning: Avoid procedures that result in greater than localised burning of the sheets or framing members.

Prefabricated frames

General: Protect frames from damage or distortion during erection.

Metal separation

General: Install lagging to separate non-ferrous service pipes and accessories from the framing.

Unseasoned or CCA treated timber

General: Do not fix in contact with framing without fully painting the timber and/or the steel.

Earthing

Permanent earthing: Required.

Temporary earthing: Provide temporary earthing during erection until the permanent earthing is installed.

Protection

General: Restore coatings which have been damaged by welding or other causes. Thoroughly clean affected areas back to base metal and coat with a zinc rich organic primer.

Grommets: Provide grommets to isolate piping and wiring from cold-formed steel framing.

3.2 WALL FRAMING

Wall studs

General: General: Where approved, install lipped studs framing in accordance with manufacturer's published recommendations.

Provide studs in single lengths without splices. Place a stud under each structural load point from the roof or ceiling (except at openings). Provide multiple studs at points of concentrated load.

Maximum stud spacing: 600 mm.

Fix noggings at 1350 mm maximum centres vertically and as required for skirtings, wet area lining or fixing of services and fixtures.

Heads to openings

Requirement: Provide lintels appropriate to load and span.

STRUCTURE

0342 Light steel framing

Additional support

General: Provide additional support in the form of noggings, trimmers and studs for support and fixing of lining, cladding, hardware, accessories, fixtures and fittings.

Wall ties

Requirement: Where new stud walls abut existing stone or masonry walls, only fixings that are into the mortar joints are approved.

Approved masonry ties: Abey Hardware stainless steel Alligator Expansion Ties for Tying Brickwork to frame.

Damp-proof course

Requirement: Provide damp-proof courses under the bottom plate of stud walls built off slabs or masonry dwarf walls, as follows:

- Walls of amenities / toilets / cleaners: Turn up a minimum of 150 mm on the wet side and tack to studs.

Installation: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses, sarking and waterproof membranes.

Flashings

Location: Provide flashings to external openings sufficient to prevent the entry of moisture. Form trays at the ends of sill flashings.

3.3 SERVICES SHAFT FRAMING

Wall framing to fire-rated service riser shaft walls

Location: Service riser shaft from the ceiling of the Ground Floor up to Level 4 as documented;

Steel Studs: 92mm x 0.75 BMT at 450mm centres. Stud walls diagonally braced all sides to inside face with 30mm x 0.8mm galvanized steel strap in each direction to structural engineer's details.

Service riser shaft to be insulated and lined both side for the full height of the shaft with Promatect sheets to achieve FRL -/120/120. Lap studs 900 and screw through where required.

Refer to **Metal Stud Wall Framing Schedule** in this worksection.

Cross references

Refer to structural engineer's details and to the architectural drawings and details.

Refer 0511 LINING for Promat fire-rated linings with steel wall frames.

Refer to **The Schedules** in this worksection for wall types and metal stud wall framing.

3.4 COMPLETION

Cleaning

General: On completion of framing remove debris from any gaps between members and make sure void between bottom chord of roof trusses and top of any non-supporting internal wall is clear.

4 THE SCHEDULES

4.1 METAL STUD WALL FRAMING SCHEDULE

Coordinate framing with LINING worksection.

Refer to floor plans, reflected ceiling plans for location and extent. Refer to details.

Refer to the SH.02 SCHEDULE OF SUBSTRATES AND FINISHES for tiles and paint finishes.

STRUCTURE

0342 Light steel framing

Service Riser Shaft Wall

Location / General description: Services shaft for service duct and pipe risers from the ceiling level of Ground Floor up through all floors and to a level on Level 4 where is will have a similar constructed lid /'roof'. Location as shown on the architectural drawings. Service riser shaft wall to be continuous up to the balustrade level of the Level 4 plant platform framing. Profile of shaft walls in section vary as detailed to reflect the floor construction where the shaft passes through the floors. FRL – 120/120/120.

Lining material: 1 layer 9mm FRL -/120/120 PROMOTECH H boards both sides of the shaft - to the inside and the outside for the full height of the shaft.

Framing width (mm) and type: 1 x 92mm lipped steel wall studs; 0.75 BMT; braced to engineer's details

Cavity width overall: 92mm/refer architectural plan setout

Spacing (max) mm: 450mm

Insulation: 70mm Rockwool batts 50kg/cubic metres.

Cross reference: Refer to structural engineer details and to the architectural details.
Refer 0511 LINING specification

SPECIFICATION

03 STRUCTURE

0344 Steel – hot-dip galvanized coatings

0344 STEEL – HOT-DIP GALVANIZED COATINGS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide hot-dip galvanized coatings, as documented and as follows:

- Controls atmospheric corrosion to structural steelwork or steel products in the time to first maintenance.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0183 METALS AND PREFINISHES

Associated worksections

Refer to the following related worksections:

- 0341 STRUCTURAL STEEL, for new steelwork and for repairs to existing steel to the roof plant platform to structural engineers drawings;
- 0342 LIGHT STEEL FRAMING, for pre-finishes steel framing;
- 0552 METALWORK, for finishes to non-structural metal fittings and fixtures; for galvanized steel handrails and plant platform grating.
- 0671 PAINTING, for paint finishes to steel.
- Structural engineer's drawings and details for the repairs and treatment to existing steel plant platform on the roof;
- Structural engineers and architectural drawings for new steel to be galvanised for the extended roof plant platform, access ladders and for Store Room duct and wall screens.

1.3 STANDARDS

General

Coating: To AS/NZS 4680.

Coating on fasteners: To AS 1214.

Durability: To AS 2309 and AS/NZS 2312.

Metal finishing

Steel preparation methods: To AS 1627 series.

Coating mass/thickness minimum: To AS/NZS 4680.

Threaded fasteners coating mass/thickness minimum: To AS 1214 Table 2.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Coating appearance and thickness, at the galvanizing plant.

SPECIFICATION

03 STRUCTURE

0344 Steel – hot-dip galvanized coatings

1.5 SUBMISSIONS

Execution details

Holes and lifting lugs: If holes and lifting lugs are required to facilitate handling, filling, venting and draining during galvanizing, submit details on size and location.

Detailing features: If design and fabrication features of the items to be galvanized leads to difficulties during galvanizing, identify these and submit details for improvement.

2 EXECUTION

2.1 GENERAL

Care

Dimensional change: If design and fabrication features of items to be galvanized are likely to lead to dimensional change or distortion, identify these and submit proposals for its minimisation.

Embrittlement: Take due care to avoid embrittlement of susceptible steels.

Mechanical properties: Avoid mechanical damage. Make sure that mechanical properties of the base metal do not change.

Surface preparation

Surface contaminants and coatings generally: Chemical clean, then acid pickle.

Chemical cleaning: To AS 1627.1.

Acid pickling: To AS 1627.5.

- Inhibitor: Required.

Post treatment

General: Passivate.

Drilling after completion of hot-dip galvanizing

Repair: Prime drill hole surfaces to AS/NZS 4680 clause 8 before the surfaces begin to corrode.

Coating

Threaded fasteners: To AS 1214.

Structural sections

Cold worked items: Except for hollow sections, anneal to 650°C before galvanizing.

Hollow sections: Provide seal plates with breather holes.

Surface finish

Standard: To AS/NZS 4680 clause 7.

Coating quality: Continuous, adherent, smooth or evenly textured and uniform, free from defects detrimental to the end use of the finished article, such as lumps, blisters, gritty areas, uncoated spots, acids and black spots, dross and flux.

- Silicon killed steels: Dull grey is acceptable.

Friction-type bolted connections: Treat coated contact surfaces to achieve the required design slip factor, without removing excessive coating thickness.

- Contact surface preparation: To GAA After-fabrication hot dip galvanizing Chapter 4.

Slip factor test: To AS 4100 Appendix J.

Surplus zinc on fastener threads: Remove.

Coating repair

Rejection: If uncoated surfaces or areas damaged by handling at the galvanizing plant exceed the limits specified for repair in AS/NZS 4680 clause 8, reject the galvanizing.

Extent and methods: To AS/NZS 4680 clause 8.

Preparation for paint finishes

Coarse preparation: Remove spikes, and make sure edges are free from lumps and runs.

Light sweep blasting before painting: Required.

SPECIFICATION

03 STRUCTURE

0344 Steel – hot-dip galvanized coatings

- Maximum zinc removal: 10 µm.
- Abrasive grade (range): 150 – 180 µm.
- Abrasive type - clean ilmenite or garnet.
- Blasting angle to surface: 45° maximum.
- Blast pressure (maximum): 275 kPa.
- Distance of nozzle from surface (range): 350 – 400 mm.
- Nozzle type: 10 – 13 mm minimum diameter venturi type.

2.2 TESTING

Galvanizing tests

Coating mass tests: To AS/NZS 4680 Appendix G.

Magnetic method: To AS 2331.1.3.

Coating thickness tests: To AS/NZS 4680 Appendix G.

- Test method: To AS/NZS 4680 clause 9 and AS/NZS 4680 Appendix G.

Test method: To AS/NZS 4680 Appendix G.

- Frequency of tests: To AS/NZS 4680 clause 9.2.
- Method: To AS/NZS 4680 Appendix G clause G5.

Testing authority: NATA registered galvanizing plant.

2.3 SITE WORK

Site welding

Grinding of edges: Permitted.

Weld areas: Reinstate coating to AS/NZS 4680 clause 8.

Site coating reinstatement

Rejection: If any item has damaged areas exceeding the limits specified for repair in AS/NZS 4680 clause 8.1, reject the object.

Extent: Areas damaged by transport, site welding, site flame cutting, site handling, or erection.

Method: To AS/NZS 4680 clause 8.

3 SELECTIONS

Refer to structural engineer's drawings and architects details for steelwork to be galvanised.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

0381 STRUCTURAL TIMBER

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide structural timber, as documented.

Design

Designer: Mott MacDonald Australia Pty Ltd

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0181 ADHESIVES, SEALANTS AND FASTENERS
- 0184 TERMITE MANAGEMENT
- 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

Specified in this worksection

This worksection includes but is not limited to the works in the Schedules to this worksection and associated work as required and as shown on the architectural and structural drawings and as follows:

- Transporting to the ASN building, the structural timbers and associated metal collars salvaged from Bay 5 (cinema construction c1990) that have been stored off site at White Bay for reuse in the reinstatement of the timber structure in Bay 5 with new timbers to match existing as documented;
- Inspections as required of timbers off site at White Bay;
- Protection of timbers while in transit and on site;
- Cleaning of rust from cast iron collars and column bases in preparation for priming and repainting.
- The erection of structural timbers, salvages and new, in the building as detailed and as directed by the structural engineer with new connections to the metal collars as detailed by the structural engineer.
- Preparation of a strategy in consultation with the superintendent and heritage consultants for locating reinstated timbers (grouped/spread-out/representation on each level);
- Schedule of timbers required for reinstatement of part of the timber structure in Bay 5 for the extent as shown on the structural engineer's drawings.
- Recording, tagging and temporary removal of existing remnant timber structure on and above Level 2 for structural works to column and beam fixings to metal collars and then reinstatement in their original location.
- Milling of principal supplied timbers including chamfered edges to columns and profiling of beams to suit the metal collars to the original details;
- Temporary support of the timber structure during erection.
- Preparation of as-built documentation for the locations of reinstated and new timbers;
- All work as required to complete the installation of reinstated timber structure with existing and new materials to match the existing structure including timber columns, beams, joists and herringbone strutting and blocking between joists as required for new doors and partitions.
- All structural timbers required to complete the works as detailed and as scheduled.

Associated worksections

Refer to the following related worksections:

SPECIFICATION

03 STRUCTURE

0381 Structural timber

- 0202 DEMOLITION, for recording of existing remnant timber structure in Bay 5 on the west side before dismantling and reassembly with new connections at the collars; for salvaging of removed timber where the new Stair 3 and services shaft are proposed through floors for repairs.
- 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT, for timbers and finishes generally.
- 0382 LIGHT TIMBER FRAMING, for stud wall and floor framing and structural support for new ramps – plywood, timber and steel.
- 0551 JOINERY, for plywood balustrades to new ramps.
- 0655 TIMBER FLOORING, for new timber floor boards to match the existing boards to reinstated timber floors;
- 0656 FLOOR SANDING AND FINISHING, for the sanding of the timber floor and for finishing treatments.
- Structural engineer and architectural drawings for the location and details of the reinstated and new timber structure and for the details for works to the metal collars;
- Structural Engineer's and architectural drawings for location of the timber structure and for details;

1.3 RESPONSIBILITIES

New structural timbers to be supplied

General:

- The principal will supply new timbers – columns, beams and joists, required to complete the reinstatement of the timber floors as documented for Bay 5 with salvaged timbers that are stored off site at the White Bay Power Station. The new structural timbers will be delivered to the site.
- The principal will arrange for an independent inspection of the salvaged structural timber elements stored at White Bay Power Station to confirm grading.

Contractor's responsibilities

- The contractor is responsible for transporting to the ASN building, the original structural timbers and associated metal collars salvaged from Bay 5 (cinema construction c1990) that have been stored off site at White Bay for reuse in the reinstatement of the timber structure in Bay 5 with new timbers to match existing as documented.
- The contractor is responsible for carrying out of any final milling of the principal supplied new timbers including chamfered edges to columns and profiling of beams to suit the metal collars to match the original details and for cutting to size the new timbers where they exceed the length required.
- The contractor is responsible for all work to the salvaged structural timbers to ensure maximum use of the original timbers which will include but not be limited to splicing beams and columns as detailed by the structural engineer after removal of deteriorated ends of timbers; for strapping to an approved detail split timbers; for all work associated with drilling for dowels to fix the columns and beams to the metal collars.
- The contractor is responsible for the protection and retention of all painted historic signs on the timbers.

Recording

Refer to 0202 DEMOLITION

- Bay 5 Levels 2 , 3 and 4 – west side: Existing structural timbers in situ are to be fully recorded and tagged to approved methods prior to removal and reinstatement with new structural connections to and timber members to ensure the timber columns and beams are returned to their original locations. Methodology for recording, removal and reinstatement to be submitted for approval. Refer to the structural engineers drawings.

1.4 STANDARDS

General

All timber design, material and construction to comply with AS 1720.1 and AS 1720.2.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 1720.1 apply.

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Opening up of select recesses in masonry piers and preparation for fixing the timber beams in the recesses;
- Removal of render for opening up of the filled joist recesses in the walls on the west side of Levels 3 and 4 where the floors with removed;
- Inspection of original timbers salvaged from Bay 5 that are off-site in storage at White Bay and which have been assessed by the structural engineer as suitable for reuse;
- Sample clean of the cast iron collars and column bases prior to installation for approval prior to repainting;
- Reinstated existing timbers on the west side of Level 2 prior to dismantling for new structural connections to cast iron collars;
- Structural timbers on site prior to erection to confirm locations for salvaged and new columns, beams and joists with an approved methodology for installation;
- Structural connection prototype of connection between timber columns and beams to the cast iron columns as detailed on the structural engineer's drawing;
- Structural timberwork after erection - timber columns, cast iron collars and beams in place;
- All fixings of new timbers to existing timbers for trimming the floor openings for Stair 4;
- Bolts after final tightening.

1.7 SUBMISSIONS

Certification

Design: If design by the contractor is required, submit independent certification by a professional engineer of the design and documentation, and of the erected work for conformance with AS 1720.1 and project performance criteria.

Reinstatement of salvaged timbers

- Installation details for the reinstatement of the timber structure and programme of work.
- Details of how the salvaged original timbers will abut and join to existing timbers.
- Base fixing details of columns to the Level 2 concrete slab.
- Detail of wall pocket fixings for beams at the brick piers.

Methodology

- Salvaged timber should go typically at the west side of the building on all floor and then be supplemented with new structural timber (columns, beams, joists) to reinstate the original structure. The principal is to provide a methodology to confirm the heritage strategy.

Materials

Identification:

- Certification: Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying that the timber conforms to the specification, including moisture content.
- Inspection: Submit the inspection authority's certificate verifying that the timber conforms to the specification.

Moisture content: Submit records of moisture content.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

Shop drawings

General: Submit shop drawings showing the following:

- Marking plans showing the location of salvaged and existing timbers at the western end and new timbers towards the centre and eastern end of the building.
- Arrangement of members.
- Location of the selected salvaged members.
- Species, stress grade, strength group and joint group of timber.
- Size of each member.
- Tolerances on member sizes.
- Joint details
- Lifting points and method of installation
- Method of fixing and bracing.
- Long term deflection.
- Moisture content at time of manufacture (new timbers)

Contractor design: For items designed by the contractor, submit independent certification of shop details by a professional engineer for conformance to AS 1720.1 and the project performance criteria.

Prototype connection

The contractor is to provide a sample connection for the works as detailed by the structural engineer to the cast iron collars and column bases prior to installation. Refer to the structural engineer's drawings.

Note

No structural timbers are to be permanently marked as no applied finish is specified for structural timbers.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

2 PRODUCTS

2.1 TIMBER

Structural timber

Conformance: As documented and as in the **Solid timber schedule**.

Appearance grade: Appearance grade if exposed to view in the finished work. Otherwise stud grade or lintel grade, as appropriate.

Timber grading methods:

- Hardwood: To AS 1720.1 Table H2.3 strength group classification.
- Softwood: To AS 1720.1 Table H2.4 strength group classification.
- F-grades: To AS 1720.1 Table H2.1.
- MGP grade: To AS 1720.1 Table H3.1.
- Visually graded F-grade: To AS 2082 or AS 2858.

Stress grade: minimum F17

Preservative treatment: None

Termite treatment: Required. Refer to 0184 TERMITE MANAGEMENT.

New structural timber (does not include the original structural timbers)

Grit blasted or re-machined: Remove all nails and screws.

Stress grade: minimum F17

Identification

Method: Identify timber using branding, certification or both.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

Branding: Brand structural timber, under the authority of a recognised product certification program applicable to the product. Locate the brand mark on faces or edges which will be concealed in the works. Include the following data for timbers not covered by branding provisions in Australian standards or regulations for which branding is required:

- Stress grade.
- Method of grading.
- If seasoned, the word, SEASONED or DRY, or an abbreviation of seasoned, such as SEAS or S.
- The certification mark of the product certification program.
- The applicable standard.

Forest certification

Certification: Forest certification, chain of custody and product labelling to the 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT worksection and as follows:

Timber product application: All structural timbers

Timber source: The Forest Stewardship Council scheme.

Product labelling: AFS/PEFC (Australian Forestry Standard/ Program for the Endorsement of Forest Certification Schemes)

Chain of custody: Australian Forestry Standard AFS certification to AS4707

2.2 FASTENERS

Materials

Conformance: To the fasteners requirements in the *Adhesives, sealants and fasteners* worksection.

Fastener type

Metal fasteners: Select fastener as appropriate for the documented atmospheric category and the life of the structure.

Fastener configuration: If timber elements experience tension perpendicular to the grain, use the appropriate fastener configuration.

Nails and screws

Coach screw diameter: M16 U.N.O. on drawings.

Bolts

Thread: Provide thread length at least four times the bolt diameter.

Holes: Drill bolt holes 2 mm larger than the bolt diameter.

Washers

Standard: To AS 1720.1 Table 4.11.

Timber connections

Refer to the structural engineer's details for the connection of the timber beams into the masonry walls and for the works to connect the cast iron collars to the timber beams and columns.

3 EXECUTION

3.1 TRANSPORT AND DELIVERY

General

Handling and protection: Do not distort or damage timber or timber products. Protect existing painted signs on salvaged timbers

Moisture content: Maintain the equilibrium moisture content of seasoned timber.

Appearance products: Store under cover in an approved location and secure from theft.

Connections

Structural connections: refer to the structural engineer's details.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

Cross references

Refer to the architectural drawings for the location of the timber structure – existing and new.

Refer to the structural engineer's drawings and details for the timber connections and new timbers connected to existing timbers.

4 COMPLETION

4.1 COMPLETION

Tightening

Initial: Tighten bolts, screws and other fixings so that joints and anchorages are secure at the date for practical completion.

Subsequent: If unseasoned timber is used, retighten after 6 months all bolts, screws and other fixings.

As-built drawings

Prepare a report with drawings to record the location of the re-installed salvaged timbers and new timbers together with all drawings and details.

5 SELECTIONS

5.1 SCHEDULES

Solid timber schedule

Refer to the structural engineer's drawings for location of the members in the table below.

Salvaged timbers vary in size and the dimensions provided in the table are approximate.

Salvages timbers refers to the timbers stored at White Bay.

Item	Location	Cross - section (mm)	Length (mm)	Moisture content	F-grade	Treatment	Species
Floor boards *	All	35x140	Varies	Max 15%	Min F11	None	New or recycled hardwood as specified in 0655 TIMBER FLOORING
Joists TJ1 TJ2	All	280x75	Varies	New timber Max 15%; Salvaged - Existing	Min F17	None	Salvaged [Existing], or recycled – new (species by Architect)
Beams TB1 TB2	All	290x290	Varies	Existing	Min F17	None	Salvaged timber
Beams TB3	All	190X45	Varies	Existing	Min F17	None	Salvaged timber
Beams TB4	All	280X75	Varies	Existing	Min F17	None	Salvaged timber
Columns TC1 TC2	All	290x290	Varies	Existing	Min F17	None	Salvaged timber

SPECIFICATION

03 STRUCTURE

0381 Structural timber

Original cast iron collars for beam supports over columns to be used in the reconstruction. These collars are stored at White Bay.

* Refer 0655 TIMBER FLOORING worksection for new floor boards to match existing.

5.2 SCHEDULE OF SALVAGED TIMBERS FOR REINSTATEMENT

The following schedule is the structural engineer's assessment of the existing original timbers stored at White Bay.

- This schedule has informed the Timber Ordering Schedule for the new structural timbers needed to complete the timbers needed in the reinstatement of the timber structure in Bay 5 of the ASN building.

Columns				
			To order	
Required Quantity	Good existing	Maybe existing	Including maybe as good	Excluding maybe
Lengths ~3090-3150m				
20	9	6	5	11

Posts				
			To order	
Required Quantity	Good existing	Maybe existing	Including maybe as good	Excluding maybe
2	0	0	2	2

End Beams				
			To order	
Required Quantity	Good existing	Maybe existing	Including maybe as good	Excluding maybe
26	4	3	19	22

Lengths ~ 3450 - 3550mm

Required end beam length ~3150 --> ~300-400mm embedment on good existing end beams

Mid Beams				
			To order	
Required Quantity	Good existing	Maybe existing	Including maybe as good	Excluding maybe
10	11	1	0	0

Lengths ~3270-3330mm

Joists				
			To order	
Required Quantity	Good existing	Maybe existing	Including maybe as good	Excluding maybe
185	90	0	95	95

5.3 TIMBER ORDERING SCHEDULE

New timber ordering schedule

The below schedule uses quantities which take into account existing structural timber which is fit for reinstatement and does not include any contingency.

SPECIFICATION

03 STRUCTURE

0381 Structural timber

To each of the timber numbers listed below, the principal will be adding a 15% contingency in the timber order. This is to cover shrinkage, warping etc. during seasoning and is also to cover any latent defects in the salvaged timber identified as being sound for reuse.

Member Type	Dimensions mm (seasoned) Depth x width x length (L)	Number to Order:
Columns	310 x 300 x 3400L + 600L contingency	11 + 3 spares
Level 4 - Roof Posts	175 x 175 x 3400L + 600L contingency	2 + 1 spares
Side Beams	310 x 300 x 3500 + 600L contingency	22 + 4 spares
Central Beams	310 x 300 x 3500 + 600L contingency	0
Floor Joists	280 x 75 x 3700 + 600L contingency Joists can be longer and span more than on bay	95 + 15 spares

Material Specifications	
Property	Specifications
Species and grade	Australian Hardwood Structural Strength Grade: S1, S2/ SD1, SD2 F-Grade: Minimum F17 (F27 expected as typical grade) Durability: Class 1,2
Stress Grade	F11
Finish	Dressed all around
Natural Termite Resistance	Resistant
Profile	Square edges
Treatment	None
Straightness	Timber to be straight and aligned fit for intended purpose
Moisture Content	To be delivered seasoned. Timber to be provided with dimensions to allow seasoning to seasoned dimensions given above.

SPECIFICATION

STRUCTURE

0382 Light timber framing

0382 LIGHT TIMBER FRAMING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide timber floor framing and light wall timber stud wall framing, as specified and as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0181 ADHESIVES, SEALANTS AND FASTENERS.
- 0184 TIMBER PRODUCTS, FINISHES AND TREATMENT
- 0184 TERMITE MANAGEMENT

Specified in this worksection

This worksection includes but is not limited to the following:

- Light timber framing for new stud walls;
- Light timber ceiling framing designed to support sheeting flooring below suspended mechanical plant above new amenities on all levels in Bay 5.
- Light timber floor framing for support of plywood sheet flooring on the Ground Floor in Bay 5;
- Packing for timber floor framing on the ground floor where required for providing a level floor finish;
- Timber floor framing for support of compressed fibre cement floors to the new amenities on the ground floor;
- Timber framing for new timber ramps and steps built above timber floor boards;
- Timber framing for new sheet plywood ramps above concrete floors;
- Miscellaneous timber framing as required to complete the works as documented.

Associated worksections

Refer to the following related worksections:

- 0381 STRUCTURAL TIMBER, for reinstatement of the timber structure of columns and beams in Bay 5 with new and existing timbers; reinstatement of existing and new floor joists for the new timber floor boards to the reinstated structure.
- 0342 LIGHT STEEL FRAMING, for steel stud walls to fire-rated services shafts;
- 0511 LINING, for sheet lining boards to be fixed to timber ceiling and wall framing including fibre cement, compressed fibre cement, plasterboard, fire-rated plasterboard and for fire-rated board lining to the fire-rated services duct wall system;
- 0472 ACOUSTIC INSULATION, for sound insulation to timber stud walls to amenities on all floor.
- 0383 SHEET FLOORING, for compressed fibre cement sheeting, structural particleboard flooring; and for plywood sheet flooring with access panels for protection of the existing concrete slabs on the Ground Floor of Bay 5;
- 0655 TIMBER FLOORING, for timber floor boards to match existing and for timber Stair 3 and Stair 4 treads and landings;
- 0472 ACOUSTIC INSULATION, for sound insulation in stud walls and in ceilings where mechanical plant is located above timber framed ceilings.

SPECIFICATION

STRUCTURE

0382 Light timber framing

- 0551 JOINERY, for skirtings, for plywood ramp balustrades and for miscellaneous trim to timber framing as detailed.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for sheet wall linings and sheet flooring finishes and their location.
- Architectural and Structural Engineers drawings for details of light timber wall and floor framing and for the ceiling framing above amenities and below mechanical plant.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in the AS 1684 series apply.

1.4 STANDARDS

General

Framing: To AS 1684.2, AS 1684.3 or AS 1684.4, as appropriate.

Design: To AS 1720.1.

1.5 TOLERANCES

Floors

Maximum deviation from a 3 m straightedge laid in any direction on the floor framing: 5 mm.

Walls tolerances table

Property	Permitted deviation
Generally: Verticality in 2 m	1:500
Generally: Flatness ¹ in 2 m	3 mm
Features ² : Verticality in 2 m	1:1000
Features ² : Horizontality in 2 m	1:1000
1. Flatness: Measured under a straight edge laid in any direction on a surface. 2. Features: Conspicuous horizontal or vertical lines including external corners, parapets, reveals, heads, sills.	

1.6 SUBMISSIONS

Certification

Requirement: Submit certification by a professional engineer of the design, documentation and erected work to AS 1684 and AS 1720.1. Include the following:

- Reactions: Provide location and magnitude of reactions to be accommodated by the support structure.
- Floor / ceiling framing and wall member sizes: A schedule of proposed member sizes, certified as meeting stated project requirements for spans, spacing, loads and deflections.
- Species and stress grade.

Materials

Identification: Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying that the timber conforms to the documented requirements.

Inspection: Submit the inspection authority's certificate verifying that the timber conforms to the documented requirements.

Moisture content: Submit records of moisture content.

SPECIFICATION

STRUCTURE

0382 Light timber framing

Termite resistance: All internal structural timbers are to be termite resistant or treated to be resistant to termites.

CCA treated timber: If proposed to be used, provide details for approval.

Structural HVL timbers: If proposed for new floors on the ground floor of Bay 5, timbers to be equal to Hyspan H2-S Terminator with a 25 year warranty.

Shop drawings

Requirement: Submit shop detail drawings certified by a professional engineer stating that the design has been carried out to AS 1684 and AS 1720.1 requirements for the configurations and loadings.

Include the following where proposed to be used:

- Timber structures for the ceiling framing above new amenities; for new floor above the concrete on the Ground Floor; for timber raised floor framing for the Ground Floor amenities
 - . Floor plans, showing all beam / joist layouts, member sizes and bracing
 - . The method of assembly, connection, lifting, holding down and bracing.

Survey Ground floor Bay 5

Requirement: Provide and submit a detailed survey of the existing concrete floor on the ground floor prior to shop drawings for the new steel Stair 3 and setout of new amenities on the Ground Floor of Bay 5.

Levelling

Design: The new Stair 3 is setout with equal risers from the existing Ground Floor concrete slab to the First Floor. The new timber framed plywood sheet floor is designed to be removable and the finished floor level for the plywood is to be the same as the Stair 3 riser height.

Allow for the timber joists to the ground floor to be packed below with timber to allow for a level floor finish. All joists are to be separated from the existing concrete with 200um polythene plastic sheet cut to size. Only the underside of the joists are to be packed if required.

Subcontractors

Prefabricated items: Submit the name and contact details of proposed manufacturers, suppliers and installers where structures are to be prefabricated.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Ground floor joists and membrane separation before sheeting.
- Staggered floor joists on tied down wall plates to ceiling plant platforms before covering up
- Prefabricated units before installation.
- Fabricated items before priming or water-repellent treatment.
- Bolts after final tightening.
- Timber work after erection but before it is covered.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Do not distort or damage timber or timber products.

Moisture content: Maintain the equilibrium moisture content of seasoned timber.

Protection from weather: Provide temporary protection for members until permanent covering is in place.

SPECIFICATION

STRUCTURE

0382 Light timber framing

2.2 MARKING

Identification

Branding: Permanently mark new structural timber under the authority of a recognised product certification program applicable to the product. Locate the brand mark on faces or edges which will be concealed in the works. For timbers not covered by the branding provisions of Australian standards or regulations for which branding is required, include the following data:

- Stress grade.
- Method of grading.
- If seasoned, the word, SEASONED or DRY, or an abbreviation of seasoned, such as SEAS or S.
- The certification mark of the product certification program.
- The applicable standard.

2.3 TIMBER

Certification

Requirement: Certification, chain of custody and product labelling to the 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT worksection.

Termite resistant timbers

All timbers used in the project are to be termite resistant. Refer Materials in **Submissions**

2.4 COMPONENTS

Fasteners

General: Conform to the 0181 ADHESIVES, SEALANTS AND FASTENERS worksection.

Installation: Do not split or otherwise damage the timber.

Coating: Before placing bolts in contact with CCA treated timber, coat the shank of the bolt in a grease or bituminous coating.

3 EXECUTION

3.1 FLOOR / CEILING FRAMING

Beams and joists

Levelling: Level joists by checking or by packing for the full width of the member with dense corrosion resistant material which is secured in place. To the Ground Floor, l

Maximum thickness of packing: 3 mm.

Spring: Lay joists in long lengths and allow for straightening under loading.

Additional support: Provide a frame member behind every joint in fibre cement sheeting or lining.

Joints

Requirement: Locate joints only over supports:

- Minimum bearing of bearers: 50 mm.
- Minimum bearing of joists: 30 mm.

Fixing and restraint

Fixing: Secure bearers and joists to supports to provide restraint against lateral movement.

Deep joists: To AS 1684.2 clause 4.2.2.3.

Trimmers or blocking dimensions:

- Depth: Joist depth less 25 mm.

SPECIFICATION

STRUCTURE

0382 Light timber framing

- Minimum thickness: ≥ 25 mm.

Ground Floor Bay 5

Floor joists are not to be fixed into the existing concrete slab. The joists and sheet flooring are to be removable in the future without adverse impacts to the existing building fabric of heritage significance.

Wall plate beams

Fixing: Fix timber wall plates/joists as detailed to top of masonry walls with galvanized tie down steel straps to architectural and engineer's details.

Requirement: Provide timber fixing plate beams to transfer the design loads where timber joists bear on walls.

Cross reference

Refer to the 0381 STRUCTURAL TIMBER and to the structural engineer's drawings for existing timber floor joists and for new hardwood joists to match existing to the reinstated and new timber structure and for new herringbone strutting at 1800mm centres to match existing.

Refer to architectural details for floor ceiling structure with timber joists above the amenities to support structural particleboard platform floor above.

3.2 RAMP FLOOR FRAMING

Ground floor raised floor, ground floor ramps and steps

Raised timber floor with a finished overall depth of 170mm is to be constructed with 150 x 45 joists at 450mm centres as detailed on the engineers drawings. Alternative are termite resistant joists hySPAN H2-S Terminator of the same dimension. Plywood finish to raised floor as specified in 0383 SHEET FLOORING. All joists are to have a separation layer / dpc below and are not to be fixed to the existing concrete slab.

Timber framed plywood sheet floors to ramps (N) Ramp 2 and 2/no Step Ramps designed to negotiate change in level from the concrete floor up to the raised floor that is to protect the existing concrete.

Ramps are supported by structural grade timber joists F11 - 70 x 50 mm at 600mm centres to supported as detailed to support plywood sheet flooring. Ramp fall as detailed are to be achieved with graded hardwood bearers and timber posts. Provide noggings between joists where detailed sized to match the joists. Posts and bearers are to have a separation layer / dpc below and are not to be fixed to the existing concrete slab.

Steps: Where detailed frame up timber steps to raised floor level with the amenities on the ground floor. With timber joists spanning the north-south and supported on hardwood framing as detailed.

Ramps are designed to be removable with to have no impacts on the existing building fabric – walls and floors. Finish the edges of the ramps with dressed hardwood wedges – oil sealed.

Refer to the architectural drawings for full details for the ramp floors and support framing and for the steel balusters and plywood balustrades.

Refer to the architectural drawings for full details for the ramp floors and support framing and for the steel and plywood balustrades. Refer 0552 METALWORK for steel balusters and handrails to ramps.

Steps and floors above new timber floors

Fixings to the new timber floor boards are to be minimised as steps and raised floors are designed to be removable and to have minimal impacts on the existing and reinstated building fabric.

Timber framed floor to Ground Floor amenities

Floors to be constructed with 150 x 45 joists at 450mm centres as detailed termite resistant joists hySPAN H2-S Terminator to take 15mm CFC sheet flooring. Support joists on timber plates on dwarf brick walls. Refer to the architectural details.

Steel plate ramps

Steel checker plate ramp to the new Level 1 connection between Bays 4 and 5: 1 in 14 steel plate ramp is to be supported on profiled timber hardwood joists on the timber floor in Bay 4. Refer to the details and to 0552 METALWORK for the steel plate ramp and support and to the architectural details.

SPECIFICATION

STRUCTURE

0382 Light timber framing

3.3 WALL FRAMING

Timber wall framing

Timber wall framing – termite resistant is to be used for wall framing where wall are non fire-rated. Steel stud wall framing can only be used with the approval of the superintendent.

Bracing

Bracing material: Metal

Additional support

Requirement: Provide additional support in the form of noggings, trimmers and studs for fixing lining, cladding, hardware, accessories, fixtures and fittings, as required.

Spacing of noggings: Maximum 1350 mm centres.

Damp-proof course

Requirement: Provide damp-proof courses under masonry dwarf walls and below timber joists on concrete slab on the Ground Floor, as follows:

- Internal walls: Turn up at least 75 mm on the inside and tack to timber joists. Project 10 mm beyond the dwarf wall and turn down at 45°.
- Walls of Toilets: Turn up at least 200 mm on the wet side and tack to studs.

Installation: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints.

Junctions: Preserve continuity at junctions of damp-proof courses, sarkings and waterproof membranes.

Flashings

Location: Provide flashings to external openings to prevent the entry of moisture. Form trays at the ends of sill flashings.

3.4 COMPLETION

Tightening

Requirement: Tighten bolts, screws and other fixings so that joints and anchorages are secure at the date of practical completion.

4 SELECTIONS

4.1 TIMBER STUD WALL FRAMING SCHEDULES

Coordinate framing with LINING worksection.

Refer to floor plans, reflected ceiling plans for location and extent. Refer to details.

Refer to the SH.02 SCHEDULE OF SUBSTRATES AND FINISHES for tile and paint finishes.

WT/01 - Stud Wall Type 01

Location / General description:

GROUND FLOOR
Airlock/Female WC
Airlock/Male WC
Airlock/Kitchenette
Female WC/Kitchenette
Male WC/Cleaner
Male WC/Female WC
Kitchenette/Kitchenette
Male WC (1300mm High Wall)
LEVELS 2, 3 and 4
Airlock/Female WC
Airlock/Access WC

SPECIFICATION

STRUCTURE

0382 Light timber framing

Airlock/Male WC
Access WC/Female WC
Access WC/Male WC
Access WC/Cleaner
Female WC/Kitchenette
Kitchenette/Kitchenette
Male WC/Cleaner
Male WC (1300mm High Wall)

Lining material: Continuous from raised floor to u/s of ceiling/plant platform framing.
Framing width (mm) and type: 1 layer of 9mm fibre cement (FC) to both sides.
Cavity width overall: 1 x 90mm timber wall studs.
Spacing (max) mm: 90mm
Insulation: 600mm
Cross reference: 75mm mineral fibre or polyester partition batts 11kg/cubic metre.
Refer to architectural details.

WT/02 - Stud Wall Type 02

Location / General description: **GROUND FLOOR**
Passage 1/Airlock
Passage 1/Male WC
Passage 1/Kitchenette
Passage 2/Cleaner
Area B/Male WC
Area B/Cleaner
LEVELS 2, 3 and 4
Passage 1/Airlock
Passage 1/Female WC
Passage 1/Male WC
Passage 1/Kitchenette
Passage 2/Cleaner
Passage 2/Male WC
Area (A, B or C)/Male WC

Lining material: Continuous from raised floor to u/s of ceiling/plant platform framing.
Framing width (mm) and type: 1 layer of 9mm FC to one side only - wet area side;
Cavity width overall: 1 layer of 13mm plasterboard (PBD) to one side only - dry area side.
Spacing (max) mm: 1 x 90mm timber wall studs.
Insulation: 90mm
Cross reference: 600mm
75mm mineral fibre or polyester partition batts 11kg/cubic metre.
Refer to architectural details.

WT/03 - Stud Wall Type 03

Location / General description: **LEVELS 2, 3 and 4**
Female WC

Lining material: Continuous from raised floor to u/s of ceiling/plant platform framing.
Framing width (mm) and type: 1 layer of 9mm FC to one side only - wet area side.
Cavity width overall: 1 x 42mm timber wall studs.
Spacing (max) mm: 42mm
Insulation: 600mm
75mm mineral fibre or polyester partition batts 11kg/cubic metre.

SPECIFICATION

STRUCTURE

0382 Light timber framing

Cross reference: Refer to architectural details.

WT/04 - Stud Wall Type 04

Location / General description: **GROUND FLOOR**

EDB/Cleaner

EDB/Female WC

EDB/Store

Passage 2/EDB

Passage 2/Store

Store/Kitchenette

Store/Area A

LEVELS 2, 3 and 4

Passage 2/EDB

Passage 2/Store

EDB/Store

Store/Kitchenette

Store/Breakout or Area A or Foyer

Lining material: Continuous from raised floor to u/s of ceiling/plant platform framing.
1 layer of 13mm Fyrchek to both sides.
Note: 1 layer of 13mm Fyrchek MR to be used instead where side of wall is in a wet area.

Framing width (mm) and type 1 x 90mm timber wall studs.

Cavity width overall: 90mm

Spacing (max) mm: 600mm

Insulation: 75mm mineral fibre or polyester partition batts 11kg/cubic metre.

Cross reference: Refer to architectural details.

Service Riser Shaft Wall

Refer to 0342 LIGHT STEEL FRAMING

SPECIFICATION

STRUCTURE

0383 Sheet flooring

0383 SHEET FLOORING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide sheet flooring as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0188 TIMBER PRODUCTS, FINISHES AND TREATMENT
- 0184 TERMITE TREATMENT
- 0181 ADHESIVES, SEALANTS AND FASTENERS

Specified in this worksection

- Compressed fibre cement sheeting to raised floors to amenities on the ground floor and to above timber floor boards on the upper levels to wet areas.
- Plywood sheet flooring to the raised floor above the ground floor concrete.
- Structural particleboard sheet flooring above the ceiling joists to the amenities on each floor.
- Compressed fibre cement flooring to new wet areas scheduled to take floor tiles on each level
- Access panels in sheeted floors for services access.
- Access panels in ceilings and in the upper surface for access to mechanical plant above the new amenities.
- Mesh edge to perimeter of the subfloor below raised plywood floor on the ground floor to ventilate the subfloor space.

Associated worksections

Refer to the following related worksections:

- 0335 BRICK AND STONE MASONRY, for brickwork to brick piers where used as alternative to proprietary subfloor support structure to raised floors.
- 0382 LIGHT TIMBER FRAMING, for timber floor joists above concrete floors for protection and for support to sheet flooring above amenities; for timber framing
- 0655 TIMBER FLOORING, for timber floor boards to the reinstated floor structure to match existing;
- 0551 JOINERY, for plywood balustrades to ramps;
- 0671 PAINTING, for non-slip paint finish to plywood ramps and plywood step nosings on the Ground Floor of Bay 5;
- 0651 RESILIENT FINISHES, for vinyl sheeting to CFC floors to Cleaners and where scheduled.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of sheet flooring;

Refer to Architectural drawings for wet area details

Refer to Structural Engineers drawings for timber to the ground raised floor.

1.3 STANDARD

General

Flooring and decking: To AS 1684.2, AS 1684.3 or AS 1684.4, as appropriate.

SPECIFICATION

STRUCTURE

0383 Sheet flooring

Structural Plywood: To AS/NZS 2269

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Butt joints (flooring): Floor units cross cut square with plain ends for joining over supports.
- Flooring - Fitted: Flooring fitted between the walls of each room.
- Flooring - Intermittently-supported: Flooring which is supported by, and spans across, beams or joists.
- Subfloor: The structure that supports the sheet flooring
- T&G – tongue and grooved

1.5 TOLERANCES

Floors

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

1.6 SUBMISSIONS

Certification

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.

- Timbers for which certification is required: Timber joists. Refer to 0382 LIGHT TIMBER FRAMING

Inspection: If neither branding nor certification is adopted, submit a report by an independent inspecting authority verifying conformance.

- Inspecting authority: Forestry Corporation NSW

Samples

General: Submit samples for the following for approval:

Samples schedule

Item	Sample size (mm)	Number
Plywood sheet flooring	500 x 500mm	xxxxxxx
Flush counter SS sunk screws	-	3/ no for fixing of plywood sheet flooring
Access panel	450 x 450mm	1/no concealed frame for flush floor mounting in plywood
Ventilation mesh	100 x 300mm	1/no Gunmetal powdercoated aluminium 1/no Clear anodized aluminium

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Subfloor with brick piers, timber joists and bearers / wall plates in place before laying fibre cement flooring to ground floor amenities.
- Subfloor with timber joists in place before laying plywood sheet flooring to ground floor open areas.
- All services installed and tested in the subfloor before covering up.

SPECIFICATION

STRUCTURE

0383 Sheet flooring

- All building rubbish removed from all areas before covering up.

2 PRODUCTS

2.1 SHEET FLOORING

Particleboard

Particleboard flooring: To AS/NZS 1860.1, Class 1.

Particleboard formaldehyde emission Class to AS/NZS 1860.1: Class E₁.

Thickness: 18mm

Identification

General: Identify timber using branding or certification.

- Branding: Brand plywood and particleboard under the authority of a recognised product certification or accreditation program applicable to the product. Locate the brand mark on faces or edges which will be concealed.
- Provide certification from the recognised product certification or accreditation programs, as appropriate:
 - . Plywood and particleboard: Engineered Wood Products Association of Australasia Quality Control and Product Certification Scheme.

Plywood

Standard: To AS/NZS 2269.0.

Plywood formaldehyde emission class to AS/NZS 2269.0: Class E₁.

Grading:

- Stress grade: 'C' faces and 'back' 'D'
- Surface grade: CD.
- Bond: Type A to AS/NZS 2754.1.

Durability:

- Preservative treatment to AS 1604.1 Table D1:
 - . Indoors above ground: H2 minimum.
- Identification: Brand preservative treated decking timber to AS 1604.1 – to underside / back face.

Fixing Plywood flooring

- Installation: To AS 1684.2, AS 1684.3 or AS 1684.4, as appropriate. Sheets to be screw fixed for ease of removal and refixing by tenant in services installation below the floor.
- Sheet sizes: 2400 x 1200mm x 19mm

Selection: Gunnerson T&G cross laminated plywood pre-sanded Grade C face panel sheets 19mm thick for paint finishing. Refer to 0671 PAINTING

Compressed fibre cement sheeting

Standard: To AS/NZS 2908.2.

Category: 5.

- Type: B.
- Thickness: 15mm

2.2 RAISED SHEET FLOORING SUPPORT STRUCTURES

Structure for raised floors

Requirement: Raised floors are required to be installed in Bay 5 on the Ground Floor to conceal new hydraulic services above the existing concrete floor below the new amenities and for protection to the

SPECIFICATION

STRUCTURE

0383 Sheet flooring

existing concrete floor that has heritage significance. Raised floor structures are designed to be removable in the future and are to have minimal impact on existing heritage fabric and new fabric. Provide raised floors with timber structures to the following areas and as shown on the plans:

- Ground Floor Bay 5 to Amenities [5G.02, 5G.03, 5G.04], and Passage 1 – 450mm high;
- Ground Floor Bay 5 to 5G.01 Area A; 5G.05 Passage 2, 5G.08 Passage 1; 5G.07 Area B – 170mm high; timber framed ramps on the ground floor.

Cross references

- Refer to 0342 LIGHT TIMBER FRAMING, for timber and ramp floor structure;
- Refer to the structural engineers drawings for timber joist layouts
- Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES and architectural drawings for the location of sheet flooring and finished to raised floors.

Shop drawings

Shop drawings to be provided. Refer **Submissions**.

Timber framed plywood ramps, ramp edges and steps – Ground Floor

Provide graded timber joists to support the plywood ramp sheeting. Provide joists at 450mm centres.

Cross reference

Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES for sheet flooring and finishes to raised floors and ramps.

2.3 VENTILATION MESH

Mesh to perimeter of raised ground floor plywood floors

Provide ventilation grilles (pedestrian strength) of internal sub-floor spaces to raised floors internally in the floor finish.

Mesh : Lockers perforated aluminum mesh

Product Code: R01636

Finish: Natural Mill finish

Location: Provide to the edges of the plywood timber framed floor along the north and south walls on the ground floor of Bay 5.

Cross reference

Refer to the Architectural drawings and SH.02 SCHEDULE OF SUBSTRATES AND FINISHES.

2.4 FLOOR ACCESS PANELS

Access for future tenant services

Requirement: Provide accessible opening to future tenant services in the 170mm raised floor structures. Locations to be confirmed on site.

Construction: Custom-made plywood lined 450 x 450mm floor access panel with timber subframe for the plywood panel to finish flush with the adjacent floor and finish.

Locations and Finish: Ground Floor: 5G.01 Area A; 5G.05 Passage 2; 5G.07 Area B. Finish to match the floor. Refer to 0671 PAINTING

Hardware: Whitworths flush pull stainless steel. Code : SKU:38039

Number: Contractor to allow for the installation of 8/no access panels in the plywood ground floor.

Location: Confirm location of access panels with the superintendent before installation.

SPECIFICATION

STRUCTURE

0383 Sheet flooring

3 EXECUTION

3.1 GENERAL

Subfloors

General: Make sure support members are in full lengths without splicing.

Flatness: Less than 3 mm deviation of the substrate under a 3 m straight edge laid in any direction with no abrupt variations greater than 1 mm over 250 mm.

Sheet flooring on timber joists

General: Screw fix sheet flooring to seasoned joists to the steel joists with spans not greater than 1800mm.

- Joists size: Minimum 35 mm thick. Refer to engineers and architectural details
- Spacing of fasteners: to manufacturer's recommendations. Screw fixings to plywood flooring will be visible in the completed floor. Refer to **Submissions** in this worksection for samples for approval.

3.2 FIXING SHEET FLOORING

Particleboard flooring

Installation: To AS 1860.2.

Plywood flooring

Installation: To AS 1684.2, AS 1684.3 or AS 1684.4, as appropriate. Screw fix only.

Compressed fibre cement flooring

Installation: Lay the length of the sheets parallel or at right angles to the joists / steel frame. Locate end joints centrally over joists / steel frames. Provide noggings or trimmers joists, cut between and fixed to joists to support the edges of sheets.

Minimum number of spans across support: 2.

Apply sealant to screw hole and screw before fixing and stop screw head with sealant, finished slightly below the surface after fixing.

Fixing: Pre-drill screw holes with 1 mm clearance over screw diameter and countersink. Fix with corrosion resistant countersunk screws.

Spacing of fasteners:

- Sheet edge and intermediate: Less than 450 mm.
- Corners and sheet edges: At least 12 mm from sheet edges and 50 mm from corners.

Joints: Provide butt joints 5 mm wide. Insert compressible closed cell polyethylene foam backing rod and fill the joint with a flexible sealant.

Wet area flooring: Stop screw heads with sealant before installing waterproof membrane.

Particleboard flooring

Installation: In conformance with manufacturer's recommendations.

Cross reference

Refer to 0651 RESILIENT FINISHES for fibre cement underlay to top of reinstated timber floor boards to be waterproofed and finished with resilient sheet flooring.

SPECIFICATION

STRUCTURE

0383 Sheet flooring

4 SELECTIONS

4.1 SCHEDULES

Sheet flooring schedule

Property	A	B	C
Material	Compressed fibre cement	Particleboard-Structural	Plywood Flooring
Legend	CFC	PTD/FLR	PLY/F
Type Grade	Hardiepanel compressed sheet	CHH Structaflor T&G sheet flooring	Gunnersons square edge Plywood flooring (T&G removed)
Thickness (mm)	15mm	19mm Yellow Tongue	19mm
Fixing	Screw fix to the new timber floor boards to allow for removal in the future. Do not glue fix.	Refer to manufacturer's instructions	Screw fix to timber joists to allow for removal for services
Substrate support	Timber framing of joists (Bay 5 Ground Floor) and timber floor boards (levels 1,2,3 and 4 amenities)	Timber ceiling joists	Timber joist above existing concrete slab. Refer to Engineer's drawings
Finish	Ceramic tiles and vinyl sheeting	Paint finish – sheeting concealed from view above the amenities	Stain and clear finish Ramps – non-slip paint finish. Refer 0671 PAINTING
Location	To Amenities on the Ground Floor and to all other amenities above new timber floor boards.	Above new amenities	Ground Floor – floors and ramps

Cross references

For toppings to sheet flooring to achieve falls, refer to the Architectural Drawings and to 0631 CERAMIC TILING

For waterproofing refer to 0621 WATERPROOFING – WET AREAS

For locations, refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES

SPECIFICATION

04 ENCLOSURE

0411 Waterproofing – external

0411 WATERPROOFING – EXTERNAL

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide deck waterproofing systems to substrates, as documented, which are:

- Waterproof for a five minutes duration rainfall intensity, for an average recurrence interval of 100 years.
- Graded to falls to dispose of stormwater without ponding above the depth of lapped seams.
- Able to accommodate anticipated building movements.
- Able to accommodate its own shrinkage over the warranty life of the roofing system.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection:

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Waterproof membranes includes but is not limited to:

- Waterproof membrane to the roof Store Room (former Lift Motor Room) concrete roof slab.
- Return for applying waterproof membrane over the safe roof access anchors when installed.

Associated worksections

Refer to the following worksections:

- 0552 METALWORK, for safe roof access system from the roof plant platform up to the Store Room (former Lift Motor Room) roof for maintenance.
- 0421 ROOFING, for removal of the roof access hatches in Bays 4 & 5 roof and for restoring the slate roof to existing details where they are removed; for new roof access panel in Bay 5 slate roof;
- 0612 CEMENTITIOUS TOPPINGS, for cement based toppings to provide falls where scheduled.
- 0621 WATERPROOFING – INTERNAL for waterproof membranes to the floors to wet areas including Male/Female/Access Toilets and Cleaners.
- Architectural drawings for the location of the Store Room (former Lift Motor Room) on the roof.

1.3 STANDARDS

Membrane materials

Standard: To AS 4654.1

Membrane design and installation

Standard: To AS 4654.2.

Stormwater drainage

Standard: To AS/NZS 3500.3.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 4654.1 and AS 4654.2 and the following apply:

- Acrylic - liquid applied: Water based formulations which air dry to form plastic membranes.

SPECIFICATION

04 ENCLOSURE

0411 Waterproofing – external

- Bond breakers: A system preventing a membrane bonding to the substrate, bedding or lining.
- Double detail joint: A joint formed by turning up and bonding the horizontal membrane to a vertical substrate and adding an overflashing of membrane material bonded to the vertical substrate and folded over and bonded to the horizontal membrane. In certain situations the double detail can be achieved by bonding an angle profile of membrane material to the junction prior to laying the membrane.
- Elastomer: A polymer having elastic properties similar to rubber.
- PVC membrane: Flexible plastic sheet membrane (vinyl).
- Polyurethane - liquid applied: Water or solvent based formulations which moisture cure to form an elastic rubber membrane.
- Seamless membranes: Membranes applied in liquid or gel form and air cured to form a seamless film.
- Slip sheet: A sheet used to isolate the membrane system from the supporting substrate or from the topping or mortar bedding. The most common material is polyethylene sheeting.
- Substrate: The surface to which a material or product is applied.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made as follows:

- Services in the roof to confirm they are to remain;
- Steel channel and fixings to confirm repairs or if channel can be removed.
- Substrate cleaned and preparation completed.
- Membrane installed.
- Membrane after the safe roof access system is installed.

Notice required: 2 working days.

1.6 SUBMISSIONS

Execution records

Placing records: Photographically record the application of membranes and label with the following information:

- Date.
- Portion of work.
- Substrate preparation.
- Weather during application and curing.
- Protection provided from traffic and weather.

2 PRODUCTS

2.1 MEMBRANES

Membrane systems

Requirement: Provide a proprietary membrane systems certified as suitable for the intended external waterproofing. Refer **Selections**.

SPECIFICATION

04 ENCLOSURE

0411 Waterproofing – external

2.2 PROTECTION

Protection

Description: Protection board: plywood board sheeting if required before safe roof access system anchors are installed.

Protect wireless antennae for CCTV on the west wall of the Store Room (former LMR) at all times.

3 EXECUTION

3.1 PREPARATION

General

Existing substrate: The existing concrete roof slab is laid to falls and appears to have no applied finish or membrane. The concrete roof substrate needs to be ground to remove all laitance, surface grime build-up to provide a good solid substrate which can be repaired where needed by the waterproofer prior to membrane installation.

Steel beam: The central east west steel channel beam on the top of the slab is bolted into the roof slab and supports connections from 2 threaded rod ties from the roof level to the existing steel platform. Investigate with the structural engineer, the removal of the steel beam in the centre of the roof before installing membrane. Allow for the retention of this beam in the new membrane installation. Allow for the removal or preparation of any existing membranes if they are found to exist on inspection.

Substrates: Prepare substrates as follows:

- Prepare existing finish to membrane manufacturer's instructions.
- Fill all cracks in substrates wider than 1.5 mm with a filler compatible with the membrane system.
- Fill voids and hollows in concrete substrates with a concrete mix not stronger than the substrate.
- Remove projections.
- Remove deleterious and loose material.
- Remove all traces of a concrete curing compound if used.
- Leave the surface free of contaminants, clean and dust free.

Moisture content

Concrete substrates (toppings): Cure for more than 21 days.

Moisture content: Verify that the moisture content of the substrate is compatible with the water vapour transmission rate of the membrane system by testing to AS 1884 Appendix A.

Test type: select from the following:

- Hygrometer test: Seal a hygrometer to the substrate for more than 16 hours and measure the relative humidity of the air between the instrument and the slab.

Falls

Verify that falls in substrates are greater than 1.5%.

Priming

Compatibility: If required, prime the substrates with compatible primers for adhesion of membrane systems.

3.2 APPLICATION

Protection during installation

Damage: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage.

Curing of liquid applied systems

General: To the manufacturers' instructions.

SPECIFICATION

04 ENCLOSURE

0411 Waterproofing – external

Control of movement

General: Provide control joints located over control joints in the substructure.

Fillets and bond breakers: Size to allow the membrane to accommodate movement.

Control joint covers: Install after fixing hobs and membranes.

Membrane terminations

Membrane upturns: Provide upturns above the maximum water level expected from the exposure conditions of rainfall intensity and wind.

- Height: To AS 4654.2 Appendix A.
- Anchoring: Secure sheet membranes along the top edge.
- Edge protection: Protect edges of the membrane.

Vertical upward terminations: terminate under an overflashing of liquid applied membrane as detailed on the drawings

Vertical downward terminations: extend membrane to the underside of a horizontal return.

Horizontal terminations: Do not provide. Use vertical terminations.

Membrane vertical penetrations

Any slab attachment including the safe roof access system: Provide separate sleeves for all pipes, ducts, and vents and have them fixed to the substrate.

Membrane at post supports or other roof attachments

Post supports fixed before membrane and membrane applied over the base plate fixings.

Membrane to roof access anchors

Where anchors are fixed after waterproofing, the base of the anchors will require additional waterproofing over the bases.

3.3 COMPLETION

Protection

General: Keep traffic off membrane surfaces until bonding has set or for 24 hours after laying, whichever period is the longer.

Reinstatement: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Warranties

Waterproofing: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the applicator.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier. Refer to 0171 GENERAL REQUIREMENTS.

4 SELECTIONS

4.1 EXTERNAL WATERPROOFING SCHEDULE

Liquid membrane system schedule

Location	Proprietary system
Store Room Roof (former Lift Motor Room Roof)	Tremco Pty Ltd Contact: Darin Fitzgerald M. 0401 772 563 T. 9638 2755 TREMproof® 200EC/Vulkem®360NF/951NF/Aggregate/951NF [Slip resistant aggregate) TREMproof® 200EC Epoxy Primer as first coat. Membrane final coat colour to approval.

SPECIFICATION

04 ENCLOSURE

0411 Waterproofing – external

	Cleaning / preparation for membrane Remove existing non-compatible membranes where present and prepare as follows: Clean the existing concrete substrate and prepare to manufacturer's instructions, including the following: - Remove all laitance, urban grime on the existing concrete slab and slab sides. - Investigate the removal of the steel beam as shown on the drawings and allow for removal if required. - Make sure the substrate is smooth and contains no voids / honeycombing that any affect the membrane coating. - Fill all voids / holes/ cracks in the substrate with appropriate and membrane compatible filler and allow to cure. - Verify slab is laid to falls and allow to lay a cementitious topping to falls as required and as instructed by the superintendent; - Repaired areas are to be primed with TREMproof 200EC. Membrane 1. Apply two coats Tremproof 200EC Epoxy Primer at 3m²/Litre with roller to the entire substrate to receive membrane. Allow to cure overnight or minimum 8 hours. Second coat of Tremproof 200EC Epoxy Primer should be applied in a different direction to the first coat. 2. Allow moisture or condensation dry before membrane application. 3. Apply Vulkem® 360NF/951NF Slate Grey (two part) Polyurethane with roller at 0.85m²/Litre. Waterproofer is to include for returning to the site after the installation of the Safe Roof Access system to waterproof over the roof slab anchor connections. Cross reference: 0161 CEMENTITIOUS TOPPINGS for concrete toppings.

SPECIFICATION

04 ENCLOSURE

0421 Roofing

0421 ROOFING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide roofing systems and associated work which:

- Remains intact and waterproof under the local or regional ambient climatic conditions.
- Maintains the existing building free of water ingress and pollutants during and after the works.
- Protects existing internal building fabric and ceilings from mechanical damage during the works.

1.2 PERFORMANCE

Roof access

Type: normal roof access. Refer to 0552 METALWORK for safe roof access system to roof of Store Room.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following worksection:

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

The roofing works includes, but is not limited to the following:

- Removal of nominated existing roof access hatches in Bay 4 and 5 slate roofs and associated flashings and restoration of the slate roof and substrate to match existing roof;
- The installation of salvaged and new timber boards and new slate battens to match existing for restoration of the roof after the removal of the roof access hatches;
- Construction and installation complete with lead flashings of a new roof access hatch with ladder on the south face of Bay 5 slate roof;
- The supply and installation of new slates to match existing, installed to match existing fixing details and fully integrated into the existing slate roof;
- The forming of new roof penetrations for vent pipes, exhaust and supply air ducts and for the salvaging of slates and roof timbers for reuse in the works; lead flashings of ducts to the slate roof;
- Protection to openings in the roof to maintain the building waterproof at all times;
- The provision of all under and over-flashings to ducts and pipes and other roof penetrations;
- The provision of samples – material and fixings

Associated worksections

Refer to the following related worksections:

- 0411 WATERPROOFING – EXTERNAL, for new waterproof membrane to the Store Room (former Lift Motor Room) concrete roof.
- 0552 METALWORK, for installation of a safe roof access system up to the Store Room roof from the roof platform; for internal ladder access for services plant maintenance on Level 4 in Bay 5; for extensions to the existing external roof platform complete with handrails and floor grating to match existing; for replacement steel grating to the existing plant platform; for aluminium slat screens to Store Room walls to conceal new mechanical services ducts and for new external ramp and balustrades;
- 0453 DOORS AND ACCESS PANELS, for new access door and frame from the Store Room onto the roof plant platform.

SPECIFICATION

04 ENCLOSURE

0421 Roofing

- MECHANICAL SERVICES, for removal of redundant plant and for new mechanical services plant on the roof plant platform; for service duct and pipe risers penetrating the roof and for flashings.
- HYDRAULIC SERVICES, for new vent pipes penetrating the roof and for flashings;
- Architectural drawings for the location of the existing roof access hatches to be removed and new roof hatch location; Store Room and access inside Bay 4, external roof plant platform and screen to the Store Room.
- Structural engineer's drawings for the repairs and protection treatment to the existing steel plant platform structure mounted above the party wall between Bays 4 and 5 and for new steel members to the existing roof platform and platform extension.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Roof supports – rafter locations and confirmation of the new roof hatch and duct positions before forming penetrations.
- Timber roof substrate after removal of slates where new ducts are to penetrate the roof.
- Flashings installation to new ducts.
- Removal of the nominated roof hatches and timber boarding in place before covering up.

1.5 SUBMISSIONS

Samples

Requirement: Submit samples of the following:

Slates and support structure

- Slate tiles to match the size, edge details, colour of the existing slates with similar fixing details.
- Fixing accessories – to match existing
- Slate battens to match existing.
- Slate membrane layer.
- Slate fixing accessories.

Slates: Contractor is to allow in their tender price for the supply and installation of new slates to match existing. Selection: Welsh slates - Penryhn Heather Blue.

Shop drawings

Provide shop drawings for the new roof access hatch to include details of:

- Plans, sections and cross sections showing the hatch in the roof structure and slates;
- All flashings to provide a waterproof installation.

Cross reference

Refer to **Site Photographs** in this worksection of the Bay 5 roof hatch to be removed.

2 PRODUCTS

2.1 COMPONENTS

Fasteners

Finish: Prefinished exposed fasteners with an oven baked polymer coating to match the roofing material.

Fastenings to timber battens: Provide fastenings just long enough to penetrate the thickness of the batten without piercing the underside.

SPECIFICATION

04 ENCLOSURE

0421 Roofing

2.2 SLATE ROOFING

Fasteners

Standard: To AS 4597 clause 2.4.

Material

Type of slate: Welsh slate - Penryhn Heather Blue

Length: to match existing slates

Width: to match existing slates

Underlayer membrane: to match existing

Fixing method: nail or clip to match existing.

Flashings: lead flashings to match the weight of the existing flashings.

Installation

Standard: To AS 4597.

2.3 ROOF PLANT PLATFORM

Description

General: A proprietary roof walkway system including fixings.

Cross Reference

Refer to 0552 METALWORK worksection

2.4 ROOF SAFE ACCESS SYSTEM

Cross reference:

Refer to 0522 METALWORK worksection for the roof access ladder and anchors for access from the roof plant platform up to the roof of the Store Room for maintenance purposes.

2.5 ROOF ACCESS HATCH

Description:

General: A proprietary roof hatch system including framing, fixing, trim, seals, accessories and flashings.

Product: SafeMaster Safety Products Pty Ltd.

To have gas struts for assisted opening and control closing; water tight gasket, incorporating a flashing skirt, and back flashing and be lockable,

Size (mm): to suit the roof rafter spacing with minimal removal of timbers; allow for 800 x 800mm to be confirmed on site

Material: Heavy Duty Powdercoat Dulux Powdercoat Fluoraset on steel 0.55mm BMT. Colour to be selected to closely match the lead flashings.

Ladder: MLS102 SKYCLIMB mini access ladder with extendable stiles. Width 600mm by 3000mm long. Length to be confirmed on site.

2.6 ROOF PENETRATIONS

Ducts and pipe roof penetrations

To all mechanical ducts, pipes and services penetrating the roof, allow to remove slates and form neat holes in the timber lining boards to suit the pipe or duct size to form the penetration. No purlins or trusses are to be cut for the new penetrations. Where rafters are required to be cut for the size of the ducts or for the roof access hatch, reuse the removed timbers to trim the openings. Salvage the timber lining boards for use in restoring the roof where access hatches are removed.

SPECIFICATION

04 ENCLOSURE

0421 Roofing

Under and over flashings to ducts and pipes to be either copper or lead to be compatible with the existing flashing. Flashing materials to be used before installation. Dekite flashing or equal are not approved for use.

3 EXECUTION

3.1 STORAGE AND HANDLING

Slate roofing

Storage: Store roofing materials on a level base to prevent damage. Do not store materials in contact with other materials which may cause staining, cracking or other damage.

Handling: Handle roofing materials as follows:

- Use soft soled shoes when fixing or working on roofs.
- Protect edges and surfaces from damage.

3.2 INSTALLATION

Protection

General: Keep the roofing and rainwater system free of debris and loose material during construction, and leave them clean and unobstructed on completion. Repair damage to the roofing and rainwater system.

Completion: Replace any broken, cracked slates in the immediate vicinity of the works as a result of the works in this contract.

Tolerances

Shingles, shakes and slate: To AS 4597 clause 3.2.

3.3 SLATE ROOFING

Installation

Standard: To AS 4597.

3.4 COMPLETION

Cleaning

Remove: Excess debris and unused materials.

Clean off: Exposed metal surfaces that interfere with uniform weathering or oxidation.

Replace: Materials that have been damaged or deteriorated.

Roof plumbing: Clean out gutters and rainwater pipes after completion of roofing and access installation works.

Spare slates

Number: Provide 30 spare matching slates

Location: Allow for storage in the Store Room with this location to be confirmed by the superintendent.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and installer.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier/manufacturer.

4 SITE PHOTOGRAPHS

4.1 EXISTING ROOF



IMAGE 1:

Image of an existing roof hatch to be removed and slate roof and structure reinstated to match existing.

Refer Roof Plan for the number and location of roof hatches to be removed in the roof of Bays 4 and 5 and for the new roof hatch location in the Bay 5 south roof.



IMAGE 2:

Existing roof plant platform above parapet between Bays 4 and 5 and mechanical services plant (to be removed) looking west towards the Store Room (former LMR)

Existing Toilet exhaust shown near the Plant Room wall to be retained.



IMAGE 3:

View looking towards west towards the Plant Room (former LMR) with the existing roof platform and mechanical plant between Bays 4 and 5 in the foreground.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

0453 DOORS AND ACCESS PANELS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide doors, frames, doorsets, glazed steel doors and partitions and fire-resisting doorsets, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0183 METALS AND PREFINISHES
- 0181 ADHESIVES, SEALANTS AND FASTENERS

Specified in this worksection

Doors and access panels includes but is not limited to:

- flush timber doors – swing and sliding;
- flush timber doors with louvres grilles;
- fire rated doorsets;
- steel door frames – fire rated and non-fire rated;
- fire rated access panels to service ducts;
- steel framed glass doors, steel framed glass sidelights and steel framed glass partitions;
- steel framed mesh sliding doors;
- installation of doors and doorsets;
- refurbishment of existing timber cargo landing doors on the west façade on Levels 3 and 4 with new hardware to reinstate the sliding operation;
- refurbishment and fixing of existing brass salvaged door 'D' handles to be reused on new steel and glass doors;
- automatic sliding glass door operators for glass doors.

Related worksections

Refer to the following worksections:

- 0202 DEMOLITION, for salvaging of existing doors for return to the Principal; for salvaging of brass handles from steel doors in Bay 4 to be reused on new doors.
- 0455 DOOR HARDWARE, for supply and installation of door hardware to new and existing doors including door seals, smoke seals, brush seals, door hardware, hinges and keying; new hardware and refixing existing hardware.
- 0551 JOINERY, for refurbishment of existing timber doors and for joinery doors.
- 0552 METALWORK, for aluminum louvre window to Store Room, weather bars below external doors; weather strips below internal doors.
- 0421 ROOFING, for new roof access hatch and ladder.
- 0467 GLAZING AND GLASS COMPONENTS, for glass in steel framed glass doors, highlights and partitions; internal fixed glass screens; for glazing films; for glass to automatic sliding glass doors.
- 0511 LINING, for access panels in walls and ceilings; fire-rated access panels for services access.
- 0531 SUSPENDED CEILINGS, for ceiling access panels in suspended ceilings.
- 0383 SHEET FLOORING, for access panels and ventilation mesh to edges of raised floors.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

- 0671 PAINTING, for decorative paint finishes for doors and door frames; for painting of steel and glass doors and partition frames; for painting of steel rails and brackets on sliding cargo doors and for extent of external painting included in this contract and for exclusions from this contract.
- MECHANICAL SERVICES, for powdercoated or clear aluminum louvres to be installed in timber doors; for access panels required for services access.
- ELECTRICAL SERVICES, for details of access control requirements for doors and automatic hold open devices to new fire doors.
- Architectural drawings for the floor plans, Door and Window Schedule, steel door frame profiles, glazed steel doors and glazed steel partition frames.

Recently completed works by the principal.

External building fabric maintenance works undertaken to the ASN Co Building included the following works:

- Installation inside Bay 5 of new head tracks and steel framing support for the guides for the sliding operation of timber cargo landing doors on the east façade on all floors from Level 1 to Level 4 inclusive.

These sliding doors are to be inspected after demolition of the cinemas and condition recorded. The sliding operation is to be confirmed as working after the new timber floors have been installed. The contractor is to allow for works to the lead flashing screwed to the rear of the doors. Refer to the photos in this worksection.

Refer to **Doors** in this worksection for refurbishment work to these doors and work to the cargo landing doors to the east and west side of Bay 5.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Balanced construction: Flush door construction where the facings on one side of the core are nominally equal in thickness, grain direction, properties and arrangement to those on the other side of the core, such that uniformly distributed changes in moisture content will not cause warpage.
- Door frame: Includes jamb linings.
- Doorset: An assembly comprising a door or doors and supporting frame, guides and tracks including the hardware and accessories necessary for operation.
 - . Fire-doorset: A doorset which retains its integrity, provides insulation and limits, if required, the transmittance of radiation in a fire.
 - . Smoke-doorset: A doorset which restricts the passage of smoke.
- Flush door: A door leaf with two plane faces which entirely cover and conceal its structure. It includes doors with intermediate rail, cellular, blockboard, medium density fibreboard (MDF) and particleboard cores.
 - . Solid core door: A flush door with a solid core continuous between stiles and rails or edge strips and fully bonded to the faces.
- Joinery door: A door leaf with either stiles and rails, or stiles, rails and muntins, framed together. A joinery door may also incorporate glazing bars.
 - . Louvred door: A joinery door with spaces filled in with louvre blades.
 - . Panelled door: A joinery door with spaces filled in with panels including glass.
 - . Boarded door: A timber framed and braced door with vertical lining boards on outer face.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

- Existing Bay 5 sliding timber cargo landing doors and hardware including door tracks, door rollers, hangers, doors handles and locking hardware to east façade on Levels 1, 2, 3, and 4 after demolition works;
- Timber cargo landing doors Levels 3 and 4 and glass screen frame fixed to the west façade before removal.
- Bay 5 Entry hinged doors to Level 2 before installation of new door hardware to confirm location and fixings.
- Setout position and confirmation of external platform floor level for the new Store Room door that is to connect onto the roof platform before forming door opening in concrete wall.
- Door frames in place before building in to masonry – brick and sandstone and stud walls.
- Door frames installed before fixing trim.
- Fabricated steel glass doors and partitions delivered to site before installation.
- Steel structural frames before fixing to timber structure and floor as required for support of glass and steel partitions in Bay 4 on Levels 2, 3 and 4.
- Framing or structure to receive floor guides / floor tracks to sliding doors
- Head tracks (where specified) and floor guides installed before existing timber boarded cargo doors are rehung.
- Openings prepared before steel framed mesh sliding doors are installed.
- Automatic doors operators – support framing for installation.

Hold Points:

- Existing cargo landing doors and hardware after demolition works to confirm the floor details and the base condition of existing doors and sliding door hardware.
- Set out of the position of the new Lobby Doors in Bay 4 on Levels 2, 3 and 4 relative to the existing timber structure at the head;
- Setout of the new Store Room door to confirm location and threshold level relative to the existing webforge plant platform floor on the roof.

1.5 SUBMISSIONS

Samples

General: Submit 2 samples as follows:

Colour range from prefinished production material (e.g. anodised or organic coated extrusions and sheet). Following the colour selection, submit 5 sets of samples showing the colour range.

- Finishes to prepared surfaces.
- Joints using proposed techniques.
- Proposed sections for frames, louvres and slats.

Provide samples for :

- Steel member sections for steel framed glass doors and for steel framed glazed partitions to match existing – stiles, head, bottom rails, transom and glazing bars.
- Refurbished salvaged brass 'D' handles for reuse on new steel framed glazed doors prior to fixing.
- Aluminium louver door grille sample and colours to match timber door paint colour.
- Mesh for the sliding steel framed doors.

Shop drawings

Submit shop drawings showing details of each assembly, component and connection, and information relevant to fabrication, surface treatment and installation. Shop drawings are to be provided for approval for the following:

- 1] Steel framed glass doors, highlights and partitions for the new building Entry 4L2/01 to match existing installation details in Bay 4 Level 2;
- 2] Lift Lobby steel framed glass doors and partitions in Bay 4 on Levels 3 and 4;
- 3] Steel framed mesh sliding doors to kitchenettes;

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Shop drawings are to be to a scale that best describes the detail, showing the following for:

- Full size sections of members.
- Layout (plan and elevation) of the doors and partitions assembly.
- Junctions and fixings to steel structural frames and to adjoining building surfaces.
- Methods of assembly.
- Methods of installation, including fixing and caulking.
- Glazing details
- Louvre details
- Door hardware installation and lock boxes where required.

Automatic sliding door operators

- Glass sliding doors: Submit shop drawings showing location of motor, wiring, power requirements, location and type of safety devices, location of manual operation switch, and other electronic components. For glass refer to 0467 GLAZING AND GLASS COMPONENTS

Hardware, fittings and accessories including fixing details.

Certification: Submit an engineers' certificate confirming conformance with AS 2047.

Tests

Type tests: Submit results, as follows:

- Fire-resisting and smoke doors: To AS 1905.1 and BCA Spec C3.4.
- Weighted sound reduction index (R_w): To AS/NZS ISO 717.1.

Maintenance documentation

Recommendations: Submit manufacturer's published recommendations for service use.

2 PRODUCTS

2.1 FRAMES

Steel frames

General: 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 prefinished with a protective coating.

Finish: Grind the welds smooth, cold galvanize the welded joints and shop prime.

Hardware and accessories: Provide 4 mm backplates and lugs for fixing hardware including hinges and closers. Screw fix the hinges into tapped holes in the backplates.

Installation in new openings formed in existing walls: Allow for all backplates, fixing lugs and grout filling to all fire door frames.

Base metal thickness:

- General: Minimum 1.1 mm.
- Fire-resisting doorsets: Minimum 1.5 mm.

Metallic-coated steel sheet: To AS 1397.

- Coating class interior: ZF100.

Steel door frames to glazed steel doors and steel glazed partitions

Steel door frames manufactured from steel sections to match the Level 2 entry steel frames.

Flush finish steel door frames

Split-type jamb system Ezy-Jamb manufactured from cold rolled steel to profiles with perforated sides for flush jointing to plasterboard wall linings. Refer to the Door and Window Schedule drawing for frame details.

Steel framed mesh lined doors

35 x 35 x 3mm steel door frames for mesh linings. Refer to the architectural details. Power coat finish

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Timber frames

Hardwood: To AS 2796.1:

- Grade: Select.

Softwood: To AS 4785.1:

- Grade: Select.

Joints:

- Morticed head and through tenons.
- Trenched head:
 - . Bare faced tenons on jambs.
 - . Full let-in jambs.

2.2 DOORS

General

Doors: Proprietary products manufactured for interior or exterior applications and for the finish required.

Materials

Standards: Conform to the following:

- Decorative laminated sheets: To AS/NZS 2924.1.
- Plywood and blockboard for interior use: To AS/NZS 2270.
- Seasoned cypress pine: To AS 1810.
- Timber – hardwood: To AS 2796.1.

Certification

Panel doors: Provide panels branded under the authority of a recognised certification program applicable to the product. Locate the brand on faces or edges which will be concealed in the works.

Flush doors

General: Provide flush doors of balanced construction.

Solid core: Solid flush doors as follows:

- Flush door with blockboard: Core plate of timber strips laid edge to edge, fully bonded to each other and to facings each side of no less than two sheets of timber veneer.

Smoke doors: Solid core not less than 35 mm thick with non-combustible internal face.

Electrical Distribution Cupboard doors: Solid core not less than 35mm thick with internal non-combustible internal lining and smoke seals.

Doors with aluminium louvre grilles: Solid core not less than 35mm thick. Refer to MECHANICAL SERVICES and Architectural drawings for Door and Window Schedule .

Doors undercut for ventilation: Refer to MECHANICAL SERVICES and Architectural drawings for Door and Window Schedule .

Construction

Adhesives:

- Internal: To AS/NZS 2270.
- External: To AS/NZS 2271.

Door thickness:

- General: 35 mm.
- External doors and doors over 900 mm wide: 40 mm.
- Fire doors: As required to meet the FRL as tested.

Cut outs: If openings are required in flush doors (e.g. for louvres or glazing), do not make cut outs closer than the width of the stiles at the edges of the doors.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Edge strips: Minimum thickness 10 mm. Increase overall thickness to greater than 15 mm to accommodate the full depth of the rebate in rebated doors. 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.

- Location: fix all around

Louvre grilles: Construct by inserting the louvre blades into a louvre frame, and fix the frame into the door. Refer MECHANICAL SERVICES specification and to this specification for louvre door grilles to Toilet doors. Refer to this specification for louvres to other doors.

Double doors

General: Bevel square edged doors as necessary to prevent binding between the leaves.

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. Seek approval for the use of a Metal T section which is not included in the Door Hardware Schedule.

Tolerance

Squareness: The difference between the lengths of diagonals of a door: Maximum 3 mm.

Twist: The difference between perpendicular measurements taken from diagonal corners: Maximum 3 mm.

Nominal size (mm):

- Height: ± 2 .
- Width: + 2, - 0.

Steel framed glazed doors

Refer **Frames** in this worksection

2.3 DOORSETS

Automatic sliding door assemblies

Standard: To AS 5007.

Arrangement: As documented in the **Automatic sliding door schedule** and as detailed on the architectural drawings

Control systems: Refer to **Automatic Door Operators** for sliding glass doors operators in this worksection.

Fire rated access panels to services shaft

General: Proprietary products comprising fire-rated doors side hung to steel door frames, including hardware and accessories such as hinges and lock and installation lugs.

Proprietary Item: Trafalgar Fire Rated Access Panel (FRW) FRL -/120/60 for installation in the Fire-rated service shaft with a FRL -/120/120.

Door panel: Paint grade Trafalgar panel incorporating Maxilite high performance fire rated board. Doors located in Toilets are to have a tiled finish to match the wall tiles.

Location and sizes: Allow for one fire-rated access panel per floor to the service duct 600mm W x 1800mm H. Final location in the Female WC on each level above Ground to be confirmed on site.

Frame Types: Flanged Edge (FE) to all walls without tiles - prepare and paint to match the wall finish material or paint colour; Wet Wall (WW) walls with tiles;

Hinge: Fully concealed hinges.

Lock: Key lock

Fire tests for fire-rated access panels

Provide fire tests to AS1530.4

Fire-resisting doorsets

Standard: To AS 1905.1 and BCA Spec C3.4.

Floor access panels

Refer to 0383 SHEET FLOORING

04 ENCLOSURE

0453 Doors and access panels

Cross reference: Refer to **Access Panel Schedule – Walls** in this worksection.

2.4 ANCILLARY MATERIALS

Trims

Timber: Solid timber at least 19 mm thick, mitred at corners.

Extruded gaskets and seals

General: As schedules in the **Door Hardware Schedule** in DOOR HARDWARE.

Materials: Non-cellular (solid) elastopressive seals as follows:

- Flexible polyvinyl chloride (PVC): To BS 2571, 100% solids with high consistency, ultraviolet stabilised.
- Rubber products (neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber): To BS 4255-1.

Flashings

General: Corrosion resistant, compatible with the other materials in the installation, and coated with a non-staining compound where necessary.

Standard: To AS/NZS 2904.

Jointing materials

General: Compatible with each other and with the contact surfaces and non-staining to finished surfaces. Do not provide bituminous materials on absorbent surfaces.

Nylon brush seals

General: Dense nylon bristles locked into galvanized 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.

Pile weather strips

General: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised. Brush seals to sliding timber cargo landing doors to seal the gaps be sized on site.

Standard: To AAMA 701/702.

Weather bars

General: Provide a weather bar under hinged external doors, locate under the centres of closed doors.

Type: Refer to 0552 METALWORK.

3 EXECUTION

3.1 FRAMES

General

Frames: Install the frames as follows:

- Plumb, level, straight and true.
- Fixed or anchored to the building structure.
- Isolated from any building loads, including loads caused by structural deflection or shortening.

Frame fixing

Brackets: Metallic-coated steel:

- Width: Minimum 25 mm.
- Thickness: Minimum 1.5 mm.

Depth of fixing for building into masonry:

- Brackets: Minimum 200 mm.
- Expansion anchors: Minimum 50 mm.
- Plugs: Minimum 50 mm.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

- Rods: Minimum 60 mm.

Jamb fixing centres: Maximum 600 mm.

Joints

General: Make accurately fitted joints where fasteners, pins, screws, adhesives and pressure indentations are not visible on exposed surfaces.

Steel frames

Building into masonry: Attach galvanized steel rods to jambs, build in and grout up fire door frames.

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.

Custom steel frames

Refer to details for steel framed glass doors to match existing doors on site.

Back filling fire door frames

All fire resistant metal door frame is required to be back filled / grout filled for compliance with the current edition of AS1905.1.

Steel flush finish door jambs

Where scheduled fix 'EzyJambs' flush steel door jambs to stud walls to manufacturer's instructions.

Finishing

Trim: Provide mouldings, architraves, reveal linings, and other internal trim using materials and finishes matching the door frames to make neat and clean junctions between the frame and the adjoining building surfaces.

Seals

General: Provide the fixings, rebates, grooves, and clearances required for installation and operation of the seals. Allow seals unwound from coils to settle before use.

Weatherproofing

Flashings and weatherings: 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.

3.2 DOORS

Priming

General: Prime timber door leaves on top and bottom edges before installation.

Refurbishment and repairs of existing cargo landing doors in Bay 5

Existing timber boarded, ledged, framed and braced doors (swing and sliding) are to be refurbished in these works, before preparation and repainting as specified in 0671 PAINTING and as follows:

East wall

- 5L1/XD1: Level 1 cargo landing doors – sliding. Doors to be inspected after demolition.
- 5L2/XD3: Level 2 cargo landing doors – sliding. Doors appear to be in good condition.
- 5L3/XD1: Level 3 cargo landing doors – sliding. Doors to be inspected after demolition.
- 5L4/XD1: Level 4 cargo landing doors – sliding. Doors appear to be in good condition.

West wall

- 5L2/XD1: Level 2 cargo landing doors – swing. Doors recently painted externally.
- 5L3/XD2: Level 3 cargo landing doors – sliding. Doors to be inspected after demolition.
- 5L4/XD2: Level 4 cargo landing doors – sliding. Doors to be inspected after demolition.

Refer to **1.2 Cross references: Recent works undertaken by the principal.**

The internal face and hardware of the existing internal sliding cargo landing timber doors have been partly uncovered after being concealed by the cinema walls on the eastern side in Bay 5 on Levels 1 and 3. Eastern cargo landing doors in Levels 2 and 4 are not concealed. Allow to fully inspect these doors and after removal of the support beams, provide new floor guide / floor track to 5L1/XD1,

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Eastern wall cargo landing doors

5L1/XD1: Level 1 cargo landing doors – sliding. Doors to be inspected after demolition.

5L2/XD3: Level 2 timber doors – swing. Entry Doors recently painted externally.

5L3/XD1: Level 3 cargo landing doors – sliding. Doors to be inspected after demolition.

5L4/XD1: Level 4 cargo landing doors – sliding. Doors appear to be in good condition.

5L2/XD3, 5L3/XD1 and 5L4/XD1. To 5L3/XD2 and 5L4/XD2 on the west façade, the doors fixed to the internal wall face are to be refurbished to reinstate the sliding operation as detailed to match the east wall doors with new rails, brackets and casters.

- Allow to inspect existing hardware to these doors and replace to match existing which includes: new rollers to doors at head and at floor, new floor guide/track, new head track to the western doors. Provide new pull handles to the ends of the door stiles to all doors as specified in the Door Hardware Schedule.
- Remove hasp and staples and door handles only where which protrude internally that will impact on the new internal glazing and hand over to the Principal.
- Allow to remove doors off head tracks and refurbish the timbers and steel door hardware if in good condition and accepted by the superintendent for retention. Sliding operation to be restored to all doors.
- Allow to remove rotten timbers and splice in new bottom rails and bottom of jamb and meeting stiles replacement of 5 vertical lining boards to match existing to 5L2/XD1 .
- Prepare doors for repainting internally unless noted otherwise and paint. Refer 0671 PAINTING for scope of external painting.

Western wall cargo landing doors

5L2/XD1: Level 2 landing doors – swing. Doors recently painted externally.

5L3/XD2: Level 3 landing doors – sliding. Doors to be inspected after demolition.

5L4/XD2: Level 4 landing doors – sliding. Doors to be inspected after demolition.

5L2/XD1 : Level 2 west Entry swing double doors and timber frame.

- Remove panic bars and closers and fill holes left from removed fixings and prepare / sand ready for painting; New door hardware as specified in 0455 DOOR HARDWARE.
- Repair meeting stile rebates where damaged.
- Refix loose lining board to second door leaf.
- Second door leaf (south leaf) has 'dropped' as evidenced by the scrapping across the existing fibre cement sheeting on top of the timber threshold beam. This door frame has a rotted bottom rail and jamb and meeting stile at the bottom.
- Allow to remove doors from hinges and replace rotten timbers with new timbers spliced into the existing.
- Prepare doors for repainting – all faces and paint. Refer 0671 PAINTING for scope of external painting.

5L3/XD2 (Level 3) and 5L4/XD2 (Level 4) : Levels 3 and 4 cargo landing doors supported off timber beams fixed to masonry wall are similar

These doors are currently not operational and were fixed to the wall when the timber floors were removed and now sit on a timber beam on the wall face.

- The timber floor is to be reinstated in its original location and at original levels on Level 4. Remove the doors and support beam where the new timber floor is being reinstated in the original position.
- Provide a steel head and track for the sliding operation of these doors to be reinstated to match the details for the eastern sliding cargo doors. Install new glass screen as specified and as detailed to the interior face.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

- Prepare doors for repainting – all faces and paint. Refer 0671 PAINTING for scope of external painting.

Cross reference

Refer to the architectural drawings and to the DOOR AND WINDOW SCHEDULE.

3.3 SALVAGED TIMBER DOORS LEVEL 2 BAY 4

New Entry to Lift Lobby

Scope: Record insitu and then remove existing timber and glass double doors and store with protection in the Store Room above Level 4. Consult with the superintendent for acceptable storage location on site until these doors can be stored in the Store Room. Retain and protect throughout the works, the timber frame and fixed glazed highlight with painted sign. To timber frame screw fix batten into the rebate and prepare and paint with the re-painting of the door and fanlight frame. Batten fixing is to be removable. Refer to details.

Cross references

Refer 0202 DEMOLITION

Refer 0467 GLAZING AND GLASS COMPONENTS for security film to outside face of highlight glass.

3.4 STEEL FRAMED GLASS DOORS

Steel framed glazed steel doors and steel glazed partitions

General scope: New steel framed glass doors, sidelights, partitions and highlights with horizontal and vertical mullions to the following areas as scheduled:

- 5G.07 AREA B – Doors 5GD/XD1 and partition. Bay 5 Ground Floor
- 4G.09 LIFT LOBBY – Doors 4GD/D03. Bay 4 Ground Floor
- 4L2.01 ENTRY – Doors 4L2/XD1. Bay 4 Level 2
- 4L3.03 LIFT LOBBY – Doors 4L3/D05 and partitions. Bay 4 Level 3
- 4L4.02 LIFT LOBBY – Doors 4L4/D04 and partitions. Bay 4 Level 4

All new steel doors and partitions to match the existing steel doors and partitions on Level 2 Bay 4.

General: Steel windows shall comply with the following and as detailed:

Material: Traditional steel industrial sections to match the existing frame sections and details.

Base Finish: Mild steel for paint finish

Assembly: Mitre and weld frame joints to match existing details. Tenon and rivet glazing bars.

Opening Type: Fixed partitions, fixed highlight and double doors

Glazing Method: Oil based putty - to match existing details.

Finish: Paint - colour to match existing. Prepare and prefinish prior to installation.
Refer 0671 PAINTING noting that the finish may differ depending on location.

Hardware: Hinges: Steel Tuff hinges (zinc coated) welded on to match existing.
Door Handles / hardware generally, refer to DOOR HARDWARE as scheduled.

Member sizes: To match existing member sizes.

Glass: Clear glass sized to comply with AS 1288,
Obscure glass / decals where required and where scheduled.

Cross reference

Refer to architectural drawings for details, to the Door and Window Schedule drawings and to 0202 DEMOLITION, for steel sections salvaged from the steel and glass doors and partition removed on Level 2 Bay 4.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

3.5 STEEL FRAMED MESH DOORS

Kitchenette and Bin Store sliding doors

Requirement: Custom steel framed sliding to conceal kitchenettes on each floor when not in use.

Frames: 35 x 35 x 3 mm steel frames with intermediate horizontal and vertical members as detailed.

Mesh: Round end slots with staggered centres. Lockers L25440 Code E. Aluminium powdercoat finish.

Hardware: Brio Overhead sliding door tracks BRIO Zero Clearance 100

Pull: Profiled clear finished hoop pine 35 x 35 full height timber batten face fixed to one end of each mesh door as detailed. Timber to be stained to match the floor boards and then clear finished.

Finish: Dulux Power coat Duralloy Dulux 'White Satin' – Satin 11295 Duralloy. Provide sample for approval.

Cross reference

Refer to the architectural details.

Mesh screen above the mesh sliding doors are to be similarly framed and mesh lined as detailed.

3.6 AUTOMATIC SLIDING DOOR OPERATORS

Frameless glass sliding door operators

Bay 5 - Level 2 Entry

Operator: DORMA TS301 Telescopic Auto Sliding Operator - heavy duty bi-parting chain driven electrically motor locked sliding door type equal to the DORMA TS301 Series to suit a 12mm tempered and toughened frameless glass sliding door leaf in 2 panels. Frameless glass with top rails and Type K floor guides.

Cross reference

Refer to the architectural details.

3.7 LOUVRE DOOR GRILLES

Doors with louvre grilles

Toilet Doors: Where scheduled provide and installed aluminium louvre grilles where detailed and to the sizes as schedules on the mechanical drawings.

Cross reference

Refer to MECHANICAL SERVICES and the Door and Window Schedule drawings for louvre door grilles to Toilets.

3.8 COMPLETION

Operation

General: Make sure moving parts operate freely and smoothly, without binding or sticking, at correct tensions or operating forces and that they are lubricated where appropriate.

Protection

Temporary coating: On or before the date for practical completion, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

4 SELECTIONS

4.1 SCHEDULE OF DOORS AND FRAMES

NOTES:

Refer to DOOR HARDWARE and to the Schedule of Doors and Frames for notes on the door

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

hardware.

Doors shown on the plans, without door numbers are existing doors and no work is required except for painting as specified in PAINTING.

Coordinate this schedule with the Door and Window Schedule drawings for door sizes and hardware, and for door seals specified in the DOOR HARDWARE worksection.

Coordinate this schedule with PAINTING worksection for repainting of existing doors and frames.

Door thicknesses are noted as a nominal dimension and are to be adjusted to suit supplier's standard thicknesses unless they are to match existing. Door sizes are shown on the door schedule drawing.

All new and existing steel door frames are to be painted.

The name of the space below the door number is the room that the door opens into.

Refer to SIGNS AND DISPLAYS for statutory signage.

Refer to MECHANICAL SERVICES for door louvre grille requirements and to schedule below.

Refer to ELECTRICAL SERVICES for the security system requirements and to the **Remarks / Hardware** column in the table below.

Legend

TME - to match existing; (N) – New; (E) Existing; (SD) Salvaged; VOS - verify on site; (T) Timber; O/A overall; /P - Paint

Table

NOTE: All door sizes are to be verified on site with site measurement before order.

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
GROUND FLOOR – BAY 4 DOORS – EXISTING AND NEW						
4GD/XD1 Lobby 4G.01	55mm (E) double doors	Existing timber framed, ledged and braced vertical boarded double doors	-	*(N)P Paint to internal face only	Existing timber / (N)P	No new hardware. Existing panic bars and door closers; Refer ELECTRICAL SERVICES (N)Exit sign. Security – Reed Switch *(N)P - Paint to internal door faces and edges. NOTE: External repairs & repainting completed 2016.
4GD/D01 (Fire Stair 1) Lobby 4G.01	(E) double Fire Doors	Existing	Existing	(N)P Paint	Existing steel / (N) Paint	Exit door to fire isolated exit to exit to street. No new hardware. Existing hardware to be refurbished. (N) exit sign in Stair 1 and Lighting . Refer ELECTRICAL SERVICES; new internal signs

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4GD/D02 Lobby 4G.01	50mm 920x2040	Fire Door FRL -/120/30	Internal	Paint	Steel Door Frame Type 2 / Paint	Exit Door to Lobby; door closer; auto hold open device; lockset with electric strike ES2000; card reader for entry in Lobby 4G.01; Sentrol Reed switch (concealed); (N) Exit sign.
4GD/D03 Area 4B 4G.04	Double steel framed glass doors Overall width 2025x2445 Verify on site	Glazed steel framed doors	-	Paint	Custom Steel frames to suit the steel and glass doors – to detail	Steel and glass doors similar to Bay 4, L1 doors. Door closers; Lockset with electric strike ES2000 / narrow backset; card reader entry; lever handles; Free lever internally to Area 4B side and to Lift Lobby – Fail-safe Open in the case of fire. Refer ELECTRICAL SERVICES.
4GD/D04 Airlock 4G.05	35mm 920x2040	Flush Solid Core	Internal	Paint	T Frame / Paint Type 3	Push plate and pull handle – separate items, Door closer (access compliant). Door signs for Female, Male, Access and Ambulant.
4GD/D05 Male Toilet 4G.06	35mm 720x2040	Flush Solid Core	Internal	Paint	T Frame / Paint Type 3	Toilet door hardware to outward opening door; door closer; Door sign
4GD/D06 Female Toilet 4G.07	35mm 720x2040	Flush Solid Core	Internal	Paint	T Frame / Paint Type 3	Toilet door hardware to outward opening door; door closer; Door sign
4GD/D07 Unisex Access / Ambulant Toilet 4G.08	35mm 920x2040	Flush Solid core	Internal	Paint	T Frame / Paint Type 3	Toilet door hardware to meet AS1428.1 Access standard requirement. Door closer (access compliant); Door signs for Access , Unisex and Ambulant

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4GD/D08 Link 0 4G.10	50mm 1020x2290 Verify with location of retained services in the LINK	Fire Door FRL -/120/30	Internal	Paint	Steel Frame Type 2 / Paint	Auto hold open device; secure face LINK 0; free handle Bay 5 side; lockset with electric strike ES2000; Card reader in LINK 0; Sentrol Reed switch (concealed); Door closer. Rex button for remote automatic opening for access in LINK 0 – location to be shown on site; Tenancy Door sign by others;
4GD/D09 Fire Stair 2 4G.11	(E) Fire Door	Existing	Existing	(N) Paint	Existing steel / (N) Paint	No new hardware. Exit Sign; Door sign New painted internal directional signs (to match existing sign writing font and colour) in Stair 2 for direction to exit on Level 2 to BCA / Fire Engineering requirements. Exit sign LINK 0 side.
GROUND FLOOR – BAY 5 DOORS – EXISTING AND NEW						
5GD/XD1 Exterior / Area B 5G.07	Double steel framed glass doors 1800 O/A x 2810H	New steel framed glass double doors in steel partition with glass sidelights	-	Paint	Steel frames to suit the steel and glass doors / Paint	New double doors and sidelights. Exit door hardware; narrow backset lockset in lock box; free internal lever handle; door closers. Sentrol Reed switches; Card reader; (N) Exit Sign internally. Refer Architectural Details.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5GD/D01 Kitchenette 5GD/D01A Bin Store	2 x sliding steel framed custom mesh doors Overall 4135x2410 in 2 doors 1 x sliding steel framed custom mesh doors Overall 1235x2410	Enclosure to Kitchenette and to Bin Store	-	Powder-coat	As detailed	Overhead sliding door tracks and guides as specified. Steel frames to detail. Full length steel angle pull handles to slide doors open and close. No locks. Overhead sliding door tracks BRIO Zero Clearance 100 Refer to details.
5GD/D02 Airlock 5G.02	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Full height push plate and internal pull handle as separate items; Door closer (access compliant); Door signs for Male, female and Access. Louvre grille by MECHANICAL SERVICES.
5GD/D03 Female Toilet 5G.03	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; Door closer; Door sign – Female and Ambulant. Louvre grille by MECHANICAL SERVICES.
5GD/D04 Male Toilet 5G.04	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; Door closer ; Door sign Louvre grille by MECHANICAL SERVICES.
5GD/D05 Store	35mm 780*x2410 *VOS	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Lockset (lever handle internal face only); concealed door hinges (Rocyork hinge – RY45 concealed adjustable); Refer details for door frames.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5GD/D06 EDB 5G.05	35mm Double doors 1715 O/A x 2410 rebated meeting stiles. Verify width on site	Flush solid core doors; internal face non - combustible finish – plastic Laminate	Internal	Paint and PL to inside face.	Steel 'EzyJamb' Frame Type 4 / Paint	Panic bolt and ferrule top and bottom to one leaf; Lockset (no lever handles) concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); smoke seals; Door sign; Refer details for door frames.
5GD/D07 Cleaner to Passage 2 5G.06	35mm 820x2180	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door, Storeroom lockset; concealed door hinges; Door closer; Door sign Undercut door 20mm
Fire Stair 2 4G.11	-	-	-	-	-	Existing fire door and frame to be removed and stone wall reinstated to original as detailed.
LEVEL 1 – BAY 4 - EXISTING AND NEW						
4L1/D.01 Link 1 4L1.03	50mm 1020x2350 Verify with location of retained services in the LINK	Fire Door FRL -/120/30	Internal	Paint	Steel Frame Type 1 / Paint	Auto hold open device; secure face LINK 1; lockset with electric strike ES2000; Card reader for entry in LINK 1 only; Sentrol Reed switch (concealed); Door closer; Rex Push button for remote automatic opening in LINK 1 – location as shown on the plans; Door sign; Exit sign
4L1/D.02 Fire Stair 1 4L1.01	(E) double fire doors	Existing	Existing	(N) Paint both faces	Existing (N) Paint	Existing Hardware; new panic bars and door closers; Sentrol Reed switches (concealed); fire exit only; alarmed 24hrs; Exit sign, door sign.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4L1/D.03 Fire Stair 2 4L1.04	50mm 920x2040	Fire door FRL -/120/30	Internal	Paint	Steel Frame Type 1 / Paint	Existing door removed to east wall. New exit fire door into Stair 2 on north wall with Exit door hardware; Door closer; Exit sign; door sign.
LEVEL 1 – BAY 5 - EXISTING AND NEW						
5L1/D.01 Kitchenette 5L1/D.01A Bin Store	2 x sliding steel framed custom mesh doors Overall 4135x2210 1 x sliding steel framed custom mesh doors Overall 1235x2210	Enclosure to Kitchenette and to Bin Store	-	Powder-coat	As detailed	Overhead sliding door tracks and guides as specified. Steel frames to detail. Full length steel angle pull handles to slide doors open and close. No locks. Overhead sliding door tracks BRIO Zero Clearance 100 Refer to details.
5L1/D.02 Store Passage 2 5L1.06	35mm 780*x2210 *VOS	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Refer to details for door frames.
5L1/D.03 EDB Passage 2 5L1.06	35mm Double doors 1715 O/A x 2210 rebated meeting stiles to 2/no doors Verify width on site	Flush solid core; internal face non - combustible finish – plastic laminate	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Panic bolts and ferrule top and bottom to one leaf to the double set; Locksets; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Refer to details for door frames. Smoke seals; Door signs. Refer details for door frames.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L1/D.04 Cleaner 5L1.07	Double doors 35mm 1635 O/A x 2210	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening doors; rebated meeting stiles, Storeroom lockset; panic bolts top and bottom to one leaf. concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign Undercut door 20mm
5L1/D.05 Door number not used						
5L1/D.06 Female Toilet 5L1.03	35mm 820x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign – Female and Ambulant. Louvre grille by MECHANICAL SERVICES.
5L1/D.07 Unisex Access / Ambulant Toilet 5L1.04	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware to meet AS1428.1 Access standard requirement; door closer (access compliant); concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign; Louvre grille by MECHANICAL SERVICES.
5L1/D.08 Male Toilet 5L1.05	35mm 820x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware; door closer; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign Louvre grille by MECHANICAL SERVICES.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L1/XD1 Area B 5L1.08	55mm (E) double doors – internal sliding	Framed, ledged and braced vertical boarded timber double doors	-	(N)P Internal face and edges only. Colour to confirm NOTE: Exterior recently repainted	(E)T (N)P Work to frames as specified	New steel head support frame / track recently installed. Allow for bottom track and rollers to doors on (E) timber floor – recess (E)slab for doors to slide open; (N) pull handles to edge of each door for operation. (N) fixed glass screen 5L1/W2 internally as detailed. Refer GLAZING.
LEVEL 2 – BAY 4 - EXISTING AND NEW						
4L2/SD Entry 4L2.01	Salvaged (E) double timber framed glass doors	-	-	-	-	No hardware required, (E) doors to be recorded, removed for storage on site. Refer DEMOLITION. Repairs to (E) frames refer JOINERY & PAINTING.
4L2/XD1 Entry 4L2.01	(N) steel framed 2/no glass doors 965x2435	Glazed steel framed doors	-	Paint	Steel TME/ paint	New glazed steel Entry doors; narrow backset to lock set in steel lock pocket. Free lever handle internally. Refix salvaged refurbished door brass pull handles from steel glass doors removed in the Lobby. Doors to be held open during business hours. Allow doors to be hooked to the steel base plate of the partition.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4L2/D.01 Link 2 4L2.03	50mm 1020x2350 Verify with location of retained services in the LINK	Fire door FRL -/120/30	Internal	Paint	Steel Frame Type 1 / Paint	Auto Hold Open door; secure face LINK 2; free handle FOYER side. Lockset with electric strike ES2000; Card reader for entry in LINK 2; Sentrol Reed switch (concealed); Door closer. Rex Push button for remote automatic opening – location to be confirmed on site. Door sign; Exit sign in Bay 5;
4L2/D.02 Fire Stair 1 4L2.05	50mm 920x2040	Fire door FRL-/120/30	Internal	Paint	Steel Frame Type 1 / Paint	New Fire Door; EXIT door hardware to STAIR 1. Panic bar, Door closer; Exit sign; door sign; Sentrol Reed switches (concealed); fire exit only alarmed 24hrs.
4L2/D.03 Fire Stair 2 4L2.06	(E) Fire Door	Existing	Existing	(N) Paint all faces	Existing steel / (N) Paint	No new hardware. Exit Sign in stair; Door sign.
LEVEL 2 – BAY 5 - EXISTING AND NEW						
5L2/XD1 Hickson Rd Steps 1	(E) double doors 55mm	Framed, ledged and braced vertical boarded timber double doors	-	(N) Paint internal faces	Existing Timber / (N) paint internally	Refer photos of existing hardware; retain hinges; replace panic bars and replace door closers; repair doors as specified; New floor catches to both door leafs to hold open; Exit signs, door signs. Refurbish doors and repaint internal face as specified. Doors recently repainted externally.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L2/XD2 Foyer 5L2.01	2/no frameless glass automatic sliding doors Verify width on site	Glass	-	-	-	Refer GLAZING AND GLASS COMPONENTS and ELECTRICAL SERVICES; Rex push button operation for entry into building and for exit. 'Fail safe slide open' in the case of fire. Refer Architectural Details; Refer Structural Engineer's details for steel head.
5L2/XD3 Office 5L2.08	55mm (E) double doors – internal sliding	Framed, ledged and braced vertical boarded timber double doors	-	Paint to internal faces. Colour to confirm	-	New steel head support frame / track recently installed. Allow for bottom track and rollers to doors on (N) timber floor. (N) pull handles to end of each door for operation. (N) fixed glass screen 5L2/W2 internally as detailed. Refer GLAZING.
5L2/D.01 Foyer (Kitchenette) 5L2.01 5L2/D.01A Bin Store	2 x sliding steel framed custom mesh doors overall 1435x2380 1x sliding steel framed custom mesh doors overall 1235x2380	Enclosure to Kitchenette and to Bin Store	-	Powder- coat	As detailed	Overhead sliding door tracks and guides as specified. Steel frames to detail. Full length steel angle pull handles to slide doors open and close. No locks. Overhead sliding door tracks BRIO Zero Clearance 100 Refer to details.
5L2/D.02 4 (Store) Passage 2 5L2.06	35mm 780*x2380 *VOS	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Refer to details for door frames.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L2/D.03 EDB Passage 2 5L2.06	35mm Double doors 1715 O/A x2380 rebated meeting stiles Verify width on site.	Flush solid core; internal face non - combustible finish	Internal	Paint and PL to inside face.	Steel 'EzyJamb' Frame Type 4 / Paint	Padbolt and ferrule top and bottom to one leaf; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); smoke seals, Door sign.
5L2/D.04 Cleaner /Passage 2 5L2.06	35mm Double doors 1635 O/A x2340	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening doors; rebated meeting stiles, Storeroom lockset; Panic bolts top and bottom to one leaf. concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign Undercut door 20mm
5L2/D.05	Number not used					
5L2/D.06 Female / Ambulant Toilet 5L2.03	35mm 920x21-0	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign – Female and Ambulant. Louvre grille by MECHANICAL SERVICES.
5L2/D.07 Unisex Access Toilet 5L2.04	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware to meet AS1428.1 Access standard requirement; door closer (access compliant); concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign; Louvre grille by MECHANICAL SERVICES.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L2/D.08 Male / Ambulant Toilet 5L2.05	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware; door closer; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign Louvre grille by MECHANICAL SERVICES.
5L2/XD3 Office 5L2.08	55mm (E) double doors – internal sliding	Framed, ledged and braced vertical boarded timber double doors	-	Paint to internal faces. Colour to confirm	-	New steel head support frame / track recently installed. Allow for bottom track and rollers to doors on (N) Timber floor. (N) pull handles to end of each door for operation. (N) fixed glass screen 5L2/W2 internally as detailed. Refer GLAZING.
LEVEL 3 – BAY 4 - EXISTING AND NEW						
4L3/D.01 Link 3 4L3.01	50mm 1020x2350 Verify with location of retained services in the LINK	Fire door FRL -/120/30	Internal	Paint	Steel Frame Type 1 / Paint	Auto Hold Open door; secure face LINK 3; free handle BREAKOUT 1 side. Lockset with electric strike ES2000; Card reader for entry in LINK 3 ; Sentrol Reed switch (concealed); Door closer. Door sign;
4L3/D.02 Fire Stair 1 4L3.05	55mm (E) double fire doors	Existing	Existing	(N) Paint both sides	Existing / (N) paint	Existing Hardware; replace panic bars and door closers and make good where existing hardware removed. Exit sign, door sign. Sentrol Reed switches (concealed); fire exit only alarmed 24hrs;
4L3/D.04 Fire Stair 2 4L3.02	Existing Fire Door	Existing	Existing	(N) Paint both sides	Existing / (N) paint	Existing hardware. Door closer; Exit sign; door sign.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4L3/D.05 Lift Lobby 4L3.03	(N) steel framed 2/no glass doors overall 1800x2435	Glazed steel doors	-	Paint	Steel / paint to match L1 doors	New glazed steel doors to match doors on L1 – Bay 4; narrow backset to lock set in steel lock pocket. Panic bolts; Tuff hinges; Lever handles both side and free handles internally. Door closers; Exit Sign
LEVEL 3 – BAY 5 - EXISTING AND NEW						
5L3/D.01 Kitchenette Breakout 5L3.03 5L3/D.01A Bin Store	2 x sliding steel framed custom mesh doors overall 4135x2380 1x sliding steel framed custom mesh doors overall 1235x2380	Enclosure to Kitchenette and to Bin Store	-	powder coat	As detailed	Overhead sliding door tracks and guides as specified. Steel frames to detail. Full length steel angle pull handles to slide doors open and close. No locks. Overhead sliding door tracks BRIO Zero Clearance 100 Refer to details.
5L3/D.02 4 (Store) 5L3.08	35mm 780*x2380 *VOS	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Refer to details for door frames.
5L3/D.03 EDB Passage 2 5L3.08	35mm Double doors overall 1715x2380 rebated meeting stiles Verify width on site.	Flush solid core; internal face non - combustible finish	Internal	Paint and PL to inside face.	Steel 'EzyJamb' Frame Type 4 / Paint	Padbolt and ferrule top and bottom to one leaf; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); smoke seals, Door sign.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L3/D.04 Cleaner / Passage 2 5L3.08	35mm Double doors overall 1635x2380	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening doors; rebated meeting stiles, Storeroom lockset; Bolts top (skeleton?) and bottom to one leaf. concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign Undercut door 20mm
5L3/D.05	Number not used					
5L3/D.06 Female / Ambulant Toilet 5L3.05	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign – Female and Ambulant. Louvre grille by MECHANICAL SERVICES.
5L3/D.07 Unisex / Access Toilet 5L3.06	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware to meet AS1428.1 Access standard requirement; door closer (access compliant); concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign; Louvre grille by MECHANICAL SERVICES.
5L3/D.08 Male / Ambulant Toilet 5L3.07	35mm 820x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware; door closer; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign Louvre grille by MECHANICAL SERVICES.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L3/XD1 Area C 5L3.10	55mm (E) double doors; internal sliding	Framed, ledged and braced vertical boarded timber double doors	-	Paint to internal faces. Colour to confirm	-	New steel head support frame / track recently installed. Allow for bottom track and rollers to doors. (N) pull handles to end of each door for operation. (N) fixed glass screen 5L3/W2 internally as detailed. Refer GLAZING.
5L3/XD2 Void	55mm (E) double doors; internal – fixed to wall in open position	Framed, ledged and braced vertical boarded double doors	-	(N)Paint both faces. External colour to match other Bays; internal to confirm	-	Remove bottom T beam and fixings of doors to wall. Allow for new steel head support frame and sliding door tracks and guides to (N)T floor to fix the doors to reinstate sliding operation; . Replace (E) fixed glass window and framing and provide (N) steel support and head frame for glass screen 5L3/W5
LEVEL 4 – BAY 4 NEW DOORS						
4L4/D.01 Kitchenette 4L4.03	50mm 920x2040	Fire door FRL-/120/30	Internal	Paint	Steel Frame Type 1 / Paint	New exit door with exit door hardware; Door closer; Exit sign; door sign. Sentrol Reed switches (concealed); fire exit only - alarmed 24hrs.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4L4/D.02 Link 4 4L4.01	50mm 1020x2360 Verify with location of retained services in the LINK	Fire door FRL -/120/30	Internal	Paint	Steel Frame Type 1 / Paint	Auto Hold Open door; secure face LINK 4; free handle AREA A side. Door closer; Push button for remote automatic opening – location as shown on plan. Exit sign. Lockset with electric strike ES2000; Card reader on LINK 4; Sentrol Reed switch (concealed); Door closer. Door sign; Exit sign in Bay 5.
4L4/D.03 Fire Stair 2 4L4.04	Existing Fire Door	Existing	Existing	(N) Paint both sides	Existing / (N) paint	Existing Hardware - door closers, Exit sign, door sign.
4L4/D.04 Lift Lobby 4L4.02	(N) steel framed 2/no glass doors 965x2435	Glazed steel doors	-	Paint	Steel / paint to match L1 doors	New glazed steel doors to match doors on L1; narrow backset to lock set in steel lock pocket. bolts ? Lever handles both side and free internally. Door closers; Exit Sign
LEVEL 4 – BAY 5 NEW DOORS						
5L4/XD1 VOID	55mm (E) double doors; internal sliding – bi parting	Framed, ledged and braced vertical boarded double doors	-	Paint to internal faces. Colour to confirm	-	Allow for bottom track and rollers to doors on(N) Timber floor. (N) pull handles to end of each door for operation. (N) fixed Glass screen 5L3/W2 internally as detailed. Refer GLAZING.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L4/XD2 VOID	55mm (E) double doors; internal sliding	Framed, ledged and braced vertical boarded double doors	-	Paint	-	Remove bottom T beam and fixings of doors to wall. Allow for new steel head support frame and sliding door tracks and guides to (N)T floor to fix the doors to reinstate sliding operation; . Replace (E) fixed glass window and framing and provide (N) steel support and head frame for glass screen 5L4/W5
5L4/D.01 Kitchenette Breakout 5L4.03 5L4/D.01 Bin Store	2 x sliding steel framed custom mesh doors overall 4135x2380 1 x sliding steel framed custom mesh doors overall 1235x2380	Enclosure to Kitchenette and to Bin Store	-	Powder-coat	As detailed	Overhead sliding door tracks and guides as specified. Steel frames to detail. Full length steel angle pull handles to slide doors open and close. No locks. Overhead sliding door tracks BRIO Zero Clearance 100 Refer to details.
5L4/D.02 (Store) Passage 2 5L4.08	35mm 780*x2380 *VOS	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Refer to details for door frames.
5L4/D.03 EDB Passage 2 5L4.08	35mm Double doors overall 1735x2380 rebated meeting stiles Verify width on site.	Flush solid core; internal face non - combustible finish	Internal	Paint and PL to inside face.	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening door; Lockset; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Padbolt and ferrule top and bottom to one leaf; smoke seals, Door sign

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Adhesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
5L4/D.04 Cleaner / Passage 2 5L3.08	35mm Double doors overall 1635x2380	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Outward opening doors; rebated meeting stiles, Storeroom lockset; Panic bolts top and bottom to one leaf. Concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign Undercut door 20mm
5L4/D.05	Number not used					
5L4/D.06 Female / Ambulant Toilet 5L4.05	35mm 920x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Push plate and pull handle as separate items; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); Door closer; Door sign – Female and Ambulant. Louvre grille by MECHANICAL SERVICES.
5L4/D.07 Unisex / Access Toilet 5L4.06	35mm 920x210	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware to meet AS1428.1 Access standard requirement; door closer (access compliant); concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign; Louvre grille by MECHANICAL SERVICES.
5L4/D.08 Male / Ambulant Toilet 5L4.07	35mm 820x2100	Flush solid core	Internal	Paint	Steel 'EzyJamb' Frame Type 4 / Paint	Toilet door hardware; door closer; concealed door hinges (Rocyork hinge – RY45 concealed, adjustable); door sign Louvre grille by MECHANICAL SERVICES.
ROOF - PLANT ROOM – BAY 4						
4L5/D.01 Plant Room 4L5.01	(E) 50mm (tbc) door	Fire Door	Internal	(N) Paint	Existing steel / (N) paint	Existing door and hardware; change lock from LMR to standard store lock. Free internal handle. Smoke seals; door closer.

SPECIFICATION

04 ENCLOSURE

0453 Doors and access panels

Door No. & Room Name & Number	Nominal Door Thickness (mm) & Size (mm)	Door Type	Ad-hesive grade	Finish	Frame Type / Finish	Remarks / Hardware Refer to DOOR HARDWARE SCHEDULE
4L5/XD1 Roof	35mm 820x2040	Flush Solid Core	External	Paint	Steel Door Frame Type 3	Key function to lockset both sides for locking and unlocking Door closer.

4.2 DOORSETS SCHEDULE

Doorsets performance schedule

Property	A
Fire-resistance level (FRL)	-/120/30 with medium temperature smoke seals

Automatic door schedule

Property	A – Level 2 Bay 5 Entry
Product	DORMA TS301 Telescopic Auto Sliding Operator. Refer Details
Door numbers	5L2/XD1
Action	2 sliding panels – same direction
Glazing	12 mm toughened glass - polished edges
Frame type	Frameless
Operation	Automatic sliding with push button (Rex) operation for entry into the building and for exit. 'Fail safe slide open' in the case of fire.
Opening size	Refer to the DOOR AND WINDOW SCHEDULE and details
Operator Support	Refer to architectural details and to engineers details for steel head beam on wall.

Access Panel Schedule - Walls

Type	AP/W1
Product	Fire-rated 2 Hour FRL -/120/60 Trafalgar panel incorporating Maxilite high performance fire rated board door for tile finish. Wet Wall flange (WW); Concealed hinges & lockable
Frame type	Fully welded and full primed mild steel
Operation	Hinged outwards and lockable
Opening size	600 x 600mm – Location to be confirmed on site for access into the service shaft. Refer to HYDRAULIC SERVICES
Location	2/no per floor on Levels 1, 2, 3 and 4
Allowance	1/no fire-rated access door to the Service shaft on Level 1, 2, 3 and 4. Location in the Female WC cubicle on each level to be confirmed. 1/no fire-rated access door to the Hydraulic services shaft on Level 1, 2, 3 and 4. Location in the Cleaner located below the wall mounted HWU.

04 ENCLOSURE

0453 Doors and access panels

4.3 EXISTING DOOR HARDWARE



Level 2 Bay 5 Existing entry Door 5L2/XD1
Existing panic bolts to be replaced and new mounted at the compliant height.

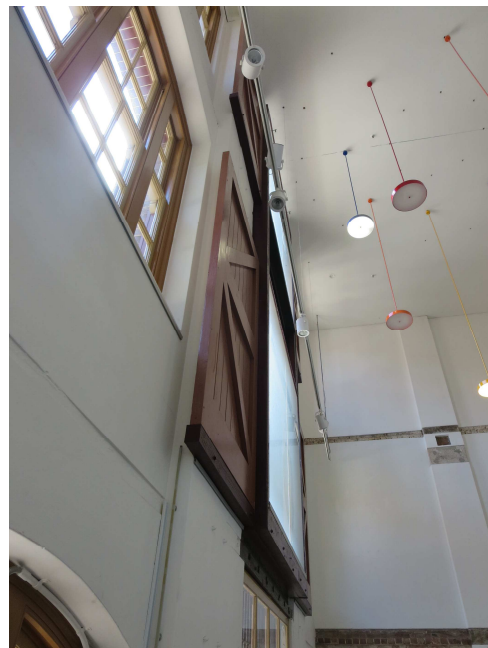


Level 2 Bay 5 Existing entry Door 5L2/XD1
Existing strap hinges to remain.

Doors have recently been painted.



Level 2 Bay 5 Existing entry Door 5L2/XD1
Where existing hardware is removed, allow to fill all holes and sand before painting.



BAY 5 Levels 3 & 4: Level 2 view [west wall] looking up at the cargo doors fixed to walls (on Level 3) on a timber beam with framed glass panel internally. Doors sliding operation to be reinstated with steel new head and roller glides to match the door details on the east façade when timber floor structure is installed; new glass screen internally to cargo doors as detailed.

04 ENCLOSURE

0453 Doors and access panels

4.4 CARGO LANDING DOORS – EAST FAÇADE



Lower cinema

Internal view of cargo landing doors to Levels 1 and 2 on the east wall showing the head track and rollers have been installed.

Doors have been screw fixed together in the closed position with a timber block at the bottom of the doors.

The steel track is to be painted.

Refer 0671 PAINTING



Lower cinema

View of the timber cargo landing doors on Level 2 showing a lead upturned flashing screw fixed to the back of the door and timber block bolted to the timber beam.

This is similar to the upper cinema Levels 3 & 4 doors.

The timber support block is to be removed with the new timber floor installation. The removal of the lead flashing from the back of the doors is to be carried out after the exterior timber threshold beam has been inspected.

Level 1 doors are similar.

04 ENCLOSURE

0453 Doors and access panels



Upper cinema

Mild steel rail and sliding door guides to timber cargo landing doors on Level 4 east wall.

Similar to doors on levels 1, 2 3 and 4.



Upper cinema

View of the timber cargo landing doors on Level 4 east wall showing a lead upturned flashing screw fixed to the back of the door and timber block bolted to the timber beam.

This is similar to the lower cinema Levels 1 & 2 doors.

The timber support block is to be removed with the new timber floor installation. The removal of the lead flashing from the back of the doors is to be carried out after the exterior timber threshold beam has been inspected.

Level 3 doors are similar.

ENCLOSURE

0455 Door hardware

0455 DOOR HARDWARE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide door hardware, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS
- 0183 METAL AND PREFINISHES

Associated worksections

Refer to the following related worksections:

- 0453 DOORS AND ACCESS PANELS, for the door schedule and doors requiring hardware.
- Architectural drawings for the plans and for the door schedudule.

1.3 INTERPRETATION

Abbreviations

General: For the purposes of this worksection, the abbreviations given in AS 4145.1 Appendix D apply.

Definitions

General: For the purposes of this worksection, the general definitions given in AS 4145.1 Section 2 apply.

Lock function: For the purposes of this worksection, the general definitions given in AS 4145.1 Appendix E apply.

1.4 SUBMISSIONS

Door-by-door schedule

General: Submit a door-by-door hardware schedule.

Information sources: This worksection and **Doorset Schedule** in 0453 DOORS AND ACCESS PANELS

Key control system

New works: Submit details of the proprietary key control security system proposed by the lock manufacturer for locks required to accept a group key (master, grandmaster).

Alterations and additions: Submit details to extend the existing key control security system for locks required to accept a group key.

Maintenance manuals

Automatic door operators: Submit the installer's proposal for continuing maintenance after completion on an annual renewal basis.

Manual: Submit the manufacturer's published recommendations for use, care and maintenance of the hardware provided.

Records

Door hardware schedule: Submit an amended schedule, prepared by the door hardware supplier, showing changes to the contract door hardware schedule resulting from the following:

SPECIFICATION

ENCLOSURE

0455 Door hardware

- Approval of a hardware sample.
- Acceptance of an equivalent to a specified proprietary item.
- A contract variation to a door hardware requirement.

Execution details

Re-use of recovered hardware: Submit a proposal describing the standard of cleaning, repair and testing of recovered items and the location where each is to be reused.

Samples

Generic items: Submit samples of hardware items offered as meeting the description of items not specified as proprietary items.

Reconditioned items: Submit samples of hardware items offered as meeting the standard of cleaning, repair and testing of recovered items.

Particular samples required: Reuse of brass handles salvaged from Bay 4 steel/glass doors being removed.

Subcontractors

Automatic door operators: Submit names and contact details of proposed supplier and installer.

Pressure floor mat: Submit names and contact details of proposed supplier and installer.

Technical data

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.

Keys: For locks keyed to differ and locks keyed alike, verify quantities against key records, and deliver to the contract administrator at practical completion.

Warranties

Requirement: Submit the following:

- Warranty for hardware and installation.

Automatic door operators: Submit a warranty (or interlocking warranties) from the supplier and installer for the system and its installation, for a period of at least twelve months from the date of practical completion.

Minimum period: Refer to 0171 GENERAL REQUIREMENTS.

Form of warranty: Materials and installation.

2 PRODUCTS

2.1 GENERAL

Supply

Delivery: Deliver door hardware items, ready for installation, in individual complete sets for each door, as follows:

- Clearly labelled to show the intended location.
- In a separate dust and moisture proof package.
- Including the necessary templates, fixings and fixing instructions.

Hardware specified 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.

Replacement items

Door hardware: Match items being replaced with existing unless documented otherwise. Upgrade hinges as necessary to conform to **Hinges for timber doors table**.

SPECIFICATION

ENCLOSURE

0455 Door hardware

2.2 LOCKS AND LATCHES

Standard

General: To AS 4145.2.

Padlocks

Standard: To AS 4145.4.

Lock and latch classification

Rating systems: To AS 4145.1 Section 3.

Performance requirements: To AS 4145.2 Section 3.

2.3 HINGES

Butt hinge materials

Timber doors in timber or steel frames:

- Material: stainless steel
- Product: Lockwood

Doors fitted with closers: Provide low friction ball bearing hinges.

Fire-resisting doors: To AS 1905.1.

Power transfer hinges: Do not load and install with other compatible hinges.

Lift-off doors: If toilet cubicles require lift-off doors, provide lift-off hinges and allow for door panel with sufficient clearance at the head to facilitate door removal.

Solid core doors

Number of hinges: Determine the number of hinges required based on the nominated door leaf size and weight only. For other door leaf sizes or for doors with applied finishes, use the weight of the door to determine the number of hinges required. For a door leaf over 80 kg, use pivot hinges.

Size of hinges: Determine the size of the hinge based on the door leaf thickness:

- 35 to 43 mm thick door: 100 x 75 mm butt hinges with a minimum thickness of 2.5 mm.
- 44 to 55 mm thick door: 100 x 100 mm butt hinges with a minimum thickness of 2.5 mm.
- > 55 mm thick door: Refer to the door by door hardware schedule.

Hinge pin: Supply fixed pins to hinges of doors opening out or designated as a security doors. For all other doors, provide loose pins.

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.

Hinges for timber doors table

Nominal door leaf size (H x W x T) (mm)	Door leaf weight	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

SPECIFICATION

ENCLOSURE

0455 Door hardware

Nominal door leaf size (H x W x T) (mm)	Door leaf weight	Number of hinges
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	Pivot hinges

2.4 DOOR HANGING SYSTEMS

General

Requirement: Provide sliding door tracks as documented in the **Door hardware selection schedule**.

2.5 ANCILLARIES

Bolts

General: Provide bolts including barrel bolts, flush bolts and tower bolts with keepers, including lock plates, staples, ferrules or floor sockets.

Mortar guards

General: For steel door frame installations, provide mortar guards designed to allow the full extension of the lock tongue or similar devices and the correct operation of the locking mechanism.

Rebated doors

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

Strike plates

General: Use strike plates provided with the locks or latches. Do not provide universal strike plates.

Door stops

General: provide door stops as scheduled in the Door Hardware Schedule.

2.6 DOOR CONTROLLERS

Standard

General: To AS 4145.5.

General

Performance: Provide door controllers, pivots, floor or overhead door closers, and automatic door operators, which are suitable for the door type, size, weight and swings required and the operating conditions, including wind and air conditioning pressure.

Automatic door operators

General: Provide complete automatic door operators for opening and closing doors, including door hanging (hinges, pivots or sliding gear) and electrical connection to distribution board.

- Access key switch: required.
- Automatic activation options: Proximity card read and Rex Push Button
- Manually adjustable function: Required
- Operation mode: Automatic sliding
- Power failure: Stay open: Doors open automatically and stay open

Installation: Provide necessary recesses and cores, grout in components where required, and repair any damage. Provide cover plates for access to units in door heads, frames or transoms.

SPECIFICATION

ENCLOSURE

0455 Door hardware

Automatic adjustable function: If the door opening angle or width is manually set below the maximum possible, under conditions of continuous traffic the doors must automatically creep to full opening, returning to reduced opening on the next cycle.

Radio remote door controllers: Provide a device, comprising a radio receiver and separate transmitter, for activating a motorised door operator so as to open and close the door by remote radio signal.

Key switch: If there is no separate access to the enclosure, provide a key switch mounted externally for opening and closing the door from outside the enclosure without the transmitter. Provide two keys.

Light: Provide an internal light which any signal to the receiver also switches on and which remains on for not less than 2 minutes and switches off automatically.

Receiver: House within a wall unit incorporating a push-button switch permanently illuminated. Mount within the enclosure and connect to power.

Transmitter: Portable battery-powered unit sending a coded signal effective up to not less than 12 m from the receiver.

Closers

Hinged and pivot doors:

- Fire-resisting doors: Provide closers tested and certified for use as components of fire-resisting door assemblies:
 - . Standard: To AS 1905.1.

2.7 ELECTRONIC CONTROL DEVICES

General

Requirement: Provide electric strikes, electric locks, drop bolts, or similar devices to suit door construction and hardware.

Electromagnetic hold-open devices: To AS 1905.1 and AS 1670.1.

Fail-safe: Connect door control devices in a fail-safe mode to permit egress in the event of power failure.

Fail-secure: Connect door control devices in a fail-secure mode to prevent egress in the event of power failure.

Authorised products: Provide equipment listed in the ActivFire Register of Fire Protection Equipment.

Glass doors: Provide tumbler, drop bolts or magnetic holders.

Double leaf doors (solid frame): Provide an electric strike or lock on the fixed leaf, connected to the door frame by concealed flexible wiring.

Activation

Activation device: Provide keypads, card readers or other activation devices, and locate next to entry points.

External: Provide weatherproof (IP56) hoods or housings for external units.

Mounting height: 900 to 1100 mm from floor level and not less than 500 mm from internal corners.

Cross reference

Refer to ELECTRICAL SERVICES for security and to the SCHEDULE OF DOOR HARDWARE included in this worksection.

2.8 KEYING

Temporary construction keys and cylinders

Requirement: Provide one of the following:

- Loan cylinder: Install for construction locks and replace at practical completion.
- Construction keyed master key cylinder: Keep up-to-date records of keys issued including recipient's name, company and contact details, date issued and date returned.

ENCLOSURE

0455 Door hardware

Delivery of keys

Great grandmaster, grandmaster and master keys: Arrange for the manufacturer or supplier to deliver direct to the principal.

Group keying

Keying system: Provide a group keying system as documented in the **Key codes schedule**.

Existing system: Obtain the details of existing group or master key systems to which a new system is required to be an extension.

Future extensions: Provide master and grandmaster group keying systems which are capable of accommodating future extensions.

Keying control security system: If cylinder or pin-tumbler locks accept a group key (e.g. master key, maison key) provide to those locks a proprietary keying control security system.

Stamping: Stamp keys and lock cylinders to show the key codes and/or door number as scheduled.

Identification

Labelling: Supply each key with a purpose-made plastic or stamped metal label legibly marked to identify the key, attached to the key by a metal ring.

Key material

Lever locks: Malleable cast iron or mild steel.

Pin tumbler locks: Nickel alloy, not brass.

Number of keys table

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

3 EXECUTION

3.1 INSTALLATION

General

Handing: Before supply, verify on site, the correct handing of hardware items.

Operation: Make sure working parts are accurately fitted to smooth close bearings, without binding or sticking, free from rattle or excessive play, lubricated where appropriate.

Mounting height

Locks and latches: Centreline of the door knob or lever spindle above finished floor: To BCA D2.21: 900-1100mm above the floor.

Locks

Cylinders: Fix vertically and with consistent key alignment.

Door stops

Fixing: Fix on the floor, skirting or wall, as appropriate, to prevent the door or door furniture striking the wall or other surface.

SPECIFICATION

ENCLOSURE

0455 Door hardware

Fasteners

Materials: Provide materials compatible with the item being fixed, and of sufficient strength, size and quality to perform their function.

- Concealed fixings: Provide a corrosion resistant finish to concealed fixings.
- Exposed fixings: Match exposed fixings to the material being fixed.

Security: Locate exposed fixings to lock furniture on the inside faces of external doors and on the inside faces of internal doors to lockable rooms.

Support: Provide appropriate back support (for example lock stiles, blocking, wall noggings and backing plates) for hardware fixings.

- Hollow metal sections: Provide backing plates drilled and tapped for screw fixing, or provide rivet nuts with machine thread screws. Do not use self-tapping screws or blind rivets.

Floor springs

General: Form a recess in the floor slab for the floor spring box and grout the box in place so that the cover plate is flush with the finished floor.

Hinges

Metal frames: Fix hinges using metal thread screws.

Timber doorsets: Install butt hinges in housings equal in depth to the thickness of the hinge leaf (except for hinges designed for mounting without housing), and fix with countersunk screws.

3.2 COMPLETION

Adjustment

General: Leave the hardware properly adjusted with working parts in working order, and clean, undamaged, properly adjusted, and lubricated where appropriate.

Automatic door operators: Maintain and adjust the system throughout the defects liability period.

Keys

Contractor's keys: Immediately before practical completion, replace or reset cylinders to which the contractor has had key access during construction to exclude the contractor's keys.

Product warranties

Warranty: Cover materials and workmanship in the form of interlocking warranties from the manufacturer or distributor and the installer.

4 SELECTIONS

4.1 DOOR-BY-DOOR SCHEDULE

Refer to the following attached Door Hardware Schedule prepared by AssaAbloy. All hardware is to be verified before order and installation. Submit a door hardware schedule for approval

Cover Letter

Project Name: ASN CO.BUILDING BAY 4-5

10/01/2018 01:31 PM

Project ID: 42273 - (1) (10-01-2018)**Revision Note:****Project Address:** 1-15 HICKSON ROAD THE ROCKS NSW 2000**Keying System:** ABLOY PROTEC2 - Serviced Level (New)**Architect Company:** TKD (TANNER KIBBLE DENTON) ARCHITECTS**Architect Project ID:** 170056**Sales Rep:** Peter Solling**This schedule is based on the following documentation.****Project Comments:** 17NSWPS189

All aspects of this Door Hardware Schedule should be checked and confirmed with all of the current documentation available for this project by the Hardware Supplier. Confirm frame type and door construction prior to the ordering of any hardware.

A new Abloy Protec 2 Restricted Master Keying system has been included in this door hardware schedule. Master keyed cylinders are to be installed on completion of the project. Final master key requirements and cut key quantities are to be provided by the client at a later date. One cut key per cylinder has been included in this door hardware schedule. Any additional cut keys will need to be priced separately.

Temporary construction keyed (loan) cylinders have been allowed for on all key lockable doors for the duration of the construction period. The Hardware Supplier should allow for 4 construction keys. The builder should organise and allow for the cost of the change over from temporary construction (loan) cylinders to the final master keyed cylinders.

Where door closers have been scheduled to aluminium or timber glazed doors, a larger top rail (nominal 120mm) should be specified to allow for secure mounting of the door closer. The Hardware Supplier is to confirm with the door supplier the need for a drop or trim plate.

Where door closers have been scheduled they should generally be mounted to the less visible side of the door. The door closers scheduled require a minimum nib room of 60mm when mounted to the pull side of the door.

Panic Bar sizes will need to be confirmed with actual door widths and heights prior to ordering.

The Hardware Supplier should confirm seal compatibility (with specified meeting stile, aluminium doors, etc.) and the lengths required.

The builder should organise and allow for the cost of providing final kickplate measurements to the Hardware Supplier prior to ordering.

Where electronic products have been included in this door hardware schedule, the voltage, power and security mode requirements are to be verified by the electrical security contractor prior to ordering. The electronic products included in this door hardware schedule should be checked and coordinated with the information shown on the electrical drawings to ensure adequate power and cabling has been allowed for. The builder is to confirm that the electronic products included in this door hardware schedule are to be part of the Hardware Suppliers package.

Signage has been included as a note only, details of signage requirements to be confirmed between signage contractor & builder.

Project Name: ASN CO.BUILDING BAY 4-5

© 2018 ASSA ABLOY Pty Limited ABN 90 086 451 907 This document is the intellectual property of ASSA ABLOY Pty Limited. Any changes or alterations to this document can only be made by the author or authorised representative of ASSA ABLOY Pty Limited. No party, other than the author or authorised representative of ASSA ABLOY Pty Limited, is permitted to provide this document in whole or in part, unless expressly permitted in writing by ASSA ABLOY Pty Limited.

Door Hardware Schedule

Total Pages: 20
Project Name: ASN CO.BUILDING BAY 4-5

Code	Qty	Description	Brand	Finish
Mark: 4GD/XD1	Room:	LOBBY		
Door Type: Existing			Frame Type: Existing	
Height: 1	Width:	1		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
NB:EXISTING DOOR	1	NO HARDWARE REQUIRED		
Mark: 4GD/D01	Room:	FIRE STAIR 1		
Door Type: Existing			Frame Type: Existing	
Height: 1	Width:	1		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
NB:EXISTING DOOR	1	NO HARDWARE REQUIRED		
Mark: 4GD/D02	Room:	LOBBY		
Door Type: Fire Rated			Frame Type: Pressed Metal	
Height: 2040	Width:	920		
LW10000FPSSS	3	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS
CK 570	1	TEMPORARY OVAL CYLINDER		
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS
EMHOB-1	1	EM800 HOLD OPEN BRACKET	LOCKWOOD	
EMHO830-2	1	E/HOLD MAGNET 24VDC INTER BUTTON EM830	LOCKWOOD	
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD	
1801/70SC	1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER	LOCKWOOD	SC
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC
7714DASSS	1	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS
NB:REED SWITCH	1	BY SECURITY CONTRACTOR		
NB:CARD READER	1	BY SECURITY CONTRACTOR		
Door Notes:	LH%			
Mark: 4GD/D03	Room:	AREA 4B		
Door Type: Steel Framed Glazed			Frame Type: Steel	
Height: 1	Width:	1		
NB:HINGES TO	8	BE SUPPLIED BY FABRICATOR		
CK 570	1	TEMPORARY OVAL CYLINDER		
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC
3782X-SS	1	3782 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS
LC8810	1	277MM CABLE TRANSFER DEVICE - LEAD COVER	LOCKWOOD	CP
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD	
4800SC	1	4800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC
4905/70SC	1	4905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC
BAH-159/B/400/D/SSS/TM	2	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN	
P3513DSC	2	F/BOLT RC'D PLASTIC D TIP	INTERLOCK	SC
P3524	1	F/BOLT ROD 600MM PLASTIC D TIP	INTERLOCK	NONE
DN205	1	FLUSHBOLT FERRULE	DORIC	
7726DASIL	1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION	LOCKWOOD	SIL
7726-180SIL	1	7726 SERIES DROP PLATE	LOCKWOOD	SIL
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC
NB:REED SWITCH	2	BY SECURITY CONTRACTOR		
NB:CARD READER	1	BY SECURITY CONTRACTOR		
NB:LOCK BOX	1	TO BE SUPPLIED BY FABRICATOR		
Door Notes:	PAIR%			

Door Hardware Schedule				Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5			
Code	Qty	Description	Brand	Finish	
Mark: 4GD/D04	Room:	AIRLOCK			
Door Type: Solid Core			Frame Type:	Timber	
Height: 2040	Width:	920			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS	
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:		RH			
Mark: 4GD/D05	Room:	MALE TOILET			
Door Type: Solid Core			Frame Type:	Timber	
Height: 2040	Width:	720			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS	
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC	
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC	
2616-104SIL	1	2616 SERIES ANGLED MOUNTING PLATE	LOCKWOOD	SIL	
2616-153	1	2616 SERIES OPENING DAMPER	LOCKWOOD		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:		RH%			
Mark: 4GD/D06	Room:	FEMAILE TOILET			
Door Type: Solid Core			Frame Type:	Timber	
Height: 2040	Width:	720			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS	
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC	
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC	
2616-104SIL	1	2616 SERIES ANGLED MOUNTING PLATE	LOCKWOOD	SIL	
2616-153	1	2616 SERIES OPENING DAMPER	LOCKWOOD		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:		RH%			
Mark: 4GD/D07	Room:	UNISEX ACCESS/AMBULANT TOILET			
Door Type: Solid Core			Frame Type:	Timber	
Height: 2040	Width:	920			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS	
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC	
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:		LH			

Door Hardware Schedule				Total Pages: 20			
Project Name: ASN CO.BUILDING BAY 4-5							
Code	Qty	Description	Brand	Finish			
Mark: 4GD/D08	Room: LINK 0						
Door Type: Fire Rated		Frame Type: Pressed Metal					
Height: 2290	Width: 1080						
LW10000FPSSS	5	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS			
CK 570	1	TEMPORARY OVAL CYLINDER					
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC			
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE			
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS			
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD				
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC			
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC			
BAH-159/B/400/D/SSS/TM	1	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN				
NB: REED SWITCH	1	BY SECURITY CONTRACTOR					
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR					
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR					
NB: CARD READER	1	BY SECURITY CONTRACTOR					
NB: REX BUTTON	1	BY SECURITY CONTRACTOR					
Door Notes:		RH%					
Set Notes:		* AUTOMATIC OPERATOR TO HAVE HOLD OPEN FUNCTION SET.					
Mark: 4GD/D09	Room: FIRE STAIR 2						
Door Type: Existing		Frame Type: Existing					
Height: 1	Width: 1						
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR					
NB: EXISTING DOOR	1	NO HARDWARE REQUIRED					
Mark: 5GD/XD1	Room: EXTERIOR/AREA B						
Door Type: Steel Framed Glazed		Frame Type: Steel					
Height: 2650	Width: 1800						
NB: HINGES TO	8	BE SUPPLIED BY FABRICATOR					
CK 570	1	TEMPORARY OVAL CYLINDER					
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC			
3782X-SS	1	3782 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS			
LC8810	1	277MM CABLE TRANSFER DEVICE - LEAD COVER	LOCKWOOD	CP			
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD				
4800SC	1	4800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC			
4905/70SC	1	4905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC			
BAH-159/B/400/D/SSS/TM	2	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN				
P3513DSC	2	F/BOLT RC'D PLASTIC D TIP	INTERLOCK	SC			
P3524	1	F/BOLT ROD 600MM PLASTIC D TIP	INTERLOCK	NONE			
DN205	1	FLUSHBOLT FERRULE	DORIC				
7726DASIL	1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION	LOCKWOOD	SIL			
7726-180SIL	1	7726 SERIES DROP PLATE	LOCKWOOD	SIL			
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC			
NB: REED SWITCH	2	BY SECURITY CONTRACTOR					
NB: CARD READER	1	BY SECURITY CONTRACTOR					
NB: LOCK BOX	1	TO BE SUPPLIED BY FABRICATOR					
Door Notes:		PAIR%					
Mark: 5GD/D01	Room: KITCHENETTE						
Door Type: Steel Framed Glazed		Frame Type:					
Height: 1	Width: 1						
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR					
NB: CUSTOM PULL	1	HANDLE TO ARCHITECTS DETAIL					
Door Notes:		SLIDING					

Door Hardware Schedule					Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5				
Code	Qty	Description	Brand	Finish		
Mark:	5GD/D02	Room:	AIRLOCK			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2120	Width:	920			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS		
20807NNSS	1	208 EXTERIOR PLATE	LOCKWOOD	SS		
20924NN/P4SS	1	209 INTERIOR PLATE WITH P4 PULL HANDLE	LOCKWOOD	SS		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				
Mark:	5GD/D03	Room:	FEMAILE TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2120	Width:	920			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS		
20807NNSS	1	208 EXTERIOR PLATE	LOCKWOOD	SS		
20924NN/P4SS	1	209 INTERIOR PLATE WITH P4 PULL HANDLE	LOCKWOOD	SS		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		LH				
Mark:	5GD/D04	Room:	MALE TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2120	Width:	920			
LW10075FPSSS	3	HINGES 100 X 75 X 2.5mm FIXED PIN	LOCKWOOD	SSS		
20807NNSS	1	208 EXTERIOR PLATE	LOCKWOOD	SS		
20924NN/P4SS	1	209 INTERIOR PLATE WITH P4 PULL HANDLE	LOCKWOOD	SS		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
KP X 150 X 1.2MM SS	2	FULL DOOR WIDTH KICKPLATE	OTHER	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		LH				
Mark:	5GD/D05	Room:	STORE			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2040	Width:	780			
RY-45	3	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 201	1	TEMPORARY ROUND CYLINDER				
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		LH%				

Door Hardware Schedule				Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5					
Code	Qty	Description	Brand	Finish	
Mark: 5GD/D06	Room: EDB				
Door Type: Solid Core		Frame Type: Steel			
Height: 2040	Width: 1715				
RY-45	6	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 201	1	TEMPORARY ROUND CYLINDER			
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP	
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC	
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC	
A120DS	1	RP120 DBLE DR SET BK 6300MM - 3*2100MM	RAVEN	BL	
A8SIC36	2	RP8SI DOOR BOTTOM CA 920MM	RAVEN	CA	
A16SIC2250	1	RP16SI ASTRAGAL CA 2250MM	RAVEN	CA	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	PAIR%				
Mark: 5GD/D07	Room: CLEANER TO PASSAGE 2				
Door Type: Solid Core		Frame Type: Steel			
Height: 2120	Width: 820				
RY-45	3	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS	
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	PAIR%				
Mark: 4L1/D01	Room: LINK 1				
Door Type: Fire Rated		Frame Type: Pressed Metal			
Height: 2350	Width: 1225				
LW10000FPSSS	5	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS	
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD		
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC	
BAH-159/B/400/D/SSS/TM	1	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN		
NB: REED SWITCH	1	BY SECURITY CONTRACTOR			
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB: CARD READER	1	BY SECURITY CONTRACTOR			
NB: REX BUTTON	1	BY SECURITY CONTRACTOR			
Door Notes:	RH%				
Set Notes:	* AUTOMATIC OPERATOR TO HAVE HOLD OPEN FUNCTION SET.				

Door Hardware Schedule					Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5						
Code	Qty	Description	Brand	Finish		
Mark: 4L1/D02	Room:	FIRE STAIR 1				
Door Type: Fire Rated		Frame Type: Existing				
Height: 1	Width:	1				
NB:RE-USE	4	EXISTING HINGES	OTHER			
CK 570	1	TEMPORARY OVAL CYLINDER				
CY504T/XSC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X CAM MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
FE109/0MSIL	1	1 POINT EXIT DEVICE 60MM BS MORTICE LOCK 900MM SIL	LOCKWOOD	SIL		
FE209/0VSIL	1	2 POINT EXIT DEVICE VL 900MM SIL	LOCKWOOD	SIL		
FE0050SIL	1	FE SERIES VERTICAL EXTENSION KIT 3000MM	LOCKWOOD	SIL		
1801/70SC	1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER	LOCKWOOD	SC		
A4000X305 CAN	1	SEQUENCE SELECTOR TO SUIT EXIT DEVICE	LOCKWOOD	CAN		
7714DASSS	2	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS		
NB:REED SWITCH	2	BY SECURITY CONTRACTOR				
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:RE-USE	1	EXISTING HARDWARE	OTHER			
Door Notes:		PAIR%				
Set Notes:		* Confirm if extension rod kit is required prior to ordering hardware.				
Mark: 4L1/D03	Room:	FIRE STAIR 2				
Door Type: Fire Rated		Frame Type: Pressed Metal				
Height: 2040	Width:	920				
LW10000FPSSS	3	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS		
3772--SS	1	3772 - ESCAPE LOCK	LOCKWOOD	SS		
1807SC	1	1807 SQUARE END PLATE	LOCKWOOD	SC		
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC		
7714DASSS	1	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		LH%				
Mark: 5L1/D01	Room:	KITCHENETTE				
Door Type: Steel Framed Glazed		Frame Type:				
Height: 1	Width:	1				
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR				
NB:CUSTOM PULL	1	HANDLE TO ARCHITECTS DETAIL				
Door Notes:		SLIDING				
Mark: 5L1/D02	Room:	STORE PASSAGE 2				
Door Type: Solid Core		Frame Type: Steel				
Height: 2040	Width:	780				
RY-45	3	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 201	1	TEMPORARY ROUND CYLINDER				
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		LH%				

Door Hardware Schedule					Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5				
Code	Qty	Description			Brand	Finish
Mark:	5L1/D03	Room:	EDB PASSAGE 3			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2040	Width:	1715			
RY-45	6	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)			OTHER	
CK 201	1	TEMPORARY ROUND CYLINDER				
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK			ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL			ABLOY	NONE
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER			LOCKWOOD	SP
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP			LOCKWOOD	SC
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP			LOCKWOOD	SC
A120DS	1	RP120 DBLE DR SET BK 6300MM - 3*2100MM			RAVEN	BL
A8SIC36	2	RP8SI DOOR BOTTOM CA 920MM			RAVEN	CA
A16SIC2250	1	RP16SI ASTRAGAL CA 2250MM			RAVEN	CA
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L1/D04	Room:	CLEANER			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2040	Width:	1635			
RY-45	6	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)			OTHER	
CK 570	1	TEMPORARY OVAL CYLINDER				
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK			ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL			ABLOY	NONE
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK			LOCKWOOD	SS
3772-RK32SS	1	3772 SERIES REBATE KIT- 32MM LIP STRIKE			LOCKWOOD	SS
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE			LOCKWOOD	SC
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER			LOCKWOOD	SC
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP			LOCKWOOD	SC
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP			LOCKWOOD	SC
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L1/D06	Room:	FEMAILE TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2040	Width:	820			
RY-45	3	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)			OTHER	
21407NNSS	1	214 EXTERIOR PLATE			LOCKWOOD	SS
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE			LOCKWOOD	SS
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED			LOCKWOOD	SS
A250SC	1	A250 FLOOR MOUNTED DOOR STOP			LOCKWOOD	SC
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				
Mark:	5L1/D07	Room:	UNISEX ACCESS/AMBULANT TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2040	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)			OTHER	
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK			LOCKWOOD	SS
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER			LOCKWOOD	SC
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR			LOCKWOOD	SC
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED			LOCKWOOD	SS
A250SC	1	A250 FLOOR MOUNTED DOOR STOP			LOCKWOOD	SC
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		LH				

Door Hardware Schedule					Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5						
Code		Qty	Description	Brand	Finish	
Mark:	5L1/D08	Room:	MALE TOILET			
Door Type:	Solid Core		Frame Type:	Steel		
Height:	2040	Width:	820			
RY-45	3	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)		OTHER		
21407NNSS	1	214 EXTERIOR PLATE		LOCKWOOD	SS	
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE		LOCKWOOD	SS	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED		LOCKWOOD	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP		LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:	LH					
Mark:	5L1/XD1	Room:	CINEMA 1			
Door Type:	Existing		Frame Type:			
Height:	1	Width:	1			
BAH-160/A/SSS/C/TM	2	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN		BARBEN	SSS	
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR				
Door Notes:	SLIDING					
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.					
Mark:	4L2/SD1	Room:	ENTRY			
Door Type:	Existing		Frame Type:	Existing		
Height:	1	Width:	1			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:EXISTING DOOR	1	NO HARDWARE REQUIRED				
Mark:	4L2/XD1	Room:	ENTRY			
Door Type:	Steel Framed Glazed		Frame Type:	Steel		
Height:	2435	Width:	1930			
NB:HINGES TO	8	BE SUPPLIED BY FABRICATOR				
CK 570	1	TEMPORARY OVAL CYLINDER				
CY504T/RSC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH R (RABBIT EAR) CAM MK		ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL		ABLOY	NONE	
3541R-SCNCYLSS	1	SHORT BACKSET LOCK WITH EXTERNAL CYLINDER FABRICATOR PACK WITH SECURITY STRIKE		LOCKWOOD	SC	
4800SC	1	4800 SQUARE END PLATE WITH CYLINDER HOLE		LOCKWOOD	SC	
4981/70SC	1	4981 SQUARE END PLATE TO SUIT 3540 SERIES WITH 45 DEGREE 70 LEVER ONLY		LOCKWOOD	SC	
P3513DSC	2	F/BOLT RC'D PLASTIC D TIP		INTERLOCK	SC	
P3524	1	F/BOLT ROD 600MM PLASTIC D TIP		INTERLOCK	NONE	
DN205	1	FLUSHBOLT FERRULE		DORIC		
7726DASIL	1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION		LOCKWOOD	SIL	
7726-180SIL	1	7726 SERIES DROP PLATE		LOCKWOOD	SIL	
DS110.BSS	2	HOOK AUTO DOOR HOLDER		SCOPE		
NB:LOCK BOX	1	TO BE SUPPLIED BY FABRICATOR				
NB:REFIX SALVAGED	1	REFURBISHED BRASS DOOR HANDLES		OTHER		
Door Notes:	PAIR%					

Door Hardware Schedule

Total Pages: 20

Project Name: ASN CO.BUILDING BAY 4-5				
Code	Qty	Description	Brand	Finish
Mark: 4L2/D01	Room:	LINK 2		
Door Type: Fire Rated		Frame Type: Pressed Metal		
Height: 2350	Width:	1225		
LW10000FPSSS	5	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS
CK 570	1	TEMPORARY OVAL CYLINDER		
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD	
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC
BAH-159/B/400/D/SSS/TM	1	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN	
NB: REED SWITCH	1	BY SECURITY CONTRACTOR		
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
NB: CARD READER	1	BY SECURITY CONTRACTOR		
NB: REX BUTTON	1	BY SECURITY CONTRACTOR		
Door Notes:	RH%			
Set Notes:	* AUTOMATIC OPERATOR TO HAVE HOLD OPEN FUNCTION SET.			
Mark: 4L2/D02	Room:	FIRE STAIR 1		
Door Type: Fire Rated		Frame Type: Pressed Metal		
Height: 2040	Width:	920		
LW10000FPSSS	3	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS
FE109/0MSIL	1	1 POINT EXIT DEVICE 60MM BS MORTICE LOCK 900MM SIL	LOCKWOOD	SIL
1807SC	1	1807 SQUARE END PLATE	LOCKWOOD	SC
7714DASSS	1	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC
NB: REED SWITCH	1	BY SECURITY CONTRACTOR		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
Door Notes:	RH%			
Mark: 4L2/D03	Room:	FIRE STAIR 2		
Door Type: Existing		Frame Type: Existing		
Height: 1	Width:	1		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
NB: EXISTING DOOR	1	NO HARDWARE REQUIRED		

Door Hardware Schedule				Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5					
Code	Qty	Description	Brand	Finish	
Mark: 5L2/XD1	Room:	HICKSON RD STEPS 1			
Door Type: Existing			Frame Type: Existing		
Height: 1	Width:	1			
NB:RE-USE	8	EXISTING HINGES	OTHER		
CK 570 EXT	1	EXTENDED TEMPORARY OVAL CYLINDER	OTHER		
CY504T50/XSC	1	ABLOY PROTEC2 CY504EX (570E) CYLINDER 50MM LONG WITH X CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772-RK32SS	1	3772 SERIES REBATE KIT- 32MM LIP STRIKE	LOCKWOOD	SS	
FE109/0MSIL	1	1 POINT EXIT DEVICE 60MM BS MORTICE LOCK 900MM SIL	LOCKWOOD	SIL	
FE209/0VSIL	1	2 POINT EXIT DEVICE VL 900MM SIL	LOCKWOOD	SIL	
FE0050SIL	1	FE SERIES VERTICAL EXTENSION KIT 3000MM	LOCKWOOD	SIL	
1801/70SC	1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER	LOCKWOOD	SC	
A4000X305 CAN	1	SEQUENCE SELECTOR TO SUIT EXIT DEVICE	LOCKWOOD	CAN	
7726DASIL	2	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION	LOCKWOOD	SIL	
DS110.BSS	2	HOOK AUTO DOOR HOLDER	SCOPE		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:RE-USE	1	EXISTING HARDWARE	OTHER		
Door Notes:	PAIR%				
Set Notes:	* Confirm if extension rod kit is required prior to ordering hardware. * Door gap between existing door and auto sliding door to be checked prior to ordering hardware.				
Mark: 5L2/XD2	Room:	FOYER			
Door Type: Frameless Glazed			Frame Type:		
Height: 1	Width:	1			
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR			
NB:CARD READER	1	BY SECURITY CONTRACTOR			
NB:REX BUTTON	1	BY SECURITY CONTRACTOR			
Door Notes:	SLIDING				
Set Notes:	* AUTOMATIC OPERATOR TO ARCHITECTS SPECIFICATION				
Mark: 5L2/XD3	Room:	OFFICE			
Door Type: Existing			Frame Type:		
Height: 1	Width:	1			
BAH-160/A/SSS/C/TM	1	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN	BARBEN	SSS	
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR			
Door Notes:	SLIDING				
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.				
Mark: 5L2/D01	Room:	FOYER (KITCHENETTE)			
Door Type: Steel Framed Glazed			Frame Type:		
Height: 2380	Width:	1			
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR			
NB:CUSTOM PULL	1	HANDLE TO ARCHITECTS DETAIL			
Door Notes:	SLIDING				
Mark: 5L2/D02	Room:	STORE PASSAGE 2			
Door Type: Solid Core			Frame Type: Steel		
Height: 2340	Width:	780			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 201	1	TEMPORARY ROUND CYLINDER			
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	LH%				

Door Hardware Schedule					Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5				
Code	Qty	Description	Brand	Finish		
Mark:	5L2/D03	Room:	EDB PASSAGE 2			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2340	Width:	1715			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 201	1	TEMPORARY ROUND CYLINDER				
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP		
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC		
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC		
A120LDS	1	RP120 LNG DBLE DR SET BK 7500MM - 2*2750MM, 1*2000MM	RAVEN	BL		
A8SIC36	2	RP8SI DOOR BOTTOM CA 920MM	RAVEN	CA		
A16SIC2500	1	RP16SI ASTRAGAL CA 2500MM	RAVEN	CA		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L2/D04	Room:	CLEANER PASSAGE 2			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2340	Width:	1635			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 570	1	TEMPORARY OVAL CYLINDER				
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS		
3772-RK32SS	1	3772 SERIES REBATE KIT- 32MM LIP STRIKE	LOCKWOOD	SS		
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC		
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC		
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC		
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L2/D06	Room:	FEMALE AMBULANT TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS		
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				
Mark:	5L2/D07	Room:	UNISEX ACCESS TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS		
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC		
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				

Door Hardware Schedule				Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5			
Code	Qty	Description	Brand	Finish	
Mark:	5L2/D08	Room:	MALE AMBULANT TOILET		
Door Type:	Solid Core	Frame Type:	Steel		
Height:	2260	Width:	920		
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
P21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS	
P21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS	
P2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS			
Door Notes:	LH				
Mark:	4L3/D01	Room:	LINK 3		
Door Type:	Fire Rated	Frame Type:	Pressed Metal		
Height:	2350	Width:	1225		
LW10000FPSSS	5	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS	
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD		
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC	
BAH-159/B/400/D/SSS/TM	1	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN		
NB:REED SWITCH	1	BY SECURITY CONTRACTOR			
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:CARD READER	1	BY SECURITY CONTRACTOR			
NB:REX BUTTON	1	BY SECURITY CONTRACTOR			
Door Notes:	RH%				
Set Notes:	* AUTOMATIC OPERATOR TO HAVE HOLD OPEN FUNCTION SET.				
Mark:	4L3/D02	Room:	FIRE STAIR 1		
Door Type:	Fire Rated	Frame Type:	Existing		
Height:	1	Width:	1		
NB:RE-USE	4	EXISTING HINGES	OTHER		
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/XSC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
FE109/0MSIL	1	1 POINT EXIT DEVICE 60MM BS MORTICE LOCK 900MM SIL	LOCKWOOD	SIL	
FE209/0VSIL	1	2 POINT EXIT DEVICE VL 900MM SIL	LOCKWOOD	SIL	
FE0050SIL	1	FE SERIES VERTICAL EXTENSION KIT 3000MM	LOCKWOOD	SIL	
1801/70SC	1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER	LOCKWOOD	SC	
A44000X305 CAN	1	SEQUENCE SELECTOR TO SUIT EXIT DEVICE	LOCKWOOD	CAN	
7714DASSS	2	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS	
NB:REED SWITCH	2	BY SECURITY CONTRACTOR			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:RE-USE	1	EXISTING HARDWARE	OTHER		
Door Notes:	PAIR%				
Set Notes:	* Confirm if extension rod kit is required prior to ordering hardware.				
Mark:	4L3/D04	Room:	FIRE STAIR 2		
Door Type:	Existing	Frame Type:	Existing		
Height:	1	Width:	1		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:EXISTING DOOR	1	NO HARDWARE REQUIRED			

Door Hardware Schedule				Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5					
Code	Qty	Description	Brand	Finish	
Mark: 4L3/D05	Room:	LIFT LOBBY			
Door Type: Steel Framed Glazed		Frame Type: Steel			
Height: 2435	Width:	1930			
NB:HINGES TO	8	BE SUPPLIED BY FABRICATOR			
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/RSC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH R (RABBIT EAR) CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3541R-SCNCYLSS	1	SHORT BACKSET LOCK WITH EXTERNAL CYLINDER FABRICATOR PACK WITH SECURITY STRIKE	LOCKWOOD	SC	
4800SC	1	4800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
4981/70SC	1	4981 SQUARE END PLATE TO SUIT 3540 SERIES WITH 45 DEGREE 70 LEVER ONLY	LOCKWOOD	SC	
BAH-159/B/400/D/SSS/TM	2	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN		
P3513DSC	2	F/BOLT RC'D PLASTIC D TIP	INTERLOCK	SC	
P3524	1	F/BOLT ROD 600MM PLASTIC D TIP	INTERLOCK	NONE	
DN205	1	FLUSHBOLT FERRULE	DORIC		
7726DASIL	1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION	LOCKWOOD	SIL	
7726-180SIL	1	7726 SERIES DROP PLATE	LOCKWOOD	SIL	
NB:LOCK BOX	1	TO BE SUPPLIED BY FABRICATOR			
Door Notes:	PAIR%				
Set Notes:	* Confirm required hardware prior to ordering hardware. * Bottom of Pull handle to be mounted a 1000mm above FFL. * 3541 to be mounted a 900mm above FFL.				
Mark: 5L3/D01	Room:	KITCHENETTE BREAKOUT			
Door Type: Steel Framed Glazed		Frame Type:			
Height: 2380	Width:	1			
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR			
NB:CUSTOM PULL	1	HANDLE TO ARCHITECTS DETAIL			
Door Notes:	SLIDING				
Mark: 5L3/D02	Room:	STORE			
Door Type: Solid Core		Frame Type: Steel			
Height: 2340	Width:	780			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 201	1	TEMPORARY ROUND CYLINDER			
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	LH%				
Mark: 5L3/D03	Room:	EDB PASSAGE 2			
Door Type: Solid Core		Frame Type: Steel			
Height: 2340	Width:	1715			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 201	1	TEMPORARY ROUND CYLINDER			
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP	
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC	
791O/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC	
A120LDS	1	RP120 LNG DBLE DR SET BK 7500MM - 2*2750MM, 1*2000MM	RAVEN	BL	
A8SIC36	2	RP8SI DOOR BOTTOM CA 920MM	RAVEN	CA	
A16SIC2500	1	RP16SI ASTRAGAL CA 2500MM	RAVEN	CA	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	PAIR%				

Door Hardware Schedule				Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5					
Code	Qty	Description	Brand	Finish	
Mark: 5L3/D04	Room:	CLEANER PASSAGE 2			
Door Type: Solid Core			Frame Type:	Steel	
Height: 2340	Width:	1635			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS	
3772-RK32SS	1	3772 SERIES REBATE KIT- 32MM LIP STRIKE	LOCKWOOD	SS	
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC	
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC	
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:		PAIR%			
Mark: 5L3/D06	Room:	FEMALE AMBULANT TOILET			
Door Type: Solid Core			Frame Type:	Steel	
Height: 2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS	
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS			
Door Notes:		RH			
Mark: 5L3/D07	Room:	UNISEX ACCESS/AMBULANT TOILET			
Door Type: Solid Core			Frame Type:	Steel	
Height: 2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS	
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC	
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS			
Door Notes:		LH			
Mark: 5L3/D08	Room:	MALE AMBULANT TOILET			
Door Type: Solid Core			Frame Type:	Steel	
Height: 2260	Width:	820			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER		
21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS	
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS	
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS	
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC	
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS			
Door Notes:		LH			

Door Hardware Schedule				Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5					
Code	Qty	Description	Brand	Finish	
Mark: 5L3/XD1	Room: AREA C				
Door Type: Existing			Frame Type:		
Height: 1	Width: 1				
BAH-160/A/SSS/C/TM	1	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN	BARBEN	SSS	
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR			
Door Notes:	SLIDING				
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.				
Mark: 5L3/XD2	Room: VOID				
Door Type: Existing			Frame Type:		
Height: 1	Width: 1				
BAH-160/A/SSS/C/TM	1	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN	BARBEN	SSS	
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR			
Door Notes:	SLIDING				
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.				
Mark: 4L4/D01	Room: KITCHENETTE				
Door Type: Fire Rated			Frame Type:	Pressed Metal	
Height: 2040	Width: 920				
LW10000FPSSS	3	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
CK 570 EXT	1	EXTENDED TEMPORARY OVAL CYLINDER	OTHER		
CY504T50/XSC	1	ABLOY PROTEC2 CY504EX (570E) CYLINDER 50MM LONG WITH X CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
FE109/0MSIL	1	1 POINT EXIT DEVICE 60MM BS MORTICE LOCK 900MM SIL	LOCKWOOD	SIL	
1801/70SC	1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER	LOCKWOOD	SC	
7714DASSS	1	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK	LOCKWOOD	SSS	
NB: REED SWITCH	1	BY SECURITY CONTRACTOR			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
Door Notes:	RH%				
Set Notes:	* DOOR TO ALARMED.				
Mark: 4L4/D02	Room: LINK 4				
Door Type: Fire Rated			Frame Type:	Pressed Metal	
Height: 2360	Width: 1225				
LW10000FPSSS	5	HINGES 100 X 100 X 2.5mm FIXED PIN	LOCKWOOD	SSS	
CK 570	1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC	
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE	
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS	
ES2100	1	ES2100 E/STRIKE 12-30VDC M/FUNCTION DOOR MONITORED	LOCKWOOD		
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC	
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC	
BAH-159/B/400/D/SSS/TM	1	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN		
NB: REED SWITCH	1	BY SECURITY CONTRACTOR			
NB: AUTOMATIC DOOR	1	OPERATOR BY CONTRACTOR			
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB: CARD READER	1	BY SECURITY CONTRACTOR			
NB: REX BUTTON	1	BY SECURITY CONTRACTOR			
Door Notes:	RH%				
Set Notes:	* AUTOMATIC OPERATOR TO HAVE HOLD OPEN FUNCTION SET.				
Mark: 4L4/D03	Room: FIRE STAIR 2				
Door Type: Existing			Frame Type:	Existing	
Height: 1	Width: 1				
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR			
NB: EXISTING DOOR	1	NO HARDWARE REQUIRED			

Door Hardware Schedule

Total Pages: 20

Project Name: ASN CO.BUILDING BAY 4-5

Code	Qty	Description	Brand	Finish
Mark: 4L4/D04	Room:	LIFT LOBBY		
Door Type: Steel Framed Glazed		Frame Type: Steel		
Height: 2435	Width:	1930		
NB:HINGES TO	8	BE SUPPLIED BY FABRICATOR		
CK 570	1	TEMPORARY OVAL CYLINDER		
CY504T/RSC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH R (RABBIT EAR) CAM MK	ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE
3541R-SCNCYLSS	1	SHORT BACKSET LOCK WITH EXTERNAL CYLINDER FABRICATOR PACK WITH SECURITY STRIKE	LOCKWOOD	SC
4800SC	1	4800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC
4981/70SC	1	4981 SQUARE END PLATE TO SUIT 3540 SERIES WITH 45 DEGREE 70 LEVER ONLY	LOCKWOOD	SC
BAH-159/B/400/D/SSS/TM	2	ENTRY PULL HANDLE 1/2SET DFIX SSS	BARBEN	
P3513DSC	2	F/BOLT RC'D PLASTIC D TIP	INTERLOCK	SC
P3524	1	F/BOLT ROD 600MM PLASTIC D TIP	INTERLOCK	NONE
DN205	1	FLUSHBOLT FERRULE	DORIC	
7726DASIL	1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION	LOCKWOOD	SIL
7726-180SIL	1	7726 SERIES DROP PLATE	LOCKWOOD	SIL
NB:LOCK BOX	1	TO BE SUPPLIED BY FABRICATOR		
Door Notes:	PAIR%			
Set Notes:	* Confirm required hardware prior to ordering hardware. * Bottom of Pull handle to be mounted a 1000mm above FFL. * 3541 to be mounted a 900mm above FFL.			
Mark: 5L4/XD1	Room:	VOID		
Door Type: Existing		Frame Type:		
Height: 1	Width:	1		
BAH-160/A/SSS/C/TM	1	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN	BARBEN	SSS
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR		
Door Notes:	SLIDING			
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.			
Mark: 5L4/XD2	Room:	VOID		
Door Type: Existing		Frame Type:		
Height: 1	Width:	1		
BAH-160/A/SSS/C/TM	1	ENTRY PULL HANDLE 1/2 SET 400X16MM 200CEN	BARBEN	SSS
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR		
Door Notes:	SLIDING			
Set Notes:	* PULL HANDLES TO BE MOUNTED ON EDGE OF DOOR LEAF.			
Mark: 5L4/D01	Room:	KITCHENETTE BREAKOUT		
Door Type: Steel Framed Glazed		Frame Type:		
Height: 2380	Width:	1		
NB: TRACK & FITTINGS	1	TRACK & FITTINGS BY FABRICATOR		
NB:CUSTOM PULL	1	HANDLE TO ARCHITECTS DETAIL		
Door Notes:	SLIDING			
Mark: 5L4/D02	Room:	STORE PASSAGE 2		
Door Type: Solid Core		Frame Type: Steel		
Height: 2340	Width:	780		
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER	
CK 201	1	TEMPORARY ROUND CYLINDER		
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR		
Door Notes:	LH%			

Door Hardware Schedule					Total Pages: 20	
Project Name:		ASN CO.BUILDING BAY 4-5				
Code	Qty	Description	Brand	Finish		
Mark:	5L4/D03	Room:	EDB PASSAGE 2			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2340	Width:	1715			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 201	1	TEMPORARY ROUND CYLINDER				
CY414T/SC	1	ABLOY PROTEC2 RIM LOCK (201 TYPE) CYLINDER MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
213SPAONOCYL	1	213 STREAMBOLT TP NO CYLINDER	LOCKWOOD	SP		
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC		
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC		
A120LDS	1	RP120 LNG DBLE DR SET BK 7500MM - 2*2750MM, 1*2000MM	RAVEN	BL		
A8SIC36	2	RP8SI DOOR BOTTOM CA 920MM	RAVEN	CA		
A16SIC2500	1	RP16SI ASTRAGAL CA 2500MM	RAVEN	CA		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L4/D04	Room:	CLEANER PASSAGE 2			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2340	Width:	1635			
RY-45	8	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
CK 570	1	TEMPORARY OVAL CYLINDER				
CY504T/X7SC	1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK	ABLOY	SC		
CUTKEYS-P2S	1	CUTKEYS PROTEC2-SERVICED LEVEL	ABLOY	NONE		
3772X-SS	1	3772 - KEY ENTRY ESCAPE LOCK	LOCKWOOD	SS		
3772-RK32SS	1	3772 SERIES REBATE KIT- 32MM LIP STRIKE	LOCKWOOD	SS		
1800SC	1	1800 SQUARE END PLATE WITH CYLINDER HOLE	LOCKWOOD	SC		
1905/70SC	1	1905 SQUARE END PLATE WITH 70 LEVER	LOCKWOOD	SC		
791X300SC	1	VISIBLE FIX PANIC BOLT 300MM TP	LOCKWOOD	SC		
7910/SX450SC	1	VISIBLE FIX OFFSET PANIC BOLT 450M TP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
Door Notes:		PAIR%				
Mark:	5L4/D06	Room:	FEMALE AMBULANT TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
21407NNSS	1	214 EXTERIOR PLATE	LOCKWOOD	SS		
21524NN/P2SS	1	215 INTERIOR PLATE & P2 PULL HANDLE	LOCKWOOD	SS		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				
Mark:	5L4/D07	Room:	UNISEX ACCESS TOILET			
Door Type: Solid Core		Frame Type:		Steel		
Height:	2260	Width:	920			
RY-45	4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)	OTHER			
3774-TASS	1	3774 - ANTI-LOCKOUT PRIVACY LOCK	LOCKWOOD	SS		
1814/70SC	1	1814 SQUARE END PLATE WITH PRIVACY INDICATOR EMERGENCY TURN & 70 LEVER	LOCKWOOD	SC		
1939S/70#SC	1	1939 SQUARE END PLATE WITH DISABLED TURN & 70 LEVER SELECTOR	LOCKWOOD	SC		
2615DASSS	1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED	LOCKWOOD	SS		
A250SC	1	A250 FLOOR MOUNTED DOOR STOP	LOCKWOOD	SC		
NB: SIGNAGE	1	PROVIDED BY SIGNAGE CONTRACTOR				
NB:DOOR GRILLE	1	TO MECHANICAL SERVICES REQUIREMENTS				
Door Notes:		RH				

Door Hardware Schedule					Total Pages: 20	
Project Name: ASN CO.BUILDING BAY 4-5						
Code		Qty	Description		Brand	Finish
Mark:	5L4/D08	Room:	MALE AMBULANT TOILET			
Door Type:	Solid Core		Frame Type:	Steel		
Height:	2260	Width:	820			
RY-45		4	CONCEALED HINGE 3 AXIS ADJUSTABLE (ROCYORK)		OTHER	
21407NNSS		1	214 EXTERIOR PLATE		LOCKWOOD	SS
21524NN/P2SS		1	215 INTERIOR PLATE & P2 PULL HANDLE		LOCKWOOD	SS
2615DASSS		1	2615 SERIES CAM ACTION DOOR CLOSER SIZE 1-5 DELAYED		LOCKWOOD	SS
A250SC		1	A250 FLOOR MOUNTED DOOR STOP		LOCKWOOD	SC
NB: SIGNAGE		1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:DOOR GRILLE		1	TO MECHANICAL SERVICES REQUIREMENTS			
Door Notes:		LH				
Mark:	4L5/D01	Room:	PLANT ROOM			
Door Type:	Fire Rated		Frame Type:	Existing		
Height:	1	Width:	1			
NB:RE-USE		3	EXISTING HINGES		OTHER	
CK 570		1	TEMPORARY OVAL CYLINDER			
CY504T/X7SC		1	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH X7 CAM MK		ABLOY	SC
CUTKEYS-P2S		1	CUTKEYS PROTEC2-SERVICED LEVEL		ABLOY	NONE
3772X-SS		1	3772 - KEY ENTRY ESCAPE LOCK		LOCKWOOD	SS
1801/70SC		1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER		LOCKWOOD	SC
1905/70SC		1	1905 SQUARE END PLATE WITH 70 LEVER		LOCKWOOD	SC
7714DASSS		1	7714 DA SIZE 1-4 P/A DC FORMED COVER CLOSER ADJUSTABLE BACKCHECK		LOCKWOOD	SSS
A120S		1	RP120 SINGLE DR SET BK 5200MM - 2*2100MM, 1*1000MM		RAVEN	BL
A8SIC36		1	RP8SI DOOR BOTTOM CA 920MM		RAVEN	CA
NB: SIGNAGE		1	PROVIDED BY SIGNAGE CONTRACTOR			
NB:RE-USE		1	EXISTING HARDWARE		OTHER	
Door Notes:		LH				
Mark:	4L5/XD1	Room:	ROOF			
Door Type:	Solid Core		Frame Type:	Steel		
Height:	2260	Width:	820			
LW10075FPSSS		3	HINGES 100 X 75 X 2.5mm FIXED PIN		LOCKWOOD	SSS
CK 570		2	TEMPORARY OVAL CYLINDER			
CY504T/VSC		2	ABLOY PROTEC2 AUSTRALIAN OVAL CYLINDER (570) WITH V CAM MK		ABLOY	SC
CUTKEYS-P2S		2	CUTKEYS PROTEC2-SERVICED LEVEL		ABLOY	NONE
3774VVSS		1	3774 - ANTI-VANDAL LOCK WITH INTERNAL LOCKING CYLINDER		LOCKWOOD	SS
1801/70SC		1	1801 SQUARE END PLATE WITH CYLINDER HOLE & 70 LEVER		LOCKWOOD	SC
1901/70SC		1	1901 SQUARE END PLATE WITH CYLINDER & 70 LEVER		LOCKWOOD	SC
7726DASIL		1	7726 SERIES SIZE 2-6 CLOSER ADJUSTABLE BACKCHECK DELAYED ACTION		LOCKWOOD	SIL
A250SC		1	A250 FLOOR MOUNTED DOOR STOP		LOCKWOOD	SC
Door Notes:		RH				

04 ENCLOSURE

0467 Glazing and glass components

0467 GLAZING AND GLASS COMPONENTS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide and glass components in conformance, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0181 ADHESIVES, SEALANTS AND FASTENERS
- 0183 METALS AND PREFINISHES
- 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

Specified in this worksection

Glazing and glazing assemblies, including but not limited to:

- glass selection.
- glass in steel framed doors and partitions.
- frameless glass barriers and patch fittings to existing windows with low sills.
- frameless glass fixed screens to inside face of the cargo landing doors.
- frameless glass sliding doors with automatic door operators – internal and to Bay 5 L2 entry.
- proprietary frameless glass balustrades with and without timber top rails.
- Glazing plastic panels to internal face of circular timber gable louvres and semi-circular timber louvres above cargo landing doors in Bay 5.
- Clear glass to replace obscure glass in existing timber window sashes; clear glass in new sashes to be fitted to existing double hung timber windows.
- Clear glass in new timber windows.
- decal film strips to glazing.
- Security film to outer face of Bay 4 existing timber highlight glazing with historic signage.
- mirrors.
- general performance requirements for glass workmanship and installation.
- All glass as specified and as detailed.

Associated worksections

Refer to the following worksections:

- 0202 DEMOLITION, for salvaging of steel sections from removed steel framed glass partitions and doors; for salvaging of existing door handles for reuse on new steel glazed doors.
- 0453 DOORS AND ACCESS PANELS, for steel framed glass doors, highlights and partitions and modification to existing steel framing; for automatic door operators for glass sliding doors.
- 0455 DOOR HARDWARE for supply and installation of hardware, including door closers, door seals, electromagnetic hold open devices.
- 0551 JOINERY, for new timber window frames to be glazed; for new timber sashes to be glazed and fitted to existing windows;
- 0552 METALWORK, for custom steel support frames for internal automatic glass sliding doors and operators; for selected cargo landing doors and fixed glass screen channel supports and floor guides.

04 ENCLOSURE

0467 Glazing and glass components

- 0671 PAINTING, for clear finish to timber handrail to frameless glass balustrade; for paint finish to other ancillary framing to glass components to be paint finished.
- ELECTRICAL SERVICES, for security, electromagnetic hold open devices to doors and power to the automatic sliding door operators.
- Architectural plans for the door and window schedule and for details of glass assemblies and for frameless glass balustrades locations and details.
- Engineer's drawings for structural steel to Level 2 entry automatic sliding door operator and for steel angle support to frameless glass balustrades base shoe.

1.3 STANDARDS

General

Materials and installation: To AS 1288.

Glass doors: Selection and installation: To AS 2407.

Quality requirements for cut-to-size and processed glass: To AS/NZS 4667.

Terminology for work on glass: To AS/NZS 4668.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Glass components before they are installed.
- Glass balustrade pockets before installation

1.5 SUBMISSIONS

Certification

Balustrade design: Submit a professional engineers' certificate confirming conformance with AS/NZS 1170.1 clause 3.6.

Sealant compatibility: Submit statements from all parties to the installation certifying the compatibility of sealants and glazing systems to all substrates.

Installation

Glazing: Provide certification from the fabricator, that the method of glazing, the selection of sealant systems and conditions next to the glass comply with the following:

- Not detrimental to the long term structural performance, weathering capabilities and visual qualities of the glass.
- Not cause delamination or other impairment to laminated glass during the service life.

Samples

Requirement: Submit samples, each at least 200 x 200 mm, showing specified visual properties and the range of variation, if any, for each of the following types of glass or glazing plastics:

- Glazing security film and decal films.
- Glazing plastic – acrylic.
- Glass for frameless window barriers with finished polished edges.
- Frameless glass balustrade pocket 200mm long.
- Glass for frameless glass balustrades with finished polished edges.
- Glass for new steel framed doors and partitions.
- Mirror glass.
- Patch fittings (1/no of each type specified) for fixing frameless glass barriers to low sill windows.

Shop drawings

Requirement: Submit shop drawings showing the following:

SPECIFICATION

04 ENCLOSURE

0467 Glazing and glass components

1] Pocket and pocket fixing details for frameless glass balustrades.

- Layout (plan and elevations) of glass balustrade assembly showing glass sheet sizes, floor shoe / channel and fixing details, steel support angle and timber floor structure.

2] Low window sill barriers:

- Stainless steel glass anchors and glass sample for frameless glass barrier screens to low sill existing windows.

3] Glass screens inside timber cargo landing doors:

- Glass and frames for fixed glass screens to inside of cargo landing doors.
- Full size section of members.
- Method of glazing.
- Method of assembly.
- Clearances and tolerances.
- Glazing gaskets and sealant beads.

4] steel framed doors and partition walls, timber window frames and sashes:

- Full size section of members.
- Method of glazing.
- Method of assembly.
- Clearances and tolerances.
- Glazing gaskets and sealant beads.

Refer to the following:

- 0452 METALWORK for shop drawing requirements for steel frame supports to internal glass sliding automatic doors
- 0453 DOORS AND ACCESS PANELS for shop drawings for steel framed glass doors, steel and glass partition walls and highlights to be glazed.
- 0551 JOINERY, for shop drawings for timber window frames and sashes to be glazed.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

Evidence of experience: required.

Warranties

General: Submit warranties as specified in 0171 GENERAL REQUIREMENTS.

2 PRODUCTS

2.1 GLASS

Glass and glazing materials

General: Free from defects which detract from appearance or interfere with performance under normal conditions of use.

Glazing plastics: Free from surface abrasions, and warranted by the manufacturer for 10 years against yellowing or other colour change, loss of strength and impact resistance, and general deterioration.

Safety glasses

Standard: To AS/NZS 2208.

Certification: Required.

Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Type: Grade A to AS 1288.

Opacified glass

Description: Glass with an opacifier permanently bonded to the inner face.

04 ENCLOSURE

0467 Glazing and glass components

Heat soaking

Requirement: All toughened and heat strengthened glass products.

Standard: To EN 14179-1.

Unacceptable blemishes in heat-treated flat glass (including tinted and coated glass)

Standard: To ASTM C1048.

2.2 GLAZING MATERIALS

General

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.

Jointing materials

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.

Elastomeric sealants

General: Provide elastomeric sealants as documented

Sealing compound (silicone): To ASTM C920 or ISO 11600.

Priming

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

Control joints

Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Foamed materials (in compressible fillers and backing rods): Closed-cell or impregnated types which do not absorb water.

Bond breaking: Provide backing rods, and other back-up materials for sealants, which do not adhere to the sealant.

2.3 GLAZING FILM

Security glazing film to existing highlight above existing entry doors to Bay 4 on Level 2

Supply and install glazing film to the external face to upgrade the highlight glass panel with signage to upgrade the glass for safety purposes.

Glazing Film: Clear 3M security glazing film or equal to approved sample

Decal glazing film to frameless glass entry doors and glass screens

Solid strip glazing film 75mm high to comply with AS1288 and AS1428.1-2009: Design for access and mobility

Glazing Film: All Protection Tinting - Item: 'Milk Glass 801'. T. 02 9484 4488.

Samples

Submit samples for approval prior to installation. Refer **Submissions**.

2.4 MIRRORS

Safety mirrors

Type to AS 1288: Vinyl backed Grade A safety mirror.

Safety compliance: To AS/NZS 2208.

Solid backed annealed glass mirrors

Backing: 9 mm waterproof plywood.

Adhesive fixing to backing: Non-acidic silicone adhesive at the rate recommended by the manufacturer.

04 ENCLOSURE

0467 Glazing and glass components

2.5 GLASS BALUSTRADES

Glass balustrade systems

Standard

Glass balustrades: To AS 1288, Section 7.

General: As documented and as specified in **Execution**.

Glass: 12mm toughened tempered frameless glass with edges arrised and polished.

3 EXECUTION

3.1 GLASS PROCESSING

General

Processing: Perform required processes on glass, including cutting, obscuring, silvering and bending. Form necessary holes, including for fixings, equipment, access openings and speaking holes. Process exposed glass edges to a finish not inferior to ground arrised.

3.2 INSTALLATION

General

General: Install the glass as follows:

- Permanently fix in place each piece of glass to withstand the normal loadings and ambient conditions at its location without distortion or damage to glass and glazing materials.
- No transfer of building movements to the glass.

Temporary marking: Use a method which does not harm the glass. Remove marking on completion.

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.

Frameless installations: Join the vertical edges of adjacent glass panels with silicone jointing compound where larger sheets of glass cannot be supplied or delivered. Silicone colour to be clear and approved before installation.

3.3 FIXING MIRRORS

Vinyl backed Grade A safety mirrors and solid backed annealed glass mirrors

Solid backed annealed glass mirrors:

- Installation to backing: Clean the back of the glass panel and apply walnuts of adhesive together with double sided adhesive tape for temporary support and affix directly to the backing.

Cross reference: Refer to the architectural details drawings of toilets for the location of mirrors and mirror sizes.

3.4 GLASS IN TIMBER WINDOWS

Remove window glazing putty Pry out loose chunks of window glazing compound with a putty knife. Soften remaining areas with a heat gun and scrape the putty away.

Reglazing

To existing timber windows where shown on the plans, allow to remove the existing obscure glass and reglaze in clear glass. Carefully remove the putty retaining where possible the existing metal glazing sprigs. Where required, provide new sprigs and re-putty glass with a linseed oil based glazing putty and paint finish. To new timber window sashes replacing louvres, allow to putty fix glass to sash frames using the same traditional detail as the existing.

SPECIFICATION

04 ENCLOSURE

0467 Glazing and glass components

Timber window sashes to be reglazed

Ground Floor Bay 5: 5GD/W1, 5GD/W3, 5GD/W4 and 5GD/W6. Verify the number of sashes per window on site.

New timber window to be glazed

Ground Floor Bay 5: 5GD/W5

3.5 STRUCTURAL GLASS BALUSTRADES

Standard

Glass balustrades: To AS 1288, Section 7.

Proprietary item – frameless with and without connected handrail

CRL 240 'B5G Mill Aluminium Series Square' base shoe – two piece mounting system for base fixing into steel angle as detailed. Catalogue number: B5G20D. Cappings to square base to be FS-307 to both sides of the shoe.

Glass: 12mm toughened tempered frameless glass with edges arrised and polished.

Finish: Mill finished Aluminium

Handrail: CRL – Blumcraft 346 (50.8mm diameter) series wood cap rails. Timber selection suitable for staining. Refer to PAINTING for clear finish to timber rail.

To outer edge to base shoe structural adhesive tape fix 3mm steel plate as detailed.

Steel support to Balustrade system: CRL-Blumcraft's Glass Railing Systems. Available from C.R. Laurence of Australia Pty Ltd.

Fixing: All pre-drilled CRL base shoes have a +1/8 (3mm) / -1/16 (1.5mm) tolerance between each hole drilled in the base. Before drilling installation holes into the steel substrate it is recommended that the installer place the base shoe into the planned final position, then mark the position of the holes to be drilled into the steel substrate.

Certification: Structural Engineer's Certification required for loadings compliance.

Cross reference: Refer to architectural details.

3.6 GLASS BARRIERS

Glass barriers to low window sills

Requirement: To inside of window sills in Bay 5 on all floors that are lower than 1000mm, allow to install a frameless glass panel balustrades to the internal face of the masonry wall as detailed. Provide custom glass fixings where needed as detailed. Refer to **Submissions** for samples to be submitted for approval.

Glass: 12mm toughened tempered glass with edges to be arrised and polished.

Glass fixing anchors: Fethers Code: BF1150-38/15 for face wall fixing. M12 Threaded rod as standard. Supply with timber inserts for masonry fixing. For side wall glass fixing, provide bracket and anchors as detailed.

Finish: Satin stainless steel.

Level 2 barriers to east windows to be mounted higher as detailed due to the raised floor levels at the windows.

Glass barriers to windows to landings in Stair 2 – Bay 4

Provide similar glass barriers to the landings against the windows in Stair 1.

Cross reference

Refer to the architectural details

04 ENCLOSURE

0467 Glazing and glass components

3.7 GLASS SCREENS

Glass screens inside timber cargo landing doors

In Bay 5, where the function of the sliding timber cargo doors are being reinstated, a fixed glass screen is to be installed inside the building behind the opening to provide the barrier when the cargo doors are open. The glass screens are fixed in position with components as follows:

Glass: 2/no 12mm toughened glass panels with central vertical clear silicon joint seal. Exposed edges to be abraded and polished.

Top and Bottom framing: Capral Frameless glazing – deep pocket for recessed toughened glass panels accepts 12-19mm glass - EN5482 Glazing Channel (bottom); EN5483 Glazing Channel (top).

Support structure: Steel support is to match the Bay 4 Level 4 glass screen installation and as detailed. Allow for 75 equal angle steel glass head support and weld fabricated 2/no. 50 SHS elbow brackets and masonry fixings to wall.

Locations

Provide screens to all cargo landing doors on Levels 1, 2, 3 and 4 on both the east and the west walls.

Cross reference

Refer to the architectural details

3.8 AUTOMATIC GLASS SLIDING DOORS

Sliding glass doors

Refer to architectural details for automatic frameless glass door – 12mm toughened glass with polished edges.

Refer to 0453 DOORS AND ACCESS PANELS for automatic sliding door to 2L2/XD2.

3.9 EXISTING GABLE TIMBER LOUVRES

Gable timber louvres

To seal the inside face of the circular and semi-circular gable timber louvre frames in Bay 5, allow to remove birds mesh and install 4.5mm clear polished acrylic sheets cut to match the outer frame size. Stainless steel screw fix to the timber frames to approval with foam seal around the edges between the timber frames and the acrylic sheet. Allow to paint the louvres and frames before installation. Colour to match existing.

3.10 COMPLETION

Trade clean

Method: Clean with soft clean cloths and clean water, finishing with a clean squeegee. Do not use abrasive or alkaline materials.

Extent: All frames and glass surfaces inside and outside.

ENCLOSURE

0472 Acoustic insulation

0472 ACOUSTIC INSULATION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide acoustic insulation, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0181 ADHESIVES, SEALANTS AND FASTENERS

Specified in this worksection

This worksection includes but is not limited to:

- Acoustic insulation to mechanical plant and ducts above amenities on each level.
- Bulk acoustic / sound insulation in stud walls.

Associated worksections

Refer to the following related worksections:

- 0511 LINING, for sheet linings to walls and ceilings to be insulated; for fire-rated sheet linings to the service riser shaft.
- 0342 LIGHT STEEL FRAMING, for insulation in fire-rated stud walls to services shafts.
- MECHANICAL SERVICES drawings for location of FCU's on each level to be acoustically wrapped.
- HYDRAULIC SERVICES, for sound wrap insulation to plumbing pipes exposed above the amenities.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Acoustic insulation: Materials or methods of construction to reduce the transmission of airborne and structure-borne sound through floors, walls and ceilings or other enclosing elements in buildings.
- Acoustic material: Building material with specific acoustic properties to achieve sound transmission loss, sound absorption, damping of resonance or resilience against impact noise.
- Acoustic underlay: A resilient material laid between the structural floor and the flooring material to provide sound isolation.
- Airborne sound: Sound radiated directly from a source, such as a loudspeaker or machine, into the surrounding air.
- Fire hazard properties: Terminology to BCA A2.4.
- Fibre batts: Flexible insulation supplied as factory cut pieces and composed of mineral wool (glass and rock fibre) or polyester fibre.
- FBS-1 (fibre-bio-soluble) mineral wool: Insulation composed of bio-soluble glass or rock fibres.
- Impact sound: Sound caused by impacts on building structure. Typical sources include footsteps, dropped objects on horizontal surfaces and the slamming of doors.
- Sound insulation (isolation): Reduction of sound energy passing through building elements.

ENCLOSURE

0472 Acoustic insulation

- Structure-borne sound: Sound waves transmitted within the building structure and re-radiated into other spaces as airborne sound. Typical sources include direct impact from dropped objects and vibrating machinery.

1.4 SUBMISSIONS

Fire hazard properties

General: Submit evidence of conformance to **PRODUCTS, GENERAL Fire hazard properties.**

Warranties

Manufacturer's published product warranties: Submit on completion.

Samples

General: Submit samples and data sheets of the following for approval:

- For each type of acoustic panel submit 3 samples - minimum size 300 x 300mm

1.5 INSPECTION

Notice

Inspection: Give notice so inspection can be made of the insulation installed before the work is completed

2 PRODUCTS

2.1 GENERAL

Fire hazard properties

General: Fire hazard indices for all materials when tested in conformance with AS/NZS 1530.3:

- Spread of flame index: ≤ 9 .
- Smoke developed index: ≤ 8 if spread of flame > 5 .

Facing materials:

- Flammability index when tested to AS 1530.2: ≤ 5 .

2.2 MARKING

Identification

Identification: Deliver materials to the site in the manufacturer's original sealed packaging, legibly marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern. Provide technical data sheets if not shown on labels.
- Handling and installation instructions.
- Safety data sheets.

ENCLOSURE

0472 Acoustic insulation

2.3 INSULATION MATERIALS

Bulk insulation

Mineral wool blankets and batts: Glasswool and rockwool bonded with thermosetting resin.

Polyester blankets and batts: Thermally bonded polyester fibres.

Board insulation

Mineral wool panels: High density glasswool and rockwool bonded with thermosetting resin.

Wet processed fibreboard (including softboard): To AS/NZS 1859.4.

Composite plasterboard panels: Proprietary items.

Flexible sheet insulation

Impregnated vinyl: Lead impregnated vinyl sheeting.

Recycled glass

Non-combustible sounding absorbing panel made from recycled glass. Reap noise control from Pyrotek.

Fasteners and supports

General: Metallic-coated steel.

Resilient mounts: Proprietary fixing clips with rubber or acrylic pads.

Adhesives

General: Compatible with the substrate and the insulation and suitable for internal and external use where required.

Sealants

Acoustic sealant: Non-hardening sealant compatible with the substrate materials.

Fire-resisting sealant: Non-hardening sealant compatible with the substrate materials and having a fire-resistance rating equal to that of the building element it seals.

Sealant strips: Closed cell resilient foam.

3 EXECUTION

3.1 GENERAL

Bulk insulation

General: Firmly butt together fibre blankets or batts, with no gaps except as follows:

- Access openings and vents: Do not obstruct.
- Light fittings: To AS/NZS 3000 clause 4.5.
- Electrical cables: To AS 3999 clause 2.6.

Glasswool and rockwool insulation: Conform to the ICANZ Industry Code of Practice for the Safe Use of Glass Wool and Rock Wool Insulation.

Marking: Deliver mineral wool products to site in packaging labelled FBS-1 BIOSOLUBLE INSULATION.

3.2 WALL SYSTEMS

Framed walls and partitions – bulk insulation

Product type: Fibre batts.

Installation: Friction fit between framing members. If other support is not provided, staple nylon twine to the framing and stretch tight.

Framed walls and partitions – rigid insulation

Product type: Mineral wool panels.

ENCLOSURE

0472 Acoustic insulation

Installation: Fix to face of studs with adhesive and temporarily fasten with single screw until plasterboard installed. If construction is required to be non-combustible, check BCA Spec C1.10.

3.3 CEILINGS

Framed ceilings – bulk insulation

Product type: Fibre batts.

Installation: Fit tightly between framing members. If support is not otherwise provided, staple nylon twine to the framing and stretch tight.

4 SELECTIONS

4.1 SCHEDULES

Bulk insulation schedule

Property	A	B
Product	Tontine Acoustisorb 3	Pyrotek Soundlag 4525C
Material	Polyester partition batts	Flexible acoustic barrier bonded to a 25mm thick flexible convoluted foam
Type	Acoustic	Acoustic
Thickness (mm)	75mm	25mm
Density (kg/m ³)	11kg/m ³	5kg/m ²
Application	Walls Inside stud walls around and between toilets and cleaners. Refer to Wall Types in 0382 LIGHT TIMBER FRAMING for walls to be insulated.	Mechanical Plant Both FCUs (01 & 02) on each level are to be acoustically wrapped with Pyrotek Soundlag 4525C. The extent of the wrapping should cover the entire unit, the flexible connections on both sides and 500 mm of the duct on the supply side. Refer Mechanical Services Drawings for the location of the Fan Coil Units (FCUs)

INTERIOR

0511 Lining

0511 LINING

1 GENERAL

1.1 RESPONSIBILITIES

Requirement: Provide internal lining systems, as documented.

Performance

Requirement: Provide lining system with a surface that is:

- Resistant to impacts expected in use.
- Resistant to moisture encountered under expected environmental conditions.
- Free of irregularities.
- A suitable substrate for the nominated final finish.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0183 FIRE STOPPING

Specified in this worksection

Linings includes but is not limited to the following:

- plasterboard ceiling and wall linings – standard and fire-rated;
- fibre cement linings to partition walls;
- fire-rated wall linings to steel wall frames to services shafts;
- access panels in ceilings.
- recessed trims to set plasterboard linings;

Associated worksections

Refer to the related worksections:

- 0342 LIGHT STEEL FRAMING for steel stud wall to be lined with fire-rated panels and all miscellaneous framing as documented;
- 0382 LIGHT TIMBER FRAMING, for timber stud walls to be lined with plasterboard and fibre cement linings; timber joists to ceilings and raised floors; to ceilings above rooms below mechanical plant and for fixing ceilings to and all miscellaneous framing required to complete the works as documented.
- 0383 SHEET FLOORING, for compressed fire cement, particleboard and plywood sheet flooring;
- 0472 ACOUSTIC INSULATION, for acoustic insulation generally.
- 0453 DOORS AND ACCESS PANELS for access panels and doors in lined surfaces.
- 0531 SUSPENDED CEILINGS, for framing to suspended ceilings to take access panels.
- 0671 PAINTING, for paint finishes to linings.
- 0551 JOINERY, for plywood to balustrades and wall linings; for skirtings, and timber trim generally.
- ELECTRICAL SERVICES, for wall and ceiling mounted fittings incorporated in lined surfaces.
- MECHANICAL SERVICES, for mechanical services penetrating or mounted on linings.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for location and designation of linings.
- Architectural Reflected Ceiling Plans for location of different ceiling finishes.

SPECIFICATION

INTERIOR

0511 Lining

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS/NZS 4491 and the following apply:

- Decorative overlaid wood panels: Particleboard or fibreboard with a bonded decorative finishing surface such as thermosetting resin (low pressure melamine), PVC film, paper foils or wood veneer.
- Dry processed fibreboard: A panel manufactured by bonding lignocellulosic fibres (derived from wood or other materials) with a synthetic resin adhesive and curing under heat and/or pressure. The panels are manufactured with a forming moisture content of less than 20%.
- Fibre cement sheet linings: Treated cellulose fibre in a matrix of cement and sand autoclaved sheet, sealed on one side.
- High pressure decorative laminate (HPDL):
 - . Panels consisting of core layers impregnated with phenolic and/or aminoplastic resins and a surface layer(s) impregnated with aminoplastic resins (mainly melamine resins).
 - . Sheets consisting of a decorative face and layers of fibrous sheet materials (e.g. paper) impregnated with thermosetting resins and bonded together under heat and pressure of at least 5 MPa.
- Particleboard: Panel manufactured from wood particles and/or lignocellulosic materials under pressure and heat with adhesive added.
- Wet processed fibreboard: A panel manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and/or pressure, the bond of which is derived from the felting of the fibres and the panels are manufactured with a forming moisture content greater than 20%.
- Plywood
 - . Interior use generally: To AS/NZS 2270.
 - . Interior use, exposed to moisture: To AS/NZS 2271.
 - . Visible surface with a clear finish: Veneer quality A.
 - . Other visible surfaces: Veneer quality B.

1.4 TOLERANCES

Permitted deviations

Gypsum lining: To AS/NZS 2589 clause 4.2.2.

Other lining: 4 mm from a 1.8 m straightedge.

Substrates

Requirement: Plumb, level, in true alignment and to the lining manufacturer's recommendations.

Timber, steel framing and battened masonry: To AS/NZS 2589 clause 4.2.

1.5 SUBMISSIONS

Tests

Type tests: Submit results as follows:

- Fire hazard properties:
 - . Average specific extinction area (non-sprinklered buildings): < 250 m²/kg to AS/NZS 3837.
 - . Group number: To AS/NZS 3837 and BCA Spec A2.4 or AS ISO 9705.
 - . Smoke growth rate index (non-sprinklered buildings): < 100 to AS ISO 9705 and BCA Spec A2.4.

Warranties

Requirement: Submit the following:

- Fire-resistance ratings to fire rated linings

Lining materials: Submit the manufacturer's published product warranties.

SPECIFICATION

INTERIOR

0511 Lining

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Substrate or framing before installation of linings with insulation in place.
- Finished surface of installation before applying:
 - . Sealer.
 - . Finish coatings or decorative papers.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Requirement: Dry and undamaged lining stacked in pallets horizontally on a smooth, level surface. Prevent distortion or moisture ingress.

Timber or fibreboard panels: Store off the ground in a well-ventilated area.

Handling: Do not drag sheets across each other or across other materials. Protect edges, corners and surface from damage.

Acclimatisation

Timber panels: Store on-site in final interior conditions for 2 to 3 weeks before installing. Do not install until the air conditioning system of the installation area is operating.

2.2 MARKING

Identification

General: Deliver materials to the site in the manufacturer's original sealed packaging, legibly marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern. Provide technical data sheets if not shown on labels.
- Handling and installation instructions.
- Safety data sheets (SDS).

Certification

General: Label panels under the authority of a recognised certification program applicable to the product. Locate the label on faces or edges which will be concealed in the works.

2.3 MATERIALS AND COMPONENTS

Plasterboard

Standard: To AS/NZS 2588.

Location: Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES

Grade: Standard and fire-rated as scheduled.

Thickness (mm): Refer to 0382 LIGHT TIMBER FRAMING for Wall Types and plasterboard thicknesses; not less than 13mm for non-fire-rated plasterboard. Refer to details.

SPECIFICATION

INTERIOR

0511 Lining

Sheet width (mm): Selected to minimize material wastage

Sheet length (mm): Selected to minimize material wastage

Edge finish: Square edge, recessed or bevelled to suit the specified joint finish to AS/NZS2588

Fibre cement

Standard: To AS/NZS 2908.2.

Wall and ceiling linings: Type B category 2

Compressed fibre cement: Type A Category 5

Minimum thickness: 6 mm.

Location: Refer to SH03 SCHEDULE OF SUBSTRATES AND FINISHES

Type: Type B, Category 2; compressed sheets to Type A, Category 5

Thickness (mm): Refer Wall Types in 0382 LIGHT TIMBERFRAMING and as detailed for direct stick sheeting to masonry walls.

Plywood and blockboard

General interior use: To AS/NZS 2270.

Areas requiring moisture resistance: To AS/NZS 2271.

Visible surfaces with a clear finish: Veneer quality A.

Other visible surfaces: Veneer quality B.

Back/face veneer: Veneer quality C or D.

Pre-sealed plywood: Plywood pre-sealed both sides and edges with a machine applied sealer.

Particleboard

Standard: To AS/NZS 1859.1.

Classification: STD and MR

Fasteners

Steel nails: Hot-dip galvanized.

Adhesives

For wallboards: Gunnable synthetic rubber/resin based mastic contact adhesive formulated for bonding flooring and wallboards to a variety of substrates.

Sealants

Fire-resistance rated sealant: Non-hardening sealant, conforming to FIRE- STOPPING worksection, compatible with the materials to be sealed and having a fire-resistance rating equal to that of the building element it seals.

Acoustic sealant: Non-hardening sealant compatible with the materials to be sealed and rated to R_w 65.

Engineered mineral boards

Fire rated service riser shaft wall board: Laminated cementitious board which when subjected to heat and pressure in an autoclave, forms a sturdy, multi-purpose matrix engineered mineral board to achieve the specified fire-resistance rating.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Conditions

Commencement: Do not commence lining work until the building or installation area is enclosed and weathertight, and all wet trades have been completed.

Substrates or framing

General: Before fixing linings, check and adjust the alignment of substrates or framing, if necessary.

INTERIOR

0511 Lining

Battens

General: Fix at each crossing with structural framing members, to solid walls or ceiling support.
Provide wall plugs in solid substrates.

Ceiling linings

General: Do not install until the timber roof structure is fully loaded for at least 14 days.

Accessories and trim

General: Provide accessories and trim as necessary to complete the installation.

Adhesives

General: Provide adhesive types appropriate for the purpose, and apply them so they transmit the loads imposed without causing discolouration of the finished surfaces.

Fire-resisting and acoustic installations

Sealing: Apply sealant to the manufacturer's recommendations and as follows:

- Around services pipes and penetrations.
- Electrical outlets and recessed lights: Line back and sides of fixture with plasterboard and seal around fixture junction with sealant.
- Around perimeter of lining panels: Provide continuous runs of sealant.

3.2 PLASTERBOARD LINING

Supports

General: Install timber battens or proprietary cold-formed galvanized steel furring channels as follows:

- Where framing member spacing exceed the recommended spacing.
- Where direct fixing of plasterboard is not possible, due to the arrangement or alignment of the framing or substrate.
- Where the lining is the substrate for tiled finishes.
- Where required for penetrations for services, including mechanical grilles and lighting fixtures.

Transverse walls: Locate noggings as follows:

- At least 150 mm from the horizontal joint.
- Make sure noggings do not protrude beyond the face of studs.

Installation

Gypsum plasterboard and fibre reinforced gypsum plaster: To AS/NZS 2589.

Suspended flush ceilings: Fix using screw or screw and adhesive to ceiling members or support frame.

Screws used for plasterboard fixing must comply with AS 3566 Self-drilling screws for the building and construction industries. Part 2: Corrosion resistance requirements.

Multiple sheet layers

Application: Fire-resistance rated and acoustic rated walls.

Joints: Fill and flush up all joints and fasteners in each layer and caulk up perimeters and penetrations before installing subsequent layers. Stagger all sheet joints by minimum 200 mm.

Joints

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.

Butt joints: Make joints over framing members or provide back blocking.

External corner joints: Make joints over metallic-coated steel corner beads.

Dry joints: Provide square edged sheet and finish with a PVC-U joining section.

Control joints: Provide purpose-made metallic-coated control joint beads at not more than 12 m centres in walls and ceilings and to coincide with structural control joints.

Wet areas: Install additional supports, flashings, trim and sealants as required.

Joints in tiled areas: Do not apply a topping coat after bedding perforated paper tape in bedding compound.

INTERIOR

0511 Lining

Cross reference

Refer to the architectural details for the service duct, for Change room walls, for kitchen and amenities generally.

3.3 FIBRE CEMENT LINING

Supports

General: Install timber battens or proprietary cold-formed galvanized steel furring channels as follows:

- Where framing member spacing exceed the recommended spacing.
- Where direct fixing of fibre cement is not possible, due to the arrangement or alignment of the framing or substrate.
- Where the lining is the substrate for tiled finishes.
- Where required for penetrations for services, including mechanical grilles and lighting fixtures.

Installation

Joints and layout: Run sheets across the framing members. In flush jointed applications, stagger end joints in a brick pattern and locate them on framing members, away from the corners of large openings. Provide supports at edges and joints.

Fixing

Timber framed construction: Nail only or combine with adhesive.

Steel framed construction: Screw only or combine with adhesive.

Wall framing: Conform to the following:

- Do not fix to top and bottom plates or noggings.
- In tiled areas: Provide an extra row of noggings immediately above wall-to-floor flashings. Fix sheet at 150 mm centres to each stud and around the perimeter of the sheet.

Ceilings: Fix using screw and/or adhesive to ceiling furring members. Do not fix sheets directly to the bottom chords of trusses.

- Ceiling battens: Fix at 600 mm maximum centres.

Wet areas: Do not use adhesive fixing alone.

Multiple sheet layers

Application: Fire-resistance rated walls.

Joints: Fill and flush up all joints and fasteners in each layer and caulk up perimeters and penetrations before installing subsequent layers. Stagger all sheet joints by minimum 200 mm.

Joints

Joint width:

- Butt joints: 1 to 2 mm.
- Expressed joints: 10 mm maximum.

Joint backing for expressed joints: Black self-adhesive polyurethane tape.

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.

External corner joints: Make joints over metallic-coated steel corner beads.

Dry joints: Provide square edged sheet and finish with a PVC-U joining section.

Control joints: Provide control joints to coincide with structural control joints and as follows:

- Walls: ≤ 7.2 m centres.
- Ceilings: To divide into bays not larger than 10.8 x 7.2 m.
- Soffit linings: To divide into bays not larger than 4.2 x 4.2 m or 5.6 x 3.6 m.
- Control joint beads: Purpose-made metallic-coated.
- Support: Provide framing parallel to the joint on each side. Do not fix the lining to abutting building surfaces.

Wet areas: Provide additional supports, flashings, trim and sealants as required.

Joints in tiled areas: Bed perforated paper tape in bedding compound. Do not apply a topping coat.

SPECIFICATION

INTERIOR

0511 Lining

- Control joints: Not more than 4.2 m centres and space to suit joints required in tiling.
- Internal corners: Reinforce with metallic-coated steel angles. In corners subject to continuous moisture, flash over the angle and under the sheeting with continuous bitumen coated aluminium flashing.

3.4 FIRE-RATED SERVICE RISER SHAFT LINING

Wall sheet linings

Sheets: 9mm PROMATECT-H boards installed both side of the service riser shaft as detailed. Steel stud walls to structural engineer's details. Wall insulation as specified in **Steel Stud Wall Framing Schedule** in 0382 LIGHT STEEL FRAMING worksection.

Fire rating: FRL -/120/120

Certification: Inspection and certification from Promat required

Contact details: Gareth O'Donnell NSW technical Support - Promat Australia Pty Ltd T. 9630 4900
M. 0477 769 350

Cross references

- Refer to the structural engineer and architectural details for steel framing..

Confirm the internal shaft dimension and setout of the shaft before commencing riser shaft construction.

3.5 ACCESS PANELS

Ceiling access panels

Refer to the architectural Reflected Ceiling Plans and to the MECHANICAL, HYDRAULIC and ELECTRICAL SERVICES drawings and specification for access requirements. All to be read in conjunction with the architectural reflected ceiling plans.

Wall access panels

Refer to 0453 DOORS AND ACCESS PANELS worksection.

Finish

General: Match the access panels to the ceiling in appearance and performance; paint finish.

Identification

General: Provide each access panel with an identification mark.

Non-demountable ceilings

General: Provide access panels supported and anchored to permit ready removal and refixing.

Reinforcement

General: Reinforce the back of the access panel to prevent warping and facilitate handling.

Allowances

To ceilings on each level in amenities allow for 2 additional 600mm square access panels. Location of access panels to be reconfirmed on site.

Selections

Refer to Access Panels Ceilings in this worksection.

3.6 TRIM AND ACCESSORIES

General

Requirement: Provide trim such as beads, mouldings and stops to make neat junctions between lining components, finishes and adjacent surfaces.

Proprietary items: Provide complete with installation accessories.

Timber and MDF trim: Fix using full length so that trim is secure and without movement. Where nail or screw fixings are used, make sure fastener finishes sufficiently below face of trim so that stopping piece finishes flush with the face.

SPECIFICATION

INTERIOR

0511 Lining

Fire-resistance rated walls

Requirement: Seal to soffit with sealant with an equivalent fire-resistance level. Square edge finish.

3.7 COMPLETION

General

Damaged or marked lining and components: Replace.

Exposed surfaces: Touch up shop applied finishes and restore damaged or marked areas.

Timber panels: If appearance is not uniform, replace panels.

Cleaning: Clean completed surfaces to remove irregularities and leave panels smooth and clean, to the manufacturer's recommendations. If required, sand with fine paper to remove irregularities and refinish panel surface.

- Debris and unused material: Remove from site.

Warranties

Requirement: At practical completion, submit warranties against defective materials and installation.

4 SELECTIONS

4.1 SHEET LINING FOR WALLS AND CEILINGS

Cross references:

Refer to the following:

- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, the architectural drawings – floor plans, reflected ceiling plans and details.
- 0342 LIGHT STEEL FRAMING for fire-rated linings to services Shaft. Linings for the shaft are not included in the table below
- 0382 LIGHT TIMBER FRAMING for timber stud wall framing and Wall Types
- 0531 SUSPENDED CEILINGS, for steel ceiling framing for sheet linings as scheduled below.

Linings schedule – walls and ceilings

Lining Type	PBD Standard Plasterboard	PBD/FR Fire rated Plasterboard	FC Fibre Cement
Location	Stud walls generally; Ceilings generally where not scheduled for PBD/FR Walls to non-wet areas.	Bay 4 – Ground Ceiling to 4G.01 Lobby	Walls - Wet areas including Male and Female Toilets, Access Toilets, Cleaners
Proprietary System / Item	CSR Gyprock or equal	CSR Fyrchek or equal	James Hardie Villaboard
Thickness mm / Material	1 x 13 1 x 16 2 x 16	2 x 16	1 x 6
Edge Type	recessed	recessed	recessed
Joint Type	flush set joints	flush set joints	flush set joints
Fixing	Screw fix or screw fix with adhesive to furring channels.	Screw fix or screw fix with adhesive to furring channels.	Screw fix or screw fix with adhesive to furring channels.

SPECIFICATION

INTERIOR

0511 Lining

Substrate / Insulation / Trim Refer to the Wall Types in 0382 LIGHT TIMBER FRAMING for insulation	75mm polyester partition batts 11kg/m ³ where scheduled.	Bradford Fireseal Party wall batts – rockwool. 100mm thick	75mm polyester partition batts 11kg/m ³ where scheduled in wall types.
Fixing system	Refer to 0531 SUSPENDED CEILINGS for sheet ceiling linings fixed to suspended ceilings. Refer to 0382 LIGHT TIMBER FRAMING for ceiling structures above rooms supporting mechanical plant. Refer to 0342 LIGHT STEEL FRAMING for Wall Types.		
FRL	-	-	-/120/120 -
Finish	Paint	Paint	Paint Ceramic Tile/paint

Refer to LIGHT STEEL FRAMING for insulation to the fire-rated Service Riser Shaft

Refer to JOINERY for plywood ramp balustrades.

4.2 ACCESS PANELS

Access Panel Schedule - Ceilings

Type	AP
Product	Standard Trafalgar
Door panel and frame type	Metal – Pre-primed steel. Wet edge frame
Operation	Hinged – key locked * Lockwood key lock.
Opening sizes**	600 x 600mm
Finish	Paint to match ceiling

* Confirm locking requirements with superintendent prior to ordering access panels

**Access panel sizes can be reduced to 450 x 450mm where approved by services consultants.

Tender allowance for access panels

Tenderers are to allow in their tender pricing for the supply and installation of additional access panels (600 x 600mm) to the number shown on the services drawings and the architectural reflected ceiling plans as follows:

- Ground Floor Bay 5: allow for 2 additional standard ceiling access panels
- Ground Floor Bay 4 Amenities: allow for 2 access panels
- Level 1: allow for 2 additional standard ceiling access panels
- Level 2: allow for 2 additional standard ceiling access panels
- Level 3: allow for 3 additional acoustic ceiling access panels
- Level 4: allow for 2 additional acoustic ceiling access panels

05 INTERIOR

0525 Cubicle systems

0525 CUBICLE SYSTEMS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide toilet cubicles, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Cubicle systems include, but are not limited to the following:

- Toilet partition systems complete with doors and hardware.
- Provision of shop drawings and samples.

Associated worksections

Refer to the following worksections:

- 0552 METALWORK, for grab rails and toilet roll holders to be fixed to toilet cubicles and miscellaneous metalwork.
- 0621 CERAMIC TILING, for floor tiles to which toilet cubicles are fixed to and for wall tiles.
- 0651 RESILIENT FINISHES, for vinyl flooring to Cleaners.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES for finishes in rooms with cubicles.
- SH03 SCHEDULE OF SANITARYWARE AND TAPWARE for schedule of sanitary fittings and tapware in Toilets.
- Architectural drawings for plans and wet area details for location of cubicle partitions.
- HYDRAULIC SERVICES drawings for hot and cold water, thermostatic mixing valves, and for sewer drainage services to Toilets, Cleaners and Kitchenettes and refer to the specification.

1.3 INTERPRETATION

Abbreviation

General: For the purposes of this worksection the following abbreviation applies:

- ABS: Acrylonitrile-Butadiene-Styrene.

Definitions

General: For the purposes of this worksection the following definitions apply:

- Cubicle: A small space or compartment partitioned off, often within a wet area.
- High pressure decorative laminates (HPDL):
 - . Panels consisting of core layers impregnated with phenolic and/or aminoplastic resins and a surface layer(s) impregnated with aminoplastic resins (mainly melamine resins).
 - . Sheets consisting of a decorative face and layers of fibrous sheet materials (e.g. paper) impregnated with thermosetting resins and bonded together under heat and pressure of at least 5 MPa.
- Particleboard: A panel manufactured under pressure and heat from wood particles and/or lignocellulosic material with the addition of an adhesive.

05 INTERIOR

0525 Cubicle systems

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Set-out before installation.
- Completion of installation.

1.5 TOLERANCES

General

Deviation (from true grid lines and planes): 1:1000 to a maximum of 3 mm.

Misalignment (of adjoining surfaces at panel junctions): 1 mm.

Panel thickness: ± 0.5 mm.

Length and width: 0.1% of the dimension or 0.5 mm, whichever is the greater.

Flatness, twist, winding and bow: 1 mm deviation from a 2.4 m straightedge placed in any position.

Maximum deviation of edges from the intended true line: ± 1 mm.

1.6 SUBMISSIONS

Samples

General: Submit samples as follows:

- Each selected panel and door finish, at least 300 x 300 mm, with associated selected edge strips and trims and specified colour.
- All hardware and metal components in the selected finish.

Shop drawings

General: Submit shop drawings to a scale that best describes the detail, showing the following:

- Overall layout and dimensions.
- Materials, thicknesses and finishes of elements including doors, divisions, fronts, pedestals and top rail.
- Assembly hardware.
- Door hardware type and location.
- Method for concealing fixings to ambulant grab rails so they are not exposed on the outer face.
- Relationship of assembly to adjacent building elements.

Subcontractors

General: Submit name and contact details of proposed manufacturers and installers.

Evidence of experience: required

Tests

Type tests: Submit results as follows:

- Graffiti removal: Removal of spray paint and permanent markers from the nominated surface.

Warranties

Cubicle system assemblies: Submit the manufacturer's published product warranties.

2 PRODUCTS

2.1 MARKING

Identification

General: Deliver materials to the site in the manufacturer's original sealed containers or packaging, legibly marked to show the following:

05 INTERIOR

0525 Cubicle systems

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern. Provide technical data sheets if not shown on labels.
- Handling and installation instructions.
- Safety data sheets (SDS).

2.2 PRODUCT SYSTEMS

Sheet faced reconstituted wood-based panels and doors

Particleboard: Moisture resistant particleboard to AS/NZS 1859.1.

Dry processed fibreboard: Moisture resistant high density fibreboard to AS/NZS 1859.2.

Finishes: Conform to the following:

- Decorative overlay: To AS/NZS 1859.3.
- Edge strip: 2 mm ABS colour matched to decorative overlay.
- High pressure decorative laminates: Sheets made from thermosetting resins to AS/NZS 2924.1.
- Stainless steel: Type 316.
 - . Edge: Adhesive fixed stainless steel folded channel.

High pressure decorative laminate (HPDL) and panels and doors

Material: Compact high pressure decorative laminate panels with an integral surface finish and edges sealed by the manufacturer.

Edge: Factory prefinished square cut, ground smooth and arrised, and oiled by the manufacturer.

2.3 ACCESSORIES

Hardware

Fixing hardware: Bolts, dowels, brackets, standards, cappings and stabilising bars supplied to complete the cubicle assembly.

Door furniture: As documented in the **Cubicle schedule**.

3 EXECUTION

3.1 PANELS

Acclimatisation

General: Condition wood-based product components in the anticipated environment for two weeks before assembly.

Manufactured cubicle system installation

Assembly: Attach divisions and nibs to walls and fronts with purpose-made proprietary fixings. Cut nibs and divisions that abut walls, as required, so that assembly is plumb. Seal edges as recommended by the manufacturer.

Floor mounted/overhead braced type: Fix fronts to the floor with proprietary fittings and at the top to a metal channel headrail, supplied as part of the system. Run headrail across the fronts and fix to the walls at each end. Form the channel into a box section over doorways by snapping in a mating channel insert.

05 INTERIOR

0525 Cubicle systems

Heads of openings: Fix stabilising head channels by screwing to the top of the partitions. Provide an infill strip to the channel across the opening.

Freestanding type: Fix fronts to the floor with proprietary fittings.

4 SELECTIONS

4.1 SCHEDULES

Cubicle schedule

Property	CP1
Manufactured cubicle systems	
	TOILET PARTITIONS
Manufacturer	TPI Commercial Joinery T.1300 400 711 T.02 9709 6641 www.tpi.net.au
Locations	Bay 5 Ground Floor: Male and Female Toilets Bay 5 Level 1: Male and Female Toilets Bay 5 Level 2: Male and Female Toilets Bay 5 Level 3: Male and Female Toilets Bay 5 Level 4: Male and Female Toilets
Installation	Install to manufacturer's directions
Product name	Floor Mounted Overhead Braced in 13mm Compact Laminate. With Modulux® Total Privacy Solution. Aluminium to be Square Clear Anodised. Screw fixing
Cubicle function	Toilet partition 2000mm high
Type Model	TPI FO13CL Floor mounted
Front base fixing	Floor mounted
Material and thickness: Division (mm)	13mm Compact Laminate (13CL)
Material and thickness: Front and nib (mm)	13mm Compact Laminate (13CL)
Finish: Type	Plastic Laminate
Finish: Colour	Laminex 'Black' Natural Finish.
Doors	
Material	13mm Compact Laminate (13CL)
Size	Ambulant Doors: 1700 mm (H) x 720-750mm with Floor Clearance: 200mm
Finish: Colour	Laminex 'Black' Natural Finish.
Hardware	
Finish	Diecast Zinc, Alloy ZP3 Xcel-Slidelock SCP: Satin Chrome Plated
Indicator bolts	Metlam Xcel series Concealed Screw Fix
Lock	Easy Glide side lock Satin Chrome, Concealed screw fix. Finish: Diecast Zinc, Alloy ZP3 ABS Snap On Cover Plate
Hinges	Diecast Zinc, Alloy ZP3 : Metlam 106C Concealed Fix Gravity Hinge. Left or right hand open as required.

05 INTERIOR

0525 Cubicle systems

Property	CP1
Manufactured cubicle systems	
Coat hook/door stop	Diecast Zinc, Alloy ZP3. SCP Metlam 101 Bumper – 1/no per toilet door
Coat Hook	Diecast Zinc, Alloy ZP3. SCP Metlam 102 Coat Hook to back of doors

SPECIFICATION

INTERIORS

0532 Suspended ceilings

0532 SUSPENDED CEILINGS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide suspended ceilings as documented and as follows.

- Consistent in finish treatment.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Suspended ceilings including but not limited to the following;

- Proprietary suspension systems / light steel framing and trim for flush sheet linings.
- Support structure for selected flush ceiling mounted services fittings.
- All suspension systems, trim and accessories

Related worksections

Refer to the following related worksections:

- 0382 LIGHT TIMBER FRAMING, for timber stud wall framing.
- 0511 LINING, for plasterboard – standard and fire-rated for walls and ceilings; fibre cement sheet linings to walls; flush ceiling mounted access panels to be fixed to suspended ceiling structure.
- 0671 PAINTING, for decorative paint finishes to walls, ceilings and access panels.
- ELECTRICAL SERVICES, for electric fittings recessed into ceilings; for electrical, communications fittings and other services to be fixed to ceilings.
- MECHANICAL SERVICES, for mechanical services and air conditioning ductwork and ceiling registers, kitchen exhaust range hoods mounted below and passing through ceilings.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES and Reflected Ceiling Plans, for designation and location of ceilings and access panels.
- Architectural reflected ceiling plans for location of new ceilings and for access panel locations.

1.3 STANDARDS

General

Suspended ceilings: To AS/NZS 2785.

1.4 TOLERANCES

Suspension system

Flatness, twist, winding and bow: 1.5 mm deviation from a 1.5 m straightedge placed in any position.

Sheeted or flush ceiling system

Suspension system bearing surface for flush lined ceiling: To AS/NZS 2589 Table 4.2.2.

SPECIFICATION

INTERIORS

0532 Suspended ceilings

1.5 SUBMISSIONS

Prototypes

General: Provide a prototype of the ceiling system, including at least one example of each of the specified components, including services terminals.

- Size: At least 10 m².
- Location: to be where directed by the superintendent.

Samples

General: Submit samples as follows:

- Suspension system: Sections proposed for the suspension system, including suspension rods, clips, and wall angles.
- Accessories including access panels and wall trims.

Tests

Type tests: Submit results as follows:

- Fire hazard properties:
 - . Average specific extinction area (non-sprinklered buildings): < 250 m²/kg to AS/NZS 3837.
 - . Group number: To AS/NZS 3837 and BCA Spec A2.4 or AS ISO 9705.
 - . Smoke growth rate index (non-sprinklered buildings): < 100 to AS ISO 9705 and BCA Spec A2.4.
- Fire resistance level: To AS 1530.4.
- Weighted suspended ceiling normalized level difference: To AS/NZS ISO 717.1.
- Weighted sound absorption coefficient: To AS ISO 11654 as tested to AS ISO 354.

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- The suspension system before the installation of lining.
- The completed ceiling before site painting.
- Fire-rated ceiling in Bay 4 before installation of fire-rated plasterboard.
- Fire-rated ceiling in Bay 4 with all joints fire sealed before site painting.

2 PRODUCTS

2.1 SUSPENSION SYSTEM

Proprietary system

General: As documented in the **Proprietary suspension system schedule**.

Protective coatings for steel components: To AS/NZS 2785 Table F1.

2.2 LININGS

Cross reference

Refer to 0511 LININGS for plasterboard, fibre cement sheet linings to ceilings and bulkheads.

Plasterboard

Standard: To AS/NZS 2588.

Sealants

Fire-resistance rated sealant: Non-hardening sealant compatible with the ceiling materials and documented fire-resistance level.

SPECIFICATION

INTERIORS

0532 Suspended ceilings

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Working environment

General: Do not start work before the building is enclosed, wet work is complete and dry, and all work above the ceiling, including services, is complete.

Protection

General: Protect existing work from damage during the installation.

Partitions

General: If partitions are attached to the underside of the ceiling systems, include the partition mass in the seismic mass of the ceiling.

Stability

General: Install the ceilings level and fix to prevent looseness or rattling of ceiling components under normal conditions.

Structure-borne sound

General: Provide a ceiling system which does not amplify structure-borne sound. Provide suitable proprietary products or systems for reducing contact vibrations between structure and ceiling.

Control of movement

Abutments: Install the ceiling to allow for differential movement at abutting surfaces.

Alignment: Align ceiling control joints with the structural control joints. Do not bridge structural control joints.

Prefinishes

General: Repair damaged prefinishes by recoating.

3.2 SUSPENSION SYSTEM

Suspension system

Support members: Provide support members as follows:

- Space as required by the loads on the system and the type of ceiling.
- Allow for the installation of services and accessories, including ductwork, light fittings and diffusers.
- Provide additional back support or suspension members for the fixing of services and accessories to prevent distortion, overloading or excessive vertical deflection.

Failure: Provide a ceiling system where failure of any one suspension point does not cause a progressive failure of the ceiling.

Height adjustment: Provide height adjustment with a length adjustment device at each suspension point, permitting length variation of at least 50 mm.

Restriction: Do not attach the suspension system to the lip or flange of purlins.

Services

Support: Conform to the following:

- If the service has not been designed to accept the ceiling load, do not fix suspension members to services (e.g. ductwork).
- If services obstruct the ceiling supports, provide bridging and suspension on each side of the services.

Bracing

General: Provide bracing to prevent lateral movement and to resist the imposed horizontal seismic force.

Fasteners

General: Provide concealed fasteners. If material supporting hangers is less than 3 mm thick, do not use screw fasteners.

SPECIFICATION

INTERIORS

0532 Suspended ceilings

3.3 PLASTERBOARD LINING

Cross Reference

Refer to LINING specification for plasterboard sheet linings.

Installation

Gypsum plasterboard and fibre reinforced gypsum plaster: To AS/NZS 2589.

Suspended flush ceilings: Fix using screw or screw and adhesive to ceiling members or support frame.

Multiple sheet layers

Application: Fire-resistance rated and acoustic rated ceilings.

Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before commencing succeeding layers. Stagger all sheet joints by minimum 200 mm.

Joints

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.

Butt joints: Make joints over framing members or otherwise provide back blocking.

External corner joints: Make joints over metallic-coated steel corner beads.

Control joints: Align lining control joints with structural control joints and as follows:

- Ceilings: At maximum 12 m centres.
- Control joint beads: Purpose-made metallic coated.
- Location: If possible, position joints to intersect light fixtures, vents or air diffusers.

Wet areas: Install additional supports, flashings, trim and sealants, as required.

3.4 ACCESS PANELS

Cross reference

Refer to **Access Panel Schedule – Ceilings** in LINING worksection and for number to be provided over and above that shown on the drawings.

Finish

General: Match the access panels to the ceiling in appearance and performance.

Identification

General: Provide each access panel with an identification mark.

Non-demountable ceilings

General: Provide access panels supported and anchored to permit ready removal and refixing.

Reinforcement

General: Reinforce the back of the access panel to prevent warping and facilitate handling.

3.5 TRIM

Plasterboard junction of walls to ceilings

Square set junction of plasterboard to wall finish as specified in LININGS

Fire-resistance rated walls

Requirement: Seal to soffit with sealant with an equivalent fire-resistance level.

SPECIFICATION

INTERIORS

0532 Suspended ceilings

4 SELECTIONS

4.1 SUSPENSION SYSTEM

Proprietary suspension system schedule

	Plasterboard (PBD, PBD/FR)
Supporting system:	
- Type	Concealed
- Proprietary item	Rondo screw up ceiling suspension system incorporating: - 28mm furring channels and direct fixing clips; - 25mm or 38mm top cross rails and furring channel.
- Basic grid (l x b) (mm)	Top cross rails: 1200 span x 1200 spacing max to suit cross rail. Furring channels spacing: 600mm cts max/ 1200mm span.
- Material	Galvanised steel
Ceiling lining:	
Material	Plasterboard: standard and fire-rated
Proprietary item	Refer 0511 LINING worksection
Form	Sheet
Thickness (mm)	13 mm ; 6mm FC Refer 0511 LINING worksection.
Finish	Paint
Colour	Refer 0671 PAINTING
Trim	
Form	Shadowline stopping angle to all areas.
Proprietary item	Rondo part No P 50.
Material	Galvanised steel
Finish	Paint.
Colour	To match ceiling.
- Trim location	Perimeter and abutments in all lined areas. Refer SH02 SCHEDULE OF SUBSTRATES AND FINISHES and reflected ceiling plans and details.

4.2 LINING

Sheet lining schedule

Refer to **Selections - Sheet Linings for Walls and Ceilings** in 0511 LININGS

SPECIFICATION

INTERIOR

0551 Joinery

0551 JOINERY

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide joinery work, as documented and as detailed.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0181 ADHESIVES, SEALANTS & FASTENERS
- 0185 TIMBER PRODUCTS, FINISHES AND TREATMENT.

Specified in this worksection

Joinery includes, but is not limited to the following:

- New timber windows
- New timber sashes replacing louvre sashes and fitted into existing timber double hung window frames
- Timber skirtings to match existing skirtings.
- New timber skirtings
- Plywood balustrades to new internal ramps.
- New timber glazed sashes to replace louveres in existing timber windows.
- Kitchenette cupboards
- Miscellaneous timber trim.

Associated worksections

- Associated worksections: Conform to the following:
- 0467 GLASS AND GLASS COMPONENTS, for glass in timber windows; for timber handrails to proprietary glass balustrade system.
- 0552 METALWORK, for metal handrails and stanchions for the plywood balustrades.
- 0382 LIGHT TIMBER FRAMING for timber stud framing; for floor and ramp framing; for solid timber edges to plywood ramps.
- 0383 SHEET FLOORING, for plywood sheet flooring to the Ground Floor of Bay 5; particleboard sheeting above amenities.
- 0655 TIMBER FLOORING, for timber treads to new steel Stairs 3 and 4 to match the timber floor boards; for timber ramps and landings up to raised floors to amenities
- 0453 DOORS AND ACCESS PANELS, for timber doors and for repairs to existing timber boarded cargo landing doors.
- 0671 PAINTING, for paint to timber joinery.
- SH.02 SCHEDULE OF SANITARYWARE AND TAPWARE, for sinks and taps in kitchenette cupboards.

1.3 TOLERANCES

General

Requirement: Fabricate and install joinery items to substrates undamaged, plumb, level, straight and free of distortion.

SPECIFICATION

INTERIOR

0551 Joinery

Tolerances table

Property	Tolerance
Plumb and level	1:800
Offsets in flush adjoining surfaces	0.5 mm
Offsets in revealed adjoining surfaces	2 mm
Alignment of adjoining doors	0.5 mm
Difference in scribe thickness for joinery items centred between walls	2 mm
Doors centred in openings	0
Joints in finished surfaces	0

1.4 SUBMISSIONS

Certification

Certificate: Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying conformance to grading, species, and noting moisture content.

Inspection: If neither branding nor certification is adopted, submit a report by an independent inspecting authority verifying conformance.

Environmental rating evidence:

- Minimal VOC's or no VOC's for sealants, adhesives and processed fibreboard.
- Low or no formaldehyde.
- Forest certification for sawn timber and for timber source for processed fibreboard

Timing: Before fabrication

Drawings

Proprietary items: Submit the manufacturer's standard drawings and details showing:

- Methods of construction.
- Assembly and fixing, with dimensions and tolerances.

Maintenance manuals

General: Submit manufacturer's published recommendations for service use.

Samples

General: Submit samples as follows:

- Boards: Two of each type complete with specified finish and edging.
- Joints: Two of each type.
- Typical hardware item: Two samples, showing each finish.
- Stone cladding: Provide three variants, two samples of each variant showing maximum variation.
- Stainless steel items: Two of each type.
- Kitchenette cupboard door: One sample, complete with hardware.
- Drawer front: One sample, complete with hardware.
- Profiled timbers: Two of each type of skirting; timber sash frame

Shop drawings

General: Submit shop drawings to a scale that best describes the detail, showing the following:

- Overall dimensions.
- Materials, thicknesses and finishes of elements including doors, divisions, shelves and benches.
- Type of construction including mitre joints and junctions of members.
- Hardware type and location.
- Temporary bracing, if required.
- Procedures for shop and site assembly and fixing.
- Locations of benchtop joints.

SPECIFICATION

INTERIOR

0551 Joinery

- Stone benchtop layout including joint arrangement and penetrations.
- Locations of fixtures, sinks, and other items to be installed in the units.
- Relationship of fixture to adjacent building elements.
- Details of fabrication involving other trades or components.
- Proposals for the break-up of large items as required for delivery to the site.
- Proposed method of joining the modules of large items.

Timing: Before fabrication.

Plywood ramp balustrades

General: Submit shop drawings for the plywood ramp balustrades to a scale that best describes the detail. Shop drawings are to show the following:

Internal plywood ramp shop drawings:

- Plans, elevations and detail sections showing the plywood sheet balustrade joint locations, steel plates and steel stanchions and handrails.
- Overall dimensions and detail dimensions.
- Materials, thicknesses and finishes of elements .
- Type of construction including mitre joints and junctions of members.
- Procedures site assembly and fixing.
- Relationship to adjacent building elements.
- Details of fabrication involving other trades or components.
- Proposals for the break-up of large items as required for delivery to the site.
- Proposed method of joining the modules of large items.

Timing: Before commencement of fabrication for approval.

Co-ordination: Refer to 0552 METALWORK and to details for the handrails incorporated into the plywood balustrade detailing.

Timber window sashes

Timber window sash shop drawings:

- Large scale details of new glazed timber window sashes to match existing details to fit existing double hung window framed after louvres have been removed.
- Method of installation with new sash cords.

Timber skirtings

Timber skirting shop drawings

- Detail section of timber skirting to match existing skirting SK/T1
- Detail section of timber skirting to match existing skirting SK/T2

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Shop fabricated or assembled items ready for delivery to the site.
- Openings prepared to receive assemblies.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.
- Surfaces prepared for, and immediately before, site applied finishes.
- Completion of installation.

2 PRODUCTS

2.1 DELIVERY AND STORAGE

General

Requirement: Deliver joinery units to site in unbroken wrapping or containers and store so that its moisture content is not adversely affected. Do not store in areas of wet plaster. Keep storage time to a minimum by delivering items only when required for installation.

2.2 JOINERY MATERIALS AND COMPONENTS

Visible work

Clear finished timber and veneer: Make sure all visible surfaces are free of branding, crayon or chalk marks and of blemishes caused by handling.

Joinery timber

Hardwood for trim: To AS 2796.1.

Hardwood for furniture: To AS 2796.3.

- Grade: Select

Seasoned cypress pine: To AS 1810.

Softwood for trim: To AS 4785.1.

Softwood for furniture: To AS 4785.3.

- Grade: FSEL

Finished sizes of milled timbers: Not less than the documented dimensions unless qualified by a term such as nominal, out of or ex to which industry standards for furnished sizes apply.

Plywood

Interior use generally: To AS/NZS 2270.

Interior use, exposed to moisture: To AS/NZS 2271.

Visible surface with a clear finish: Veneer quality A.

Other visible surfaces: Veneer quality B.

Presealed plywood: Plywood pre-sealed both sides and edges with a machine applied sealer.

Prefinished plywood: Austral Plywoods Airaply F17 Super EO board. "A" Bond. Colour: Ebony

Fire Resistance: BCA Group 3 – Sprinklered building

Wet processed fibreboard (including hardboard)

Standard: To AS/NZS 1859.4.

Classification: tempered MR

Bending strength: medium

Particleboard

Standard: To AS/NZS 1859.1.

Classification: STD and MR

Melamine overlaid particleboard: Particleboard overlaid on both sides with low pressure melamine.

Dry-processed fibreboard (including medium density fibreboard)

Standard: To AS/NZS 1859.2.

Melamine overlaid medium density fibreboard: Medium density fibreboard (STD MDF) overlaid on both sides with low pressure melamine.

Decorative overlaid wood panels

Standard: To AS/NZS 1859.3.

High-pressure decorative laminate (HPDL) sheets

Standard: To AS/NZS 2924.1.

Classification: horizontal HDS; vertical VGS

Minimum thickness: Conform to the following:

SPECIFICATION

INTERIOR

0551 Joinery

- For horizontal surfaces fixed to a continuous substrate: 1.2 mm.
- For vertical surfaces fixed to a continuous substrate: 0.8 mm.
- For post formed laminate fixed to a continuous substrate: 0.8 mm.
- For vertical surfaces fixed intermittently (e.g. to studs): 3.0 mm.
- For edge strips: 0.4 mm.

Stone facings

General: Provide stone or engineered stone slabs within the visual range of the approved samples. Repair mud veins or lines of separation that are integral to the selected pattern with resin fillers and back lining.

Splashbacks

Glass: 6 mm toughened colourback glass to AS/NZS 2208.

- Glass type: Starphire ultra clear glass with colour backing.

Certification

General: Brand panels under the authority of a recognised certification program applicable to the product. Locate the brand on faces or edges which will be concealed in the works.

Plywood formaldehyde emission class to AS/NZS 2270: Required

Reconstituted wood-panel formaldehyde emission class to AS/NZS 1859.2: Required

3 EXECUTION

3.1 JOINERY

General

Joints: Provide materials in single lengths whenever possible. If joints are necessary, make them over supports.

Framing: Frame and trim where necessary for openings, including those required by other trades.

Concealed surfaces: Prime surfaces concealed by substrates.

Deficiencies: Examine joinery units for completeness and remedy deficiencies.

Substrate: Damp clean and vacuum substrate surfaces that will be permanently concealed.

Acclimatisation

General: Acclimatise the joinery items by stacking in the in-service conditions with air circulation to all surfaces after the following are complete:

- Air conditioning operational.
- Lighting operational.
- Site drainage and stormwater works are complete.
- Space fully enclosed and secure.
- Wet work complete and dry.

Accessories and trim

General: Provide accessories and trim necessary to complete the installation.

Fasteners

Visibility: Do not provide visible fasteners except in the following locations:

- Inside cupboards and drawer units.
- Inside open units, in which case provide proprietary caps to conceal fixings.

Visible fasteners: Where fasteners are unavoidable on visible joinery faces, sink the heads below the surface and fill the sinking flush with a material compatible with the surface finish. In surfaces which are to have clear or tinted finish, provide matching wood plugs showing face (not end) grain. In surfaces which are to have melamine finish, provide proprietary screws and caps finished to match.

Fix joinery units to substrates as follows:

- Floor mounted units: 600 mm centres maximum.

SPECIFICATION

INTERIOR

0551 Joinery

- Wall mounted units: To each nogging and/or stud stiffener.

Fasteners: Screws with washers into timber or steel framing

Adhesives

General: Provide adhesives to transmit the loads imposed and for the rigidity of the assembly, without causing discolouration of finished surfaces.

Finishing

Junctions with structure: Scribe, plinths, benchtops, splashbacks, ends of cupboards, kickboards and returns to follow the line of structure.

Joints: Scribe internal and mitre external joints.

Edge strips: Finish exposed edges of sheets with edge strips which match sheet faces.

Matching: For surfaces which are to have clear or tinted finish, arrange adjacent pieces to match the grain and colour.

Hygiene requirements: To all food handling areas and voids at the backs of units in all areas, seal all carcass and junctions wall/floor, and cable and pipe entries with silicone beads for vermin proofing. Apply water resistant sealants around all plumbing fixtures and make sure sealants are fit for purpose.

Benchtops

Installation: Fix to carcass at least twice per 600 mm length of benchtop.

Joint sealing: Fill joints with sealant matching the finish colour and clamp with proprietary mechanical connectors.

Edge sealing: Seal to walls and carcasses with a sealant, which matches the finish colour.

Splashbacks

Glass: Fix with non-acidic silicone adhesive. Apply at the rate recommended by the manufacturer.

Installation: Clean the back of the glass panel and apply walnuts of adhesive together with double sided adhesive tape for temporary support, and affix directly to the substrate.

Labelling

General: Permanently mark each unit of furniture with the manufacturer's name, on an interior surface.

3.2 JOINERY ASSEMBLAGES

Standard

Domestic kitchen assemblies: To AS/NZS 4386.1.

AFRDI Blue Tick: required

Plinths

Material: Select from the following:

- Exterior general purpose plywood.
- High moisture resistant particleboard.
- High moisture resistant medium density fibreboard.

Thickness: 18 mm.

Fabrication: Form up with front and back members and full height cross members at not more than 900 mm centres.

Finish: High-pressure decorative laminated sheet:

- Class: horizontal HDS; vertical VGS
- Pattern: N/A
- Texture: N/A
- Colour: Refer to **Selections**

Fasteners: Conceal with finish.

Installation: Scribe to floor and secure to wall to provide level platform for carcasses.

Carcasses

Material: Select from the following:

SPECIFICATION

INTERIOR

0551 Joinery

- Overlaid high moisture resistant particleboard.
- Overlaid high moisture resistant medium density fibreboard.

Thickness: 18 mm.

Joints: Select from the following:

- Proprietary mechanical connections.
- Dowels and glue.
- Screws and glue.
- Proprietary joining plates and glue.

Adjustable shelves: Support on proprietary pins in holes bored at equal centres vertically.

- Spacing: 32 mm.

Finish: to match the doors

Fasteners: Conceal with finish.

Installation: Secure to walls at not more than 600 mm centres.

Drawer fronts and doors

Material: Select from the following:

- Melamine overlaid high moisture resistant particleboard.
- Melamine overlaid high moisture resistant medium density fibreboard.

Thickness: 16 mm.

Door size: Not exceeding 1.5 m² on face, with 2400 mm maximum height and 900 mm maximum width.

Drawer fronts: Rout for drawer bottoms.

Finish: plastic laminate

Colour: Refer to **Selections**

Drawer backs and sides

Material: PVC film wrapped particleboard.

Thickness: 12 mm.

Colour: Refer to **Selections**

Installation: Mitre corners leaving outer skin of foil intact, finish with butt joints, glue to form carcass and screw to drawer front. Rout for drawer bottoms.

Drawer bottoms

Material: PVC film laminated hardboard.

Thickness: 3 mm.

Colour: Refer to **Selections**

Drawer and door hardware

Hinge types: Concealed metal hinges with the following features:

- Nickel plated.
- Adjustable for height, side and depth location of door.
- Self-closing action.
- Hold open function.

Selections and Hold open angle: Blum clip top furniture 120deg hinge or 90deg hinge where adjacent partition. Provide with soft close function.

Slides / drawer runners: Metal runners and plastic rollers with the following features:

- 30 kg loading capacity.
- Closure retention.
- White thermoset powder coating or nickel plated.

Selection: Blum soft close drawer runner with soft close function; depth to suit.

INTERIOR

0551 Joinery

Cutlery tray

Selection: Hafele stainless steel cutlery tray insert in width to suit. Code: 557.80.042

3.3 WORKING SURFACES

Stone benchtops

Material:

- Type: Re-constituted stone
- Thickness: 20mm
- Nosing: 6mm Pencil Round Edge

Benchtop backing:

- Material: Low-Formaldehyde Contact MR MDF
- Thickness: 18mm
- Finish: Melamine
- Sealant: Fill joints with sealant matching finish and colour.

Balance underside: Laminate undersides of benchtops.

3.4 TIMBER SKIRTINGS

BAY 5 skirtings

Requirement: Supply and install timber skirtings to match the existing skirtings SK/T1 and supply and install new timber skirtings SK/T2 where scheduled.

Timber Skirtings to match existing SK/T1

General: Fabricate and install timber skirtings to match the profile and size of the existing skirting to new floors on Levels 2 and 4 in Bay 5 and to reinstate where they are missing on Levels 1, 2 and 3.

Skirtings: Existing skirtings 150mm x 25mm with profiled top edge. Confirm dimensions on site. Refer to detail drawings. Confirm the extent of existing skirtings on site. All existing skirtings are to be retained where found on retained walls.

Tender allowance for replacement skirtings SK/T1 to match existing to existing masonry walls

- Ground Floor: no existing timber skirtings.
- Level 1: Retain existing skirtings insitu on masonry walls. Allow for 30 lineal metres of new skirting to match existing for walls where skirting are missing or in poor condition; new SK/T1 to be installed to east wall as detailed.
- Level 2: All new skirtings to be allowed for all walls. Install to walls at floor level below the raised floors for when the raised floors removed in the future. Reuse of sound salvaged existing skirtings from demolition from this floor to approval.
- Level 3: Retain existing skirtings insitu on masonry walls. Allow for 30 lineal metres of new skirting to match existing (SK/T1) to existing concrete slabs for walls where skirting are missing or in poor condition; new SK/T1 to be installed to the east wall and to new timber floors.
- Level 4: All new timber skirtings SK/T1 to all existing masonry walls.

Refer to 0202 DEMOLITION and SH.02 SCHEDULE OF SUBSTRATES AND FINISHES for location of new timber skirtings.

Timber skirtings SK/T2

General: Fabricate and install new timber skirtings where detailed and where scheduled to sit flush with the plasterboard sheet linings as detailed to new stud walls.

Skirtings: Skirtings 150mm x 19mm with rounded top outer edge as detailed.

Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES for location of new timber skirtings.

- Ground Floor: SK/T2 to new stud walls only as detailed.
- Level 1: SK/T2 to new stud walls only as detailed.
- Level 2: SK/T2 to new stud walls only as detailed.
- Level 3: SK/T2 to new stud walls only as detailed.

INTERIOR

0551 Joinery

- Level 4: SK/T2 to new stud walls only as detailed.

Repairs to existing skirtings SK/T1

Repairs: Allow to infill holes in existing skirting with solid timber after the removal of attachments and electrical outlets. Inset timber to be flush for the face of the skirting, sand and prepare for painting. Refer 0671 PAINTING.

3.5 TIMBER TREADS TO STAIR 3 AND STAIR 4

Cross Reference

Refer to 0655 TIMBER FLOORING for hardwood treads to the new steel framed Stair 3 and Stair 4 where the treads are to match the new timber floor boards.

3.6 PLYWOOD BALUSTRADES

General

Requirement: Provide plywood sheet balustrades to ramps, consisting of balustrade and steel stanchions, steel cover plates and handrails as detailed.

Sheet balustrades: 2/no sheets 13mm prefinished Colour: Ebony.

Posts: 16 x 36mm plates with continuous fins 10 x 100mm for plywood fixing.

Top plate: To top of plywood install 40 x 3mm steel plate welded to posts/balusters where weld is not visible. Extend plate down the ends of the plywood balustrade.

Finish to steel: Powdercoat - Dulux Electro 'Black Ace: Flat 9069116F

Handrail: 28mm diam. satin finished stainless steel with 10mm plate brackets fixed to steel posts as detailed.

Details: Refer to the architectural plans and details. Refer to 0522 METALWORK for the handrail and baluster post details,

3.7 TIMBER WINDOW WITH LOUVRES

Windows with timber louvres

Requirement: Remove the existing louvres from the following double hung timber windows:

- 5GD/W3 Ground Floor: Construct 2/no new timber sashes with clear glass to fit into the existing window frame. Repair as required, the existing frame to take the new sashes after removal of the louvres sashes. Replace the sash cords for the window to be fully operational and then secure the window in the locked position with new sash catch and sash locks.
- 5L1/W4 First Floor: All 6/no sashes to this timber double hung window have been replaced with timber louvres. Remove the louvre sashes and construct new timber sashes for clear glass with all member sizes and details to match the existing windows.

Finish

Prepare and paint finish internal and external faces to match existing paint colours.

3.8 NEW TIMBER WINDOW

General

Requirement: After removal of the double brick infill from the original window opening below the entry steps Steps 1 into Bay 5, allow to construct 5L1/W5 as a new fixed sash glazed window in a frame.

Frame: Head and jamb frames : hardwood Fin 140 x 65

Sill : Fin 175 x 65mm, back plough

Sash: size as detailed on the drawings

Fixed sash: for laminated glass with decal.

INTERIOR

0551 Joinery

3.9 TRIM

General

Requirement: Provide trim such as beads, stops and skirtings to make neat junctions between lining components, finishes and adjacent surfaces.

Fixing

To existing masonry walls: timber wall plugs set into existing joints at approx. 600 mm centres maximum.

To new stud walls: Nail to plate or framing at 600 mm centres maximum.

3.10 COMPLETION

Protection

Plywood balustrades: Provide full protection to balustrades and handrails prior to handover.

Cleaning

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary protective coatings.

Requirement: Remove all dust, marks and rubbish from all surfaces and internal spaces. Clean and polish all self-finished surfaces such as anodised and powder coated metals, sanitary ware, glass, tiles and laminates.

4 SELECTIONS

4.1 JOINERY SCHEDULE

Kitchenettes

To the following kitchenettes, provide materials and finishes as scheduled below.

- Ground floor Kitchenette: Joinery Unit JN01
- Level 1 Kitchenette: Joinery Unit JN02
- Level 2 Kitchenette: Joinery Unit JN03
- Level 3 Kitchenette: Joinery Unit JN04
- Level 4 Kitchenette: Joinery Unit JN05

Code	Type	Location	Description	Image
L1	Melamine	Joinery – Kitchenettes benchtop support, carcass & Kickplate	Supplier: Polytec Construction: Melamine on 18mm Thick Low-Formaldehyde Contact MR MDF Colour: Natural White Finish: Matt	
L2	Plastic laminate	Joinery – Kitchenettes Doors and Drawer fronts	Supplier: Polytec Construction: 1.2 on 18mm Thick Low-Formaldehyde Contact MR MDF Colour: Natural White Finish: Matt	

SPECIFICATION

INTERIOR

0551 Joinery

Code	Type	Location	Description	Image
ST1	Reconstituted Stone	Joinery – Kitchenettes Benchtop	Supplier: Quantum Quartz Construction: Reconstituted Quartz Stone with 6mm Pencil Round Edge Dimensions: 20mm Thick Colour: Luna White	
SB1	Splashback	Joinery – Kitchenettes	Supplier: Starphire Construction: Low-Iron Colour-Back Glass Colour: to Match Dulux Snowy Mountains Quarter SW1G3	
BIN	Garbage Bin	Joinery – Kitchenettes	Supplier: Hafele Style: Hailo Tandem TZ Inset Bin Construction: 2 x 15L Bin Unit Dimensions: to Suit O/A 300W Cabinet with Drawer Front Colour: Dark Grey Code: 502.72.761	

SPECIFICATION

05 INTERIOR

0552 Metalwork

0552 METALWORK

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide metal fixtures that are:

- Undamaged, plumb, level and straight.
- Free of surface defects or distortions.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0183 METALS AND PREFINISHES, for metal finishes.

Specified in this worksection

Metalwork fixtures includes but is not limited to:

- metal materials generally including all fastenings and accessories
- metal fabrication generally
- steel stairs, balustrades and handrails
- internal steel balusters and handrails to ramps
- external steel balusters, floor grating and handrails to ramps and steps
- perforated metal mesh risers to new steel stairs
- perforated metal mesh above new walls internally
- perforated mesh to steel framed sliding doors to kitchenettes
- checker plate ramps
- aluminium screens to roof plant and support structure
- steel roof plant platform grating and handrails – existing and extensions
- safe roof access systems and ladders – internal and external
- custom steel support frames for internal automatic glass sliding doors and operators
- floor division strips
- non-slip inserts to treads in external Steps 1 and 2
- non-slip nosings to treads to existing Stair 1
- grab rails and metalwork accessories.
- miscellaneous metalwork and trim as required to complete the works as detailed.

Related worksections

Refer to the following worksections

- 0341 STRUCTURAL STEEL, for structural steel to new internal steel stairs, external ramp, roof plant platform extension, steel columns and miscellaneous steelwork;
- 0344 STEEL – HOT-DIP GALVANIZING, for galvanized finishes to steelwork;
- 0655 TIMBER FLOORING, for non-slip metal insets into timber treads to new Stairs 3 and 4;
- 0421 ROOFING, for new roof access hatch in Bay 5 roof and flashings to all new roof penetrations;
- 0341 SUSPENDED CEILINGS, for metal suspended ceiling systems;
- 0355 BRICK AND STONE MASONRY, for steel lintels to openings, masonry wall ties;
- 0382 LIGHT STEEL FRAMING, for steel studs wall framing to services shaft;for furring channels;

SPECIFICATION

05 INTERIOR

0552 Metalwork

- 0453 DOORS AND ACCESS PANELS, for steel door frames, fire-rated and non-fire-rated, louvres in doors, access panels, steel framed and glass doors, partitions and highlights, steel plate reveals to openings; steel support frames for sliding cargo landing doors and floor guides;
- 0467 GLAZING AND GLASS COMPONENTS, for aluminium heads and base frame for frameless glass screens;
- 0612 CEMENTITIOUS TOPPINGS, for toppings and for toppings to external Steps 2 with non-slip insets and insets in existing Steps 1 treads;
- 0632 CERAMIC TILING, for metal wall tile trims and tile joints; for floor division strips and edge strips to tiled floors;
- 0651 RESILIENT FINISHES, for metal floor division strips and edge strips;
- 0671 PAINTING, for protective paint systems to metalwork;
- 0581 SIGNS AND DISPLAYS, for signage;
- 0455 HARDWARE, for hardware to doors and windows including kick and push plates;
- HYDRAULIC SERVICES, for service pipes, floor wastes, lineal strip drain drains and grates; flashings to roof and other services pipes;
- FIRE SERVICES, for fire services metal pipework;
- MECHANICAL SERVICES, for metal ducts and support hangers from concrete slabs;
- ELECTRICAL SERVICES, for electrical fittings and cable trays;
- Architectural drawings for details of metalwork items;
- Structural Engineering drawings and details for structural steel and for shop drawings to be provided.

1.3 STANDARDS

General

Access for maintenance: To AS 1657.

Tactile indicators: To AS/NZS 1428.4.1.

1.4 INSPECTION

Notice

Inspections: Give notice so that inspection may be made of the following:

- Shop fabricated or assembled items ready for delivery to the site.
- Commencement of shop or site welding.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.
- Steel surfaces prepared for, and immediately before, site applied finishes.

1.5 SUBMISSIONS

Execution

Welding procedures: Submit details of proposed welding procedures before fabrication.

Welding dissimilar metals: Submit the following details:

- Type and thickness of materials to be welded.
- Proposed joint preparation and welding procedures.
- Proposed filler metal.
- Expected dilution (proportion of fused parent metal in the weld metal).

Fastenings to aluminium (including aluminium alloys): Stainless steel or aluminium.

Installation of proprietary items

General: Submit the manufacturer's standard drawings and details showing:

SPECIFICATION

05 INTERIOR

0552 Metalwork

- Methods of construction.
- Assembly and fixing, with dimensions and tolerances.

Maintenance manual

General: Submit manufacturer's published recommendations for service use.

Materials

Manufacturer's data: Submit manufacturer's published product data including standard drawings and details.

Stainless steel: For each batch of stainless steel supplied to the works, submit the certificate of compliance or test certificate specified in the applicable standard.

Samples

General: Submit samples of the following:

- Each type of joint.
- Each type of finish illustrating the range of variation.
- Sections for use in fabricated work.

Samples schedule

Item	Sample size	Number	Notes
Steps 1 and 2	300mm long	2 no / nosings	Confirm selected nosing suits the existing concrete rounded nosing profile for set back from the nosing edge.
Stair nosings for existing concrete Fire Stair 1	300mm long	2 no / nosings	Confirm specified nosings suits the existing concrete nosing profile. Provide similar alternative if required to suit the existing tread edge.
Stair 3 and Stair 4 Non-slip inserts	300 mm long	2 no / nosings	Latham Asbraloy ACS-50 aluminium bar with standard sparkling black infill
Powdercoated aluminium louvre screen slat and frame – Roof Plant Room	300mm slats x 4 on a section of framing including sealed end to slats and powdercoat	2/no	Dulux Fluoraset powdercoat Sample 1: Xtreme Coin' 9647289S (R165G170 B173 – LRV 44%) Satin Finish. Sample 2: 'Xtreme Silver' 9647273Q (R165 G170 B173 – LRV 36%) Satin Finish
Stair 3 & 5 risers Mesh 1 Aluminium perforated metal mesh - anodized	500mm section of the stair riser with folds as detailed	1/no mesh and 1/no anodized	Sample : anodizing by AAF Colour - 'Platinum MATT (E87CM)
Sliding steel framed mesh doors & mesh to conceal services over amenities – all floors Mesh 2 Aluminium perforated metal mesh – powder coat finish	300 x 300mm	1/no samples	As specified Sample : Duralloy Dulux 'White Satin' – Satin 11295 Duralloy
Galvanized steel checker / floor plate	300 x 300mm	1/no	Standard pattern
Handrail and bracket 1] Internal ramps 2] Steel Stair 4 3] Stair 3	300mm length for each handrail with one bracket	1/no for each different handrail	

SPECIFICATION

05 INTERIOR

0552 Metalwork

External Access ramp – 1] handrail and bracket 2] floor grating 1 3] floor grating 2	1] 300mm long 2] 300 x300 mm 3] 300 x300 mm	1] 1/no 2] 1/no 3] 1/no	2] 50mm stainless steel heelguard grating 3] 30mm serrated Rhino grating
External Steps 1 & 2 - handrail and bracket	300mm handrail	1/no	
External Roof Plant Floor grating	300 x 300mm	1/no	
Internal Service Platform floor grating – Bay 5 Level 4	300 x 300mm	1/no	
Woven wire mesh – balustrades to Service Platform Bay 5 level 4.	300 x 300mm	1/no	Stainless steel sample
Refer Schedule of Metalwork Accessories in this worksection for submission of samples for approval			

Shop drawings

Shop drawings to be provided for the following:

- External access ramp – complete structure with floor grating, handrails and connections to the retaining wall.
- Roof plant platform extension – structure, grating and handrails
- Internal Level 4 service platform – structure and balustrades.
- Mesh 2 panels for coordination with mechanical duct penetrations and other service penetrations.
- Mesh 1 Stairs 3 and 4 risers.
- Screen to services – Roof Level.
- Stairs 3 and 4 complete with handrails as detailed
- Internal Ramp 2 balusters and handrails
- Safe roof access systems and ladders – internal on Level 4 and external - roof.

Shop drawing requirements

General: Confirm on site all dimensions and submit shop drawings showing the following information:

- Layout / setout drawings for site installation at a scale not less than 1:50.
- Details illustrating fabrication, components and fixings where not part of a standard system at a scale not less than 1:10.
- Details of fabrication and components.
- Details of fabrication involving other trades or components.
- Information necessary for site assembly.
- Proposals for the break-up of large items as required for delivery to the site.
- Proposed method of joining the modules of large items.
- Relationship to adjacent building elements.

Certification

General: Engage a Professional Engineer and submit certification for the design and installation of the Safe Roof Access system – internal and external to meet all statutory requirements for safe access including Workcover Authority.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

SPECIFICATION

05 INTERIOR

0552 Metalwork

Tests

Type tests: Submit results, as follows:

- Stainless steel: Before fabrication commences, submit satisfactory evidence that relevant procedure test plates have passed the tests specified in AS/NZS 1554.6.

Materials

Manufacturer's data: Submit manufacturer's published product data for proprietary items.

Stainless steel: For each batch of stainless steel supplied to the works for fabrication of custom made items, submit the certificate of compliance or test certificate specified in the applicable standard.

Location: Submit with Architectural Manual upon completion of the works.

Cross reference

Steel Stair 4 show drawings are included in 0341 STRUCTURAL STEEL and detailed on the structural engineer and architectural drawings.

2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

Metals and components

Performance: Provide metals in sections of strength and stiffness suited to their required function, finish and method of fabrication.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Aluminium structures

Standard: To AS/NZS 1664.1 or AS/NZS 1664.2.

Metals

Performance: Provide metals so that they transmit the loads imposed and ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces.

Incompatible metals: Separate using concealed layers of suitable materials in appropriate thicknesses.

Fasteners

Performance: Provide non-galvanic corrosion fasteners.

Materials: Provide fasteners in materials of mechanical strength and corrosion resistance at least equal to that of the lowest resistant metal joined.

To copper and copper alloys: Provide copper or copper-alloy fixing devices only.

To aluminium and aluminium alloys: Provide aluminium alloy or non-magnetic stainless steel fixing devices only.

To stainless steel: Provide appropriate stainless steel materials only.

Fabrication

Workshop: Fabricate and pre-assemble items in the workshop wherever practicable.

Edges and surfaces: Keep clean, neat and free from burrs and indentations. Remove sharp edges without excessive radiusing.

Tube bends: Form bends in tube without visibly deforming the cross section.

Colour finished work: Match colours of sheets, extrusions and heads of fasteners.

Thermal movement: Accommodate thermal movement in joints and fastenings.

Tolerances: ± 2 mm from design dimensions.

SPECIFICATION

05 INTERIOR

0552 Metalwork

Joints

General: Fit joints to an accuracy appropriate to the class of work. Finish visible joints made by welding, brazing or soldering using grinding, buffing or other methods appropriate to the class of work, before further treatment.

Self-finished metals: Free of surface colour variations, after jointing.

Joints: Fit accurately to a fine hairline.

Marking

General: Provide suitable and sufficient marks or other means for identifying each member of site-erected assemblies, and for their correct setting out, location, erection and connection. Mark bolted connections to show the bolting category. Do not mark stainless steel by notching.

Splicing

General: Provide structural members in single lengths.

3.2 WELDING AND BRAZING

General

Quality: Provide finished welds which are free of surface and internal cracks, slag inclusion, and porosity.

Site welds: Avoid site welding wherever possible. If required locate site welds in positions for down hand welding.

Butt weld quality level: Not inferior to the appropriate level recommended in AS 1665 Appendix A.

Brazing

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.

3.3 STAINLESS STEEL FABRICATION

Welding stainless steel

Certification of welders: To AS 1796.

Riveting

General: Riveting may be used only to join stainless steel sheet or strip less than 1 mm thick. Drill (not punch) the rivet hole, and drive the rivet cold. On completion, clean and passivate the riveted assembly.

Soldering

General: Do not solder stainless steel.

3.4 AUTOMATIC SLIDING DOOR FRAMES

Entry automatic glass sliding door

Door: To the main entry glass sliding door of 2 sliding leafs 5L2/XD2 provide and install a 150x100x5mm RHS beam with end plates to the head of the opening fixed to the masonry with 2/M16 chemical anchors into brickwork all on the structural engineer's drawings. Head beam detailed to support the automatic door controller. Head steel beam to continue past the existing timber trim to the existing opening. Refer to the Window and Door Schedule

Finish: Refer to 0671 PAINTING for paint system for mild steel.

3.5 HANDRAILS

Steel handrails

General: Handrails are to be supplied and installed to external steps, internal steps, ramps – internal and external, new and existing stairs and as scheduled below and detailed on the architectural drawings. Handrails include but are not limited to the following schedule of handrails. Refer to the architectural details for all handrails.

SPECIFICATION

05 INTERIOR

0552 Metalwork

Item / Level	Description
External – Level 2	
Handrails to Existing Steps 1 and 2	32mm OD 304 grade satin stainless steel handrails with 10mm profiled bracket rod welded to existing baluster. Paint on steel balusters to be stripped back for welding SS to steel. Repair paint to baluster and repaint existing balustrades.
External Access Ramp Handrails	Refer to External Ramp and Balustrades in this worksection.
Internal – Ground	
(N) Ramp 2 Handrail	32mm OD 304 grade satin stainless steel handrails welded to 12 x 10mm profile plate bracket as detailed. Weld fix bracket to 16 steel plate posts x 40mm at 1200mm centres. Refer to details for end extensions and profiles of handrails. At bottom of ramp, weld a 100 x 10mm flat plate connecting the base of both end balusters. Plate to be concealed by sheet flooring. Grind smooth all welds, prime and paint finish. All plate balusters are to be prepared and painted before plywood balustrades are installed.
(N) Stair 3 Handrail	Refer to the details (N) Stair 3 details. 38mm OD 304 grade satin stainless steel handrails.
Internal – Level 1	
(N) Stair 3 Handrail	As per (N) Stair 3 Handrail above.
Internal – Level 2 to 4	
(N) Stair 4 Handrail	Refer to the details for (N) Stair 4 details. 38mm OD 304 grade satin stainless steel handrails.
Roof	
Roof Plant Platform	Refer to Roof Plant Platform in this worksection.

3.6 EXTERNAL ACCESS RAMP AND BALUSTRADES

Access ramp into Bay 4

Location: new access ramp from the Hickson Road footpath to the north of Steps 1 to Bay 4 up to the main entry on Level 3 in Bay 4. Ramp to extend over the void between the building and the footpath.

Demolition: Includes removal of a section of the raised plinth to the top of the Void wall down to the level of the footpath; removal of the existing steel balustrade with wall brace brackets and southern Steps 2 handrail and hand over to the principal; removal of one waste bin at the entry of the ramp and relocation to an approved location in the vicinity. Removal of the Tenant sign post to the south of Steps 2; investigation and relocation of the electrical cables at high level on the Void wall where the ramp starts and the position will conflict with the ramp structure fixings to the Void wall.

Construction generally: Steel framed ramp floor consisting of stringers, floor beams, braces, and balustrade shaped to the ramp plan as detailed on the architectural drawings. Ramp fixings are to be all from the Void wall with no fixings to the existing building masonry wall.

Lighting: ramp is to be illuminated by LED vertical strip lights set between 2/no 50x10 plate balusters to architects details.

Grated floor: Non-slip stainless steel grated floor grating to custom sizes to suit the ramp shape is required. Refer to the architectural drawings and to **Submissions**.

Slip resistance

Site slip resistance test of completed installation to AS 4663.

SPECIFICATION

05 INTERIOR

0552 Metalwork

Cross references

Refer to the architectural drawings for details of the access ramp, handrails, balustrade , guard rail at base and for connection over Steps 2 at the top landing. Stainless steel plate tactile indicators are as specified in this worksection.

Refer to CEMENTITIOUS TOPPINGS for repair toppings to Steps 1 and 2.

Refer to PAINTING for paint finish to all new steel work.

3.7 STEEL FLOOR PLATE RAMPS

New ramps to new openings

General: To address the change in floor levels between Bays 4 and 5 at the new opening to be formed on Level 1, a ramp is required in Bay 4 above the timber floor.

Construction:

Timber support option: Fabricate and install a 3mm galvanised steel checker / floor plate ramp supported on splayed timber hardwood joists running with the slope of the 1 in 14 grade ramp cut from 180 x 75mm at centres as shown on the drawings. At the low end of the ramp, provide a dressed hardwood wedge / splayed timber edge 20mm high. Provide cross splayed joists at the top and the bottom of the ramp to secure the ends. Steel floor plate to be c/s screw fixed to the timber joists where shown on the drawings. Fixings to the existing timber floor to be approved.

Steel support option: Weld 5mm steel ribs to the underside of the steel floor plate at similar spacing to the timber joists, profiled to achieve the ramp fall. Provide cross ribs at approx. 600mm centre. Floor plate to be fixed c/s screw fixed to a top timber joist as detailed. No other fixings required to the existing timber floor.

For both options allow for a timber wall plate scribed to the existing walls to allow for a straight edge to the floor plate.

Cross Reference:

Refer to the architectural drawings and details. Refer to 0671 PAINTING for non-slip finish.

3.8 ALUMINIUM SLAT SCREENS – ROOF PLANT

Screens

Requirement: To exhaust ducts, pipes and other service risers that rise out of the Bay 5 north roof against the south wall of the Plant Room (former Lift Motor Room), fabricate and install a powdercoat aluminium slat screen on south side, west and east walls below the concrete roof slab. Extend to

Screens: Screen to be constructed with 100 x 15mm aluminium RHS extrusions set with 50mm gaps between slats on aluminium subframe. Screens equal to Supaslat screens by Metalart Industries. T. 03 9357 9444

Screen support frame from building: Screens to be fixed to a heavy duty galvanized frame. Frame to the south to be supported by a 50 x 50 x 5mm steel angle frame fixed to the Plant Room masonry wall top and bottom and each angle fixed with 4/No M12 chemset anchors. Provide 75 x 75 SHS posts where shown on the details, welded to the top and bottom angles. Provide 50 x 50 x 5mm angle braces top and bottom to a horizontal head and bottom beam 75 x 50mm RHS. Heavy duty hot dip galvanize after fabrication. For west and east wall returns where the screen is closest to the Plant Room walls, posts are to be fixed to the masonry wall making allowance for existing services to be retained. Provide a separation layer between the aluminium and galvanized steel. Verify setout from the screen on these elevations for shop drawing approval.

Refer to the architectural details.

Finish: Dulux Fluoraset powdercoat for aluminum screen. Refer **Submissions** for colour selection in this worksection. Paint finish for galvanized steel frame. Colour to match the screen.

SPECIFICATION

05 INTERIOR

0552 Metalwork

3.9 ALUMINIUM MESH

Aluminium mesh

General: Perforated aluminium mesh is detailed for the risers of the new steel Stair 3 and 4 and for the tops of new walls and as a cover for concealing pipe risers. The following meshes are required

Mesh 1

Steel Stair 3 and 4 risers: Equal to Locker Group perforated aluminium Pattern R02141 in 1.6mm sheet aluminium with 2mm diameter holes at 3mm centres offset. Open area 40%. Mesh to be factory folded to the profile detailed.

Finish: Anodized finish AAF colour 'Platinum MATT (E87CM)'. Provide samples for approval. Refer **Samples** in this worksection. Refer to architectural and structural engineer's details for the new steel stair.

Mesh 2

Mesh to tops of stud walls as covers for pipe risers to new amenities pods on all levels and to steel framed mesh sliding doors.

Material: Equal to Locker Group perforated round end slot staggered centre aluminium Pattern L25440 Code E in 1.6mm sheet aluminium. Open area 40%. Factory fold pipe cover screen to profile detailed. All sheets to be in long lengths.

Finish: Powder coat finished. Provide samples for approval. Refer **Samples** for Mesh 2 in this worksection.

Installation: To upper screens, paint timbers behind the mesh 'white' before fixing the screen and anodize the angle frame to match the mesh.

To tops of walls, mesh is installed to screen plant above new rooms. To underside of concrete slabs fix 'white' painted dressed timber batten.

Cross reference

Refer to architectural details.

3.10 FIXED STEEL LADDERS

Assembly

Materials, design and construction: To AS 1657.

Fixing: Fix ladder stiles securely to the building structure at tops and bottoms of flights, and at intermediate points.

Locations: Level 4 Bay 5 and external on roof

Refer to Fixed Steel Ladders in **Selections**.

3.11 SERVICE PLATFORM FOR MAINTENANCE ACCESS - INTERNAL

Level 4 platform for AC plant maintenance

General: Supply and install steel structure to service platform is to be constructed above the bottom chord of 2 timber trusses. Platform is required to service the in-line duct fans to mechanical services. Main channel floor beams to floor to span across the truss bottom plates and fixed to straps that wrap around the bottom chords. Secondary beams span across the main beams to support the floor grating.

Floor structure: Refer to structural engineer's details.

Floor grating: Equal to Webforge grating – galvanised steel

Platform balustrade: To the perimeter of the service platform and to the top of the amenities, supply and install a 1000mm high balustrade to all sides with galvanized steel 'T' posts with woven wire mesh infill panels.

Mesh balustrades: 304 stainless steel woven wire mesh equal to Lockers M00216 mesh. 11.2 mm apertures, 1.6mm wires; 2 mesh 16 swg; open area 77%, weight 2.5 kg/m².

Location: Refer to the RCP for Level 4 and architectural details.

SPECIFICATION

05 INTERIOR

0552 Metalwork

Access to service platform: provide ladder access up to platform above the Toilets and step-over bridge over ducts for access. Location of the ladder access from Level 4 up to the platform and then service platform is to be approved by the principal.

3.12 SAFE ROOF ACCESS SYSTEM

Plant Room roof access

General: Design and construct a certified system of anchorage points for personal fall arrest or restraint to allow safe access to the Plant Room Roof for maintenance of the mechanical plant and general roof maintenance purposes, including access onto the Plant Room roof via a fixed rung ladder and ladder landing platform bracket from roof plant platform. Include the provision of all signage required by relevant legislation. Provide anchorage/restraint points, body harness and all connecting sub-system accessories. Work to be carried out after the roof slab has been waterproofed.

Include provision for project specific training for nominated representatives of the Principal in the use of the system.

Standard

Materials, design and construction: Comply with the recommendations of AS 1891 and Workcover Codes of Practice for Safe Work on Roofs – Part 1&2.

Safety signage: AS1319.

Cross reference

Refer to 0411 WATERPROOFING – EXTERNAL for requirements to return to waterproof over the roof anchors installed after the completion of the waterproofing.

3.13 ROOF PLANT PLATFORM

Steel roof plant platform repairs and extension

General: Existing air conditioning plant are to be removed from the existing roof platform that is constructed above the parapet between Bays 4 and 5. The steel roof structure is to be repaired and some members replaced to structural engineers details. The platform is to be extended with similar details to the existing platform before new air conditioning plant is installed. Refer to the architectural drawings for the extent of the platform and for the spacing of the plant.

Repairs and extension

All 150 PFC's are to be replaced with matched PFC's hot dip galvanized 250mm long. All 75x75x5 EA struts both sides are to be replaced with matching hot dip galvanized sections. All bolts at strut connections, top and bottom, are to be replaced with new galvanized bolts. All remaining steel work is to be wire brushed to remove any corrosion and new protective coating applied to accessible sections. Refer 0671 PAINTING.

Deck floor: Replace existing mesh decking to match existing and to support the new plant loads. Provide new mesh decking to the platform extension. Decking expanded Metal Walkway by Locker Group – galvanized steel.

Steel grating panels: custom panel sizes suit the size of the platform extensions. Confirm sizes required in shop drawings.

Galvanised mild steel Webforge or equal handrails and stanchions are to match existing and to be joined to the existing handrails. Stanchions to have a base plate for bolting to the perimeter platform PFC. Provide toe guards around the perimeter of the platform.

Finish: Galvanised mild steel. Refer to the drawings for length of extension.

3.14 TACTILES

Timber floors and Stair 4

Tactiles: where shown provide and install 316 stainless steel tactile studs as scheduled in this worksection.

Tactiles to comply with AS/NZS 1428.4 and the BCA Section D Clause 3.8.

SPECIFICATION

05 INTERIOR

0552 Metalwork

External Access Ramp

Provide stainless steel plate tactiles to the top and the bottom of the external access ramp where shown on the access ramp plan.

- Dimensions: 300 x widths as shown x 6.5mm (1.8mm base) as a custom size.
- Material: 316L stainless steel.
- Type: Hazard
- Installation: Install via direct adhesion and screw fix.
- Slip resistance rating: R13, V
- Luminous reflectance value (mean): 19.57

Tactiles to be equal to Endura Integrated TGSI Plate from TGSI Pty Ltd

3.15 NON-SLIP EXTERNAL STEP NOSINGS

External Steps 1 and 2

Non-slip inserts in new granolithic toppings to be equal to Latham ACS-50 Asbraloy aluminium safety insert tread. Size 50mm x 10mm deep. Asbraloy Aluminium Suregrip infill to be the standard 'sparkling black' – LRV 28.9. Cast in the non-slip inserts in the new topping (Steps 2) or block out existing topping (Steps 1) for the installation of the non-slip inserts. Extend inserts to within 150mm of the end of each tread. Inserts to be in long lengths and cut to the dimensions required.

3.16 NON-SLIP STAIR NOSINGS

Stair nosings

Existing stairs: To existing concrete stairs where there are no non-slip stair nosings, allow to provide and install new non-slip nosings to comply with AS1428.1-2009.

Nosings: Aluminium SC8 nosings and with SCR Solid Strip of Silicon Carbide Grit. Colour 'Black' as available from Staircare Australia. T. 9939 3838. Fix in accordance with manufacturer's instructions. Clean existing concrete thoroughly prior to fixing.

Fire Stair 1

Length of nosings on each tread to be not less than the tread width less 200mm on each side for Fire Stair 1. Reconfirm lengths with the superintendent prior to cutting nosings to length for installing.

Stair 3 and Stair 4

Nosings to Stair 3 treads to extend for the full length of the stair tread. Refer to specification in **Samples** in this worksection for Latham bar to be inserted into the timber tread.

3.17 COMPLETION

Cleaning

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

4 SELECTIONS

4.1 FIXED STEEL LADDERS

Fixed steel ladder component schedule - internal and external

Member	Sizes (mm)
Material	High Grade Aluminum
Width	Overall Width: 600mm Width between stiles: 520mm
Treads – rung type	Rung size: 50x43mm (Profiled) Rung spacing: 300mm

SPECIFICATION

05 INTERIOR

0552 Metalwork

Member	Sizes (mm)
Ladder landing platform	600 x 600mm
Stile extension	Extension above landing: 1000-1350mm
Clearance behind ladder	Minimum clearance behind ladder: 200mm (Vertical)
Safety system	Equal to Safemaster Climb 2 – Fixed Access Ladder system or equal
Compliance	Manufactured in accordance with AS1657, AS/NZS1891.4 and relevant OHS Codes of Practice /Guidelines.
Weight	Rung sections: 3.37kg/m (excludes brackets and fixings)
Working Load Limit	Recommended load for single person: 150kg
Locations	1. External - from Roof Platform to Plant Room Roof; 2. Internal - from Level 4 to top of Amenities to internal plant platform
Internal Bay 5 Level 4 ladder Location of the internal fixed ladder in Bay 4 is to be approved by the superintendent. Ladder is to provide access to the southern roof access hatch and also to the service platform. Provide shop drawings for both ladders for approval.	

05 INTERIOR

0552 Metalwork

5 SELECTIONS

5.1 SCHEDULE OF METALWORK ACCESSORIES

Refer to the Architectural drawings and details for new toilets – Male, Female, Ambulant and Access Toilets, for position and setout of sanitary fittings and grab rails.

Samples

Requirement: Provide samples for each of the items schedules below for confirmation of finish and manufacturer.

Contractor to allow reasonable time for the provision of samples and for approval prior to placing of orders.

LEGEND	ITEM	DESCRIPTION	LOCATION	IMAGE	CONTACT
CH1	Coat Hook	Coat Hook Finish: Satin Chrome Fixing: Concealed Screw Fix Code No: 202CSCP	Access WCs BAY 4: 4G.08 BAY 5: 5L1.04 5L2.04 5L3.06 5L4.06 Refer to Architectural Drawings.		Metlam Contact: Jennifer McCarthy P: 1300 638 526
HD1	Hand Dryer	Dyson Airblade V Finish: Sprayed Nickel Code No: HU02	Male, Female and Access WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer to Architectural Drawings.		Dyson Airblade Hand Dryer Contact: John Bryant P: 1800 239 766

SPECIFICATION

05 INTERIOR

0552 Metalwork

HD2	Hand Dryer	Xlerator Hand Dryer Finish: White Enamel Code: XL-W	Male, Female and Access WCs BAY 4: 4G.06 4G.07 4G.08 Refer to Architectural Drawings.		Zogics Australia Contact: P: 1300 964 427
GR1	Access Compliant Grab Rail	90° RH + 300 Straight Grab Rail Set Finish: Satin Finished Stainless Steel Fixing: Concealed Code No: RBA4090-301	Access WCs BAY5: 5L2.04 5L4.06 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
GR2	Ambulant Compliant Grab Rail	90° Angled Ambidextrous Ambulant Grab Rail Finish: Satin Finished Stainless Steel Fixing: Concealed. RBA 4090-99-001 Dress Plate to all exposed fixings. Code No: RBA4090-450	Male and Female WCs BAY4: 4G.06 4G.07 BAY 5: 5G.03 5G.04 5L1.03 5L1.05 5L2.03 5L2.05 5L3.05 5L3.07 5L4.05 5L4.07 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
GR3	Access Compliant Grab Rail	90° LH + 300 Straight Grab Rail Set Finish: Satin Finished Stainless Steel Fixing: Concealed Code No: RBA4090-300	Access WCs BAY 5: 5L1.04 5L3.06 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778

SPECIFICATION

05 INTERIOR

0552 Metalwork

GR4	Ambulant Compliant Grab Rail	Drop Down Grab Rail Finish: Satin Stainless Steel Fixing: Concealed Code: RBA4007-122	Access WCs BAY 4: 4G.08 To be used in conjunction with GR5 and GR6. Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
GR5	Access Compliant Grab Rail	300mm Straight Grab Rail Finish: Satin Stainless Steel Fixing: Concealed Code: RBA4000-030	Access WCs BAY 4: 4G.08 To be used in conjunction with GR4 and GR6. Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
GR6	Access Compliant Grab Rail	40° Grab Rail, Left Hand Finish: Satin Stainless Steel Fixing: Concealed Code: RBA4040-800	Access WCs BAY 4: 4G.08 To be used in conjunction with GR4 and GR5. Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
SD1	Soap Dispenser	Bobrick Budget Horizontal Soap Dispenser Finish: Satin Finished Stainless Steel Fixing: Concealed Code No: B2112	Male, Female and Access WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778

SPECIFICATION

05 INTERIOR

0552 Metalwork

SD1	Soap Dispenser	Bobrick Soap Dispenser Contura Series Surface-Mounted Soap Dispenser Finish: Satin Finished Stainless Steel: Fixing: Concealed Code: B4112	Male, Female and Access WCs BAY 4: 4G.06 4G.07 4G.08 Refer to Architectural Drawings.	 B4112	RBA Group Contact: Vicky Bennett P: 1300 788 778
TGSI	Tactile Ground Surface Indicator	TI Series Tactile Indicator Studs Finish: Stainless Steel Fixing: Suitable for Timber Substrate and Concrete Substrate. Code No: LTSS NOTE: Prior to ordering TGSI for concrete floors, approval of luminance against the concrete to be approved.	Refer to Architectural Drawings.		Latham Contact: Zane Khilji P: 02 9879 7888
TPH1	Toilet Paper Holder	Bobrick Double Toilet Roll Holder Finish: Satin Finished Stainless Steel Fixing: Concealed Code No: B6867	Male, Female and Access WCs BAY 5: 5G.03 5G.04 5L1.03 5L1.04 5L1.05 5L2.03 5L2.04 5L2.05 5L3.05 5L3.06 5L3.07 5L4.05 5L4.06 5L4.07 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778
TPH2	Toilet Paper Holder	Surface Mounted Twin 9" Jumbo Toilet Roll Holder SSS Finish: Stain Stainless Steel Fixing: Concealed Code: 10-0040	Male and Female WCs BAY 4: 4G.06 4G.07 Refer to Architectural Drawings.		ASI JD Macdonald Contact: Angela Macrfi P: 03 8558 7200

SPECIFICATION

05 INTERIOR

0552 Metalwork

TPH3	Toilet Paper Holder	Bobrick Single Toilet Roll Holder Finish: Satin Finished Stainless Steel Fixing: Concealed Code No: B6857	Access and ambulant toilet cubicles - position as detailed BAY 4: 4G.08 Refer to Architectural Drawings.		RBA Group Contact: Vicky Bennett P: 1300 788 778

05 INTERIOR

0573 Extinguishers and blankets

0573 EXTINGUISHERS AND BLANKETS

1 GENERAL

1.1 RESPONSIBILITIES

General

Fire Extinguishers: Fire extinguishers are specified in FIRE SERVICES.

Requirement: Provide fire extinguishers in accordance with legislative and authority requirements.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

This worksection includes:

- Fire extinguishers

Associated worksections

Refer to the following related worksections

- 0581 SIGNS AND DISPLAYS, for signage for fire blankets.
- FIRE SERVICES, for specification and location of fire extinguishers and signage.
- HYDRAULIC SERVICES, for fire hose reels, fire hydrants and signage.

Cross reference

Refer to the Fire Services drawings for the location of fire extinguishers. Locations to be confirmed prior to fixing in place, in particular, fixing to existing brick walls is to be approved.

1.3 AUTHORISED PRODUCTS

General

General: Provide equipment listed in the ActivFire Register of Fire Protection Equipment.

2 PRODUCTS

2.1 EXTINGUISHERS

Fire extinguishers

Locations: Refer to the FIRE SERVICES drawings for proposed location for the fire extinguishers and sizes. Locations in accordance with AS2444.

3 EXECUTION

3.1 COMPLETION

Maintenance

Fire extinguishers: Refer to FIRE SERVICES Maintenance requirements.

Fire blankets: To AS 1851.

05 INTERIOR

0581 Signs and display

0581 SIGNS AND DISPLAY

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide signage systems, as documented and as follows:

- Appropriately secured.
- Located within a clear line of vision.
- To contrast with the background.
- With clean, well defined edges or arises, and free from blemishes.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Signage works includes but is not limited to the following:

- Statutory signage
- Non-statutory signage
- The provision of shop drawings and samples.

Associated worksections

Refer to the following worksections:

- MECHANICAL SERVICES, for signs for marking and labeling signage for mechanical services and for signs to indicate where safe access to plant is provided and for where no access is allowed..
- ELECTRICAL SERVICES, for illuminated exit signs, plant and services marking and labeling signage.
- HYDRAULIC SERVICES, for signage for fire hydrants and fire hose reels.
- FIRE SERVICES, for signage for fire blankets and fire extinguishers.

1.3 STANDARDS

Signs

Safety signs - design and use: To AS 1319.

Signs and graphics for disabled access: AS 1428.1 and AS 1428.2.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given below apply.

- Illuminated signs: Signs consisting of cabinets enclosing an illuminated source, lighting translucent face panels bearing the specified signage.
- House signage: Internal and external project specific signs.
- Statutory signage: Signs prescribed by the BCA and statutory authorities.

SPECIFICATION

05 INTERIOR

0581 Signs and display

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Custom-built graphics items fabricated and ready to be delivered to the site.
- Graphics items delivered to site before installation.
- Building locations or substrates prepared to receive graphics items before they are installed.

1.7 SAMPLES

General

Materials: Submit samples showing each colour and finish of exposed graphics materials and accessories. If there is a range of colours and/or textures for a particular item, submit samples showing the extremes and mean of the range.

1.8 SUBMISSIONS

Shop drawings

General: Submit shop drawings and or samples showing the following information where relevant:

- Painted signs to match existing in Stair 2 and to Lift Lobbies on each floor. Signs are to be directly painted on the walls.
- Computer generated graphic images.
- Full size spacing templates for individually mounted characters.
- Location template drawings for anchorages to permanent construction. Show type of anchorage.

2 PRODUCTS

2.1 MATERIALS

Materials standards

Aluminium:

- Plate for engraving: Alloy and temper designation 6063-0.
- For casting: To AS 1874.

Stainless steel: Surface finish designation 4 (general purpose polished).

3 EXECUTION

3.1 WORKMANSHIP

Production

General: Form graphics items accurately with clean, well defined edges or arises, free from blemishes.

Engraved and filled: Lettering precision cut and filled colouring material. Clean faces of all filling material.

Casting: Produce shapes free of pits, scale, blow holes or other defects, hand or machine finished if necessary.

Printed lettering: Lettering and graphic images screen/digitally printed on:

- Aluminium plate.
- Stainless steel plate.
- Brass plate.

Installation

General: Install signage level and plumb, securely mounted, with concealed theft-resistant fixings. Fix self-adhesive signs free of bubbles and creases.

SPECIFICATION

05 INTERIOR

0581 Signs and display

4 SELECTIONS

4.1 GENERAL SIGNS

Existing signs

Existing painted gold and black lettering on the walls inside Stair 2 are to be retained.

4.2 STATUTORY SIGNS

Required fire door and required smoke door

Position	- On or adjacent to the door, on the side of the door that faces a person seeking egress, and - if the door is in the held open position, on either the wall adjacent the doorway or both sides of the door.
Message if auto door with auto hold open device	FIRE SAFETY DOOR – DO NOT OBSTRUCT
Message if self closing door	FIRE SAFETY DOOR DO NOT OBSTRUCT DO NOT KEEP OPEN
Message if door discharging from a fire isolated exit	FIRE SAFETY DOOR – DO NOT OBSTRUCT
Letter height (minimum)	20 mm
Sign type	Stainless steel engraved and filled with raised braille
Compliance	BCA D2.23

Braille and tactile exit signage-buildings required to be accessible

Position	To BCA Spec D3.6 for every door in BCA E4.5
Message	Exit (and) Level (followed by the floor level number)
Letter height (minimum)	BCA Spec D3.6
Sign type	Stainless steel engraved and filled with raised braille
Compliance	BCA E4.5, BCA D3.6 and BCA Spec D3.6

Fire exit offence notice (NSW)

Reinstate any signage that may have been removed during construction to meet BCA requirements

Position	Adjacent door providing access to (but not within) a fire exit stair, passage or ramp
Message	OFFENCES RELATING TO FIRE EXITS It is an offence under the Environmental planning and Assessment Act 1979 to: Place anything in or near this fire exit that may obstruct persons moving to and from the exit. Interfere with or obstruct the operation of any fire doors. Remove, damage or otherwise interfere with this notice.
Letter size	> 8 mm (title) > 2.5 mm (rest)
Sign type	Stainless steel engraved and filled.
Compliance	Environmental Planning and Assessment Regulation 2000 clause 183

SPECIFICATION

05 INTERIOR

0581 Signs and display

Unisex accessible sanitary facilities

Position	To BCA Spec D3.6
Message	Braille and tactile signage incorporating the international symbol of access. Indicate suitability for left or right handed use.
Symbol size	AS 1428.2 clause 16, Table 1.
Letter height (minimum)	Braille: BCA Spec D3.6 Raised characters: Sans serif type font 20 mm.
Sign type	Stainless steel engraved and filled with raised braille
Compliance	AS 1428.1 BCA D3.6

Unisex accessible and ambulant sanitary facilities

Position	To BCA Spec D3.6
Message	Braille and tactile signage incorporating the international symbol of access. Indicate suitability for left or right handed use.
Symbol size	AS 1428.2 clause 16, Table 1.
Letter height (minimum)	Braille: BCA Spec D3.6 Raised characters: Sans serif type font 20 mm.
Sign type	Stainless steel engraved and filled with raised braille
Compliance	AS 1428.1 BCA D3.6

Ambulant sanitary facilities

Position	To BCA Spec D3.6. At each bank of sanitary facilities where accessible unisex sanitary facilities are provided.
Message	Braille and tactile signage incorporating the male/ female ambulant symbol.
Symbol size	AS 1428.2 clause 16, Table 1.
Letter height (minimum)	Braille: BCA Spec D3.6 Raised characters: Sans serif type font 20 mm.
Sign type	Stainless steel engraved and filled and with raised braille.
Compliance	AS 1428.1 BCA D3.6

Non-accessible sanitary facilities

Position	At each bank of sanitary facilities that are not provided with an accessible unisex sanitary facility.
Message	Braille and tactile signage incorporating the international symbol of access. Indicate location of the nearest accessible unisex sanitary facility.
Letter height	AS 1428.2 clause 17, Table 2.
Symbol size	AS 1428.2 clause 16, Table 1.
Sign type	Stainless steel engraved and filled and with raised braille
Compliance	AS 1428.1 BCA D3.6

Electrical Distribution Board (EDB)

Position	To each EDB on each level of Bay 5

SPECIFICATION

05 INTERIOR

0581 Signs and display

Message	Electrical Distribution Board
Letter size	30mm
Sign type	Stainless steel engraved and filled.
Compliance	AS/NZS 3000 clause 2.9.2.4

Fire hose reels and Fire Hydrants

Position	Refer to the HYDRAULIC SERVICES drawings
Message	FIRE HOSE REEL (and/or) FIRE HYDRANT
Letter height (minimum)	Existing
Sign type	Retain existing brass signage plaques
Compliance	AS 2441; AS 2419.1 BCA E1.3 and BCA E1.4

Fire hose reel location sign

Position	Above or adjacent the FHR if located in a recess or obscure location
Message	To AS 2441 Figure 10.1
Letter height (minimum)	16 mm
Sign type	Inlay black letters filled letter Brass – to match existing
Compliance	AS 2441

Portable fire extinguishers signs. Refer to FIRE SERVICES

Lifts – warning

Position	Near every call button for passenger lift(s)
Message	DO NOT USE LIFTS IF THERE IS A FIRE (or) Do not use lifts if there is a fire
Letter size	10 mm (upper case) 8 mm (lower case)
Sign type	Brass incised, inlaid or embossed on aluminium plate securely and permanently attached to the wall. or existing signs retained for reuse
Compliance	BCA E3.3

Stair 2 Signs

Remove existing signs in Stair 2

Directional arrows and sign posting is to be provided within Stair 2 in Bay 4 directing persons descending and ascending along the stair flight to the Level 2 point of discharge to Hickson Road.

- The signposting is to be in green color contrast with the wall background and be minimum of 75mm thick band width.
- A notice in 50mm font size is to be placed at the foot of each stair flight in Stair 2 and mid landing advising that Level 2 is the discharge level. The door on Level 2 in Stair 2 are to be clearly signposted to alert occupants that it is the point of discharge to open space.

Shop drawings to be submitted for approval for all signage.

06 FINISH

0611 Rendering and plastering

0611 RENDERING AND PLASTERING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide plaster finishes as documented and as follows:

- Resistant to impacts expected in use.
- Free of irregularities.
- Consistent in texture and finish.
- Firmly bonded to substrates for the expected life of the application.
- Without obvious shrinkage cracks.
- As a suitable substrate for the nominated final finish.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Rendering and plastering includes but is not limited to the following:

- cement render and plaster materials;
- the application of cement render to selected internal brick walls – new and existing substrates;
- making good and joining up existing render and plaster surfaces after demolition, removal of extraneous items and relocation of services;
- repairs and making good existing rendered surfaces generally after demolition to approval including crack repairs, repairs where fixings from removed walls and concrete slabs have left holes in existing finish, repairs after joist recesses need to be regained by render removal;
- repairs after services have been removed.

Associated worksections

Associated worksections: Conform to the following worksections:

- 0202 DEMOLITION, for extent of removal of existing masonry walls, concrete floors and beams.
- 0335 BRICK AND STONE MASONRY, for brick repairs to existing walls after demolition and for new masonry walls to be cement rendered.
- 0621 WATERPROOFING – INTERNAL, for existing masonry walls where waterproofing extends up the wall over rendered finishes.
- 0631 CERAMIC TILING, for preparation of existing painted rendered substrates to be tiled.
- 0671 PAINTING, for preparation and new paint finishes to rendered surfaces – new and existing.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of rendered finishes to new and existing masonry substrates.
- Architectural drawings for demolition and new construction.

1.3 INTERPRETATION

Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- CRF: Cement render – finish.

06 FINISH

0611 Rendering and plastering

- CRM: Cement render – medium.
- CRS: Cement render – stronger.
- CRW: Cement render – weaker.
- GPF: Gypsum plaster – finish.

Definitions

General: For the purposes of this worksection the following definitions apply:

- Base coat: A plaster coat applied before the application of the finish coat.
- Bonding treatment: A treatment of a substrate which improves adhesion of a plaster system.
- Finish coat: The final coat of a coating system.
- Finishing treatment: The treatment applied to a finish coat which may include processes and results.
- Plaster: A mixture of binders, aggregate and water which are applied to substrates in a plastic state and dry and cure to a hard surface which may subsequently be decorated:
 - . Cement plaster: Contains Portland cement as the principal binder.
 - . Gypsum plaster: Contains hydrated or anhydrous calcium sulfate as the principal binder.
- Plastering: The process of coating the framing or solid surfaces of a building with a plastic material which hardens and then may be decorated or remain self-finished.
- Plastering system: One or more coats of plaster and associated treatments comprising some or all of the following in sequence:
 - . Base coat 1 or 2.
 - . Bonding treatment.
 - . Finish coat.
 - . Finishing treatment.
- Render, rendering: Plaster, plastering, usually single coat and usually cement:lime:sand.
- Substrate: The surface to which a material or product is applied.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- East, north and south walls of Bay 5 for after removal of the cinema stud and masonry walls including all attachments and fixings.
- Prototypes ready for inspection.
- Substrates immediately before applying base coats.
- Finish treatments before decoration.

Notice required

Inspection notice: 2 working days.

1.5 TOLERANCES

General

Tolerances: To the **Tolerances table**.

Tolerances table

Description	Alignment	Tolerance
Walls and other vertical structures	Vertical	6 mm in 2400 mm
Reveals sides	Vertical	3 mm in 1800 mm
Reveals head up to 1800 mm	Horizontal	3 mm in 1800 mm
Reveals head over 1800 mm	Horizontal	5 mm max

SPECIFICATION

06 FINISH

0611 Rendering and plastering

Description	Alignment	Tolerance
Reveals, piers, beams, wall stop ends up to 300 mm	Square	3 mm max
Reveals, piers, beams, wall stop ends over 300 mm	Square	5 mm max
Radius of corners	Round	Should not vary by more than $\pm 10\%$ over the length of the arris.

1.6 SUBMISSIONS

Prototypes

Render: Prepare prototype of the render system complete with beads and other embedded items:

- Size: 1200 x 2400 mm.

2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

Accessories

Beads: Provide metal proprietary sections manufactured for fixing to substrates and/or embedding in the plaster to form and protect plaster edges and junctions.

Lath: Provide a proprietary product manufactured from raised expanded metal for use with plaster:

- Mass/unit area: 1.84 kg/m² or greater.
- Material thickness: 0.70 mm or greater.
- Mesh size: 9.5 x 28.6 mm.

Metallic-coatings: For beads or lath in cement plaster: To the **Corrosion resistance and durability table** applicable to the atmospheric corrosivity category.

Admixtures

Plasticisers or workability agents: Do not use in cement plasters.

Aggregates

Sand: Fine, sharp, well-graded sand with a clay content between 1% and 5%, and free from efflorescing salts.

Sand grading for base coat plaster: To the **Sand gradation table**.

Sand gradation table

Sieve size	Percent passing	
	Minimum	Maximum
4.75 mm	100	100
2.36 mm	90	100
1.18 mm	60	90
600 µm	35	70
300 µm	10	30
150 µm	0	5
75 µm	0	3

Bonding products

General: Provide proprietary products manufactured for bonding cement-based plaster to solid substrates.

Cement

Standard: To AS 3972.

Type: GP.

SPECIFICATION

06 FINISH

0611 Rendering and plastering

Corrosion resistance and durability

Compliance: To the **Corrosion resistance and durability table(s)** or provide proprietary products with metallic and/or organic coatings of equivalent corrosion resistance and as follows:

- Galvanize: To AS/NZS 4680.

Corrosion resistance and durability table

Atmospheric corrosivity category to AS 4312	Metal lath, beads and embedded items	Minimum cement content (mix type) above damp-proof course
C3	Stainless 316 Powder coated aluminium	CRM
C4 and T ¹	Stainless 316 Powder coated aluminium	CRS
Internal	Galvanize after fabrication 300 g/m ² Metallic-coated sheet Z275/AZ150	CRM
¹ Avoid organic coating in Category T zones.		

Curing products

General: Provide proprietary products manufactured for use with the plaster system.

Gypsum plaster

General: Provide a proprietary product containing calcium sulfate hemihydrate with additives to modify setting.

Lime

Limes for building: To AS 1672.1.

Lime putty

General: Prepare lime putty as follows:

- Stand dry hydrate of lime to AS 1672.1 and water for 24 hours or more without drying out.
- Stand quicklime and water for 14 days or more without drying out.

Metal lath

Internal: Expanded metal to AS 1397 coating class Z350.

External: Stainless steel or PVC-U.

Mixes

General: Select a mix proportion to suit the conditions of application conforming to the **Mix proportion tables**.

Measurement: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Plaster mixing: Machine mix for 3 to 6 minutes.

Strength of successive coats: Make sure successive coats are no richer in binder than the coat to which they are applied.

Mix proportion table – Cement render, by volume

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 1	0 0.5	3 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
Second coat - Internal		CRF	1 1	1 2	6 9

SPECIFICATION

06 FINISH

0611 Rendering and plastering

Mix type		Substrate	Upper and lower limits of proportions by volume		
			Cement	Lime	Sand
Second coat - External	CRF	Cement render base coats	1	1	5
			1	2	6

Mix proportion table – Gypsum finish coat, by volume

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	-	1.5	-
			1	-	2	-

Mix proportion table – Gypsum finish coat, by weight

Gypsum plaster (kg)	Lime putty (kg)
17	25
34	50
51	75

Control joint products

General: Provide proprietary products manufactured for use with the plastering system and to accommodate the anticipated movement of the substrates and/or the plaster.

Water

General: Clean and free from any deleterious matter.

3 EXECUTION

3.1 PREPARATION

Substrates

General: Provide substrates as follows:

- Clean and free from any deposit or finish which may impair adhesion of plaster.
- If framed or discontinuous, support members in full lengths without splicing.
- If solid or continuous, remove excessive projections and fill voids and hollows with plaster stronger than the first coat and not weaker than the substrate.

Absorbent substrates: If suction is excessive, control it by dampening without over-wetting, and do not plaster substrates showing surface moisture.

Painted surfaces: Remove paint and hack the surface at close intervals. Refer PAINTING for paint preparation for existing painted surfaces and lead paint.

Untrue substrates: If the substrate is not sufficiently true for conformity with the thickness limits for the plaster system, or has excessively uneven suction resulting from variations in the composition of the substrate, apply additional coats without exceeding the thickness limits for the substrate or system.

Beads

Location: Fix beads as follows:

- Angle beads: At all external corners.
- Drip beads: At all lower terminations of external plaster.
- Beads for control of movement: At all control joints.
- Stop beads: At all terminations of plaster and junctions with other materials or plaster systems.

SPECIFICATION

06 FINISH

0611 Rendering and plastering

Joints in beads: Provide dowels to maintain alignment.

Mechanical fixing to substrate: ≤ 300 mm centres.

Bonding treatment

General: If bonding treatment is required, throw a wet mix onto the background. Mix proportions to the following:

- Cement plaster (cement:sand): 1:2.
- Gypsum plaster (gypsum:sand): 1:2.

Curing: Keep continuously moist for 5 days or more and allow to dry before applying plaster coats.

Thickness: $\geq 3 < 6$ mm.

Embedded items

General: To the **Corrosion resistance and durability table**. If there are water pipes and other embedded items, sheath them to permit thermal movement.

Lath

Location: Provide lath as follows:

- Chases: If chases or recesses are 50 mm wide or greater, fix metal lath extending 75 mm or more beyond each side of the chase or recess. No chases are to be made in existing masonry walls – brick or stone.
- Metal and other non-porous substrates: Fix galvanized or stainless steel metal lath to provide a key.

Installation: Fix lath as follows:

- General: Run the long way of the mesh across supports with strands sloping downwards and inwards from the intended face of the plaster.
- Fixing: Mechanically fix at centres of 150 mm or less.
- Laps: Tie with 1.25 mm galvanized wire at centres of 150 mm or less. Do not stop edges of sheets at corners but bend around.
- On solid substrates: Space the lath 5 mm or more clear of the substrate.
- Support spacing: ≤ 400 mm.

3.2 APPLICATION

Plastering

Base coats: Scratch-comb each base coat in two directions when it has stiffened.

Metal lath: Press the plaster through the apertures of expanded metal lath and wings of beads.

Incidental work

General: Return plaster into reveals, beads, sills, recesses and niches. Plaster faces, ends, and soffits of projections in the substrate, such as string courses, sills, pilasters and corbels. Run neatly finished throating on soffits of external projections. Trim around openings. Plaster exposed internal surfaces of built-in cupboards.

Joining up

General: If joining up is required, make sure joints are imperceptible in the finished work after decoration.

Control joints

General: Provide joints in the finish to coincide with control joints in the substrate. Make sure the joint in the substrate is not bridged during plastering.

Size:

- Depth: Extend the joint right through the plaster and reinforcement to the substrate.
- Width: 3 mm, or the same width as the substrate joint, whichever is greater.

Damp-proof courses: Do not continue plaster across damp-proof courses.

Plastering on metal lath: Provide control joints to divide the plastering area into rectangular panels of 10 m² or less.

V-joints: Provide V-joints, cut right through the plaster to the substrate, at the following locations:

SPECIFICATION

06 FINISH

0611 Rendering and plastering

- Abutments with metal door frames.
- Abutments with other finishes.
- Junctions between different substrates.

Plaster thickness

General: To the **Plaster thickness table**.

Plaster thickness table

Substrate	Cement render, total thickness of single or multi-coat work (mm)	Gypsum/lime plaster (mm)
Dense concrete walls	15 max	3 max
Brickwork	12 min	3 max
Metal lath measured from the face of the lath.	18 min	3 max

Temperature

General: If the ambient temperature is less than 10°C or more than 30°C, make sure the temperature of mixes, substrates and reinforcement at the time of application are between 5°C and 35°C.

3.3 REPAIRS

Repairs to existing render finishes

Requirement: The existing cement rendered walls in Bay 5 are to be repaired after the cinemas are removed. Repairs to the existing finish are required after demolition of the cinemas, concrete stairs and where, where stud walls were fixed to the render, where the existing render is cracked, loose or drummy and in the area where the timber floors were removed. This list is not conclusive.

Cross reference

Refer to SH02 SCHEDULE OF FINISHES AND SUBSTRATES for the percentage allowance of the existing wall to be re-rendered. Confirm the area of the repair works with the superintendent before commencing the render repairs

3.4 FINISHES

Finishing treatments

Plain even surfaces: Work the hardening plaster as follows:

- Carborundum stone: Rub the finish coat when set hard with a carborundum stone to achieve a finish free from sand.
- 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.
- Wood or plastic float: Float the finish coat on application to an even surface with a wood or plastic float.

3.5 COMPLETION

Curing

General: Prevent premature or uneven drying out and protect from the sun and wind.

Keeping moist: If a proprietary curing agent is not used, keep the plaster moist as follows:

- Base coats and single coat systems: Keep continuously moist for 2 days and allow to dry for 5 days before applying further plaster coats.
- Finish coats: Keep continuously moist for 2 days.

06 FINISH

0611 Rendering and plastering

4 SELECTIONS

4.1 SCHEDULES

Plastering construction schedule

Property	A	B
Substrate material	New brick	Existing brickwork and repairs
Base coat(s)	Multicoat	Multicoat to match existing thickness
Finish coat	Cement render	Cement render
Finishing treatment	Woodfloat to match existing and for joining up to existing rendered finishes	Woodfloat to match existing for paint finish

Cross reference:

- Refer to the SH02 SCHEDULE OF SUBSTRATES AND FINISHES for location of render finishes.
 - Refer to BRICK AND STONE MASONRY for fire-rated walls with specified cement render thickness to achieve the nominated fire-rating.
-

FINISH

0612 Cementitious toppings

0612 CEMENTITIOUS TOPPINGS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide cementitious toppings as documented.

Performance

Requirements:

- If floating, without edge curl.
- If bonded, without drummy areas.
- Without obvious shrinkage cracks.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

This worksection includes but is not limited to:

- Concrete toppings on compressed fibre cement sheet flooring on top of timber flooring to establish falls for specified finishes.
- Granolithic toppings for new door thresholds in masonry walls.
- Granolithic toppings to be laid on prepared existing external concrete steps and landings with non-slip silicon carbide granules.
- Special topping MMA resin flooring on concrete toppings on concrete.

Related worksections

Refer to the following worksections:

- 0202 DEMOLITION, for removal of existing concrete toppings to Bay 4 Ground Floor amenities.
- 0315 CONCRETE FINISHES, for coloured concrete toppings to new reinforced concrete slab in Bay 5 Level 2 Foyer.
- 0552 METALWORK, for non-slip stair nosings to existing concrete stairs - Stair 1 and Stair 3.
- 0621 WATERPROOFING – INTERNAL, for waterproof membrane below tiles and vinyl floors internally.
- 0631 CERAMIC TILING, for tiles to be laid over cementitious toppings.
- 0411 WATERPROOFING – EXTERNAL, for waterproof membrane to Store Room (former LMR) roof.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of floor finishes and toppings.
- HYDRAULIC SERVICES, for floor wastes, bucket wastes and strip drains in cementitious and MMA toppings.
- Architectural drawings for plans showing falls in toppings and for details.
- Structural Engineer's drawings for extent of new toppings to new concrete slabs.

SPECIFICATION

FINISH

0612 Cementitious toppings

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Concrete class:
 - . Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise in conformance with AS 1379 clause 1.5.3.
- Granolithic topping: A topping mix with the coarse aggregate restricted to between 2 mm and 3 mm.
- Substrate: The surface to which a material or product is applied.
- Topping: Mixture of binders, aggregate and water applied to substrates in a plastic state and dried and cured to a hard surface.
- Topping function:
 - . Levelling: Topping placed to receive applied floor finishes.
 - . Wearing: Topping placed to act as the finished floor.
- Topping method:
 - . Bonded or post applied: Topping which is bonded to a hardened substrate from which laitance has been removed and to which a bonding agent has been applied.
 - . Floating: Topping which is separated from a hardened substrate by a resilient layer.
 - . Monolithic or wet applied: Topping placed on a plastic substrate so that a chemical bond is created between the substrate and the topping.
 - . Separated: Topping which is separated from a concrete subfloor by a membrane.

1.4 TOLERANCES

General

Thickness: Deviation from the documented thickness:

- Thickness < 15 mm: ± 2 mm.
- Thickness $\geq 15 < 30$ mm: ± 5 mm.
- Thickness ≥ 30 mm: ± 10 mm.

Flatness: Maximum deviations from a straightedge laid in any direction on a plane surface:

- Class A: 4 mm from a 2 m straightedge.
- Class B: 6 mm from a 3 m straightedge.

1.5 SUBMISSIONS

Steps 2 into Bay 4

These steps are to be re-topped after stripping off the existing topping. Prior to removal of the existing topping, provide a photographic record of the existing and issue to the superintendent. New toppings are to match the existing topping in finish, colour and aggregate size, colour and composition. Refer to **Selections** in this worksection.

Products

General: Submit product data on the following:

- Admixtures.
- Bonding products.
- Colouring products.
- Curing products.
- Sealant products.
- Slip-resistant products.
- Surface treatment products.

SPECIFICATION

FINISH

0612 Cementitious toppings

Prototypes

General: Prepare prototypes of each topping type:

- Size: 1200 x 2400 mm.

Samples

General: Submit samples of the following products:

- Colouring products.
- Control joint products.
- Surface treatment products.

Tests

Other tests: Submit results, as follows:

- Flatness.
- In situ crushing resistance/soundness.
- Site slip resistance test of completed installation.

1.6 INSPECTION

Notice

General: Give notice so that inspections may be made of the following:

- Substrates ready for laying of toppings.
- Prototypes ready for inspection.

2 PRODUCTS

2.1 MATERIALS

Admixtures

Standard: To AS 1478.1.

Aggregates

Standard: To AS 2758.1.

Coarse aggregate: Nominal single size less than or equal to 1/3 topping thickness.

Fine aggregate: Fine, sharp, well-graded sand with a low clay content and free from efflorescing salts.

Bonding products

General: Provide proprietary products manufactured for bonding cement-based toppings to concrete substrates.

Cement

Standard: To AS 3972.

- Type: SL.

Colouring products

General: Provide proprietary products manufactured for colouring cement toppings.

Integral pigment proportion: 10% maximum by weight of cement.

Concrete

Standard: To AS 1379.

Unreinforced topping:

- Class: Normal.

Reinforced topping table

Exposure location	Strength grade	Cover to reinforcement
External coastal less than 1 km but not in the splash zone	N40	35 mm

SPECIFICATION

FINISH

0612 Cementitious toppings

Reinforcement

Standard: To AS/NZS 4671.

Mesh sizes for joint spacing as follows:

- SL 42: Up to 3 m internal, 2 m external.
- SL 62: Up to 6 m internal, 4 m external.

Curing products

General: Provide proprietary products manufactured for use with cement-based toppings and with the floor finish to be laid on the toppings.

Mixes

General: Provide toppings as follows or select mix proportions to the **Mix proportion table**:

- Air entrainment: $\leq 3\%$.
- Nominal coarse aggregate size: $\leq 0.3 \times$ topping thickness.
- Slump: 80 mm.
- Standard strength grade: N25.

Water quantity: The minimum necessary to achieve full compaction and prevent excessive water being brought to the surface during compaction.

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	1	2	1, of 2 mm - 3 mm
Separated – fine concrete	70	1 1	3 3	1 2

Slip resistance products

General: Provide proprietary products manufactured to improve the wet slip resistance of toppings.

- Silicon carbide granules:
 - . Granule size: $\geq 300 < 600 \mu\text{m}$.
- Silicon carbide two-part resin:
 - . Granule size: $\geq 300 \mu\text{m}$.
 - . Colour: black

Selection

Latham slip-resistant Suregrip silicon carbide mineral granules

Colour: 'Sparkling Black' standard infill LRV 28.9

Surface treatment products

General: Provide proprietary products manufactured for use with cement-based toppings to change the characteristics of the surface of the finished topping.

Treatment: surface hardener

Water

General: Clean and free from any deleterious matter.

FINISH

0612 Cementitious toppings

2.2 RESIN TOPPINGS

Resin / MMA toppings

Location: TOP1 in SH02 SCHEDULE OF SUBSTRATES AND FINISHES and as scheduled.

Material: Flowfast Terrosso with Flowfast Standard primer and binder

Colour: To match the existing colour.

Contact: Flowcrete Australia Pty Ltd. Tony Di Girolamo T. 02 4648 0397 M. 0425 206 382

E. Tonydg@flowcrete.com

2.3 CONTROL JOINTS

Control joint materials

General: As documented in the **Control joints schedule**.

Sealant: One-part self-levelling non-hardening mould-resistant, silicone or polyurethane sealant applied over a backing rod. Finish flush with the terrazzo surface.

- Floors: Trafficable, shore hardness greater than 35.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

3 EXECUTION

3.1 PREPARATION

Substrates

General: Provide substrates as follows:

- Clean and free from any deposit which may impair adhesion of monolithic or bonded toppings.
- Remove excessive projections and voids and fill hollows with a mix not stronger than the substrate or weaker than the topping.
- Roughen hardened concrete by scabbling or the like to remove 2 mm of the laitance and expose the aggregate.
- Steps 2 and landings: scabble back and remove 30mm of the existing concrete to treads and risers to leave a rough surface for the new topping to be installed.

Bonded toppings

General: Before laying topping wash the substrate with water and provide a bonding product, or treat as follows:

- Keep wet for 2 hours or more.
- Remove surplus water and brush on neat cement or a clean slurry of cement and water.
- Place the topping while the slurry is wet.

3.2 APPLICATION

Laying

General: Spread the mix and compact. Strike off, consolidate and level surfaces to finished levels.

Monolithic toppings: Lay while concrete subfloor is plastic and the surface water is no longer visible.

Toppings over 50 mm thick:

- Lay in two layers of equal thickness.
- Place a layer of reinforcement between the layers of toppings. Lap reinforcement 200 mm and tie. Do not create four way laps.

FINISH

0612 Cementitious toppings

3.3 SURFACE FINISHES

Finishing methods – primary finish

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Wood float finish: After machine floating, produce the final consolidated finish free of float marks and uniform in texture and appearance using wood or plastic hand floats.

Broom finish: After machine floating draw a broom or hessian belt across the surface to produce a coarse even-textured slip-resistant transverse-scored surface.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Sponge finish: After machine floating, obtain an even textured sand finish by wiping the surface using a damp sponge.

Finishing methods – supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate using fine, hard, sharp, graded abrasive particles.

Surface finishes

General: Provide surface finishes as documented in the **Cementitious toppings construction schedule**.

Slip-resistant treatment

Surface treatment: Apply silicon carbide granules after floating and before the topping surface has set, and trowel into the surface so that the granules remain exposed.

Application rate: 1 kg/m² evenly distributed.

Slip-resistant treatment to existing Steps 1 and new toppings to existing Steps 2 stair treads

Slip resistance treatment: Form a groove and fill with a silicon carbide two-part resin.

Dimensions: 10 mm deep, 50 mm wide, length to be the width of the tread.

Position to the nosing: 15mm back from the tread edge to meet standards requirements. Refer to details.

Proprietary Item

Stair tread Inserts shall be Latham Asbraloy Mill Finish extruded Slip Resistant Safety Stair Tread Bar Inserts, Type Aluminium ACS-50 with 'Supagrit' granular silicon carbide mineral infill, all as manufactured by Latham Australia Pty Limited, Gladesville NSW Australia. Email: treads@latham-australia.com

Surface treatment

General: Apply the surface treatment after floating and before the topping surface has set.

Temperature

General: Make sure that the temperature of mixes, substrates and reinforcement are not less than 5°C or greater than 35°C at the time of application.

Severe temperature: If the ambient shade temperature is greater than 38°C, do not mix topping.

3.4 CONTROL OF MOVEMENT

General

Requirement: Provide control joints as follows and as documented in the **Control joints schedule**:

- Location:
 - . Over structural control joints.
 - . At junctions between different substrates.
 - . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.

SPECIFICATION

FINISH

0612 Cementitious toppings

- Depth of joint: Right through to the substrate.
 - Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.
- Control joints to divide topping into bays: Provide joints using one of the following methods:
- Form in situ using square edge steel forms and trowelling a 3 mm radius to edges.
 - Form a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a premoulded strip.
 - Install a control joint product.

3.5 JOINT ACCESSORIES

Weather bars

General: Provide a corrosion-resistant metal weather bar under hinged external doors. Locate under the centres of closed doors.

Type: Bar

Material: Aluminium

Finish: mill finish

Dimensions: 30mm bar

Fixing: cast in during laying of toppings

Floor finish dividers

General: Finish cementitious toppings at junctions with differing floor finishes with a corrosion resistant metal dividing strip suitably fixed to the substrate, with top edge flush to the finished floor. If changes of floor finish occur at doorways make the junction directly below the centre of the closed door.

Type: Angle

Material: Aluminium

Finish: Mill finish

Dimensions: 25 x 25mm angle

Fixing: screw fix to timber floor

3.6 TESTING

Construction tests

General: Test and assess conformity of construction as follows:

- Flatness: If flatness properties are required:
 - . Method: To ASTM E1155.
- In situ crushing resistance/soundness: If a soundness category is required:
 - . Method: To BS 8204-1.
- Slip resistance: If a slip resistance classification is required:
 - . Method: To AS 4663.

3.7 COMPLETION

Curing

General: Prevent premature or uneven drying out and protect from the sun and wind.

Curing: Use a curing product or, as soon as toppings have set sufficiently, keep them moist by covering with polyethylene film for seven days.

Joint sealant

General: If required, seal joints as follows:

- Formed joints ≤ 25 mm deep: With filler and bond-breaker.
- Sawn joints: Full depth of cut.

FINISH

0612 Cementitious toppings

Protection

General: Protect finished work from damage during building operations.

4 SELECTIONS

4.1 SCHEDULES

Refer to the SH02 SCHEDULE OF SUBSTRATES AND FINISHES for location of topping types in the Schedule below.

Cementitious toppings construction schedule

	TOP1	TOP2	TOP3	TOP4
Material	Resin MMA topping - Flowcrete	Coloured Concrete topping - polished	Granolithic topping	Topping screeds as substrate for WPM and tiles; for and sheet Vinyl.
Location	Bay 4 4G.05 Airlock 4G.06 Male WC 4G.07 Female WC 4G.08 Access	Bay 5 5L2.01 Foyer	Thresholds to Doors: - 4L2/A02 Stair 1 - 4L4/A01 Stair 1 - 4GD/D02 Link 0 - 4L1/D01 Link 1 - 4L2/D02 Link 2 - 4L3/D01 Link 3 - 4L4/D02 Link 4 Replacement new topping to Steps 2 to be as specified to match existing colour, finish and aggregate size and composition.	To wet areas Bay 5 Ground 5G.02 Airlock 5G.03 Female WC 5G.04 Male WC 5G.06 Cleaner Bay 5 Level 1 5L1.02 Airlock 5L1.03 Female WC 5L1.04 Access 5L1.05 Male WC Bay 5 Level 2 5L2.02 Airlock 5L2.03 Female WC 5L2.04 Access 5L2.05 Male WC Bay 5 Level 3 5L3.04 Airlock 5L3.05 Female WC 5L3.06 Access 5L3.07 Male WC Bay 5 Level 4 5L4.04 Airlock 5L4.05 Female WC 5L4.06 Access 5L4.07 Male WC
Thickness	4 - 6mm	Refer to Structural Engineer's details and to 0315 CONCRETE FINISHES specification.	25 - 30mm	20 – 60mm
Topping function	Waterproof non-slip finish to floors in upgraded amenities in Bay 4 Ground Floor		New granolithic topping to concrete external Steps 2 and internal thresholds to new openings.	Topping to provide falls to floor wastes as detailed.
Topping method	Bonded Refer Flowcrete installation instructions		Bonded	Separate Laid on prepared CFC sheet flooring.
Flatness tolerance	< 15 mm: ± 2 mm.		< 15 mm: ± 2 mm.	< 15 mm: ± 2 mm.

SPECIFICATION

FINISH

0612 Cementitious toppings

Primary finish	Existing substrate prepared to manufacturer's directions		Wood float	Steel trowel to WPM and RESILIENT FINISHES specification
Supplementary finish	-		-	WPM and TL/F, V/S
Surface treatment product	-		Silicon carbide granules	-
Slip resistance classification	R12		R12	N/A. Prepare for WPM and finishes as specified
Topping joints	Floor division strip		'V' joint where required.	Flexible movement Tile joint where CFC covers both the new timber floor boards and existing concrete slab on Levels 1,2 and 3. Refer to architectural plans

4.2 STEPS 2 TO BAY 4

New toppings and non-slip nosings

Requirement: New toppings are to have a similar appearance as the existing toppings.

Colour: Finished colour, exposed aggregate composition is to be similar.

Samples: Samples are to be provided for approval.

Cross reference: New inset non-slip nosing as specified in 0552 METALWORK are to be installed in the new toppings as specified.

Refer to photos.

Steps 1 to Bay 5

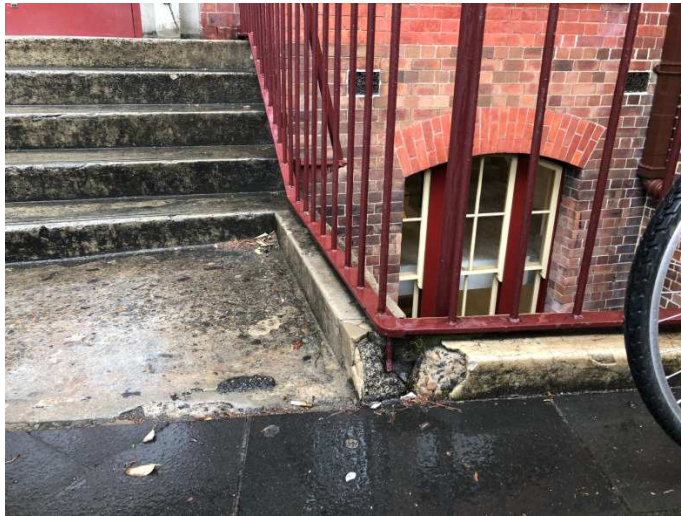
Requirement: New non-slip insets in existing toppings.



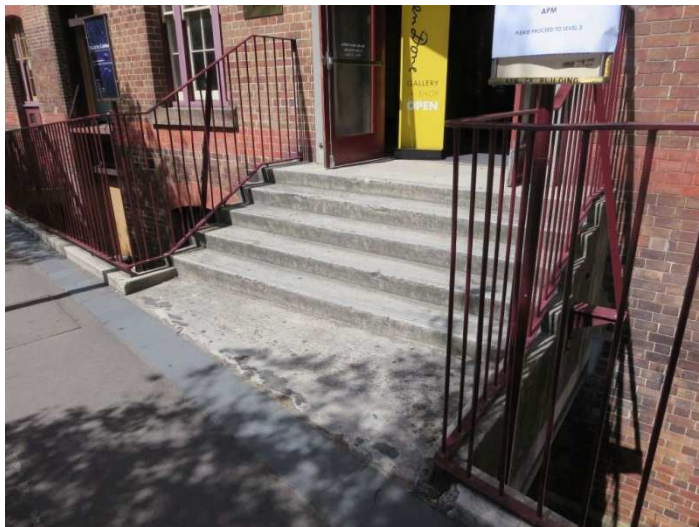
Steps 2 – after rain view

FINISH

0612 Cementitious toppings



Steps 2 – after rain. Damaged corner to be rebuilt to restore corner. SS Dowel concrete for new work



3. Steps 2 – dry view

06 FINISH

0621 Waterproofing – INTERNAL

0621 WATERPROOFING – INTERNAL

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide wet area waterproofing systems as documented which:

- Are graded to floor wastes to dispose of water without ponding.
- Prevent moisture entering the substrate or adjacent areas.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Waterproofing systems to include:

- Waterproofing of wet areas – toilets, cleaner and other wet area spaces.

Related worksections

- 0383 SHEET FLOORING, for compressed fibre cement flooring to wet areas to be waterproofed and tiled.
- 0612 CEMENTITIOUS TOPPING, for cement toppings to be laid on existing slabs in wet areas.
- 0651 RESILIENT FLOORING, for sheet vinyl floor to be laid on waterproof membranes to Cleaners.
- 0631 CERAMIC TILES, for tiles to wet area floors to be waterproofed.
- 0411 WATERPROOFING – EXTERNAL, for waterproof membrane to the plant room roof.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of spaces to be tiled or have vinyl floors that are to be waterproofed.
- HYDRAULIC SERVICES, for floor wastes, grates and grated drains to kitchen and wet areas.
- Architectural drawings and details for areas of tiling and vinyl flooring to be waterproofed.

1.3 STANDARDS

Wet areas

Standard: To AS 3740.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 3740 and the following apply:

- Substrates: The surface to which a material or product is applied.
- Bond breaker: A system preventing a membrane bonding to the substrate, bedding or lining.
- Membranes: Impervious barriers to liquid water which may be:
 - . Installed below floor finishes.
 - . Installed behind the wall sheeting or render and termed External.
 - . Installed to the face of the wall sheeting or render and termed Internal.
 - . Applied in liquid or gel form and air cured to form a seamless film.
 - . Applied in sheet form with joints lapped and sealed.

SPECIFICATION

06 FINISH

0621 Waterproofing – INTERNAL

- Waterproof (WP): The property of a material that does not allow moisture to penetrate through it.
- Waterproofing systems: Combinations of membranes, flashings, drainage and accessories which form waterproof barriers and which may be:
 - . Loose-laid.
 - . Bonded to substrates.
- Water resistant (WR): The property of a material that restricts moisture movement and will not degrade under conditions of moisture.
- Wet area: An area within a building supplied with a floor waste.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Substrate preparation completed.
- Secondary layers preparation completed.
- Before membranes are covered up or concealed.
- Flood testing, if applicable.

1.6 SUBMISSIONS

Products

Documentation: Submit copies of product manufacturer's:

- Product technical data sheets.
- Safety data sheets (SDS).
- Type tests certificates verifying conformance to AS/NZS 4858.
- Compatibility with the specified resilient finish and adhesives

Records

Placing records: Photographically record the application of membranes and information as follows:

- Date.
- Portion of work.
- Substrate preparation.
- Protection provided from traffic.

Samples

General: Submit 300 x 300 mm samples laid on site

Shop drawings

Submit shop drawings showing:

- Junctions with vertical surfaces and upstands.
- Junctions at perimeters.
- Drainage details.
- Control joints.
- Flashings.
- Penetrations.
- Corners.
- Terminations and connections.

Warranties

General: Submit details of the proposed warranty terms, form and period.

06 FINISH

0621 Waterproofing – INTERNAL

2 PRODUCTS

2.1 PRODUCTS

Membranes

Standard: To AS/NZS 4858.

Membrane systems

Requirement: Provide a proprietary membrane systems certified as suitable for the intended wet area waterproofing.

Water stop angles

Material: Rigid, corrosion resistant angles compatible with the waterproof membrane system.

Bond breakers

Requirement: Compatible with the flexibility class of the membrane to be used.

Material: Purpose made bond breaker tapes and closed cell foam backing rods or fillets of sealant.

Flashings

Requirement: Flexible waterproof flashings compatible with the waterproof membrane system.

Liquid membrane reinforcement

Requirement: Flexible fabric compatible with the waterproof membrane system.

Sealants

Requirement: Waterproof, flexible, mould-resistant and compatible with host materials.

Adhesives

Requirement: Waterproof and compatible with host materials.

3 EXECUTION

3.1 PREPARATION

Substrates

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion of membranes.
- If walls are plastered, remove loose sand.
- If walls or floors are framed or discontinuous, support members are in full lengths without splicing.
- If floors are solid or continuous:
 - . Excessive projections are removed.
 - . Voids and hollows greater than 10 mm with abrupt edges are filled with a cement:sand mix not stronger than the substrate nor weaker than the bedding.
 - . Depressions less than 10 mm are filled with a latex modified cementitious product with feathering eliminated by scabbling the edges.
 - . Cracks in substrates wider than 1.5 mm are filled with a filler compatible with the membrane system.

External corners: Round or arris edges.

Moisture content

Concrete substrates: Cure for at least 21 days.

Moisture content: Verify that the moisture content of the substrate is compatible with the water vapour transmission rate of the membrane system by testing to AS 1884 Appendix A.

Falls

Substrate: If the membrane is directly under the floor finish, make sure the fall in the substrate conforms to the fall nominated for the finish.

Sheet substrate fastening

Requirement: Fasten or adequately fix to the supporting structure.

SPECIFICATION

06 FINISH

0621 Waterproofing – INTERNAL

Control joints

Finishes: Align control joints in finishes and bedding with control joints or changes in materials in the substrate.

Water stop angles

Requirement: Provide water stop angles at door thresholds to support the waterproof membrane at junctions between waterproofed and non-waterproofed areas.

Sizing: Size the vertical leg of the water stop angle to conform to the requirements of AS 3740.

Corners: Cut the horizontal leg and bend the vertical leg at corners instead of forming vertical joints between separate lengths of angle.

Fixing: Fix water stop angles to the substrate with compatible sealant or adhesive and corrosion-resistant countersunk or wafer head screws.

Priming

General: If required by the membrane manufacturer, prime the substrates with a primer compatible with the membrane system.

Bond breakers

Requirement: After the priming of surfaces, provide bond breakers at all wall/floor, hob/wall junctions and at control joints where the membrane is bonded to the substrate.

Sealant fillet bond breakers:

- Application: Form a triangular fillet or cove of sealant to internal corners within the period recommended by the membrane manufacturer after the application of the primer.
- Widths: 5 mm x 5 mm to vertical corners. 6 mm x 6 mm – 9 mm x 9 mm to horizontal corners.

Backing rod bond breakers: Retain in position with continuous length of tape pressed firmly in place against the surfaces on each side of the rod.

3.2 APPLICATION

Protection

General: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage.

Extent of waterproofing

Waterproof or water resistant surfaces: To the requirements of BCA F1.7. Refer to **Selections**.

Vertical membrane terminations and heights

Upstands: At least 150 mm up walls to be tiles and above the finished vinyl floor level of the floor or 25 mm above the maximum retained water level, whichever is the greater.

Anchoring: Secure membranes along the top edge.

Edge protection: Protect edges of the membrane.

Flashings

Junctions between waterproof surfaces: Provide a bond breaker at internal corners behind flashings.

Junctions between waterproof surfaces and other surfaces: Provide a bead of sealant at the following junctions:

- Waterproof and water-resistant surfaces.
- Water-resistant and water-resistant surfaces.
- Water-resistant and non water-resistant surfaces.

Perimeter flashings: Provide continuous flashings to the full perimeter of waterproof areas at wall/floor junctions and to water stop angles.

Vertical flashings: Provide vertical corner flashings continuous across wall/wall junctions to at least 1800 mm above finished floor level in showers.

Vertical liquid applied flashings:

- Return legs at least 40 mm on each wall.
- Overlap the vertical termination of the floor waterproofing membrane at least 20 mm.

SPECIFICATION

06 FINISH

0621 Waterproofing – INTERNAL

Reinforcement: At coves, corners and wall/floor junctions with gaps greater than 3 mm reinforce liquid applied membranes with reinforcement fabric tape recommended by the membrane manufacturer. Fold the tape in half lengthways and imbed it in the first flashing coat of membrane with one half of the tape on each side of the corner or joint. Apply a second coat of liquid membrane to seal the fabric.

Door jambs and architraves

Requirement: If the bottom of doorjambes do not finish above the floor finish, waterproof their surfaces below floor finish level to provide a continuous seal between the perimeter flashing to the wall/floor junction and the water stop angle.

Drainage connections

Floor wastes: Provide floor wastes of sufficient height to accommodate the thickness of floor finishes and bedding at the outlet position. Position drainage flange to drain at membrane level. Turn membrane down 50 mm minimum into the floor waste drainage flanges, and adhere to form a waterproof connection.

Preformed drainage channels:

- With continuous drainage flanges: Provide a continuous waterproof connection between the membrane and the channel.
- Without drainage flanges: Provide continuous waterproofing under the channel and terminate the membrane at a floor waste with a recessed drainage flange.

Membrane horizontal penetrations

Sleeves: Provide a flexible flange for all penetrations, bonded to the penetration and to the membrane.

Membrane vertical penetrations

Pipes, ducts, and vents: Provide separate sleeves for all pipes, ducts, and vents and have fixed to the substrate.

Curing of liquid applied systems

General: To the manufacturers' instructions.

Curing: Allow membrane to fully cure before laying sheet vinyl flooring.

Overlaying finishes on membranes

Requirement: Protect waterproof membranes with compatible water-resistant surface materials that do not cause damage to the membrane.

Suitable materials: Conform to AS 3740. Refer to *Selections*.

Bonded or partially bonded systems: If the topping or bedding mortar is required to be bonded to the membrane, provide sufficient control joints in the topping or bedding mortar to reduce the movement over the membrane.

3.3 COMPLETION

Protection

General: Keep traffic off membrane surfaces until bonding has set or for 24 hours after laying, whichever period is the longer.

Reinstatement: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Warranty

Waterproofing: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the applicator.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier.

SPECIFICATION

06 FINISH

0621 Waterproofing – INTERNAL

4 SELECTIONS

4.1 SYSTEMS

Liquid membrane systems - Membrane Schedule

Location	Proprietary System
Waterproofing to all rooms with ceramic tile floors – on the Ground Floor, Levels 1,2,3 and 4.	ARDEX Moisture Barrier System – ARDEX WPM300 HYDROPOXY The waterproof membrane is to be installed over the various substrates with more than one substrate type in one area: 1] compressed fibre cement (CFC) substrate screw fixed to timber floor boards 2] concrete and timber floor boards in the one wet area 3] existing concrete. Finishes The following finishes are over waterproofed substrates: - A] Ceramic tiles on toppings on CFA on Substrates 1, 2 and 3 - B] Sheet Vinyl on Substrate 2 Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of spaces to be tiled or have vinyl floors that are to be waterproofed. Preparation - Thoroughly clean the CFC; - Photographic record to be taken of the cleaned surface (the Substrate) and repairs / infills to cracks and depressions in the surface before vacuuming to thoroughly clean Installation of ARDEX Moisture Barrier - Thoroughly mix the individual Part A & B components of the ARDEX WPM300 then mix the components in equal volumes to achieve a homogeneous mix. Apply 2 coats in accordance with the ARDEX installation instructions. The coats are applied at 90 degree angles to obtain a complete coverage. - The following day, excess sand and broomed and vacuumed off the surface prior to the installation of the smoothing cement. - Smaller hairline cracks (concrete substrates) can be treated by the application of the moisture barrier with a brush to a width of 100mm either side of the crack, and then whilst still liquid, Ardex Deckweb tape is worked into the moisture barrier with a metal ribbed roller. A second coat of the moisture barrier is then applied with a brush over the embedded tape. Alternatively water resistant ARDEX B34+B36 repair mortar combination can be used up to 100mm thick. - The moisture barrier is to be continued up all masonry, cement rendered and fibre cement sheeted walls for at least 150mm above the floor height. Application of Smoothing Cement - The self-smoothing cement is to be installed at 3 – 4mm thick to provide the necessary protection and a smooth flat cement surface for the conventional installations of the specified floor covering. Refer to ARDEX TECHNICAL BULLETIN – TB192. Compliance with the specifications in this Bulletin will provide a complete ARDEX warranty system. Forbo and Ardex adhesives are compatible with the above Moisture Barrier System – ARDEX WPM300 HYDROPOXY and Forbo's warranty will apply. NOTE: Refer to the architectural details for the location waterproof membrane to the
To all Male and Female Toilets, Access toilets and Airlocks where tiled	
To all Cleaners with sheet vinyl on the Ground Floor, Levels 1,2,3 and 4.	
Membrane to extend up walls to 150 mm above FFL to all rooms	

SPECIFICATION

06 FINISH

0621 Waterproofing – INTERNAL

	substrate and finish. Membrane is to be directly below the sheet vinyl or on top of the compressed fibre cement sheeting. For tiled floor, membrane is to be on top of the compressed fibre cement sheeting. Methodology to be submitted to the superintendent.
Plant Room Concrete Roof	Refer to WATERPROOFING – EXTERNAL

SPECIFICATION

06 FINISH

0631 Ceramic tiling

0631 CERAMIC TILING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide tiling systems to walls, floors and other substrates as documented and as follows:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Set out with joints accurately aligned in both directions and wall tiling joints level and plumb.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- GENERAL REQUIREMENTS.

Specified in this worksection

Tiling, includes but not limited to:

- floor tiling
- wall tiling
- cement based screed underlay to tiles.
- tiling adhesives
- tile joints, including caulked joints and expansion joints
- grouting to tiles
- tile protection strips
- tile accessories

Related worksections

Refer to the following worksections:

- 0181 ADHESIVES, SEALANTS AND FASTENERS, for adhesives and sealants.
- 0202 DEMOLITION, for removal of existing tile finishes to existing Bay 4 toilets.
- 0335 BRICK AND STONE MASONRY, for brick substrates.
- 0383 SHEET FLOORING, for compressed fibre cement sheet flooring substrates on timber joists and timber floor boards for waterproof membranes and toppings to take floor tiles.
- 0612 CEMENTITIOUS TOPPINGS for toppings to compressed fibre cement sheet and existing substrates.
- 0621 WATERPROOFING – INTERNAL for waterproof membranes under tiles and vinyl in wet areas;
- 0525 CUBICLE SYSTEMS, for toilet partition systems in rooms to be tiled.
- 0552 METALWORK, for flooring division strips and angle bars; for grab rails to be fixed to tiled walls.
- 0511 LINING, for sheet wall linings to be tiled.
- 0651 RESILIENT FLOORING for vinyl floor finishes and for integral coved vinyl skirting to wall tiling.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES for location of wall and floor tiling.
- SH03 SCHEDULE OF SANITARYWARE AND TAPWARE, for urinals, hand basins, toilet suites and floor wastes in areas to be tiled.

SPECIFICATION

06 FINISH

0631 Ceramic tiling

- HYDRAULIC SERVICES, for hot and cold water and for plumbing drainage to sanitary items.
- Architectural drawings for plans and elevations of rooms for wall and floor tiling;

1.1 STANDARDS

Tiling

General: Conform to the documented recommendations of those parts of AS 3958.1 which are referenced in this worksection.

Slip resistance

Classification: To AS 4586.

1.2 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Acoustic underlay: A resilient material laid between the structural floor and the flooring material to provide sound isolation.
- Adhesives:
 - . Cementitious (C): Adhesives in which the binders are hydraulic, e.g. Portland cement, with aggregates and organic additives.
 - . Dispersion (D): Adhesives in which the binders are in the form of aqueous polymer dispersion with mineral fillers and organic additives.
 - . Reaction resin (R): Adhesives in which the binders are synthetic resins with mineral fillers and organic additives. The curing occurs by chemical reaction.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates.
 - . Adhesive bedding: Tiling adhered by adhesives.
 - . Mortar bedding: Tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent tiles.
- Stepping: The relative surface level of adjacent paving elements within the expanse of the main pavement.
- Substrate: The surface to which a material or product is applied.
- Tiles: Thin slabs made from clays and/or other inorganic raw materials used generally as coverings for floors and walls and adhered to continuous supporting substrates.
 - . Cementitious: Cement based pre-finished tiles.
 - . Dry-pressed: Tiles made from a finely milled body mixture and shaped in moulds at high pressure. Also known as Type B.
 - . Extruded: Tiles whose body is shaped in the plastic state in an extruder then cut to size. Also known as Type A.
- Underlay: A non-structural layer of sheet material or an in situ levelling material on the subfloor to provide a smooth level surface.
- Wet area: An area within a building supplied with a floor waste.

1.3 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following after inspections of the waterproof membrane. Refer WATERPROOFING – WET AREAS for inspections of the waterproof membrane:

- Substrate immediately before tiling.

SPECIFICATION

06 FINISH

0631 Ceramic tiling

- Trial set-outs before execution.
- Control joints before sealing and grouting.
- Grout and sealant colours before application.
- Control joints in substrate before tiling control joint installation

Refer to Inspections required prior to tiling in 0621 WATERPROOFING – WET AREAS.

1.4 TOLERANCES

Completed tiling

Standard: To AS 3958.1 clause 5.4.6.

1.5 SUBMISSIONS

Execution

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that variations in joint widths or overall dimensions will avoid cut tiles, submit a proposal.

Materials

Product conformity: Submit current assessments of conformity as follows:

- Marking and classification of tiles with regard to water absorption and shaping to AS ISO 13006.
- Marking and classification of tile adhesive to AS ISO 13007.1.
- Weighted normalised impact sound pressure level to AS ISO 717.2 as measured for the acoustic underlay as part of the entire tiling system.
- Declaration of conformity by an AS/NZS ISO 9001 quality management system certified supplier: Slip resistance of the tiles specified in **SELECTIONS** to AS/NZS 4586.

Samples

General: Submit labelled samples of tiles, including fittings, tile accessories, grout and sealants, illustrating the range of variation in colour and finish.

Sample panels

General: Prepare a sample panel of each type of tiling system as follows:

- Size: > 2 m².
- Include samples of junction details and trim.
- Preserve the panel until related work is complete.

Location: To be advised on site by the superintendent.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

1.6 TESTS

Tests

Type tests: Submit results, as follows:

- Type test slip resistance of tiles to AS 4586.

Other tests: Submit results, as follows:

- Site slip resistance test of completed installation to AS 4663.

SPECIFICATION

06 FINISH

0631 Ceramic tiling

2 PRODUCTS

2.1 MARKING

Identification

General: Deliver materials to the site in the manufacturer's original sealed containers legibly marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Dimensions and quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern.
- Handling and installation instructions.

2.2 UNDERLAY

Fibre cement underlay

Standard: To AS/NZS 2908.2, Type B, category 2 minimum.

Thickness: 15 mm minimum as detailed.

2.3 TILES AND ACCESSORIES

Tiles

Standard: To AS ISO 13006.

Coves, nosings and skirtings: Provide matching stop-end and internal and external angle tiles moulded for that purpose.

Exposed edges: Purpose-made border tiles with the exposed edge (whether round, square or cushion) glazed to match the tile face. If such tiles are not available, mitre tiles on external corners.

Accessories

General: Provide tile accessories which match the composition, colour and finish of the surrounding tiles and as documented in the **Accessories Schedule**.

Accessories schedule - Tile trim

Location	5G.04 Male WC 5L1.05 Male WC 5L2.05 Male WC 5L3.07 Male WC 5L4.07 Male WC	5G.06 Cleaner 5L1.07 Cleaner 5L2.07 Cleaner 5L3.09 Cleaner 5L4.09 Cleaner
Type	External corner protection to tiled wall near urinal	Junction top of coved vinyl floor and ceramic wall tile
Proprietary Item	BAT Trims	BAT Trims
Size (mm) / material	Corner Guard Size 8	Angle – Size as detailed / required.
Material	Grade 304 Stainless Steel	Grade 304 Stainless Steel
Colour / finish	Mill Finish	Mill Finish

SPECIFICATION

06 FINISH

0631 Ceramic tiling

2.4 ADHESIVES

General

Standard: To AS ISO 13007.1.

Type

General: Provide adhesives compatible with the materials and surfaces to be adhered, and as documented in the **Wall tiling schedule** and to the **Floor tiling schedule**.

Prohibited uses: Do not provide the following combinations:

- Cement-based adhesives on wood, metal, painted or glazed surfaces, gypsum-based plaster.
- Organic solvent-based adhesives on painted surfaces.
- Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.
- PVA (polyvinyl acetate) based adhesives in wet areas or externally.

2.5 MORTAR

Materials

Cement type to AS 3972: GP.

- White cement: Iron salts content not more than 1%.
- Off-white cement: Iron salts content not more than 2.5%.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Bedding mortar

Mix proportion (cement : sand), by volume: Select proportions from the range 1:3 to 1:4 for satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

Water

General: Clean and free from any deleterious matter.

2.6 GROUT

Type

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

General purpose cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

Mix proportions (cement : sand), by volume:

- For joints < 3 mm: 1: 2.
- For joints ≥ 3 mm: 1:3.

Pigments

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.

SPECIFICATION

06 FINISH

0631 Ceramic tiling

3 EXECUTION

3.1 SUBSTRATES

Drying and shrinkage

General: Before tiling, allow at least the following times to elapse (for initial drying out and shrinkage) for these substrates:

- Concrete slabs: 42 days.
- Toppings on slabs and rendering on brick or blockwork: A further 21 days.

Alternatives

Additives to toppings to achieve a quicker drying can be presented for approval where compatible with the tile screed /adhesives.

3.2 PREPARATION

Standard

Preparation: To AS 3958.1 Section 4.

Ambient temperature

General: If the ambient temperature is less than 5°C or greater than 35°C, do not lay tiles.

Substrates without wet area membranes

General: Conform to the following:

- Clean off of any deposit or finish which may impair adhesion or location of tiles.
- If framed or discontinuous, support members are in full lengths without splicing.
- If solid or continuous:
 - . Remove excessive projections.
 - . Fill voids and hollows greater than 10 mm with abrupt edges with a cement:sand mix not stronger than the substrate or weaker than the bedding.
 - . Fill depressions less than 10 mm with a latex modified cementitious product and eliminate feathering by scabbling the edges.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Substrates with wet area membranes

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- Compatible with all components of the floor system.

Trial set-out

General: Prepare a trial tile set-out of each area as follows to:

- Maximise the size of equal margins of cut tiles.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut tiles at margins.
- Mark location of fittings on walls.

3.3 FIXING UNDERLAY

Installation

Requirement: Lay in staggered (brick) pattern, perpendicular to the direction of the timber floor boards, with joints in the compressed fibre cement underlay not coinciding with joints in the subfloor. Fix with screw fasteners and fastener spacing to the manufacturers recommendations. Do not nail or use adhesives on the timber floor boards. The works are designed to be removable.

06 FINISH

0631 Ceramic tiling

Timber floor boards

Test and confirm the moisture content of the installed floor boards before installing and fixing the compressed fibre cement underlay to the floor boards.

3.4 TILING GENERALLY

Sequence

General: Fix wall tiles before floor tiles.

Cutting and laying

Cutting: Cut tiles neatly to fit around fixtures and fittings and at margins where necessary. Drill holes without damaging tile faces. Cut recesses for fittings such as soap holders. Rub edges smooth without chipping.

Laying: Return tiles into sills, reveals and openings. Butt up to returns, frames, fittings, and other finishes. Strike and point up beds where exposed. Remove tile spacers before grouting.

Variations

General: Distribute variations in hue, colour, or pattern uniformly, by mixing tiles or tile batches before laying.

Protection

Floor tiles: Keep traffic off floor tiles until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

Floor finish dividers

General: Finish tiled floors at junctions with differing floor finishes with a corrosion-resistant metal dividing strip fixed to the substrate. If changes of floor finish occur at doorways, make the junction directly below the closed door.

3.5 SETTING OUT

Tile joints

Joint widths: Set out tiles to give uniform joint widths within the following limits:

- Floors:
 - . Extruded tiles: 6 mm.
 - . Vitrified: 3 to 5 mm.
- Walls:
 - . Dry pressed tile: 1.5 mm.
 - . Extruded tile: 6 mm.

Joint alignment: Set out tiling with joints accurately aligned in both directions and wall tiling joints level and plumb.

Joint position: Set out tiles from the centre of the floor or wall to be tiled.

Margins

General: Provide whole or purpose-made tiles at margins where practicable, otherwise, set out to give equal margins of cut tiles. If margins less than half a tile width are unavoidable, locate the cut tiles where they are least conspicuous.

Fixtures

General: If possible position tiles so that holes for fixtures and other penetrations occur at the intersection of horizontal and vertical joints or on the centre lines of tiles. Continue tiling fully behind fixtures which are not built in to the tiling surface. Before tiling ensure that fixtures interrupting the tile surfaces are accurately positioned in their designed or optimum locations relative to the tile layout.

3.6 FALLS AND LEVELS

Grading

General: 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.

Fall, general: 1:100 minimum unless otherwise detailed.

Change of finish: Maintain finished floor level across changes of floor finish.

3.7 BEDDING

Standard

Cement mortar: To AS 3958.1 clause 5.5.

Adhesive: To AS 3958.1 clause 5.6.

Preparation of tiles

Adhesive bedding: Fix tiles dry; do not soak.

Mortar bedding: Soak porous tiles in water for half an hour and then drain until the surface water has disappeared.

Bedding

General: Use bedding methods and materials which are appropriate to the tile, the substrate, the conditions of service, and which leave the tile firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Thin adhesive beds

General: Provide only if the substrate deviation is less than 3 mm when tested with a 3 m straight edge. Cover the entire tile back with adhesive when the tile is bedded.

Thickness: 1.5 to 3 mm.

Thick adhesive beds

General: Provide on substrates with deviations up to 6 mm when tested with a 3 m straight edge, and with tiles having deep keys or frogs.

Nominal thickness: 6 mm.

Adhesive bedding application

General: Apply adhesive by notched trowel to walls and floors and direct to tiles if required, to provide evenly distributed coverage after laying as follows:

- Domestic internal walls: > 65%.
- Domestic internal floors: > 80%.
- Other wall and floors: > 90%.
- Wet areas: 100%.

Pattern of distribution of adhesive: To the recommendations of AS 3958.1 clause 5.6.4.3. Verify by examining one tile in ten as work proceeds.

Wall tile spacers: Do not use spacer types that inhibit the distribution of adhesive.

Curing: Allow the adhesive to cure for the period nominated by the manufacturer before grouting or allowing foot traffic.

Mortar beds

For floor tiles: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, or cement-based thin bed adhesive, on to the tile back. Do not use mortar after initial set has occurred.

- Nominal thickness: 20 to 40 mm.

Thick reinforced beds: Place mortar bed in two layers, and incorporate the galvanized steel mesh reinforcement in the first layer.

Mechanical fixing

General: Provide a proprietary system of support and fixing appropriate to the type of tile and the substrate conditions.

06 FINISH

0631 Ceramic tiling

3.8 CONTROL OF MOVEMENT

General

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:

- Floor location:
 - . Over structural control joints.
 - . To divide complex room plans into rectangles.
 - . Around the perimeter of the floor.
 - . At junctions between different substrates.
 - . To divide large tiled areas into bays.
 - . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Wall location:
 - . Over structural control joints.
 - . At junctions with different substrate materials when the tiling is continuous.
 - . At vertical corners in shower compartments.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Control joints schedule

Location	Refer to the Architectural drawings
Sealant: Type	Sika Australia - To be chemically and mould resistant - To be compatible with tile adhesive and membrane where used in conjunction with such. Refer 0621 WATERPROOFING – WET AREAS One part modified silicone or polyurethane
Colour	To match the tiles to an approved sample As required for tile movement characteristics and in accordance with sealant
Width (mm)	Manufacturer recommended depth: width ratios.

1.1 GROUTED AND SEALANT JOINTS

Grouted joints

General: Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout. Wash down when the grout has set. When grout is dry, polish the tiled surface with grout film remover and a clean cloth.

Edges of tiles: Grout exposed edge joints.

Epoxy grouted joints: Make sure tile edge surfaces are free of extraneous matter such as cement films or wax, before grouting.

Sealant joints

General: Provide joints filled with sealant and finished flush with the tile surface as follows:

- Where tiling is cut around sanitary fixtures.
- At internal corners of walls in showers.
- Around fixtures interrupting the tile surface, for example pipes, brackets, bolts and nibs.

06 FINISH

0631 Ceramic tiling

- At junctions with elements such as window and door frames and built-in cupboards.

Material: Anti-fungal modified silicone.

Width: 5 mm.

Depth: Equal to the tile thickness.

1.2 JOINT ACCESSORIES

Floor finish dividers

General: Finish tiled floors at junctions with differing floor finishes with a corrosion-resistant metal dividing strip fixed to the substrate using mechanical fixings, with top edge flush with the finished floor. Where changes of floor finish occur at doorways, make the junction directly below the closed door. Grout up underneath to provide continuous support.

Type: Bar or angle

Material: 304 stainless steel

Stepping: Less than 5 mm.

Adjustments

Requirement: Check that the height of the floor finish divider is sufficient for the topping and tile thickness. Adjust as required with a matching flat bar adhesive fixed to the divider angle.

1.3 COMPLETION

Spare tiles

General: Supply spare matching tiles and accessories of each type for future replacement purposes. Store the spare materials on site.

Quantity: At least 1% of the quantity installed.

Storage location: To be provided by the superintendent.

Cleaning

General: Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the tiling, including procedures for maintaining the slip-resistance grading stating the expected life of the slip-resistance grade.

2 SELECTIONS

2.1 SCHEDULES

Wall tiling schedule

Refer to the architectural drawings and the following schedule:

SPECIFICATION

06 FINISH

0631 Ceramic tiling

2.2 WALL TILING SCHEDULE

Wall tiling schedule

Refer to the architectural drawings and the following schedule:

CODE	ITEM	LOCATION	DESCRIPTION	SUPPLIER
TL/W1	Ceramic Wall Tile Wall tile is also the skirting tile in these locations. Refer to architectural drawings for the location of TLW1	Bay 4 Ground Floor Access, Male Toilet Female Toilet Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner	Tile Style: Baton Colour: White Finish: Matt Size: 50x400mm Installation: Stackbond Refer to details / setouts.	Skheme Pty Ltd Nathan Danks T. 8755 2305
			Grout: ABA - Ardex FG8 Colour: Ardex 390 Ultrawhite	Ardex T. 1800 224 070
			Corner Trim: Provide corner trim to all exposed corners including DTA SS Square Edge Trim Code: SSQ3.8316	DTA Australia T. 03 9781 9777
			Movement Joints: Provide prefabricated stainless steel movement joints to allow for expansion and contraction of wall tiles	DTA Australia T. 03 9781 9777
TL/W2	Ceramic Wall Tile Wall tile is also the skirting tile in these locations. Refer to architectural drawings for the location of TLW2	Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner Bay 5 Level 1 Airlock, Male Toilet. Female Toilet, Access Toilet, Cleaner	Tile Style: Baton Colour: Black Finish: Matt Size: 50x400mm Installation: Stackbond Refer to details / setouts.	Skheme Pty Ltd Nathan Danks T. 8755 2305
			Grout: ABA - Ardex FG8 Colour: Ardex WA Black	Ardex T. 1800 224 070
			Corner Trim: Provide corner trim to all exposed corners including door frames. DTA SS Square Edge Trim Code: SSQ3.8316 Refer to Details	DTA Australia T. 03 9781 9777
			Movement Joints: Provide prefabricated stainless steel movement joints to allow for expansion and contraction of wall tiles	DTA Australia T. 03 9781 9777

SPECIFICATION

06 FINISH

0631 Ceramic tiling

2.3 FLOOR TILING SCHEDULE

Floor tiling schedule

Refer to the architectural drawings and the following schedule:

CODE	ITEM	DESCRIPTION	LOCATION	SUPPLIER
TL/F	Porcelain floor tile	Tile Style: November Colour: NM01 Rain Finish: Grip P3 Size: 300 x 600mm	To all floors to wet areas / Toilets as shown TL/F in Bay 5.	Classic Ceramics Teline Saleh Boghossian M.0418 221 482 T 95606566
		Grout: Ardex FG8 Colour: Ardex 273 Magellan Grey	Refer to SH.02 SCHEDULE OF SUBSTRATES AND FINISHES	Ardex T. 1800 224 070

2.4 FLOORING UNDERLAY SCHEDULE

Flooring underlay schedule

Property	A
Location	Cleaners
Material	Compressed fibre cement sheeting
Thickness	6 mm
Topping	TOP 4 Refer to 0612 CEMENTITIOUS TOPPINGS
Fixing	Lay on top of separation plastic - Fortecon polythene sheet – on top of the existing timber floor boards – all fixings are to non-mechanical and designed to be removable in the future. All fixing to be approved by the Superintendent.

06 FINISHES

0651 Resilient finishes

0651 RESILIENT FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide resilient floor coverings supplied by **FORBO FLOORCOVERINGS PTY LTD** to substrates as follows and to **Selections**:

- To remain secured for the warranty life of the covering.
- To remain consistently smooth for the warranty life of the covering.
- To form the pattern required.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- GENERAL REQUIREMENTS.

Specified in this worksections

- slip resistant sheet vinyl flooring with integral coved skirting.
- Installation
- Finishing
- Tests and warranties

Related worksections

- 0621 WATERPROOFING – WET AREAS for preparation and for waterproof membranes on concrete and compressed fibre cement.
- 0383 SHEET FLOORING, for compressed fibre cement sheet flooring underlay on top of timber floor boards to take resilient floor finishes.
- 0631 CERAMIC TILING, for wall tiling and for details of junctions to top of coved vinyl skirtings.
- 0383 SHEET FLOORING, for compressed fibre cement sheet floors to be covered with sheet vinyl.
- 0612 CEMENTITIOUS TOPPINGS, for concrete toppings laid falls on sheet flooring and concrete slabs
- 0552 METALWORK, for floor division strips between different finishes and for construction joints
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of vinyl floor finishes.
- HYDRAULIC SERVICES, for floor wastes in vinyl floors;
- SH03 SCHEDULE OF SANITARYWARE AND TAPWARE, for floor wastes in vinyl floors.
- Architectural details for coved skirtings and junction with ceramic wall tiling.

1.3 VINYL FLOOR

Contact

Forbo Representative John Liston – M. 0419 209 719 E. john.liston@forbo.com

1.4 STANDARDS

General

Installation: To AS 1884.

SPECIFICATION

06 FINISHES

0651 Resilient finishes

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 1884 and the following apply:

- Resilient floor coverings classification: To BS EN ISO 10874. Commercial Class 34.
- Substrate: The surface to which a material or product is applied.

Underlay: A non-structural layer of sheet material or an in situ levelling material on the substrate to provide a smooth and level surface suitable surface for the resilient covering.

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Substrate – waterproof membrane immediately before fixing resilient finishes, underlay or toppings.
- Completed underlay, if any.
- Sample finish detailing into floor wastes
- Sample coved skirting at an internal corner and external corner.
- Finished surface before applying sealers or polishes (if any).
- Completed installation.

1.7 SUBMISSIONS

Materials and components

Manufacturer's data: Submit the manufacturer's product data for each type of finish, and the manufacturer's recommendations for its application in the project including, if relevant, the following:

- Thickness and width of sheet.
- Adhesive and jointing method.
- Resistance to wear, indentation, chemicals, light and fire.
- Flexibility and bending strength.

Samples

Range: Submit labelled samples of resilient finishes illustrating the range of colour, pattern or texture of the product.

Minimum size per sample:

- Sheet: 450 x 450 mm.
- Linear accessories, (including coving, skirting, protection strips): A piece 300 mm long.
- Welded joints: 300 mm long.

Identification: Label each sample, with brand, product name, and manufacturer's code reference

Sample panels: Provide sample panels as follows:

- Location: Cleaner – Level 2
- Size (mm): Area of sheet floor with sample external and an internal cover corners.

Trial set-out: Prepare a trial set-out before fixing.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers.

Substrate acceptance

Applicator: Submit the installer's certification of the acceptability of the flooring substrate before commencing installation.

Tests

Type tests: Submit results, as follows:

- Manufacturer's type tests showing that materials conform to cited standards.

SPECIFICATION

06 FINISHES

0651 Resilient finishes

- Fire hazard properties: Submit evidence of conformance to **PRODUCTS, GENERAL, Critical radiant flux** and **Smoke development rate**.

- Slip resistance of resilient finishes to AS 4586.

Other tests: Submit results, as follows:

- Site slip resistance test of completed installations.
- Surface pH test.
- Moisture content test.

Warranties

Requirement: For each type of resilient finish specified, submit the manufacturer and installer's warranty of the material, workmanship and application.

Warranty items: Refer to 0171 GENERAL REQUIREMENTS.

2 PRODUCTS

2.1 GENERAL

Critical radiant flux

Standard: To AS ISO 9239.1.

Floor finishes: Conform to the values of critical radiant flux as documented.

Smoke development rate

Standard: To AS ISO 9239.1.

2.2 MARKING

Identification

General: Deliver materials to the site in the manufacturer's original sealed packaging legibly marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern. Provide technical data sheets if not shown on labels.
- Handling and installation instructions.
- Materials safety data sheets.

2.3 UNDERLAYS

Cementitious

General: Polymer modified cementitious self-smoothing and levelling compound.

Refer to 0612 CEMENTITIOUS TOPPINGS and 0621 WATERPROOFING – WET AREAS for compatible preparation and waterproofing materials for Forbo vinyl flooring where finish is fixed directly on top of the membrane.

Thicknesses: TOP4: 20 - 60 mm minimum.

Fibre cement underlay

Standard: To AS/NZS 2908.2, Type B, category 2 minimum.

SPECIFICATION

06 FINISHES

0651 Resilient finishes

Thickness: 5 mm minimum (where fully supported to top of reinstated timber floors with timber floor boards).

2.4 SHEETS

Edges of sheets

General: Make sure edges are firm, unchipped and machine-cut accurately to size and square to the face, and that tile edges are square to each other.

Adhesives

General: To the resilient finishes manufacturer's recommendations and compatible with the waterproof membrane below the sheet vinyl.

Slip resistant sheet vinyl

Slip resistance classification: To AS 4586.

2.5 VINYL SKIRTINGS

Skirting types

General: supply and install where scheduled in SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, vinyl skirtings. Skirting type as follows:

- SK/V/S1/COV – Floor sheet vinyl coved up to form the skirting; skirting is integral with floor vinyl.

3 EXECUTION

3.1 SUBCONTRACTORS

General

General: Use specialist installers recommended by the materials manufacturers.

3.2 PREPARATION

Substrates

General: To AS 1884 Section 3.

Tolerance: To the **Substrate tolerance table**

Substrate tolerance table

Property	Length of straightedge laid in any direction	Max. deviation under the straightedge
Planeness	2 m	4 mm
Smoothness	150 mm	1 mm
Projections	50 mm	0.5 mm

Concrete substrates

Surface pH: ≤ 10 when tested to AS 1884 Appendix B and compatible with the adhesive.

Moisture content: Do not commence installation unless the moisture content of the concrete has been tested to AS 1884 Appendix A and the values in clause A3.1.2 or A3.1.3 have been obtained.

Surface treatments: Mechanically remove the following surface treatments:

- Sealers and hardeners.
- Curing compounds.
- Waterproofing additives.
- Surface coatings and contamination.

06 FINISHES

0651 Resilient finishes

Concrete substrate correction: Remove projections and fill voids and hollows with a levelling compound compatible with the adhesive. Allow filling or levelling compound to dry to manufacturer's recommendations.

Cleaning: Remove loose materials or dust.

Timber and particleboard substrates

Moisture content: Do not start installation of the resilient finish unless the moisture content of battens/joists or substrate has been tested to AS/NZS 1080.1 for timber and AS/NZS 2098.1 as follows:

- Air conditioned buildings: 8 to 10%.
- Intermittently heated buildings: 10 to 12.5%.
- Unheated buildings: 12 to 15%.

Timber and particleboard substrate rectification: Remove projections. If conformance to the **Substrate tolerance table** cannot be achieved, provide an underlay in brick pattern with joints avoiding substrate joints.

Cleaning: Remove oil, grease, traces of applied finishes and loose materials or dust.

Resilient sheet flooring to wet areas with timber floor boards substrates.

Provide fibre cement underlay as specified in this worksection.

Working environment

General: Do not start work before the building is enclosed, wet work is complete and dry, overhead work is complete and good lighting is available. Protect adjoining surfaces.

Conditioning

General: Stabilise the room temperature for seven days before, and two days after, installation of resilient finishes, as follows:

- Areas with air conditioning installed: Run air conditioning at operational temperature.
- Air conditioned areas not operational: Maintain an ambient room temperature range of 15°C to 28°C.

Underlay: Expose both faces of each sheet for at least 24 hours before fixing.

Resilient sheet and tile floor coverings: Stack for at least 48 hours before installation.

3.3 SHEET INSTALLATION

Sheet set out

General: Set out sheets to give the minimum number of joints. Position joints away from areas of high stress. Run sheet joints parallel with the long sides of floor areas, vertically on non-horizontal surfaces.

Junctions

General: Scribe neatly up to returns, edges, fixtures and fittings. Finish flush with adjoining surfaces.

Joints

Non-welded: Butt edges together to form tight neat joints showing no visible open seams.

Rolling

General: If rolling is required, roll the finish in multiple directions before the adhesive sets.

Change of finish

General: Maintain finished floor level across changes of floor finish including carpet.

Cleaning

General: Keep the surface clean as the work proceeds.

Scrap recycling

Participating supplier: Forbo

Cross reference

Refer to Forbo installation instructions.

06 FINISHES

0651 Resilient finishes

3.4 SHEETING

Welded joints

Heat welding: After fixing, groove the seams using a grooving tool and weld the joints with matching filler rod, using a hot air welding gun. When the weld rod has cooled, trim off flush.

Chemical welding: Apply seaming compound 100 mm wide to the substrate centrally under the seam. Roll the seam until the compound is forced up into the joint. Clean off flush using a damp cloth.

Epoxy jointing: Join seams with epoxy adhesive.

Welded joints schedule

Sheet type	Welding type
All Forbo sheet vinyl as scheduled	Hot welding technique to Forbo installation instructions

3.5 JOINTS AND ACCESSORIES

Junctions

General: Finish junctions tapered to with adjoining surfaces. Where changes of floor finish occur at doorways locate the joint on the centreline of the closed door leaf.

Accessories

General: Provide purpose-made matching moulded accessories coves, skirtings where scheduled, edge cover strips and finishes at junctions, margins, and angles, if available. Form accessories from the sheet material for V/S. Provide solid backing for radiused coves and nosings.

Accessory type: Specify required accessories, such as nosings, wedge fillets, tile edge trim, wall and capping trim and state whether they are to be a proprietary item, purpose-made or formed.

Edge strips

General: Provide edge cover strips at junctions with different floor finishes and to exposed edges.

Metal cover strip: Extruded tapered strip 25 mm wide, of the same thickness as the sheet or tile. Fix with matching screws to timber bases or to masonry anchors in concrete bases, at 200 mm maximum centres.

Material: stainless steel to approved sample.

UPVC cover strip: Feather-edge strip matching the floor finish, fixed with contact adhesive.

Width (mm): 25mm

Colour: To match sheeting

Control joints

Location: Provide control joints as follows:

- Over structural control joints.
- At junctions between different substrates.

Depth of joint: Right through to the substrate.

Sealant width: 6 to 25 mm.

Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Coved skirtings

Site formed coving: Carry the flooring material up over a profiled coving section to form the skirting and mitre and weld all joints. Make sure the radius of the coving section conforms to the requirements of the supplier for the sheeting material and thickness. A separate coved skirting is not accepted. The coved skirting is to be the floor sheet material and integral with it.

Location: To all walls in the Cleaner areas where Forbo vinyl sheet flooring is scheduled.

3.6 TESTING

Construction tests

General: Test and assess conformity of construction as follows:

SPECIFICATION

06 FINISHES

0651 Resilient finishes

- Slip resistance: If a slip resistance classification is required:
 - . Method: To AS 4663.

3.7 COMPLETION

Protection of sheet materials

General: Keep traffic off floors until bonding has set or for 24 hours after laying, whichever period is the longer. Do not allow water in contact with the finish for 7 days.

Reinstatement

Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Cleaning

General: Clean the finished surface. Buff and polish. Before the date for practical completion, mop and leave the finished surface clean and undamaged on completion.

Certificate of compliance

General: Provide a certificate of compliance for antistatic and conductive floor installations.

Maintenance manual

General: Submit manufacturer's published use, care and maintenance requirements for each type of finish.

4 SELECTIONS

4.1 PRODUCT SCHEDULES

Sheet Schedule

Refer to SH02 SCHEDULE OF SUBSTRATES AND FINISHES for location of vinyl sheeting.

Property	VIS
Type	Vinyl
Selection	Forbo Surestep Laguna
Location	Cleaner 5L1.07 Cleaner 5L2.07 Cleaner 5L3.09 Cleaner 5L4.09
Form	Sheet
Colour	181092 Elephant 
Thickness (mm)	2 mm

SPECIFICATION

06 FINISHES

0651 Resilient finishes

Property	VIS
Slip resistance classification	R10
Slip resistance site test of completed installation	Required
Skirting	Refer to SH02 SCHEDULE OF SUBSTRATES AND FINISHES for locations. SK/V/S/COV – floor vinyl coved up to form skirting

FINISH

0655 Timber flooring

0655 TIMBER FLOORING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide timber flooring systems to subfloors, as documented and as follows:

- Appropriately secured.
- Appropriately smooth and flat for the intended use.
- Pattern forward as required.
- Structurally adequate.
- Suitable for the applied finish.
- At its equilibrium moisture content.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

The works included in this worksection includes but is not limited to:

- New timber boards to match existing for existing and reinstated timber structure in Bay 5.
- Timber treads and landings to new steel Stairs 3 and 4.
- Tactile indicators and non-slip nosings for new steel Stairs 3 and 4 timber treads.
- Repairs to existing timber floor boards to infill holes left by removal of redundant pipes and services generally.
- Repairs to magnesite floor finish in Bay 4.

Associated worksections

Refer to the following related worksections:

- 0381 STRUCTURAL TIMBER and structural engineer and architectural drawings for reinstatement of the timber structure in Bay 5 to which the new timber floor boards will be fixed to.
- 0382 LIGHT TIMBER FRAMING, for timber floor and wall framing and for ceiling framing above the new amenities.
- 0383 SHEET FLOORING, for plywood, particleboard and compressed fibre cement sheet flooring.
- 0656 FLOOR SANDING AND FINISHING, for sanding and finishing of timber floors and stair treads.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES, for location of timber floor finishes.
- Architectural drawings for details of new timber floor finishes and for Stairs 3 and 4.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Butt joints (flooring): Floor units crosscut square with plain ends for joining over supports.
- End-matched joints (flooring): Floor boards tongue and grooved at the ends to allow jointing between supports.
- Equilibrium moisture content (EMC): For given conditions of humidity and temperature, the moisture content which timber approaches at which it neither gains nor loses moisture while the conditions of its environment are maintained.

SPECIFICATION

FINISH

0655 Timber flooring

- Feature: Any natural variation or similar which affects timber appearance, including gum/resin veins, borer marks, checks and knots. The grade will determine the level of feature present.
- Flooring - Continuously-supported: Flooring which is supported by, and directly fixed to, continuous supporting surfaces, including concrete slabs and sheet flooring or underlay subfloors.
- Flooring - Fitted: Flooring fitted between the walls of each room i.e. not platform floors.
- Flooring - Floating: Any manufactured flooring panel system not fixed to the substrate.
- Flooring - Intermittently-supported: Flooring which is supported by, and spans across, beams, joists or battens.
- Flooring - Strip flooring: Flooring made from machined timber with tongues and grooves along the length of the strips.
- Moisture content (timber): The percentage by mass of water present in the timber.
- Subfloor: The structure that supports the flooring (e.g. concrete slabs, timber joists or battens, sheet flooring or underlay and light steel joists).
- Underlay: A non-structural layer of sheet material or an in situ levelling material on the subfloor to provide a smooth and level surface.

1.4 TOLERANCES

Tolerances

Maximum deviation of the finished floor surface: 3 mm from a 3 m straightedge laid in any direction.

1.5 SUBMISSIONS

Certification

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 moisture content.

Timbers for which certification is required: hardwood timber floor boards to match existing. Branding is not required.

Inspection: If neither branding nor certification is adopted, submit a report by an independent inspecting authority verifying conformance.

Samples

General: Submit samples of each timber flooring type illustrating the range of variation in colour and figure.

Samples schedule

Item	Sample size	Number
Timber floor boards to match existing to reinstated timber structure. No tongue and groove.	Boards 600mm long	6 each for 3 different hardwood species to show the variations in colour and feature.
Tactile indicators - Stair 4	5/no	5/no
Non-slip stair inserts - Stair 4	300mm in timber	1/no

Tests

Type tests: Submit results, as follows:

- Fire hazard properties: Submit evidence of conformance to **PRODUCTS, GENERAL, Critical radiant flux** and **Smoke development rate**.

Other tests: Submit results, as follows:

- Moisture content test to AS 1884 Appendix A or AS/NZS 1080.1 as appropriate.

FINISH

0655 Timber flooring

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Reconstructed timber structure – joists in place, before floor boards are laid.
- Trial set-out: Before execution.
- Sealant to joints between floor boards where joints widths exceed 2 mm
- Control joints: Before fitting skirting.
- Control joints between concrete and timber floors.
- Completed installation before sanding and the application of coated finishes.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: 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. Store only where directed by the superintendent.

Adhesive

General: Provide adhesives, as documented and as follows:

- Compatible with the subfloor and flooring to be adhered.
- Alkali resisting.
- Solvent and water content: $\leq 40\%$.
- Shear strength when cured (average): ≥ 1.47 MPa.
- Elasticity: Sufficient to withstand continuous expansion and contraction of boards.

Ventilation: Provide adequate ventilation appropriate for moisture curing.

Critical radiant flux

Standard: to AS ISO 9239.1.

Flooring system: Conform to the values of critical radiant flux, as documented.

Smoke development rate

Standard: To AS ISO 9239.1.

2.2 STRIP FLOORING

Recycled timber

Standard: To FWPA PN06.1039.

Grading: To FWPA PN06.1039 Section 5:

- Grade: recycled feature Grade 1

Type or species: hardwood. Hardwood species to be confirmed on site

Source: To be confirmed by tender. Timber floor boards are to be provided by the principal.

Appearance: Where weather staining and stains from nail holes are found to be excessive, core and plug with matching timber and obtain superintendent's approval before proceeding.

New hardwood

Standard:

- Generally: To AS 2796.1.
- Grading: To AS 2796.2 clause 1.5.

Grade: Select grade

SPECIFICATION

FINISH

0655 Timber flooring

Identification

General: Identify timber using branding or certification.

- Branding: Brand timber under the authority of a recognised product certification or accreditation program applicable to the product. Locate the brand mark on faces or edges which will be concealed in the works.
- Provide certification from the recognised product certification or accreditation programs as appropriate:
 - . Flooring: The Australia Timber Flooring Association's (ATFA) Accredited Timber Flooring Manufacturers Program.
 - . Plywood and particleboard: Engineered Wood Products Association of Australia Quality Control and Product Certification Scheme.

2.3 TIMBER REPAIRS

Existing timber floors

Where services pipes are removed in the works and where there are holes left in the existing timber floors to Level 1, the holes are to be plugged with solid timber to match the size of the holes and colour of the existing timber and set in flush with the timber.

Large holes in the floors from the removal of electrical cables are also to be reinstated with solid hardwood timber to match the existing, set-in flush with the existing timber.

2.4 MAGNESITE REPAIR

Bay 4 - Lift Lobby and Link floors

General: The existing floor finish to the Lift Lobbies is Magnesite. Where repairs are needed to the floor finish in the forming of the Links between Bays 4 and 5 and where new finishes are to join existing finishes, repair or extend the magnesite flooring to match existing.

Contact: Remedial Technology Pty Ltd T. 02 8087 7004

Repairs are not to proceed without approval of the Superintendent and the Heritage Architect.

2.5 NEW STAIRS 3 AND 4

New stairs

General: The new steel Stair 3 and 4 are designed for timber hardwood treads to match the new timber floor boards.

Stair treads: 38 x 280mm hardwood with arrised outer edge concealed cs screw fixed to steel plate tread.

Non-slip inserts to treads: Latham ACS-50 Aluminium Safety Insert tread with 'sparkling black' standard infill LRV 28.9 located where detailed on the architectural drawings. Extend the insert for the whole width of the tread as detailed and install in timber before fixing the tread to the steel support plate.

Tactile Indicators in timber and concrete: Stainless steel studs equal to Latham Tactile Indicator Studs – spiral tops - designed in accordance with AS 1428.4-2002 & AS 1428.1-2009.

Cross reference

Refer to the architectural and structural drawings for the new steel stair details for solid hardwood timber treads and landings with non-slip tread insets.

3 EXECUTION

3.1 PREPARATION

Subfloor

General: Make sure subfloors are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location and functioning of control joints.
- If solid or continuous, remove excessive projections and fill voids and hollows with a levelling compound compatible with the flooring including any adhesive.

Flatness: Not greater than 3 mm deviation of the surface under a 3 m straight edge laid in any direction with no abrupt variations greater than 1 mm over 250 mm.

Moisture content alignment of flooring and subfloor

General: Do not commence installation of flooring unless:

- Plywood underlays or timber flooring products: The moisture content has been tested to AS/NZS 2098.1 for plywood and AS/NZS 1080.1 for timber and values obtained as follows:
 - . Air conditioned buildings: 8 to 10%.
 - . Intermittently heated buildings: 10 to 12.5%.
 - . Unheated buildings: 12 to 15%.

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.

Acclimatisation

General: 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:

- Air conditioning operational.
- Lighting operational.
- Site drainage and stormwater works are complete.
- Space fully enclosed and secure.
- Wet work complete and dry.

3.2 FLOOR FIXING

Room environment

General: During fixing and stabilising, operate the heating system of radiant heated or air conditioned rooms at 1.5°C above normal maximum temperature.

Adhesive

Strip flooring: Use a urethane elastomer adhesive in addition to nails as follows:

- Intermittently supported flooring: 6 mm bead along each joist or batten.

Nailing

General: Make sure the boards are in contact with the subfloor at the time of nailing, particularly where boards are machine nailed. Skew nail in a uniform pattern. If nails are to be less than 12 mm from ends of boards, pre-drill nail holes 0 to 1 mm undersize.

Secret nailing: Do not use boards of more than 85 mm cover width, and use one nail or staple skewed at 45°. Do not cramp more than one board at a time.

Sinking: Punch nails 3 mm below finished surfaces and fill the sinking flush with a material tinted to match the flooring which is compatible with the floor finish.

Top nailing: For boards more than 65 mm cover width, use two nails skewed 10° in opposite directions. Do not cramp more than 800 mm width of boards at one time.

Screw fixing

To timber greater than 30mm, allow to drill and screw fix the timber floor boards to the joists.

FINISH

0655 Timber flooring

Control joints

Perimeters: Provide 10 mm wide joints against vertical building elements.

Strip flooring:

- Floors less than 6 x 6 m: Partially cramp strip flooring to allow a 1 mm gap every 600 mm or 1.5 mm every metre.
- Floors greater than 6 x 6 m: Additionally, divide floors into maximum dimensions of 6 m with joints 4 mm wide filled with a flexible sealant compatible with the applied finish.

Strip flooring

General: Blend floor boards from more than one pack to distribute the colour range and grade features throughout the floor.

Installation: Lay in straight and parallel lines with each board firmly butted to the next and firmly in contact with the joists. Cramp sufficient only to bring the boards together and no more than 800 mm of flooring at any one time.

Set-out: Locate joints in boards so that they are evenly and symmetrically distributed and as follows:

- General: Staggered and at least 450 mm apart.
- Butt joints: Centrally on supports.
- End-matched joints: Not in adjacent boards.

3.3 COMPLETION

Protection

General: Provide protection as follows:

- Floors: With hardboard taped at all butt joints. Do not cover with sheet plastic.
- Stair treads: Full timber or plywood casing.

Spare flooring products

General: Supply an extra 5% of flooring products, to be stored on site as spares.

Storage location: to be confirmed by the superintendent

4 SELECTIONS

4.1 SCHEDULES

Strip flooring schedule

Property	A
Critical radiant flux	To BCA Spec C1.10 Table 1
Species or group / grade	Blackbutt North Coast Hardwood; Select grade; Dressed all around - Fine sawn top & bottom 2 sides, plain end Random lengths up to 5 metres.
Stress grade	Minimum F11
Recycled	If available to the size required and no additional cost.
Profile	Square edges, no tongue and groove
Fixing: Top nailed	Drilled and nailed or drilled and screw fixed to approved sample
Size (width x thickness, mm)	140 x 38mm to match existing - dressed
Ends: Butt	Required

SPECIFICATION

FINISH

0655 Timber flooring

Property	A
Critical radiant flux	To BCA Spec C1.10 Table 1
Ends: End-matched	Not essential
Moisture content	Kin dried 20%

FINISH

0656 Floor sanding and finishing

0656 FLOOR SANDING AND FINISHING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide floor sanding and finishing as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.

Specified in this worksection

Floor sanding and finishing, includes but not limited to:

- Provision of samples for finishes selected
- preparation of timber floor boards and sheet plywood for sanding and finishing.
- Method for sealing joints to prevent seepage of finish through the joints.
- Sanding, sealing and finishing.

Associated worksections

Refer to the following related worksections: The **General requirements** worksection contains umbrella requirements for all building and services worksections.

- 0655 TIMBER FLOORING, for timber floors and timber stair treads to be sanded and finished; for non-slip inserts in timber stair treads and for tactile indicators in timber floors and stair landings.
- 0381 STRUCTURAL TIMBER, for the existing and new timber structure to which the floor boards are to be fixed to.
- SH02 SCHEDULE OF SUBSTRATES AND FINISHES for location of timber floors.
- Architectural drawings and details for timber floors and timber treads to new steel Stairs 3 and 4 to be sanded and finished.
- Structural Engineer's drawings and specifications for the reinstated timber floor structure in Bay 5 for new timber floors to match existing and for details of steel stairs – Stairs 3 and 4 that are to take timber treads.

1.1 STANDARD

General

Standard: To AS 4786.2 Timber Flooring – Sanding and Finishing

1.2 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Coating system: Applied materials to enhance wear and protect the flooring material.
- Filling: Treatment to enhance the surface appearance by:
 - . Flood filling: To fill the pores of open-grained timber or minor cracks in parquetry.
 - . Stopping: To fill punched nail head cavities.
- Flooring - Hard: Timber with a wearing surface not easily cut with an abrasive.
- Flooring - Mild: Timber with a wearing surface easily cut with an abrasive.
- Sanding - Basic: Sanding procedures resulting in an even plane surface free of irregularities.

SPECIFICATION

FINISH

0656 Floor sanding and finishing

- Sanding - Finish: Sanding procedures resulting in a surface suitable for the application of the coating system.
- Sealing: Treatment to:
 - . Prevent excessive penetration of coating system.
 - . Prevent edge bonding by the coating system.
- Staining: Treatment to alter the colour of the timber surface.

1.3 SUBMISSIONS

Execution details

General: Submit statement of proposed methods for applying coating systems.

Samples

General: Submit samples of the coating system illustrating the finished effect on the selected floor surface.

Samples schedule

Item	Sample size	Number
Materials		
Floor boards to match existing	Min 1000mm x 600mm	3
Stair 4 treads with inset non-slip nosing	1 full sized tread	2
Finish		
Finish application for Product A to sanded floor boards	1000mm x 1000mm sample board	1
Finish application for Product B to sanded floor boards	1000mm x 1000mm sample board	1

Selection requirement

Allowance: The contractor is to provide samples of the 2 products specified in **Selections** for the Superintendents approval. All costs associated with the supply and installation of the selected approved product will be covered by the Contractor.

1.4 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Before surface preparation of timber.
- Completion of finish sanding.
- After staining.
- After application of each clear finishing coat.

2 PRODUCTS

2.1 ABRASIVES

Abrasives grade table

Floor hardness	Basic sanding	Finish sanding		Sanding between finish coats of coating system
		Initial cuts	Final sand	
Hard	F24 to F30	F40 to F60	F80 to F120	F150 or finer
Mild	F36 to F40	F60 to F80	F100 to F120	F150 or finer
Soft	F60 to F80	F80 to F100 if necessary	F120	F150 or finer

FINISH

0656 Floor sanding and finishing

Final sanding

Scratching: If scratching persists during the final sanding re-sand with a finer grade of abrasive.

2.2 FINISH

Filler

General: Non-oil based and compatible with the coating system.

Sealer

General: Refer to Coating System in **Selections - Sanded floor finish schedule**

Coating systems

Type: Provide costs for the supply and installation of the coating systems as documented.

Quality: Provide premium quality lines.

Combinations:

- Do not combine clear finishes from different manufacturers in a coating system.
- Provide only the combinations of filler, stain and sealer recommended by the manufacturer of the top coats.

Delivery: Deliver all products to the site in the manufacturer's labelled and unopened containers.

Toxic ingredients

General: Comply with the requirements of Appendix I Uniform Paint Standard to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

3 EXECUTION

3.1 PREPARATION

Protection

Extent: Protect immediate area against damage during sanding and finishing.

Openings: Cover any openings such as general power outlets, switches and air grilles.

Lighting

General: Provide supplementary lighting to allow close examination of the entire process.

Substrate

General: Do not commence sanding until:

- Adhesives have cured.
- Filler has dried as indicated by the colour fading.

Before finishing: Make sure substrates are clean and free of any deposit which may impair the following:

- Application of the coating system.

Preparation

General: Punch nails / or recess screw heads 3 mm below the surface. Remove items protruding from floor such as staples, nails and tacks. Fill open grained timber with materials compatible with those used in subsequent finishing operations.

3.2 SANDING

Sanding procedure

New floors and existing floors in poor condition:

- For use as finished surface: Basic sanding and finish sanding.

FINISH

0656 Floor sanding and finishing

Basic sanding – general

General: Remove irregularities caused by cupping or mismatching of the flooring materials, with a drum type sanding machine and coarse abrasives.

Basic sanding – strip flooring

General: First cut at 45° to the length of the boards, second cut at 90° to the first cut, and third cut parallel to the length of the boards.

Boundary areas: Bring to the same surface condition as the main sanded area, using disc sanding.

Inaccessible areas: Hand scrape to produce an even, plane surface.

Stopping and filling

General: Select a colour to produce an average match with the final coated timber in tone, colour and texture.

Minor cracks: Fill and stop punched nails with a putty knife.

Deeper holes: Fill in layers greater than 6 mm allowing each layer to dry. Make sure cavities are filled slightly above the surface without air pockets.

Porous timber: Flood fill with the cloth application of water based filler diluted to a creamy consistency.

Finish sanding – general

General: Provide a clear finished surface free of scratch marks when observed under the design light level when standing.

Finish sanding – strip flooring

General: After basic sanding, cut twice parallel to the length of the boards using increasingly fine abrasives. If hard surfaces show excessive scratching apply an initial cut at 90° to the grain direction.

Boundary areas: Bring to the same surface condition as the main sanded area, using disc sanding.

Inaccessible areas: Hand scrape to produce the same surface condition as the main sanded area.

Water based coating system: Sand with a final grade of paper of minimum F220 screen back.

Cleaning

General: After each sanding operation remove all dust by all of the following:

- Removal from cracks by hand.
- Vacuum cleaning.
- Tack rag cleaning.

3.3 COATING SYSTEMS

General

Finish: Provide coating system as follows:

- Consistent film thickness.
- Consistent level of gloss.

Refer to Coating Systems Product A and B in **Selections - Sanded floor finish schedule**

Wet paint warning

General: Place notices conspicuously and do not remove them until the coating system has cured and hardened.

Application

General: Apply the coating system in conformance with the manufacturer's recommendations.

Maintain a wet edge throughout the whole area. Do not spray apply finish.

Manage the coating system application to minimize dripping through the joints between the boards.

Sanding

General: Fine sand between coats only within the depth of the finish, and remove dust.

Timber floor coating systems

Coating: If edge bonding of strip flooring is known to occur, apply a sealer compatible with the final coat.

Final coats: As specified in **Selections – Sanded floor finish schedule**.

FINISH

0656 Floor sanding and finishing

3.4 COMPLETION

Cleaning

General: Vacuum clean the area and protect with fabric drop sheets. Do not use plastic sheeting.

4 SELECTIONS

4.1 FLOOR SANDING AND FINISHING

Sanded floor finish schedule – Product A

Property	New timber floor boards to timber structure and stair treads
Basic sanding	First coat
Finish sanding	Fine sand
Coating system	Proprietary product: Peerless Jal Application in accordance with the manufacturers instructions 1 x coat Penetrating Seal – SE03 2 x coats Surface Seal – SE02 3 x coats Gemini Satin Sealer Finish – WE57
Gloss level	Satin
Staining	N/A
Filling	To large knot holes and cracks with material of colour to match and compatible with the sealing material
Stopping	Compatible material with the sealing material
Sealing	Refer Coating System
Slip resistance classification	To BCA Clause To AS1428.1

Sanded floor finish schedule – Product B

Property	New timber floor boards to timber structure and stair treads
Basic sanding	First coat
Finish sanding	Fine sand
Coating system	Proprietary product: Feast Watson Application in accordance with the manufacturers instructions 1 x coat Feast Watson Sanding Sealer to seal naturally oily timbers and sand back 1 x coat Feast Watson Proofseal 2 x coats Feast Watson Floorseal Oil – hardened tung oil satin finish
Gloss level	Satin
Staining	N/A
Filling	To large knot holes and cracks with material of colour to match and compatible with the sealing material
Stopping	Compatible material with the sealing material
Sealing	Refer Coating System
Slip resistance classification	To BCA Clause To AS1428.1

0671 PAINTING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide coating systems to substrates, as documented.

Performance

Requirement: Provide coating systems as follows:

- Consistent in colour, gloss level, texture and dry film thickness.
- Free of runs, sags, blisters, or other discontinuities.
- Paint systems which are fully opaque or at the documented level of opacity.
- Clear finishes at the level of transparency consistent with the product.
- Fully adhered.
- Resistant to environmental degradation within the manufacturer's stated life span.

Selections: Conform to the **SELECTIONS**

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- 0171 GENERAL REQUIREMENTS.
- 0183 METALS AND PREFINISHES

Specified in this worksection

Painting work includes, but is not limited to the following:

- painting systems generally over various new substrates;
- re-painting of existing painted finishes;
- painting of unpainted existing steel bracing to trusses and roof;
- painting of existing cargo landing doors and windows and skirtings
- painting of mild steel frames to cargo doors as installed by the principal
- painting of surfaces damaged by demolition and surfaces requiring painting by the introduction of new work;
- internal and external painting to the scope specified;
- non-slip paint finishes to plywood and checker plate steel ramps and step ramps.
- Provision of sample panels;
- Protection of the building and building fabric and existing finishes at all times during the works;
- Coordination of the painting works with other relevant trades
- General performance requirements for workmanship and installation.

Associated worksections

Associated worksections: Conform to the following:

- 0344 STEEL – HOT-DIP GALVANIZED COATINGS, for steel protection not nominated under this worksection including galvanising finish to steel members.
- 0552 METALWORK, for pre-finished metal items and items requiring protective metal finishes.
- 0383 SHEET FLOORING, for plywood ramps and step ramps to have a non-slip paint finish.
- 0467 GLAZING AND GLASS COMPONENTS for new steel and glass doors and steel partitions to be painted.

SPECIFICATION

06 FINISH

0671 Painting

- 0543 DOORS AND ACCESS PANELS, for new and existing timber doors to be paint finished.
- 0511 LINING, for sheet linings to be painted.
- 0611 RENDERING AND PLASTERING, for new cement render and existing render to be painted.
- 0656 FLOOR SANDING AND FINISHING, for preparation and clear finishes to timber floors and stair treads.
- SH.02 SCHEDULE OF SUBSTRATES AND FINISHES, for extent of paint finishes to new and existing materials
- MECHANICAL SERVICES, HYDRAULIC / FIRE SERVICES and ELECTRICAL SERVICES for pre-finishes & protective finishes to fixtures, service pipes and equipment.
- Architectural drawings, details and schedules.

External painting – recently completed works

External fabric maintenance works including external painting has recently been completed. The painting works completed are the external faces of timber doors and windows in Bays 4 and 5 and the repainting of the timber fanlight and frame with steel grilles to the fanlight above the Entry into Bay 5 on Level 2.

External painting included in these works

External painting included in this contract are:

- Preparation and painting of new timber windows and repainting of windows after removal of louvres, new timber sashes to existing timber window frames and after reglazing / repainting where required in colours to match existing.
- Preparation and repainting of both the internal face and edges of all timber cargo landing doors in Bay 5 (east and west elevations) and the Entry doors into Bay 5 on Level 2 (west elevation); existing timber door frame and fanlight to Entry to Bay 4 on Level 2.
- Preparation and repainting of the timber door frame, vertical steel plates / reveals and transom head to the Entry Doors 5L2/XD1 into Bay 5 on Level 2.
- Preparation and re-painting of existing steel balustrades and handrails to Hickson Road in front of Bays 4 and 5 only and to existing steps up to Bays 4 and 5 entries.
- New timber door to the Store Roof at roof level.
- Any other new works not listed above that have been scheduled for painting.

1.3 ALTERNATIVES

Paint materials

This paint system specification is based on Dulux products and methodology as a baseline standard. Alternative manufacturers may be proposed provided full information on the products and paint systems is provided and the results will be as good as or better than the Dulux products specified. Information on any warranty offered will be welcome.

1.4 STANDARDS

Painting

General: To the recommendations of those parts of AS/NZS 2311 referenced in this worksection and the following:

- AS/NZS 2311: The Painting of Buildings
 - Section 2 - Design for Painting
 - Section 3 - Preparation of Unpainted Surfaces
 - Section 7 - Maintenance of Painted Surfaces

AS/NZS2312: Guide to the Protection of Iron and Steel Against Exterior Atmospheric Corrosion.

- Power tool cleaning: To AS 1627.2.
- Hand cleaning of steel surfaces: To AS 1627.7.

SPECIFICATION

06 FINISH

0671 Painting

Guide to the protection of iron and steel against exterior atmospheric corrosion: To AS 2312.

Lead Paint

AS4361.1 Guide to Lead Paint Management Part 1: Industrial Applications.

AS4361.2 Guide to Lead Paint Management Part 2: Preventing Lead Poisoning in Australia.

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions in AS/NZS 2310 and the following apply:

- Adhesion: The sum total of forces of attachment between a dry film and its substrate.
- Gloss unit: Numerical value for the amount of specular reflection relative to that of a standard surface under the same geometric conditions.
- Levels of gloss finish: When the specular direction is 60 degrees, a surface with the following specular gloss reading are defined as follows:
 - . Full gloss finish between 50 and 85 gloss units.
 - . Semi-gloss between 20 and 50 gloss units.
 - . Low gloss between 5 and 20 gloss units (also known as low sheen).
 - . Flat finish less than 5 gloss units (also known as matt).

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Prior to commencing paint preparation
 - . Existing painted substrates to be repainted.
 - . New steel Stairs 3 and 4; steel Stair 4 screen.
 - . Existing steel bracing to trusses and under the roof at each end of Bay 5.
- Painting stages:
 - . Completion of surface preparation.
 - . After application of final coat.

1.7 SUBMISSIONS

Opaque coated samples

General: Submit labelled samples of each coating system, on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

Sample size: 300 x 300 mm unless otherwise scheduled.

Paint

General: Submit the following at least 3 weeks before the paint is required if an alternative to the specified paint system is proposed:

- Paint brand name and product range quality statement.
- Safety data sheets (SDS) showing the health and safety precautions to be taken during application.
- The published recommendations for maintenance.

Warranties

General: Submit the coating manufacturer's warranties as follows:

- Dulux Materials Warranty.

Wet samples

General: Submit two clearly labelled, 500 mL samples of each type of paint to be tested.

SPECIFICATION

06 FINISH

0671 Painting

Coated wet samples schedule

Substrate	Paint system	Colour	Sample size
Interior Surfaces	All opaque systems. Refer Painting Schedules . Coordinate with samples requested in worksections.	To be selected for interior finishes	300 x 300 mm Allow for up to 3 samples for all colours and also for where paint colours are to match existing. Sample location to be approved.
Interior surfaces	Non-slip paint ramp finish	Colour to be selected	500 x 500mm Allow for up to 3 samples of different colours on a plywood sheet to be viewed on site.
Interior surfaces	1] Stains on plywood with clear matt sealer over	Cabots Interior Stain – Water based. Colour 'Black'	500 x 500 mm Allow for up to 3 samples on a plywood sample. Sealed and unsealed samples.
Interior surfaces	2] Stained plywood alternative Refer 0511 LINING. Alternative to pre-finished plywood specified.	Austral Plywoods ariaply EBONY	500 x 500 mm Allow for up to 3 samples on a plywood sample to compare with the Cabots stain and intensity of 'black' colour for selection between 1] and 2]. Sealed samples.
Exterior Surfaces	All opaque systems – new to match existing. Refer Painting Schedules . Coordinate with samples requested in worksections.	To match existing for external finishes	500 x 500 mm Allow for up to 3 samples where paint colours are to match existing. Sample location to be approved

Dulux Group

Paints specified herein are Dulux Paints unless specified otherwise as Resene.

Dulux National Specification Manager – Sarah Nadenbousch T. 03 9263 3607 M: 0401 144 977

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Store materials not in use in tightly covered containers in well-ventilated areas with temperatures maintained at the manufacturer's recommendations.

Delivery: Deliver paints to the site in the manufacturer's labelled and unopened containers.

2.2 MARKING

Identification

General: Deliver materials to the site in the manufacturer's original sealed containers or packaging, legibly marked to show the following:

- Manufacturer's identification.
- Product brand name.

SPECIFICATION

06 FINISH

0671 Painting

- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern. Provide technical data sheets if not shown on labels.
- Handling and installation instructions.
- Safety data sheets.

2.3 PAINTS

Paint brand - Dulux

Quality: Provide only premium quality lines.

Suppliers of the paints specified are required to provide a written warranty stating that the finishes supplied must, subject to the use of the manufacturers recommended application procedures, show no deterioration and remain in good condition for the period the specified in Warranties in 0171 GENERAL REQUIREMENTS from the date of application. The paint system and finishes for each application shall be in accordance with the Schedule.

Standards

Paint types: To AS/NZS 2311 Table 4.2 and the following:

- Metal primer for steel, lead and chromate free: To AS 3730.21 and AS/NZS 3750.19.
- Metal primer, latex: To AS 3730.15.
- Metal primer for metallic-coated surfaces, solvent-borne: To AS 3730.21.
- Zinc-rich organic binder/primer for steel: To AS/NZS 3750.9.

VOC levels: all paints and primers are to be low VOC where available.

Quality Assurance

The contractor is advised that the Dulux Quality Assurance (QA) System will be adopted and that a Dulux Quality Assurance Project Activity Card (QAPAC) will also be issued for each project. This QA System verifies that the paint systems specified are executed in the works.

Combinations

General: Do not combine paints from different manufacturers in a paint system.

Putty and fillers

Material: To the recommendations of the paint system manufacturer, suitable for the substrate and compatible with the primer.

Tinting

General: Provide only products which are colour tinted by the manufacturer or supplier.

Toxic ingredients

General: To the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) No.4 Appendix I Uniform Paint Standard.

3 EXECUTION

3.1 PREPARATION

Order of work

Other trades: Before painting, complete the work of other trades as far as practicable within the area to be painted, except for the installation of fittings, floor sanding and laying flooring materials.

Protection

General: Before painting, clean the area and protect it from dust contamination. Use drop sheets and masking agents to protect surfaces, including finished surfaces and adjacent finishes, during painting.

SPECIFICATION

06 FINISH

0671 Painting

Fixtures and furniture: Remove door furniture, switch plates, light fittings and other fixtures before painting, and conform to the following:

- Labelling and storage: Attach labels or mark fixtures using a non-permanent method, identifying location and refixing instructions, if required. Store and protect against damage.
- Reinstate: Refix undamaged fixture in the original location on completion of painting.

Difficult to remove fixtures: Where removal is impractical or difficult, apply surface protection before substrate preparation and painting.

Wet paint warning

Notices: Place in a conspicuous location and do not remove until the paint is dry.

Substrate preparation – Generally

General: Prepare substrates to receive the painting systems to the paint manufacturer's recommendations.

Cleaning: Clean down the substrate surface. Do not cause damage to the substrate or the surroundings.

Filling: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth.

- Clear finish: Provide filler tinted to match the substrate.

Treated surfaces: Where surfaces have been treated with preservatives or fire retardants, make sure coating is compatible with the treatment and does not adversely affect its performance.

Unpainted surfaces

Standard: To AS/NZS 2311 Section 3.

Previously painted surfaces

Condition of substrate: AS/NZS 2311 Section 7

Location of substrate in good condition: painted masonry walls to first 3 west bays in Bay 5

Location of substrate in poor condition: any finish concealed from view that cannot be inspected until after completion of demolition

Preparation of a substrate in good condition: To AS/NZS 2311 clause 7.4.

Preparation of a substrate in poor condition: To AS/NZS 2311 clause 7.5.

Preparation of steel substrates with protective coatings: To AS/NZS 2312 Section 10 and AS 1627.1.

Cleaning external surfaces

New masonry: Allow 30 days for the masonry to cure and pH level to stabilise before painting.

3.2 LEAD PAINT

Lead Paint

Cross reference: Refer to APPENDIX for PRESNA 'SHFA Hazardous Materials Register' dated 22 June 2012.

Requirement: The contractor is to allow for any additional testing required for lead paint for materials not included in the 'SHFA Hazardous Materials Register' and for costs associated with the removal and disposal of lead paint to meet environmental authorities approval should lead paint be found.

- Submit Work Method Statement confirming methodology for paint application including works required for lead paints.

General Guidelines

The following publications are recommended for information on handling and preparing of surfaces painted with paints containing lead.

- AS 4361 Guide to Lead Management Parts 1 & 2 (Draft)
- Lead Alert Painting Your Home, by E.P.A.
- Lead Alert A Guide for Painters, by CEPA and APMF.

06 FINISH

0671 Painting

3.3 PAINTING

Painting generally

Paint with known health hazards: Provide personal protection, masking, ventilating and screening facilities to AS/NZS 4114.1 and AS/NZS 4114.2.

Light levels

General: ≥ 400 lux.

Substrate moisture content

Requirement: Use a moisture meter to demonstrate that the moisture content of the substrate is at or below the recommended maximum level for the type of paint and the substrate material.

Paint application

Standard: To AS/NZS 2311 Section 6.

Timing: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Apply subsequent coats after the manufacturer's recommended drying period has elapsed.

Painting conditions

General: Unless the paint is recommended for such conditions, do not paint under the following conditions:

- Dusty conditions.
- Relative humidity: $> 85\%$.
- Surface temperature: $< 10^{\circ}\text{C}$ or $> 35^{\circ}\text{C}$.

Priming before fixing

General: Apply one coat of wood primer, and 2 coats to end grain, to the back of the following before fixing in position:

- Bottoms of internal doors.

Sanding

Clear finishes: Sand the sealer using abrasives no coarser than 320 grit without cutting through the colour. Take special care with round surfaces and edges.

Repair

Requirement: Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition.

Maintenance painting: To AS/NZS 2311 Section 8.

Repair of galvanizing

Cleaning: For galvanized surfaces which have been subsequently welded, power tool grind to remove all surface contaminants, including rust and weld splatter. Prime affected area immediately after cleaning.

Primer: Type 2 organic zinc-rich coating for the protection of steel to AS/NZS 3750.9.

Tinting

General: Tint each coat of an opaque coating system so that each has a noticeably different tint from the preceding coat, except for top coats in systems with more than one top coat.

Services

General: Paint all new services and equipment, including those in plant rooms, if not embedded, except chromium, anodised aluminium, GRP, PVC-U, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces.

Proprietary items: Repaint only if damaged.

Windows

Operation: Make sure opening windows function correctly before and after painting.

Doors

Drying: Maintain door leaf in the open position during drying. Do not allow door hardware or accessories to damage the door finish during the drying process.

06 FINISH

0671 Painting

3.4 COMPLETION

General

Protection and masking: Remove masking and protection coverings before paint has dried.

Cleaning: On completion of painting, remove splatters by washing, scraping or other methods which do not scratch or damage adjacent finished surfaces.

Reinstatement: Repair, replace or refinish any damage, including works of other trades. Touch up new damaged decorative paintwork or misses only with the paint batch used in the original application.

Removed fixtures: Refix in original location, make sure they are properly fitted and in proper working order.

Disposal of paint and waste materials.

Requirement: Conform to requirements of the local government authority.

4 SELECTIONS

4.1 PAINTING SYSTEMS

New unpainted interior surfaces

Standard: To AS/NZS 2311 Table 5.1.

New unpainted exterior surfaces

Standard: To AS/NZS 2311 Table 5.2.

Specialised painting systems

Standard: To AS/NZS 2311 clause 5.2. Provide the following final coats:

- Two-pack gloss pigmented polyurethane: B44.
- Two-pack epoxy: B29.
- Two-pack water based epoxy: B29A.

Previously painted surfaces

Standard: To AS/NZS 2311 Tables 8.2 and 8.3.

4.2 PAINTING SCHEDULES

General

Number of coats: Except where one or two coat systems are documented, each paint system consists of at least 3 coats.

Final coat selection: To the **Interior painting schedule** and the **Exterior painting schedule**.

Low VOC emitting paints

General: Some paints are selected for long life and durability . Low VOC paints are notated with the prefix 'Enviro' in the following schedules

Paint colours

As documented in the **Paint colours schedule**.

Number of coats: Where paint colours are lighter than the existing paint colour, allow for one additional undercoat to that specified in the **Interior Painting Schedule**. Example is the deep blue and black paints used in the former cinemas that are to be repainted.

Paint colours schedule - External

Substrate	Colours
External	
External painted finishes to timber and steel	To match existing paint colours. Superintendent to provide the paint colour selections.
External – new steel – handrails, balustrades to	To match existing. Superintendent to provide the

SPECIFICATION

06 FINISH

0671 Painting

Substrate	Colours
External	
Ramp and ramp structure	paint colour selections

Paint colours schedule – Internal

Note: Paint colours are subject to change.

All paint colours are to be confirmed prior to commencement of painting with the supply of paint samples for approval.

Substrate	Colours
Mild steel to Steel Stair 4 – steelwork Mild steel to internal ramps including balusters and metal plate caps to ramp plywood	Luxathane R 737- 63003 / Clear Base with 35% 999-H0014 Flattening base. Colour – No 61 Black
Previously painted rendered masonry and new rendered masonry on Levels 1, 2, 3 and 4	White – Dulux name and colour code to be selected
New steel to steel and glass partitions in Bay 4 – Level 2 Entry airlock and any changes to the existing steel glass partitions and doors.	'Light grey' – select paint colour and paint system to match the paint colour on adjacent steel – glass doors and partitions.
New steel to steel and glass partitions in Bay 4 – Levels 2 and 4 – new Lift Lobbies.	Colour to match the recently completed Lift lobby steel and glass partitions on Level 1. Confirm the following colour with an approved sample.
New steel to steel and glass partitions in Bay 5 Ground floor Entry 5GX.01	Luxathane R 737- 63003 / Clear Base with 35% 999-H0014 Flattening base. Colour – No 61 Black
Level 4 internal service platform steelwork, balustrade and ladder	Dulux Ferrodor 810 'Mid Grey'
Existing unpainted steel bracing to trusses at the level of the bottom chord and in the roof plane at the east and west end walls of Bay 5.	Prepare and paint. Paint colour to be confirmed. Allow for Dulux 'Vivid White' PW1 H9
Cast iron shoes and collars – column to beam connectors	Previously painted: All connectors are to be cleaned and repainted – colour to be confirmed. Allow for the colour to match the cast iron shoes and collars in Bay 4.
New steel work to Cargo Bay doors	Dulux Ferrodor 810 'Mid Grey'
All levels: Mechanical services ducts exposed below timber and concrete floors	'grey/charcoal' colour selection to be confirmed on site against the new and existing timbers.
Fire services pipes – galvanised steel	No applied paint finish. Finish is galvanised steel
Existing painted concrete soffits to former cinemas on Level 2	Currently painted a dark blue. Prepare and paint a 'concrete grey colour'. Colour to be selected to match the unpainted concrete
Unpainted existing concrete to former cinemas on Level 1	Existing; infill holes and repair as require. Clean and leave unpainted. To new beam extension on Grid A; natural finish
Timber skirtings – new and existing	To match the wall colour
Reinstated, existing and timber floor structure –	NO APPLIED FINISH

SPECIFICATION

06 FINISH

0671 Painting

Substrate	Colours
columns, beams and joists and soffits of floor boards; Timber board sarking, rafters, purlins and trusses	To remain in their existing condition and colour Clean dust off existing painting finishes
Existing painted timber windows and boarded doors – sashes and frames. New timber window frames and new window sashes	To match existing paint colour. Superintendent to provide the paint colour selections
Existing gable wall timber louvres	To match existing
New timber trim to L3 void at floor level	New timber to match the existing timber – allow for 1 coat of Cabot's Cabothane Water Interior based water stain – Colour 'Black'
New plasterboard and fibre cement ceilings	Dulux 'Vivid White' PW1 H9
Plywood balustrades	Refer to Submissions in this worksection Pre-finished. Refer JOINERY: Austral Plywoods Ariaply Dark Ebony
Non-slip paint finish to plywood ramps on the Ground Floor, edges to plywood floor and steps to define the change in level on the Ground Floor and steel checker plate ramp in Bay 4 LINK 1	Resene 'Non-slip deck and Path' paint. Colour to be selected
Painted steel balusters and handrails to internal ramps.	Luxathane R 737- 63003 / Clear Base with 35% 999-H0014 Flattening base. Colour – No 61 Black
Plasterboard walls - all levels	To be confirmed.
Timber doors – new flush timber doors	1] Door face inside toilets: P2 - Dulux Black SG6G9. All levels 2] Door face outside toilets: P1 - Dulux Snowy Mountains Quarter SW1G3 . All Levels
Fire doors	Fire Stair 2 – to match existing Fire Stair 1 – to match the wall colour
Steel door frames Repaint all existing steel fire door frames to Fire Stair 1; paint to new steel fire door frames	Luxathane R 737- 63003 / Clear Base with 35% 999-H0014 Flattening base. Colour – No 61 Black
Steel screen to Stair 4 on Levels 2, 3 and 4	Mild Steel Prime Coat: Dulux Zinc Shield Powder Coat: 'Charcoal' – Satin 88351 Duralloy
Existing painted steel balustrade – Hickson Road	To match existing paint colour. Superintendent to provide paint colour selection.

SPECIFICATION

06 FINISH

0671 Painting

4.3 INTERIOR PAINTING SCHEDULE

Interior painting schedule

Item / material	Specification			Duspec Version
Existing Doors, Windows and highlight Windows. Painted timber	Refer to AUD2382 Dulux Aquanamel Gloss on Painted Timber [Interior/Exterior]			7.0
	1 st coat	AUD1227	Dulux Prepcoat 1 Step Oil Primer Sealer Undercoat	9.0
	2 nd coat	AUD1282	Dulux Aquanamel Gloss	25.0
	3 rd coat	AUD1282	Dulux Aquanamel Gloss	25.0
Existing Walls Painted Cement Render, Concrete ; Existing painted concrete soffits	Refer to AUD4998 Dulux Wash & Wear Low Sheen on Painted Cement Render [Interior]			8.0
	Primer	AUD1169	Dulux Professional Total Prep	18.0
	1 st coat	AUD1096	Dulux Wash & Wear Low Sheen	38.0
	2 nd coat	AUD1096	Dulux Wash & Wear Low Sheen	38.0
Stairs 3 and 4-steel and balustrades; New steel to steel and glass doors and partitions to match existing Bay 4 Level 2; New Mild Steel Bay 4 Levels 3 & 4 Lift Lobbys New mild steel balusters, handrails and ramp trim. Steel screen to Stair 4	Refer to AU_SD09835 Dulux Luxathane R Two Pack High Gloss / With Flattening Base added on New Mild Steel			1.0
	1 st coat	AUDI0539	Dulux Zincode 402 Zinc Primer	12.0
	2 nd coat	AUDI1115	Dulux Duremax GPE - Pc255 Two Pack Epoxy	10.0
	3 rd coat	AUDD1137	Dulux Luxathane R Two Pack High Gloss	7.0
	4 th coat	AUD11631	Dulux Flattening Base Clear	4.0
New Ceilings Plasterboard	Refer to AUD4308 Dulux Professional Enviro2 Interior Tintable Ceiling Flat on New Plasterboard [Interior]			7.0
	1 st coat	AUDD1278	Dulux Professional Enviro2 Interior Acrylic Sealer Undercoat	14.0
	2 nd coat	AUDD1466	Dulux Professional Enviro2 Interior Tintable Ceiling Flat	8.0
	3 rd coat	AUDD1466	Dulux Professional Enviro2 Interior Tintable	8.0

SPECIFICATION

06 FINISH

0671 Painting

Item / material	Specification			Duspec Version
			Ceiling Flat	
New doors	Refer to AU_SD08455 Dulux Aquanamel Gloss on New Timber [Interior/Exterior]			2.0
	1 st coat	AUDD1169	Dulux Professional Total Prep	18.0
New timber	2 nd coat	AUDD1282	Dulux Aquanamel Gloss	25.0
	3 rd coat	AUDD1282	Dulux Aquanamel Gloss	25.0
New Cement Render	Refer to AUDD4298 Dulux Wash & Wear Low Sheen on New Cement Render [Interior]			9.0
	Primer	AUDD1278	Dulux Professional Enviro2 Interior Acrylic Sealer Undercoat	14.0
	1 st coat	AUDD1096	Dulux Wash & Wear Low Sheen	38.0
	2 nd coat	AUDD1096	Dulux Wash & Wear Low Sheen	38.0
New Plasterboard	Refer to AU_SD05858 Dulux Wash & Wear Low Sheen on New Plasterboard [Interior]			7.0
	Primer	AUDD 1278	Dulux Professional Enviro2 Interior Acrylic Sealer Undercoat	14.0
	1 st coat	AUDD1096	Dulux Wash & Wear Low Sheen	38.0
	2 nd coat	AUDD1096	Dulux Wash & Wear Low Sheen	38.0
New Fibre Cement Sheeting	Refer to AUDD2723 Dulux Wash & Wear Kitchen & Bathroom Low Sheen on New Compressed Fibre Cement (to Cleaners)			9.0
	Primer	AUDD1278	Dulux Professional Enviro2 Interior Acrylic Sealer Undercoat	14.0
	1 st coat	AUDD1516	Dulux Wash & Wear Kitchen & Bathroom Low Sheen	9.0
	2 nd coat	AUDD1516	Dulux Wash & Wear Kitchen & Bathroom Low Sheen	9.0
Painted timber Skirtings	Refer to AU_SD9502 Dulux Aquanamel Semi Gloss on Painted Timber [Interior/Exterior]			1.0
	1 st coat	AUDD1169	Dulux Professional Total Prep	18.0
	2 nd coat	AUDD1281	Dulux Aquanamel Semi Gloss	22.0
	3 rd coat	AUDD1281	Dulux Aquanamel Semi Gloss	22.0
Painted timber Windows; new windows and	Refer to AUDD1891 Dulux Super Enamel High Gloss on Painted Timber [Interior/Exterior]			8.0
	1 st coat	AUDD1698	Dulux Prepcoat 1 Step Oil Primer Sealer Undercoat	3.0

SPECIFICATION

06 FINISH

0671 Painting

Item / material	Specification			Duspec Version
new sashes	2 nd coat	AUDD0026	Dulux Super Enamel High Gloss	10.0
	3 rd coat	AUDD0026	Dulux Super Enamel High Gloss	10.0
Steel structure to support Cargo Landing door tracks	Refer to AUSI1485 Dulux Ferrodor 810 Micaceous Iron Oxide on New Mild Steel (Commercial) [Exterior]			5.0
	Primer	AUDI1136	Dulux Luxaprime Zinc Phosphate Primer	5.0
	Intermediate	AUDI1125	Dulux Ferrodor 810 Micaceous Iron Oxide	5.0
	Top Coat	AUDI1125	Dulux Ferrodor 810 Micaceous Iron Oxide	5.0
Refer JOINERY. Stain samples as to be provided together with the Pre-finished Austral Plywood Airaply Ebony sample for balustrades. Superintendent to confirm selection for stain or pre-finish.				
Plywood ramp balustrades Plywood Floor	First Coat *		Cabot's Interior Stain Water Based Colour 'Black' Second coat to be allowed for but do not apply until after the inspection of the first coat.	
	Finish Coat		Cabot's Cabothane Clear Water Based – satin finish	
Non-slip paint finish to 1] plywood ramps/step ramps 2] steel checker plate ramp in level 2 Bay 4 LINK	Resene Non Slip Deck and Path paint 100% acrylic coating filled with graded silicas tinted to a range of standard colours. Colour to be selected on site with plywood floor. Pedestrian Slip Resistance Testing to AS/NZS 3661.1: 1993 and AS/NZS 4586:2004 For Resene Paints Ltd			
	First Coat		Preparation and Primer selected for the substrate to be finished	
	Finish Coat 1		Non Slip Deck and Path	
	Finish Coat 2		Non Slip Deck and Path	

4.4 EXTERIOR PAINTING SCHEDULE

Exterior painting schedule

Colours: Paint colours to match existing unless noted otherwise.

Item / material	Specification	Duspec Version
	Refer to AUSI1398 Dulux Weathermax HBR Two Pack Gloss on New Mild Steel (Commercial)	8.0

SPECIFICATION

06 FINISH

0671 Painting

Item / material	Specification			Duspec Version
New Mild Steel	[Exterior/Coastal]			
	Primer	AUDI0539	Dulux Zincode 402 Zinc Primer	7.0
	Intermediate	AUDI1115	Dulux Duremax GPE - Pc255 Two Pack Epoxy	10.0
	Top Coat	AUDI1156	Dulux Weathermax HBR Two Pack Gloss	13.0
Painted Mild Steel	Refer to AUSI1545 Dulux Weathermax HBR Two Pack Gloss on Painted Mild Steel (Commercial) [Exterior]			5.0
	Primer	AUDI1109	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Intermediate	AUDI1109	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Top Coat	AUDI1156	Dulux Weathermax HBR Two Pack Gloss	13.0
Painted Steel	Refer to AUSI1545 Dulux Weathermax HBR Two Pack Gloss on Painted Mild Steel (Commercial) [Exterior]			5.0
	Primer	AUDI1109	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Intermediate	AUDI1109	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Top Coat	AUDI1156	Dulux Weathermax HBR Two Pack Gloss	13.0
Entry Door Reveal – Level 2 Bay 5	Refer to AUUSD1891 Dulux Super Enamel High Gloss on Painted Timber [Interior/Exterior]			8.0
	1 st coat	AUDD1689	Dulux Prepcoat 1 Step Oil Primer Sealer Undercoat	3.0
	2 nd coat	AUDD0026	Dulux Super Enamel High Gloss	10.0
	3 rd coat	AUDD0026	Dulux Super Enamel High Gloss	10.0
Door hinges and steel plate in door reveals	Refer to AU_SD09397 Dulux Aquanamel Gloss / over Prepcoat All Metal Primer on Painted Ferrous Metal/Steel			1.0
	1 st coat	AUDD1698	Dulux Prepcoat All Metal Primer	2.0
	2 nd coat	AUDD0026	Dulux Aquanamel Gloss	25.0
	3 rd coat	AUDD0026	Dulux Aquanamel Gloss	25.0
Timber boarded doors External painted timber	Refer to AUUSD2382 Dulux Aquanamel Gloss on Painted Timber [Interior/Exterior]			7.0
	1 st coat	AUDD1227	Dulux Prepcoat 1 Step Oil Primer Sealer Undercoat	9.0
	2 nd coat	AUDD1282	Dulux Aquanamel Gloss	25.0
	3 rd coat	AUDD1282	Dulux Aquanamel Gloss	25.0

SPECIFICATION

06 FINISH

0671 Painting

Item / material	Specification			Duspec Version
Painted Steel Grille Above entry door to Bay 5 Level 2 Painted Steel	Refer to AUSI1545 Dulux Weathermax HBR Two Pack Gloss on Painted Mild Steel (Commercial) [Exterior]			5.0
	Spot primer	AUDI1109	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Intermediate	AUDI1261	Dulux Durebild STE - PC237 Two Pack Epoxy	13.0
	Top coat	AUDI1156	Dulux Weathermax HBR Two Pack Gloss	13.0



ASN Co Building, Bay 4-5, 1-3 Hickson Rd, The Rocks

Mechanical Services Specification

Prepared by

Stephen Meleady
Project No. 33307-SYD-M

Date:
30 JAN 2018

Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
T: (02) 8484 7000 **F:** (02) 8484 7100 **E:** wge@wge.com.au **W:** www.wge.com.au

REVISION

Revision	Date	Comment	Prepared By	Approved By
01	14/12/2017	Preliminary	ZN	SM
02	21/12/2017	Preliminary	ZN	SM
03	30/01/2018	Preliminary	ZN	SM
04	23/02/2018	Tender	ZN	SM

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: Stephen Meleady

SIGNATURE:



CONTENTS

PART A.	PRELIMINARIES.....	1
PART B.	PROJECT SPECIFIC INFORMATION	2
B.1	DESCRIPTION OF THE INSTALLATION	2
B.2	DESIGN CRITERIA.....	2
B.3	SCOPE OF WORK	4
B.4	SCHEDULES OF PERFORMANCE	11
PART C.	TECHNICAL.....	23
C.1	MATERIALS AND WORKMANSHIP.....	23
C.2	QUALITY ASSURANCE.....	23
C.3	OZONE DEPLETING SUBSTANCES	24
C.4	EQUIPMENT	24
C.5	DUCTWORK SYSTEMS	37
C.6	NOISE AND VIBRATION CONTROL.....	46
C.7	PIPEWORK, VALVES AND FITTINGS	49
C.8	INSULATION SYSTEMS.....	58
C.9	AUTOMATIC CONTROLS.....	62
C.10	ELECTRICAL FOR MECHANICAL SERVICES	67
C.11	PAINTING, FINISHES, AND IDENTIFICATION	79
C.12	TESTING AND COMMISSIONING	81
C.13	OPERATING AND MAINTENANCE MANUAL	88
C.14	MAINTENANCE.....	89
PART D.	APPENDICES.....	93
D.1	APPENDIX A - SCHEDULE OF INFORMATION REQUIRED	93
D.2	APPENDIX B - SCHEDULE OF LABOUR RATES	94
D.3	APPENDIX C - SCHEDULE OF UNIT RATES.....	95
D.4	APPENDIX D - TENDER SUMMARY	99
D.5	APPENDIX E - CONTRACT DRAWINGS	101
D.6	APPENDIX F - PROVISIONAL SUMS/CONTINGENCY SUM.....	101
D.7	APPENDIX G – QUALITY ASSURANCE	102

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

PART B. PROJECT SPECIFIC INFORMATION

B.1 DESCRIPTION OF THE INSTALLATION

B.1.1 General

Carry out work as detailed and in accordance with this specification and drawings, the whole of which shall be deemed to constitute one document.

Whether or not the words "supply and install" appear in the instructions, drawings and schedules of this specification, understand that, unless clearly excluded, equipment for the complete installation is required and must be supplied, delivered to site and installed.

Similarly, where the words "in an approved manner", "for approval", "to approval", "approval" and the like appear, understand that the approval is by the Superintendent or their representative.

The work covered by this Specification includes for the manufacture, supply, installation, testing and commissioning of a complete operating systems of mechanical services inclusive of all minor components necessary whether depicted or otherwise. In addition to the new installation, the contractor is to include for the demolition and removal of all existing mechanical services including but not limited to ductwork, air conditioning, pipework, cabling and mechanical boards.

B.1.2 Project

This project includes the base build refurbishment of Bay 5 of the 'ASN + Co.' heritage building to base build services for office space

B.2 DESIGN CRITERIA

The design criteria for the Mechanical services are as follows:

B.2.1 Design Temperatures

B.2.1.1 External Conditions

Summer : 31.1°C Dry Bulb
 : 22.7°C Wet Bulb

Full Solar Load

Winter : 7°C Dry Bulb

Heat rejection equipment will be sized on the basis of 40°C ambient.

B.2.1.2 Internal Conditions

Air conditioned spaces only

Cooling : Nominal 22.5°C Dry Bulb
 : 40 - 60% relative humidity anticipated by virtue of cooling coil performance

Heating : 22.5°C Dry Bulb

Control Tolerance : Plus, or minus 1.5°C at the point of control for heating and cooling.

Humidity Tolerance 40-60% anticipated by virtue of cooling coil performance No specific humidity control provided.

B.2.1.3 Population, lighting and power loads-Base Building Provision

The Mechanical Design Brief calls for the following population, lighting and power load allowances:

Area	Population Density	Outdoor air (L/s/person)	Lighting density (W/m ²)	Power density (W/m ²)
Foyer	2 Occupants	10	8	10
Open Plan Office	10 m ² /person or as per furniture layouts	10	10	15
Corridor	5m ² /person	10	8	-

B.2.1.4 Population, lighting and power loads-Future tenancy provisions

The Mechanical Design includes provision for future fit out for the following future population, lighting and power load allowances for additional areas not shown on current base building architectural drawings:

Area	Population Density	Outdoor air (L/s/person)	Lighting density (W/m ²)	Power density (W/m ²)
Meeting Room per office floor	10-12 Occupants	7.5	10	10

B.2.1.5 Ventilation

Toilet exhaust 10 L/(s.m²) (minimum to AS 1668.2-2012) or 25 l/s per fixture whichever is greater

Cleaners Rooms 5 l/(s.m²)

B.2.1.6 Glazing and building fabric

WGE have assumed the following U-values:

- Roof – 0.295 W/ (m².K)
- External wall – 0.33 W/ (m².K)
- Internal floor/ceiling – 0.9865 (W/ m²K)
- Partitions – 0.804 W/ (m².K)
- Glazing – 5.89 W/ (m².K) (Shading Factor – 0.9)

B.2.1.7 Total load-future tenancy provision

Capacity: Up to 50 W/m² for cooling load of NLA

Pipework and Ductwork Sizing

Max pressure Drop	:	1Pa/m
Maximum horizontal duct velocity	:	6m/s
Maximum air velocity on vertical masonry Risers	:	7m/s
Transfer Duct	:	less than 15Pa total pressure drop.

Seismic Constraints

The design parameters required in using AS1170.4 are as follows:

Probability Factor of exceedance	:	III
The importance level of the structure is level	:	III
The probability factor (kp) for the structure is	:	1.3
The hazard factor (Z) for the location of the structure is	:	0.08
The structure is determined to have an earthquake design category (EDC) of	:	III

Contractor to include for plant and ductwork bracing appropriate for seismic constraint compliance required for mechanical systems

(All seismic restraint criteria above to be advised by structural engineer)

B.3 SCOPE OF WORK

B.3.1 Specific Scope:

- Contractor to allow for decommissioning, demolition and removal of all redundant existing mechanical services including but not limited to air conditioning, ductwork, cabling, pipework, power, controls plus roof condensers.
- Supply, install and commission Toilet Exhaust System as shown and specified. Ventilation systems complete with ductwork, fans, and air diffusion equipment. All controls and speed control commissioning is by mechanical contractor.
- Supply, install, and commission 2 No. air cooled VRV/VRF Reverse Cycle heat recovery ducted air conditioning systems with individual heating /cooling to areas noted on drawings. Each Space will be able to provide heating cooling/ irrespective of other FCU's on the system. Provide thermostatic controls to each space with a centralised controller located within in each tenancy, to be located in the kitchenette area. The system will be complete with associated refrigerant pipework and all necessary insulation/valves/flow controllers, outside air fan, sound attenuation, electrics, controls as required. Condensing units shall be on the rooftop plant deck as shown. Refrigeration piping, condensate drain piping, air diffusion equipment and other minor items to the air conditioning units shall be allowed for. A/C system is to be equipped with controls allowing individual metering/billing of each tenancy.
- Supply, install and modify existing bay 4 toilet exhaust ventilation systems to suit new architectural layout.

- Cable trays shall be provided in the new services shaft for future installation of refrigeration and power cabling between tenancy and rooftop plant deck. Each system shall be powered from the isolator provided adjacent CU's by electrical trades from the tenant board.
- Ductwork, refrigeration, piping, BS Boxes, air diffusion equipment and other minor items to the above air conditioning units including but not limited to that illustrated on drawings.
- Supply, install and commission one base build supply ventilation system as shown and specified. Supply ventilation system complete with ductwork, fire dampers, fans, VSD, and air diffusion equipment. All controls and speed control commissioning is by mechanical contractor.
- Supply, install and commission one supplementary outside air supply ventilation system as shown and specified. Supply ventilation system complete with ductwork, fire dampers, fans, VSD, and air diffusion equipment. All controls and speed control commissioning is by mechanical contractor.
- Supply and install all new supply air diffusion, and return/transfer air grilles, fire dampers, non-return and balancing dampers, and ductwork as shown on the drawings complete with insulated cushion head boxes and plenums. Supply and install square pattern diffusers, linear slot diffusers as indicated on the drawings.
- Supply and install power and control wiring between the switchboard and ventilation fans and air-conditioning equipment.
- Supply and install run and fault lights and auto/off/manual switches on the fascia of the switchboards for the equipment.
- Supply and install all new flexible and rigid ductwork as shown on the drawings complete with all necessary duct spigots and balancing dampers. Allow to coordinate new duct spigots with existing ductwork where required.
- Allow to installed VSD's and speed controllers on all new fans
- Insulate all the ductwork and pipework to BCA 2014 Section J requirements.
- Acoustic treatment and supports for fan coil units, fans and condensers as outlined in "Resonate Acoustics" specification and assessment (Ref no. S17465ME1) including acoustic wrapping of indoor units on all levels.
- Full monitoring and control of all air conditioning and ventilation systems on a zonal basis using proprietary manufacturers controllers
- Fan static calculations and fan selections.
- Allow to provide a full and detailed description of the automatic controls, its interfacing, graphics and system protocols for principal approval.
- Wiring from the mechanical board to the fan coil unit shall be hard-wired through conduit. An isolator shall be allocated where visible adjacent the fan coil units for isolation.
- Detail all cast in elements or other builders works items in compliance with the programme to allow this work to be coordinated.
- Allow for space and buildability, maintainability for all mechanical fixings
- Provide Detailed construction Programme
- Provision for future additional (tenancy) condensers at roof level platform
- Provision of spare connections on Branch Selector Box on each level for future FCU addition

- Provision of spare refrigerant riser space for additional refrigerant lines

B.3.2 General Scope:

- Whether stated or not all, fans over 1000L/s is to have VSD's. In addition other fans will require VSD's as detailed.
- All refrigerant pipework when exposed, shall be protected in galvanised covers.
- Flexible duct that runs above the toilets shall be as short and straight as possible, with a maximum length of 3 metres. Provide a rigid insulated spiral duct (1000 mm long) after every 3 metres of flexible ducting.
- Mechanical Contractor to do detailed static pressure calculation on all exhaust, supply, pressurisation etc. duct runs prior to fan selection following the completion of shop drawings.
- Allow within price to perform commissioning to CIBSE Commissioning Codes or ASHRAE.
- Mechanical contractor to provide all Mechanical boards, controls, and power for all Mechanical plant.
- Provide a Controls Return Brief.
- Allow to seal around all flexible penetration through full height walls.
- Mechanical contractor to allow for a duct mounted Access panel adjacent each fire damper. (whether shown on the drawings or not.)
- Mechanical Contractor to supply and install all fire rated and acoustic treatment required to meet BCA, Australian Standards, this Specification and Acoustic Specification.
- All exposed mechanical equipment to be painted charcoal UNO. Sample to be provided to architect for approval before painting.
- Refrigerant pipework exposed to the ambient conditions to be protected with UV stable conduit/cover or galvanised duct cover.
- Complete systems of electrical power for the Mechanical Services installation.
- Complete Control System for the Mechanical Services installation including wiring from the BMS to electrical/water/gas meters. Note in the control section that the vertical fibre network will be made available to the BMS contractor
- Complete systems of piping, valves, fittings, supports, etc.
- Complete systems of ductwork, dampers, air diffusion, supports, etc.
- Complete insulation systems for ductwork and piping in accordance with BCA Section J.
- Fire stopping of mechanical services penetrations to maintain FRL. 3rd party inspected at mechanical contractor cost.
- Warranty on A/C condensers of 5 years
- Provision and installation of fire dampers where ducts penetrate fire zones & services shaft.
- Overflashing of mechanical services roof penetrations compatible with heritage roof flashing.

- Flashing and sealing airtight of duct penetrations.
- Flanging of grilles and registers.
- Commissioning and testing.
- Twelve months comprehensive maintenance and warranty commencing on the date of Practical Completion including 4 off quarterly / 12 off monthly preventative maintenance visits. Maintenance shall be carried out in accordance with the schedules as specified. Refer Green Star specification clauses.
- Shop drawings to be completed in REVIT and issued for comment by mechanical consultant.
- Co-ordination with all other components and trades.
- Preparation of a Construction Programme of the Mechanical Services works, separate from but co-ordinated with the Project Construction Programme, submitted for approval prior to preparation of shop drawings.
- Detailed "Shop Drawings" (Scale – 1:50), "Builder's Work Drawings" (Scale – 1:50) and schedules of equipment, fully depicting the entire installation, for approval prior to equipment purchase or ductwork manufacture.
- Manufacturer's certified drawings, upon request.
- Samples, where specified, prior to placing orders.
- As-installed drawings (electronic and hard copy) as further specified.
- 3 sets of bound Operation and Maintenance Manuals incorporating as-installed drawings.
- Engineering certification by calculation of the acoustic and thermal performance of the systems relative to the specified requirements, prior to equipment ordering or manufacture.
- marking and labelling of all ductwork, piping, fans, and any associated equipment.
- All exposed mechanical ductwork at low level to be provided with traffic protection via steel guard rail or equivalent.

B.3.3 Electrical by Mechanical Services Scope

- Supply, installation and commissioning of New Non-Essential mechanical services switchboards as scheduled in this specification.
- Supply, installation and commissioning of lockable isolators for all essential plant.

Note: Confirm in writing to the Principal Contractor the estimated maximum demand of each switchboard before purchase of submain cables by the Electrical Sub-Contractor. If this information is not received prior to purchase of the cables then any costs incurred due to late receipt of the information shall be met by the Mechanical Services Contractor.

- Supply and installation of shunt trip breakers in each of the new non-essential mechanical services switchboards complete with auto reset.

Supply and installation of isolators adjacent each mechanical plant powered from the mechanical services switchboards.

B.3.4 Automatic Controls

- Time and temperature zone control of fan coil units shall be provided via proprietary wall mounted controllers in each zone.
- VRF Heat recovery air conditioning units and associated fan coil units including fans, controls, valves and filters with connection to proprietary central controller and room controllers
- Proprietary air conditioning controller and individual room controllers as supplied and manufactured by the air conditioning system manufacturer
- Manufacturers central AC controller allowing for the following component parts:
 - i. Open protocol allowing for PC desktop use
 - ii. Modem connected to permanent telephone line.
- Fan coil unit's complete with supply air fans, controls, refrigerant connections, valves and filters.
- Toilet exhaust systems.
- General exhaust systems.
- Interlocks between various air conditioning and ventilation systems
- Temperature indication.
- Miscellaneous works.

B.3.5 Associated Builders Work and Services

The following building works are associated with the Mechanical Services installation. The mechanical services contractor shall lead the coordination between all building services.

Prepare and supply to the Principal Contractor all necessary detailed Builder's Work Drawings fully depicting the scope of work. This information must be provided in good time for the work to be put in hand.

All Builder's Work associated with the Mechanical Services installation which is carried out by the Principal Contractor to the Mechanical Contractor's detail shall be supervised by the Mechanical Contractor to ensure that the work is completed properly and correctly.

B.3.5.1 Builder's Work

- Airtight fire rated shafts through the building for the vertical distribution of supply and return air ductwork. Duct penetrations in the walls of these shafts shall be sealed airtight around by the Mechanical Trade.
- Fire rated shafts through the building enclosure ductwork for the vertical distribution of mechanical ventilation systems and piping.
- Provision of all vertical hoisting of equipment
- Ceiling access panels (minimum size 600mm x 600mm UNO) as shown on the mechanical drawings.
- The Provision of all openings and making good in the building structure for the passage of ducts, pipes and conduits to locations and dimensions provided by the Mechanical Trade.
- Undercutting of doors (20mm undercut for doors designated on the drawings "U/C") to Toilets.

- The provision of trimmed openings in walls, roofs, ceilings and bulkheads for air ducts, outlets, grilles, pipes, etc.
- Underflashing of all roof and wall penetrations to be compatible with roofing flashing heritage requirements(lead and Copper)
- Openingsincluding access panels in walls and at other positions as required for adjustment, access and maintenance of equipment. Detail drawings shall be provided by the Mechanical Trade.
- Installation of door grilles. Door grilles to be supplied by the mechanical contractor in conjunction with architectural door schedule.
- Supply and installation of OHS compliant access provisions, including but not limited to access stairs and walkways, for each Mechanical Services equipment.
- Water and electricity for the commissioning and test running of the plant.

B.3.5.2 Hydraulic Services

- Trapped floor wastes and tundishes as shown on the drawings.
- Provide RZPD's at any connection between mechanical and potable water.

B.3.5.3 Electrical Services

- The following electrical services works shall be provided:
 - Provision of isolators adjacent to Cu's
 - Metered Supplies to all Mechanical Boards
 - Provision of 415 Volt, 3 phase, 3 phase **non-essential** submains with tails of sufficient length to enable connection to the switchboards as listed in the Schedules. Final connection to the board by mechanical contractor and verified by the electrical contractor
 - Provision of relays and contactors within electrical services switchboards as required by the Mechanical Contractor all wired back to labelled terminals.
 - Participation in co-ordinated "end to end" commissioning of Electrical Services BMS points and control sequences including troubleshooting as necessary.
 - Participation in review and coordination of control drawings and switchboard drawings to ensure compatibility of designs and control interfaces.
 - Verify all loads from the Mechanical Contractor.

B.3.5.4 Fire Services

- Wiring from the FIB to terminals in Mechanical Services Switchboard to initiate, control and monitor mechanical plant in accordance with the BCA and AS 1668.1 (connection of cables to Mechanical terminal by Mech trades)
- Participation of co-ordinated "end to end" commissioning of FIB points and control sequences including troubleshooting as necessary.
- Participation in review and co-ordination of control drawings and switchboard drawings to ensure compatibility of designs and control interfaces.

- Fire signal to be provided to every Mechanical switchboard. Fire trip signal and auto reset for each of the non-essential mechanical services boards described above.

As-built electrical schematic drawings showing the location of shutdown switches and relevant connections within dwellings and the location of motion and daylight sensors within common areas.;

B.4 SCHEDULES OF PERFORMANCE

B.4.1 General

These Schedules of Performance have been prepared as a guide for tendering purposes only.

The Contractor shall undertake a detailed analysis of each air handling system and pipework system making due allowance for the resistance to flow of all other selected equipment prior to confirmation of fan and pump selections. Any discrepancies from the specified requirements shall be brought to the Engineers' attention prior to ordering for resolution.

Schedules of Performance shall be read in conjunction with drawings and preceding Specification Clauses.

B.4.2 Variable Refrigerant Volume (VRV) Systems

CONDENSER UNIT NUMBER	CU.1			
NUMBER OFF	1			
NUMBER OFF MODULES	1			
LOCATION	Roof Plant Platform			
MAKE	Daikin or approved equivalent			
MODEL	REYQ20TY1			
CU POWER SUPPLY (V / ϕ / Hz)	415/3/50			
CU FULL LOAD AMPS (A)	40.0			
AMBIENT ($^{\circ}$ Cdb)	33.8			
FCU TYPE	DUCTED	DUCTED	DUCTED	DUCTED
FCU NUMBER	FCU.G.01	FCU.G.02	FCU.1.01	FCU.1.02
MODEL	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8
AREA SERVED	GF - A	GF - B	L1 - A	L1 - B
SUPPLY AIR (l/s)	760	600	750	600
OUTSIDE AIR (l/s)	110	125	110	120
EXTERNAL STATIC (Pa)	140	140	140	140
TOTAL CAPACITY (kW)	15.50	14.50	15.40	14.00
SENSIBLE CAPACITY (kW)	11.40	10.00	11.30	9.50
FCU POWER SUPPLY (V/ ϕ / Hz)	240/1/50	240/1/50	240/1/50	240/1/50
FCU FULL LOAD AMPS (A)	3.4	3.4	3.4	3.4
AIR ON COIL ($^{\circ}$ Cdb/ $^{\circ}$ Cwb)	24.9/17.9	24.7/18.1	24.9/17.9	24.6/18
BS BOX	BS6Q140			
ACCESSORIES	Wired wall mounted controllers for each FAN COIL UNIT. Central controller to each tenancy			

CONDENSER UNIT NUMBER	CU.2					
NUMBER OFF	1					
NUMBER OFF MODULES	2					
LOCATION	Roof Plant Platform					
MAKE	Daikin or approved equivalent					
MODEL	REYQ30TY1 (REYQ18TY1 + REYQ12TY1)					
CU POWER SUPPLY (V / Ø / Hz)	415/3/50					
CU FULL LOAD AMPS (A)	36A + 21A per condenser module					
AMBIENT (°Cdb)	33.8					
FCU TYPE	DUCTED	DUCTED	DUCTED	DUCTED	DUCTED	DUCTED
FCU NUMBER	FCU.2.01	FCU.2.02	FCU.3.01	FCU.3.02	FCU.4.014	FCU.4.02
MODEL	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8	FXMQ140PVE8
AREA SERVED	L2 - A	L2 - B	L3 - A	L3 - B	L4 - A	L4 - B
SUPPLY AIR (l/s)	600	600	750	600	770	770
OUTSIDE AIR (l/s)	110	120	80	120	80	120
EXTERNAL STATIC (Pa)	140	140	140	140	140	140
TOTAL CAPACITY (kW)	13.5	13.9	13.6	14.2	15.8	16.0
SENSIBLE CAPACITY (kW)	9.2	9.4	10.5	9.6	12.7	12.2
FCU POWER SUPPLY (V/ Ø / Hz)	240/1/50	240/1/50	240/1/50	240/1/50	240/1/50	240/1/50
FCU FULL LOAD AMPS (A)	3.4	3.4	3.4	3.4	3.4	3.4
AIR ON COIL (°Cdb/°Cwb)	24/17	24/17	24/17	24/17	24/17	24/17
BS BOX	BS6Q140			BS4Q140		
ACCESSORIES	Wired wall mounted controllers for each FAN COIL UNIT. Central controller to each tenancy					

NOTES – For All Systems

- Unit capacities and selections must be based on actual system pipe lengths.
- Scheduled total and sensible capacities are actual heat loads, not FCU capacities.
- 39°C = maximum temperature under which plant will continue to operate without loss of performance achieving design capacities.
- 46°C = Maximum temperature under which plant will continue to operate.
- Note: External Pressure indicated includes allowance for filter resistance.
- For all low static units, manufacturers proprietary filters are to be provided.
- For all medium and high static FCU's, G4 filters are required.

B.4.3 Fan Schedule

FAN NO.	OAF-01	OAF-02	TEF-01
LOCATION	ROOF	ROOF	ROOF
SERVING FCU/AREA	ALL LEVELS	FUTURE TENANCY ALL LEVELS	ALL LEVELS
MANUFACTURER	FANTECH or Equivalent Approved	FANTECH or Equivalent Approved	FANTECH or Equivalent Approved
TYPE	MIXED FLOW	MIXED FLOW	CENTRIFUGAL
DIAMETER (mm)	450	450	560
NO. OFF	1	1	1
CAPACITY (l/s)	1390	350	1200
RESISTANCE (Pa)	250	250	250
MINIMUM MOTOR (kW)	1	1	1
MAXIMUM FAN SPEED (rps)	1370	1354	880
MAXIMUM ABSORBED POWER (kW)	1	0.37	0.65
Sound Power Inlet 63Hz	73	80	75
Sound Power Inlet 125Hz	75	78	73
Sound Power Inlet 250Hz	70	74	71
Sound Power Inlet 500Hz	67	71	69
Sound Power Inlet 1kHz	64	62	64
Sound Power Inlet 2kHz	65	64	61
Sound Power Inlet 4kHz	63	63	56
Sound Power Inlet 8kHz	58	53	52
Inlet dB(A)	51	52	50
Sound Power Outlet 63Hz	78	-	75
Sound Power Outlet 125Hz	74	-	73
Sound Power Outlet 250Hz	72	-	71
Sound Power Outlet 500Hz	71	-	69
Sound Power Outlet 1kHz	71	-	64
Sound Power Outlet 2kHz	68	-	61
Sound Power Outlet 4kHz	65	-	56
Sound Power Outlet 8kHz	59	-	52
Outlet dB(A)	55	-	50
Starting Arrangement	VSD	VSD	VSD
Comments/Accessories	Interlock with associated FCU'S. Pressure sensor flow switch. To trip in fire mode. RUN/FAULT indication to local control panel and MSSB	Interlock with associated FCU'S. Pressure sensor flow switch. To trip in fire mode. RUN/FAULT indication to local control panel and MSSB	To trip in fire mode. RUN/FAULT indication to MSSB. Operate on a time schedule

NOTES

- Key:

AA	-	Axial Aerofoil,	LC	-	Long Casing,
SC	-	Short Casing,	DI	-	Double Inlet,
SI	-	Single Inlet,	ILC	-	In Line Centrifugal,
Cent	-	Centrifugal,	DM	-	Dual Motor,
WG	-	Wire Guard,	BM	-	Bellmouth,
NRD	-	Non Return Dampers,	PPF	-	Plate mounted Propeller Fan,
FP	-	Fixed Pitch,	VP	-	Variable Pitch,
BPM	-	Bird Proof Mesh			

- Motors to be sized to allow for 110% design airflow against the corresponding increase in the system resistance (120%).
- Motors 0.28kW and greater are to be 3 phase/415V unless specifically excluded.

B.4.4 Ductwork Insulation

Refer to the drawings for the extent and nominal thickness of ductwork insulation.

Cross reference the insulation nominal thickness with the minimum R-values quoted in Section C of this specification.

B.4.5 Noise

As per acoustic engineers specification

B.4.6 Vibration Isolation

EQUIPMENT	ISOLATORS	MINIMUM ISOLATION/ DEFLECTION	BASE
FANS (CENTRIFUGAL)	Spring Isolators	98%/65mm	Steel base platform
FAN COIL UNITS	Spring Isolators	95%/50mm	Steel base
A/C CONDENSERS AND OTHER FANS	Double Deflection Neoprene	80%/ 8mm	

B.4.7 Ductwork

Ductwork Insulation shall conform to the Building Code of Australia.

The following Ductwork Systems are to be employed:

Air Conditioned Supply Air	Material:	Galvanised Steel
	Design Pressure:	250pa
	Test Pressure:	500pa
	Seal Class (Refer AS 4254.2-2012)	C
	Insulation Type:	Perforated Foil Faced
Air Conditioned Return Air	Material:	Galvanised Steel
	Design Pressure:	250pa
	Test Pressure:	500pa
	Seal Class (Refer AS 4254.2-2012)	C
	Insulation Type:	Perforated Foil Faced
General Exhaust	Material:	Galvanised Steel
	Design Pressure:	250pa
	Test Pressure:	500pa
	Seal Class (Refer AS 4254.2-2012)	C
	Insulation Type:	Perforated Foil Faced

B.4.8 Pipework

Pipework insulation shall conform to the Building Code of Australia, Section J.

The following pipework systems are to be employed:

Refrigerant Piping	Material:	Copper, type A tube
	Design Pressure:	3,400kPa
	Test Pressure:	4,400kPa
	Operating Temperatures:	-20°C to 70°C
	Insulation Type:	Armaflex FR (Fire Retardant)
Mains Water: (CW)	Material:	Copper, type B tube
	Design Pressure:	1000kPa
	Test Pressure:	1,300kPa
	Operating Temperatures:	Ambient
	Insulation Type:	N/A
Drains, Vents: (D, V)	Material:	UPVC (Generally) Copper, type B tube (where exposed)
	Design Pressure:	100kPa
	Test Pressure:	150kPa
	Operating Temperatures:	Ambient
	Insulation Type:	Armaflex FR (Fire Retardant)

B.4.9 Valves

	Duty	Valve
Chilled Water: (CHW) 150mm and below	Isolation	
	Flow Regulation	
	Vibration Isolation	
	Control	
Chilled Water: (CHW) Greater than 150mm	Isolation	
	Flow Regulation	
	Vibration Isolation	
	Control	
Condenser Water: (CNDW)	Isolation	
	Flow Regulation	
	Vibration Isolation	
	Control	

B.4.10 Controls

The Following Control Sequences are to be included:

SYSTEM	EQUIPMENT	CONTROL FUNCTIONALITY
Air Cooled Chilled Water Plant	Chillers	Startup Sequence Staging Chilled Water Temperature Reset – Constant Return Water Temperature Chilled Water Temperature Reset – Supply Air Temperature Approach
	Chilled Water Pump Systems	Chiller Chilled Water Flow Control Bypass Valve Control Chilled Water System DP Reset
	System Wide	Tuning Items:
Fan Coil Units	Coil	Temperature Control
	Dampers	Economy Cycle Outdoor Air Flow Rate Control
	System Wide	Warm Up Cycle Night Purge Airflow Sensor Verification Tuning Items
Supplementary Unit Control	Packaged AC Unit	Proprietary Control
Supplementary Outside Air	Fan	Fan Speed Control
Typical Exhaust	Fan	On/Off Fan Speed Control
Typical Toilet Exhaust	Fan	On/Off Fan Speed Control
Packaged AC Units		Local Control Centralised Control BMS Interface

SYSTEM	EQUIPMENT	CONTROL FUNCTIONALITY
After Hours Control		Control Log
Alarms		Monitor

- Fire Pump Room
- Fire Indicator Panel (FIP)
- Security Alarm Panel

B.4.11 Testing and Commissioning

The following specific system tests are to be carried out:

- Pressure testing of all pipework systems.
- Pressure and leakage rate testing of all ductwork.
- Pressure testing evacuation and charging of all refrigerant systems.
- Balancing of individual water quantities in each pipework system.
- Balancing of individual air quantities in each air handling system. Setting of maximum and minimum quantities for all air terminal boxes.
- Surveys of and recommissioning of existing air handling systems and chilled water systems where changes, modifications or deletions to existing systems are carried out.
- Functional and calibration testing of all electric and pneumatic control systems and components.
- Performance testing of all major plant system components.
- Performance testing of each total system under peak design conditions.

B.4.12 Painting, Finishes, and Identification

The following components of the installation are to be painted:

System:	Colour:
Major items of plant and equipment, including pre-painted items of package.	Manufacturers Standard Colours
Ductwork exposed in the room.	<i>Paint colour to be selected by the architect. Samples to be submitted for approval</i>
Ductwork external to the building.	To match roof colour/ To architects approval
Ductwork exposed to view.	To architects approval
Air diffusion.	To architects approval
Switchboards and control panels.	Electric Orange
Minor items, including brackets, hangers, frames, bases, plinths.	To match associated duct or equipment
Inside of air outlets grilles, openings, dampers.	<i>Paint colour to be selected by the architect. Samples to be submitted for approval</i>
Electroplated cadmium or zinc, or galvanised components	Paint to match associated

	equipment
Inside surfaces of air handling rooms and air plenums.	To architects approval
Bright aluminium clad pipework	Need not be painted. Provide colour bands at pipe markers.
Plant room floors.	To architects approval
Building surfaces made good.	Paint to match adjacent surfaces

B.4.13 Mechanical Switchboard Schedules

SWITCHBOARD DESIGNATION: MSSB-R.01_ CABLE SIZE _____mm²

LOCATION: Roof FAULT LEVEL _____kA

VOLTAGE DROP _____%

SWITCHBOARD FORM RATING: Form 2 XX

IP RATING: IP54

SUPPLY TYPE: Normal

Service	Area Served	No Off	kW	FLA	Starting Arrangement & No. Phases
VRV CU-01	GR & L1	1	-	40	VRV/VSD
VRV CU-02.1	L2- L4	1	-	36	VRV/VSD
VRV CU-02.2	L2- L4	1	-	21	VRV/VSD
TEF-01	ALL LEVELS	1	0.65	1.40	VSD
OAF-01	ALL LEVELS	1	1	1.95	VSD
OAF-02	ALL LEVELS	1	0.37	1.0	VSD

NOTES

- Refer to drawings for the number of heater banks, staging and individual capacities.
- Soft Starters or VSD's are required for motors 7.5 kW and greater.
- If Cable Size, Fault level or Voltage Drop are not provided these are to be obtained from Electrical Contractor

PART C. TECHNICAL

C.1 MATERIALS AND WORKMANSHIP

C.1.1.1 General

All materials, labour and plant are to be provided unless otherwise specified. All materials and equipment shall be new, and the best of their respective kinds and free from all defects.

Workmanship shall be carried out in a first class manner and in accordance with the true intent and meaning of this Specification and accompanying drawings, the Contract and to the entire satisfaction of the Superintendent.

All materials, equipment and work shall comply with the appropriate Australian Standard Specification or Code, or if such have not been prepared, with the appropriate British Standard. In particular, compliance with AS 3000:2000 Australian/New Zealand Wiring Rules is required.

All materials, equipment and work shall also comply with the relevant rules and regulations laid down by any Statutory Authority having jurisdiction over such work, and shall conform to the requirements of Insurance Underwriter's Codes.

Any workmanship, materials or installation, which on inspection by such authorities, is found to require modification to be acceptable to the authority concerned shall be replaced, changed, modified, or otherwise put in a form to pass the relevant regulations. Such modifications shall be at the expense of the Contractor and at no cost to the Proprietor.

Take all necessary precautions with the supply and installation of equipment specified to prevent corrosion. If, in the opinion of the Contractor, equipment specified cannot be adequately protected against corrosion, an instruction regarding the same shall be requested. Any component or accessory showing signs of rust or corrosion during the maintenance period shall be renewed or otherwise made good in an approved manner.

C.2 QUALITY ASSURANCE

The Contractor shall produce and submit to the Engineer verified records to confirm that the specification requirements have been achieved, as follows:

<u>Item as specified</u>	<u>Record</u>	<u>Frequency</u>
Equipment, ductwork, insulation, pipework, controls, electrical, noise and vibration control, painting.	Quality Assurance Certificate (Shop Drawings)	For each Shop Drawing submitted. Prior to manufacturing and installation.
Equipment	Quality Assurance Certificate (Supply)	For each item of equipment. Performance information (with Contractor's signature) submitted prior to purchase and after installation.
Engineering Certification	Quality Assurance Certificate (Engineering)	For each piping, exhaust and air handling system.
Testing and Commissioning	Commissioning Records	As specified.
The Contract Works	Practical Completion Certificate	Practical completion
Maintenance	Maintenance Log-Book	As specified.

The Contractor shall note on the record where any item fails to meet the specified requirement and the planned remedial action.

If the Contractor is certified to AS/NZ ISO 9000 then the Contractor's own Quality Assurance procedures may be used in lieu but only to the Engineer approval.

C.3 OZONE DEPLETING SUBSTANCES

The handling of ozone depleting substances shall conform in every respect to the applicable authority's environmental protection policies or legislation.

C.4 EQUIPMENT

C.4.1 General

All equipment which forms a part of the works specified herein shall be supplied, installed and commissioned by the Contractor, unless otherwise specified.

Provide equipment complying with all specified requirements, performance schedules, and the clear intent of the specification.

All materials and components shall be the best of their respective kinds, and shall be free from all defects.

Safety guards shall be fitted to all items of equipment which may cause damage or injury to personnel, or to the building and other equipment.

The Contractor shall ensure, as much as is practicable, standardisation and interchange - ability of equipment throughout the installation.

All equipment shall incorporate any access doors, access hatches, lubrication points and any other provisions required for the easy maintenance of the subject equipment. Notes to Tenderers:

- Where the equipment make/brand is nominated outright, or nominated "-- or **approved equivalent**", then a fully conforming base tender offer shall be submitted incorporating the **nominated** equipment brand.
- An alternative offer may be submitted presenting an "equivalent" brand offer for approval, only in conjunction with a fully conforming base tender. The contractor is fully responsible for all due diligence and verification as required to clearly demonstrate that the alternative in all instances is "equivalent" to the nominated or "approved equivalent" make/brand. This shall include, but not be limited to performance, capacity, construction, acoustics, spatial considerations, maintenance, efficiency etc. and in addition identify what benefit to the contract the alternative brand/make offers.
- Where equipment make/brand is nominated "-- or **similar**", the base tender offer may incorporate similar equipment that confirms to all aspects of the specification.

Ensure that the equipment offered can satisfactorily be accommodated within the available plant area and, if any equipment modifications are necessary to achieve this, these shall be allowed for in the Tender.

All equipment shall be installed to the specification and equipment manufacturer's requirements. Allow for an inspection and report to be compiled by the equipment manufacturer confirming acceptance of the installation. Any further works required by the equipment supplier shall be included. Equipment suppliers' requirements that conflict with the specification shall be brought to the attention of the Engineer.

C.4.2 Equipment Selections

The pressure and flow requirements for equipment where shown on the drawings is for Tendering purposes only. Perform a detailed analysis of each air handling system and pipework system making due allowance for the resistance to flow of all other selected equipment, prior to confirmation of equipment selections. Any discrepancies from the specified requirements shall be brought to the Engineer's attention for resolution.

Any deficiency in system performance resulting from a failure by the Contractor to comply with this Clause shall be rectified to the Engineer's satisfaction at the Contractor's cost.

C.4.3 Packaged Air Conditioning Equipment

C.4.3.1 Roof Top Packaged Units

Roof Top Packaged Units shall be of Temperzone or approved equivalent manufacture.

Each unit shall be complete with housing, air filters, cooling coils, supply air fan, insulation, all necessary piping, valves, fittings, condenser coils, condenser fans, compressors, all ancillary equipment and built in weather-proof switchboard.

The units shall be powder coated with a robust 80 micron thick power coating system and meeting the requirements of salt spray testing to AS/NZ standards.

The minimum capacity requirements of the packaged equipment shall be as detailed in the "Schedule of Performance" Section of this Specification.

C.4.3.2 Vertical Packaged Units

Vertical packaged units shall be of APAC or approved equivalent manufacture.

Each unit shall be complete with housing, air filters, cooling coils, supply air fan, insulation, all necessary piping, valves, fittings, condenser coils, condenser fans, compressors, all ancillary equipment and built in weather-proof switchboard.

C.4.3.3 Split Packaged Air Conditioning Units

C.4.3.3.1 General

Split packaged units shall be of "Temperzone", "Daikin" or approved equivalent manufacture.

Each unit shall consist of a fan coil unit section and a condensing unit section.

The fan coil section shall consist of air filters, cooling coils, supply air fan, insulation and all necessary piping, valves and fittings.

The condensing unit section shall consist of condenser coils, condenser fans, compressors, all necessary piping, valves, fittings, ancillary equipment and built in weather proof switchboard.

Air cooled condensing units shall have passivated fins.

All split packaged units shall be provided with head pressure control unless specifically noted otherwise. Head pressure shall be regulated by cycling of condenser fan / fans via a discharge pressure controller.

The minimum capacity requirements of the split packaged equipment shall be as detailed in the "Schedule of Performance" Section of this Specification.

C.4.3.3.2 Indoor Split Air Conditioning Units

Indoor split air conditioning units shall be of the same manufacture throughout the project.

The fan coil unit section shall consist of air filters, cooling coils, supply air fan, insulation and all necessary piping, valves and fittings.

The condensing unit section shall consist of condenser coils, condenser fans, compressors, all necessary piping, valves, fittings, ancillary equipment and built in weatherproof switchboard.

The minimum capacity requirements of the split air conditioning equipment shall be as detailed in the "Schedules of Performance" Section of this Specification.

C.4.3.4 Variable Refrigerant Volume (VRV) Heat Recovery System (3 pipe)

Multi-split packaged units shall be of "Daikin" VRV type or approved equivalent manufacture.

Each unit shall be complete with housing, condenser coils, condenser fan, insulation, all necessary piping, valves, fittings, compressors, all ancillary equipment and built in weatherproof switchboard.

The minimum capacity requirements of the condensing units shall be as detailed in the "Schedule of Performance" Section of this Specification.

All condenser units shall have anti-corrosion protection due to proximate to ocean as per the specification below.

No.	Parts	VRV anti-corrosion model (E type)
1	Sheetmetal casing	Hot dip zinc coated sheet plus corrosion resistance powder coating (more than 64µm
2	Discharge grille – Protection net	Low Densisty Polyethilen (LDPE) coating
3	Fasteners	SUS410 + Zinck- Nickle Plating + geomet process
4	Heat Exchanger	Copper Tube plus anti corrosion AL fin
5	Heat Exchanger End-Plate	Hot dip zinc coated sheet plus corrosion resistance powder coating (more than 64µm
6	Fan motor stand – electric box- inside sheet metal	Hot dip zinc coated sheet plus corrosion resistance powder coating (more than 64µm
7	Fan – Fan motor	Resin fan plus resign fam motor
8	Pressure Vessel (Casing of compressor and accumulator)	Hot rolled sheet metal plus painting plus rust inhibitor coating
9	Printed circuit board	Both sides resin coating

C.4.3.4.1 General

Unit shall be air cooled, split type multi-system air conditioner consisting of one outdoor unit and plural indoor units, each having capability to cool or heat independently for the requirements of the rooms.

Compressors shall be equipped with inverter controller, and capable of changing the rotating speed to follow variations in cooling and heating load.

Refrigerant is to be R410A.

Each system shall contain three refrigerant pipes and be complete with all necessary REFNET joints, branch selector boxes, fittings and accessories for a complete installation.

Provision for all electrical and control cabling systems, as necessary for complete operation of all VRV systems installed in accordance with the manufacturer's literature.

C.4.3.4.2 Outdoor Unit

Maximum refrigerant piping is 100m horizontal with 50m level difference and 40m from last branch off to furthest fan coil unit.

Condenser units shall operate without tripping or failure to an ambient temperature of 45°C, although at a reduced capacity.

Both indoor unit outdoor unit are assembled, tested, and charged with refrigerant at the factory.

The outdoor unit shall be a factory assembled unit housed in a sturdy weatherproof casing constructed from rustproofed mild steel panels coated with a baked enamel finish.

The outdoor unit shall have a minimum of two scroll compressors and be able to operate even in case that one of compressors is out of order.

The outdoor unit shall be modular in design and should allow for side by side installation.

The condenser section shall consist of condenser coils, condenser fans, compressors, all necessary piping valves, fittings, ancillary equipment and built in weatherproof switchboards.

Condensers are vertical discharge capable of up to 78Pa of external static pressure or to suit intake and discharge ducts and grilles where required. Fins are PE coated aluminum for extended life.

C.4.3.4.3 Compressor

The compressor shall be of highly efficient hermetic scroll type and equipped with inverter control capable of changing the speed in accordance to the cooling or heating load requirement.

The outdoor unit shall have the multi-step of capacity control to meet load fluctuation and indoor unit individual control.

C.4.3.4.4 Heat Exchanger

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

The aluminum fins shall be covered by anti-corrosion resin film.

C.4.3.4.5 Refrigerant Circuit

The refrigerant circuit shall include liquid and gas shut off valves and a solenoid valves.

All necessary safety devices shall be provided to ensure the safety operation of the system.

C.4.3.4.6 Safety Devices

The following safety devices shall be part of the outdoor unit: High Pressure Switch, Fan Driver Overload Protector, Inverter Overload Protector, and Over Current Relay.

C.4.3.4.7 Oil Recovery System

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigerant piping.

C.4.3.4.8 Indoor Unit

Each indoor unit shall have electronic control valves which control the refrigerant flow rate in response to load variations of the room. The fan shall be of the dual suction multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation.

The address of the indoor unit shall be set automatically in case of individual and group control.

In case of centralized control, it shall be set by liquid crystal remote controller.

The minimum capacity requirements of the split air conditioning equipment shall be as detailed in the "Schedules of Performance" Section of this Specification.

Air conditioning units shall be of the same manufacture throughout the project.

C.4.3.5 Coil Protection Coatings

Coil Protection Coatings shall be Polyurethane coating impregnated with metallic pigment to prevent loss of heat conductivity.

Coil / heat exchanger fins shall be of an aluminium and/or copper construction with a protective coating applied after construction of the coil to achieve a total coverage. The coating shall not block the possible fin perforations. Coating shall be repairable and maintainable on site.

C.4.3.5.1 Coating characteristics:

Coating shall be UV resistant, flexible, heat conductive, chemical resistant to most (aggressive) environments. A resistance list must be available

C.4.3.5.2 Application:

The entire unit shall be prepared in order to obtain access to the finned coils. Wiring and sensitive electrical components shall be protected during the cleaning and coating process. The most critical areas which have to be coated are the heat exchangers surfaces (finned coils). Protection against corrosion shall be achieved by means of a high pressure spray technique that ensures full penetration but prevents bridging (thus preventing capacity loss).

Copper elbows (returns), headers and brazing parts are pretreated with special Polyurethane primer to ensure maximal adhesion and protection to these areas.

C.4.3.5.3 Quality level

Quality level of the treatment should meet the following requirements.

C.4.3.5.4 Appearance Level

The penetration of the coil has to be 100%, to be established and proven by the working method and visual inspection.

C.4.3.5.5 Adhesion Level

The adhesion level should meet Cross hatch test level 0 (European) and 5B (USA) according to ASTM 3359-83 53151 method B-A

C.4.3.5.6 Thickness Level

The thickness level should meet 1 mil (25 µm) plus or minus 20 %.

C.4.3.5.7 Corrosion Resistance Level:

ASTM-B117 (DIN 53167) 4000 hours

Conditions:

- Salt concentration 5 % NaCl
- pH 6,5 - 7,2
- Temperature 37°C

ASTM-B287 (DIN 50021) 4000 hours

Conditions:

- Salt concentration 5 % NaCl
- pH 3,2 by Acetic Acid (HAc)
- Temperature 37°C

C.4.1 Fans

C.4.1.1 General

Specified in this section is the minimum requirement for the construction, testing and installation of fans for heating, ventilating and air conditioning of the following types:

- Centrifugal Fans
- In-Line Centrifugal Fans – EC/Dual Motors
- Square Plate Fans
- In Line Mixed Flow Fans
- Centrifugal Fans (Polypropylene)
- Smoke Spill Fans
- Propeller Fans
- Roof Mounted Exhaust Fans – Single Motor
- Ceiling Mounted Exhaust Fans
- Wall Mounted Exhaust Fans
- Window/Wall Fans

Check the scheduled estimated system resistances in the light of equipment offered. Make any necessary adjustments and submit curves with the workshop drawings showing the operating points for approval before placing orders.

A calculation for the final fan pressure capacities is the responsibility of the Mechanical Services contractor. Fan static pressures and motor kilowatt sizes are given for guidance purposes only.

Provide fan motors with rated power output of not less than 130% of the fan power required at initial operating conditions.

Provide fans with motors and drives selected to allow the fan to run up to full speed in less than 8 seconds on starting. Rate motors to start as frequently as required under normal operating conditions, but in any case, it must be possible to immediately restart a motor after prolonged operation at full load and at maximum ambient temperature without overheating or operation of protection devices.

Provide pressure operated non-return dampers fitted to the fan discharge for fans which are arranged to operate in parallel discharging into, or drawing from a common duct or chamber. Connect fan intakes and discharges to ductwork and plenums by flexible connections.

Manufacture fans to a fully developed design currently in production and readily available and supported by test data sheets and complete service facilities and spare parts. Statically and dynamically balance rotating parts on assembly.

The fan noise level must not exceed the scheduled values. All fans shall be smooth running without objectionable noise or vibration, consistent with the requirements of Section "Noise & Vibration Control" of this Specification. All fans shall be selected to meet required noise levels in conjunction with sound attenuation as applicable.

Motors and drives shall have rated power output to allow a 10% increase in air quantity against the system (duty kW x 1.35).

Fan performance requirements are also detailed in the "Schedule of Performance" section of this Specification.

Access panels shall be provided, to the approval of the Architect, in the fan casings or the connecting ductwork, to provide adequate access to the motor and impeller assemblies.

Lubrication points shall be provided external to the fan casings for periodic lubrication of bearings.

Belt driven fans shall be provided with one set of spare belts mounted in a labelled wire rack within the plantroom to approval.

Details of fan sound power levels shall be submitted with tenders.

C.4.1.2 Standards

Details of fan sound power levels shall be submitted with tenders

AS 1044	Limits of Electromagnetic Interference for Electrical Appliances and Equipment.
AS 1668.1	The use of Mechanical Ventilation and Air Conditioning in Buildings. Part 1 Fire and
AS 2784	Endless Wedge Belt and V-Belt Drives
AS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
BS 848	Fans for General Purposes
	Part 1 - Methods of Testing Performance
	Part 2 - Fan Noise Testing
AG 601	Gas Installation Code

C.4.1.3 Centrifugal Fans

Description

Centrifugal fans shall be of the backward inclined centrifugal type with non-overloading characteristics of "Richardson" or approved equivalent manufacture.

Housing

Mild steel unless otherwise scheduled and complete with curved aerodynamic air inlets, flanges on air discharge, lifting eyes and mounting brackets for spring mounts.

Impeller

Fans shall have aerofoil section blades as detailed in the "Schedule of Performance" Section of this Specification.

Fan impellers shall be statically and dynamically balanced and mounted in approved ball or roller bearings with grease seals.

Fan casings and impellers shall be descaled internally and externally and shall then be given two coats of an approved air drying bitumen base enamel.

Motor

Fans shall be driven by means of a TEFC squirrel cage induction motor of ample capacity for the required duty on continuous operation.

The fan drives shall consist of Vee belts of matched lengths and of adequate cross section to transmit the power required. Motor slide rails shall be provided for ease of belt tensioning.

A spare set of vee belts shall be provided and mounted on a rack in the plant room.

Each fan/motor assembly shall be mounted on a rigid integral MS channel and angle box frame inertia base, all mounted on spring vibration isolators.

Fan motors and drives shall be selected to allow for an increase in volume of 10% against a corresponding increase in system resistance.

Suitable belt guards shall be fitted over the fan drives.

Base

Unless schedules otherwise, mount fan and motor on rolled steel fabricated frame complete with drive and guards to form a complete unit. Incorporate provision for anti-vibration mounts.

Vibration isolators shall be as detailed in the "Noise and Vibration" Section of this Specification.

The base, frame etc. shall be descaled and then given two coats of an approved zinc rich paint.

Finish

Fan assemblies shall be installed with accordance to section "Painting, Finishes & Identification" of this specification.

C.4.1.4 Fixed-Pitch Axial Fans

Description

Fixed-pitch axial fans shall be of the direct-drive, aerofoil type, of “Fantech,” “Richardson” or “Woods” manufacture with non-overloading characteristics.

Casing

Casings shall be fabricated from hot dip galvanised steel with weld seams. Casings shall have flange connections at both ends for connection of ductwork or accessories *and fitted with an access panel*.

Provide mounting feet, either bolt on type or welded to fan housing. Comply with requirements set out in section “Noise & Vibration Control”.

Impellers

Impellers shall be fabricated from aluminium alloy, and shall incorporate provision for adjustment of blade pitch angle.

Impeller and shafts shall be statically and dynamically balanced prior to assembly of the fans, after adjustment of the fan blade pitch angles.

Motor

As per the “Performance Schedule”. Electrical connections to the fan motor to be in accordance with the section. “Electrical for Mechanical Services” of this specification.

Inlet & Outlet

Coned Inlets: Provide inlet cones or bell mouths nominally 0.2 x diameter long and reducing from 1.2 x diameter where fans do not have a ducted inlet. Where an acoustic attenuator is fitted to fan inlet locate the cone upstream from the attenuator.

Discharge Cones: Provide discharge cones nominally 1.0 x ϕ long expanding to 1.25 x ϕ where fans do not have a ducted outlet. Where an acoustic attenuator is fitted to the discharge, locate the cone downstream from the attenuator.

Guards: Provide heavy galvanised steel or bronze wire mesh guards to discharge and intake of fans where these are not connected to system ductwork and where shown on the drawings.

Finish

Fan assemblies shall be installed with accordance to section “Painting, Finished & Identification” of this specification.

C.4.1.5 In-Line Centrifugal Fans – EC/- Dual Motor

In-line centrifugal fans shall be of “Fantech TILE” Series or approved equivalent.

Impellers shall be of PGI, backward curved, single thickness design.

Each fan shall be fitted with dual, single phase, speed controllable external rotor motors, with integral thermal protection.

Casings shall be of PGI construction and shall incorporate machine formed end flanges and corners.

Access panels shall be provided for cleaning and maintenance of the motor and impeller.

C.4.1.6 Square Plate Fans

Square plate propeller fans shall be “Fantech” or similar.

Square plate fans shall be mounted on 1.6mm GSS diaphragm plates in 1.6mm casings.

Casings shall incorporate adequate access panels, and shall be flange connected to adjacent ductwork.

The axial impellers shall be driven by speed controllable external rotor motors with integral thermal protection and run in a pressed steel square plate casing.

The square plate casings shall have a hot dipped galvanised finish.

C.4.1.7 In Line Mixed Flow Fans

In-line mixed flow fans shall be of "Fantech" Mixed Vent Series or approved equivalent.

Impellers shall be injection moulded plastic, shall be of a mixed flow design and driven by speed controllable external rotor motors with integral thermal protection.

Housings shall be of epoxy coated steel with circular end flanges, integral mounting foot and designed to provide ready access to the wheel for cleaning and maintenance.

C.4.1.8 Centrifugal Fans (Polypropylene)

Fans shall be of the backward inclined centrifugal type with non overloading characteristics of 'COLASIT' or approved equivalent manufacture.

Fans shall have single thickness blades.

Fan impellers shall be moulded from polypropylene with a plastic coated metal hub and shall be statically and dynamically balanced.

Fan casings shall be fabricated from polypropylene.

Fans shall be direct or belt driven as nominated in the 'Schedule of Performance' section of this specification.

Fans shall be driven by means of a TEFC squirrel cage induction motor of ample capacity for the required duty on continuous operation and starting.

Belt drives consist of Vee belts of matched lengths of adequate cross section to transmit the power required. Motor slide rails shall be provided for ease of belt tensioning.

Each fan/motor assembly shall be mounted on an integral hot dip galvanised mild steel inertia base.

Vibration isolators shall be as detailed in the 'Noise and Vibration' section of this specification.

Fan motors and drives shall be selected to allow for an increase in volume of 10% against a corresponding increase in system resistance.

Suitable belt guards shall be fitted over the fan drives.

C.4.1.9 Propeller Fans

Propeller fans shall be "Fantech, Woods GP or similar approved.

Propeller fans shall be mounted on 1.6mm GSS diaphragm plates in 1.6mm casings.

Casings shall incorporate adequate access panels, and shall be flange connected to adjacent ductwork.

C.4.1.10 Roof Mounted Exhaust Fans - Single Motor

Roof mounted exhaust fans shall be of "Fantech" or similar approved manufacture.

Fan housings shall be weatherproof, shall be of moulded bonded reinforced fibreglass, be complete with integral bird screen and shall have an easily removable motor cover.

Impellers shall be backward inclined centrifugal units with a vertical shaft.

Roof extractor units shall be belt driven with a motor sized for an additional 10% increase in air flow against a corresponding increase in system pressure beyond the duty specified.

Motors shall be three-phase totally enclosed fan cooled and shall be suitable for operation in ambient air temperatures of 40°C.

Air discharge shall be vertical.

C.4.1.11 Ceiling Mounted Exhaust Fans

Ceiling mounted units shall be of "Fantech Vogue VRP" series or similar approved manufacture and shall incorporate a speed controlled single phase external rotor motor, sealed for life bearings, auto reset thermal protection and an axial impeller.

Fan housings shall be of PGI construction and shall be powdercoated.

Impellers are to be of PGI construction and shall be powdercoated. *Paint colour to be selected by the architect. Samples to be submitted for approval*

All other internal components are to be painted. *Paint colour to be selected by the architect. Samples to be submitted for approval*

C.4.1.12 Accessories

Accessories to be supplied with each fan shall be as detailed in the "Schedule of Performance" section of this Specification.

The nominated accessories shall be supplied by the manufacturer of the related fan.

Fan performance ratings shall be selected to allow for any losses resulting from the specified accessories.

C.4.1.13 Wire Guards

Fitted to fan inlet and/or discharges, shall be fabricated from galvanised steel, and shall be of robust construction so as to provide adequate personnel protection without detracting from the rated fan performance.

C.4.1.14 Bellmouth Entries

Shall be galvanised steel construction, shall be bolted to the casing flange at the fan inlet. Bellmouth entries shall be designed to limit the total pressure loss at the fan intake to 20% of the fan velocity pressure.

C.4.1.15 Weather-Proof Discharge Dampers

Shall be fabricated from galvanised steel, and shall be designed to ensure that rain does not enter the fan casing, or penetrate below the fan blades, at any time, whether the fan is operational or not.

C.4.1.16 Isolating Switches

Shall be provided for all roof mounted fans. Isolators shall have a minimum rating of 20 Amps and shall be of weather-proof construction. Dual motor fans or dual speed fans shall be provided with two isolating switches.

C.4.2 **Air Diffusion Equipment**

C.4.2.1 General

Air diffusion equipment shall be generally of the type nominated and in the location shown on the drawings.

Air diffusion equipment shall be selected to handle the scheduled air quantities at a noise level not exceeding NR35 when the areas are empty of personnel other than those engaged on the noise level tests.

External appearance and surface finish shall be subject to approval. Submit one sample of each type of fitting for such approval, prior to confirmation of orders for air diffusion equipment.

Liaise with all other trades to ensure compatibility of manufacture and installation of all air diffusion equipment with light fittings, T-bars, wall and ceiling penetrations, and any other relevant interfaces.

All interior parts of grilles, diffusers slots etc. shall be painted. *Paint colour to be selected by the architect. Samples to be submitted for approval.*

All air diffusion equipment shall incorporate concealed fixings and removable cores.

C.4.2.2 Related Specification section / document

- Ductwork Systems
- Noise and Vibration Control
- Painting, Finishes, and Identification
- Testing and Commissioning
- Maintenance
- "Air Terminal Schedule" on drawings

C.4.2.3 Applicable Standard / Code

Performance testing :

- ANIS / ASHRAE 70 – Method of testing the performance of air outlets and inlets.
- ANSI / ASHRAE 113 – Method for testing for room air diffusion.
- (ADPI) - Air Diffusion Performance Index– Select air diffusers for an index > 80
- ISO 3740:2000 - Acoustics - Determination of sound power levels of noise sources

C.4.2.4 Grille Finishes

All grilles, registers, diffusers, etc., within the building shall be colour anodized, baked enamel or paint finished in accordance with the Section "Painting". Colour will be advised by the Architect.

All grilles external to the building shall be anodised, baked enamel or painted to a selected colour.

C.4.2.5 Wall Mounted Supply Air Grilles / Registers

C.4.2.5.1 Sidewall Registers

Sidewall Supply Air Registers as listed in the schedule on the drawings shall be Holyoake Model or approved equal set to deliver the specified air quantities to the space as indicated taking account of spread and throw requirements.

Sidewall Registers shall be Double Deflection Registers of extruded aluminium construction, with 20mm True Airfoil Shaped individually adjustable Horizontal Front and Vertical Rear Blades of no greater than 20mm centre's. Double Deflection Supply Air Registers shall be finished in powder coat to an approved colour and fitted with accessories and dampers where indicated as manufactured by Holyoake.

C.4.2.6 Ceiling Mounted Return Air / Exhaust Grilles

C.4.2.6.1 Ceiling Mounted Return/Exhaust Grilles

Ceiling mounted "Egg crate" Return Air Grilles as listed in the schedule on the drawings shall be Holyoake Model EC125 or approved equal of aluminium construction. The "Egg crate" Core shall be 12.5mm x 12.5mm x 12.5mm and fitted in an extruded aluminium Flanged Frame and shall be supplied with removable cores, to allow the grilles to be easily removed for cleaning and maintenance.

"Eggcrate" Return Air Grilles shall be finished in powder coat to an approved colour and fitted with accessories and dampers where indicated as manufactured by Holyoake.

C.4.2.7 Weather-proof Louvres

Weather Louvres shall be Holyoake Model OHL-F/C-124 or approved equal and shall be supplied and installed by the Contractor, except where shown otherwise on the drawings.

Weather Louvres shall have straight profile 100mm louvred blades set at 76mm centres and constructed in a 107mm flanged (F) or channel (C) frame to suit the installation profile. Weather Louvres shall be of extruded aluminium construction and finished in natural anodised, powdercoat to an approved colour and fit with accessories and dampers where indicated as manufactured by Holyoake.

Louvres shall prevent the ingress of rain or water under all operating conditions and prevent direct line of sight.

Weather-proof louvres shall provide a maximum resistance to the rated air flow of 30 Pa at a face velocity of 2.5 meters per second.

C.4.2.8 Door Grilles

Door Grilles as listed in the schedule on the drawings shall be Holyoake Model DG32BFL or approved equal.

Door grilles shall be of extruded aluminium construction with sight proof double Chevron Blades together with purpose made telescopic backing flange with concealed fixing system. Door Grilles shall present a similar appearance when viewed from either elevation and be suitable for 30mm to 52mm doors. Door Relief grilles shall be finished in Natural anodised aluminium, powder coat to an approved colour.

Door grilles should be completely sight proof and have a minimum free area of 60%.

Door grilles shall be supplied by the Contractor, and fitted by others.

C.5 DUCTWORK SYSTEMS

C.5.1 Description of Systems

C.5.1.1 General

Provide ductwork and insulation systems in accordance with the requirements of this section of the specification. Read this section in conjunction with the "Insulation Systems" section of this specification.

C.5.1.2 Ductwork Types

All ductwork construction shall be suitable for the maximum operating pressures in the portion of the system under consideration.

Special consideration shall be given to the following applications:

- Flexible duct connections between branch ducts and cushion heads.
- Airtight masonry risers where clearly depicted as such on the drawings, shall be well sealed and lined to produce a smooth surface to reduce pressure drop

C.5.1.3 Insulation Types

All supply and return ductwork used to convey air for the purposes of heating and cooling shall be thermally insulated to comply with the minimum insulation levels specified in Section J5 of the current version of the Building Code of Australia (BCA).

Cushion heads and air boots shall be fully internally insulated as indicated on drawings.

Build up conditioner casings shall be internally lined on all faces, insulation and perforated metal facing.

NB: Where ductwork dimensions are indicated on drawings, the dimensions represent the minimum clear air way for the duct.

C.5.2 Ductwork Requirements

C.5.2.1 General

Unless otherwise specified, all ductwork, including but not limited to the use of flexible ductwork, shall be manufactured, installed and tested in accordance with Australian Standard "AS 4254 – Ductwork for Air Handling Systems in Buildings"

The associated drawings indicate the sizes of duct runs, registers, diffusers and the approximate position of duct runs. Actual position of duct runs shall be coordinated on site and shown on shop drawings, designed with least interference with the building structure and/or all other services.

Where ductwork is installed above ceilings that incorporate recessed fixtures; such as light fittings, speakers, smoke detectors, sprinklers heads and the like, the ductwork shall maintain a minimum clearance height of 200mm above the underside of the ceiling as well as provide adequate clearance above and around such fixtures to permit servicing, removal and relocation. Where this cannot occur, the areas of concern shall be brought to the Engineers attention.

C.5.2.2 Ductwork Dimensions

All ductwork dimensions shown on drawings are the minimum internal dimensions of the air passage eg. inside of insulation or acoustic lining where fitted.

If necessary, the duct dimensions shown on the drawings may be changed to obtain more economical sheet cutting or to avoid an obstruction, providing:

- The aspect ratio of the ductwork shall not exceed 4:1
- The ductwork shall be designed to have no less a capacity and no greater total frictional resistance than that of the original ductwork.
- Design approval is obtained prior to manufacture.
- The revised duct size will not obstruct the building structure or any other services to be installed.

C.5.2.3 Design

Where ductwork is represented in a "single line" format, and/or not fully represented on drawings (eg. obscured from a view), the Contractor shall provide a complete operating system of ductwork to handle the air quantities shown and specified. In these cases the duct system shall comply with the following:

- Unless otherwise specified, where duct dimensions are not shown ductwork frictional losses shall not exceed 0.8Pa/m and branch ducts connected to air outlets or intake grilles shall have a maximum velocity of 4 m/s.
- Ducts shall have swept radius bends, tapered transitions to minimise excessive air turbulence with the ductwork
- Adjustable balancing devices at all duct branches and air outlets, all as specifically shown on the drawings and/or detailed elsewhere in this section. Note: The contractor shall provide regular balancing dampers throughout the ductwork and shall not rely on the final balancing dampers at the main air outlets/inlets for the complete balancing of the air distribution system

Where ductwork is represented as single line, the required shop drawings shall be prepared, showing double lines, from such information. Fully detailed drawings may not be made available for this purpose.

C.5.2.4 Ductwork Classification

Each duct system shall be constructed for the specific duct pressure classification indicated below. Where the requirements of one or more variables are exceeded, the classification shall be scheduled to the higher pressure classification.

The pressure classifications for ductwork systems to be provided as part of the works shall be as follows:

Static Pressure			
Pressure Class	Operating Pressure Range, Pa		
125		≤ 125	
250	126		250
500	251		500
750	501		750
1000	751		1000
1500	1001		1500
2500	1501		2500

C.5.3 **Sheet metal Ductwork**

C.5.3.1 Materials

Materials used for the manufacture of the ductwork shall be in accordance with AS 4254. Special consideration shall be given to the manufacturing requirements for ductwork exposed to abnormal conditions including but not limited to:

saline atmosphere, chemicals, grease, high temperatures and pressures. Note the construction of the ductwork shall be suitable for the intended operation.

C.5.3.2 Ductwork Bracing

Support bracing shall be equally spaced between joints. The bracing spaces noted in the chart above indicate maximum distance between bracing and adjacent joint or bracing.

Angles and bracing shall be riveted to ducts and bolted joints shall be made with 8mm diameter galvanized steel bolts at 100mm maximum centres.

As an alternative to the angle braces noted above, ductwork can be manufactured using machined formed beading or cross breaking. This will be at the discretion of the Mechanical Engineer and the contractor shall seek approval prior to manufacture.

C.5.3.3 Joints

Where drive cleats are called for in the ductwork construction charts the drive cleats shall be a 'C' type cleat. The 'C' section of the cleat shall be 0.8mm thick galvanized sheet steel. Both the 'C' section and matching cleat shall be machine formed and free from buckles and waves. Corners of ductwork shall have GSS corner covers inserted into 'C' sections.

Drive cleats on medium pressure ductwork shall be sealed either side of 'C' section and corners with an approved duct sealant.

C.5.3.4 Flanged Joints

Where flanged joints are called for in the ductwork construction charts, the flanged joints shall be fabricated from the nominated size of rolled steel angles, with the duct ends turned up 10mm between the joint. Approved neoprene type gaskets shall be fitted during assembly of the joints with bolts required at corners and at 100mm (maximum) centres. All flanges shall be galvanized after manufacture.

Alternative flange joint profiles may be used subject to the approval of the consulting engineer. In this instance detail of gauges, profile, supports etc. shall be forwarded, however the alternative offered shall generally confirm to NATSPEC.

C.5.3.5 Longitudinal Joints

Longitudinal joints shall be Pittsburgh Lock Seam type joints. Clip Lock joints are not acceptable.

C.5.4 **Ductwork Supports**

C.5.4.1 General

Supports shall be provided to fix ductwork in position with adequate allowance for expansion and contraction. Wherever possible locate supports adjacent to cross joints in the ductwork.

Ductwork supports shall not be used to support piping, ceilings, electrical cabling or the like.

Where ductwork is supported from walls or where ductwork runs vertically, the ductwork shall be supported using gallows type brackets (to approval), at the centres specified for horizontal duct runs.

Where steel hanger straps are used to support ductwork the straps shall be arranged in pairs with tangs turned 90° under the duct and secured using pop-rivets. The straps shall be bolted to the supporting member using 10mm diameter bolts.

Where steel hanger rods are used to support ductwork the rods shall be bolted to the support member or fixed to the concrete slab over by means of "Terrier" expanding plug type fixings as applicable.

Where ductwork requires vibration isolation, details of the proposed installation shall be submitted for approval. Where ductwork comes in contact with supports or building structure, 6mm thick neoprene acoustical friction material shall be fitted to isolate ductwork from structure.

C.5.4.2 Rectangular Ducts

LONGEST SIDE DIMENSION (mm)	MINIMUM HANGER SIZE (mm)			HANGER SPACING (mm)
	STEEL ROD	STEEL STRAP	ANGLE	
UP to 600	6	25x1.6	25x25x3.0	2500
601 to 750	10	40x2.5	32x32x3.0	2500
751 to 1250	10	--	32x32x3.0	2500
1251 to 2500	12	--	38x38x5.0	1200
ABOVE 2500	16	--	51x51x5.0	1200

Where more than one duct is supported by the same rod or hanger, the size shall be determined from the sum of the longest sides of the individual ducts.

C.5.5 **Flexible Ductwork**

C.5.5.1 General

Flexible circular ductwork shall be constructed of reinforced aluminium strip or reinforced fabric, wound in a continuous interlocking spiral construction. Flexible ductwork for exhaust purposes can be uninsulated unless otherwise noted. All supply and return air ductwork is to incorporate 25mm thick insulation and a suitable outer sleeve vapour seal that is compliant with the following clauses. The outer sleeve of the insulation shall be drawn over the inter sleeve and secured using worm screw type draw band, PVC tape and foil tape.

The use of flexible ductwork shall be limited to low pressure systems. Where ductwork is used on medium pressure systems suitable duct sealant shall be applied to the collar before fitting the duct to the collar.

Flexible duct runs shall be as short and straight as possible, with a maximum length of 3 metres. Bends in flexible ductwork shall incorporate a bend centre line radius of not less than 1.5 times the duct diameter.

Sleeves used for joining two sections of flexible duct shall be a minimum of 100mm in length and collars to which the ductwork is attached shall be a minimum of 50mm in length. Secure the flexible duct to sleeve or collar using a worm screw type draw band, or approved equivalent. If the diameter of the sleeve or collar exceeds 300mm position draw band behind a bead on the metal collar or sleeve. Seal joints with 50mm wide minimum PVC tape and cover with foil tape.

Flexible ductwork shall be hung using 25mm wide hanging straps at 2m centres with the duct extended to 90% of its full length. Hanging straps may be glass fibre reinforced hanging tape or PGI. All flexible duct shall be supported a minimum of 150mm off the ceiling.

All flexible ductwork shall comply with the NCC .

Flexible ducting shall display maximum indices of Spread of Flame, zero (0) and Smoke Developed, three (3) in accordance with AS 1530.3, as referenced by AS 1668.1:1998.

The Contractor shall carry out testing of flexible ducting (to AS 1530.2) in the presence of the Engineer.

Flexible ductwork (both metal and reinforced fabric type) shall comply with all requirements of AS 4254. In addition, all aspects of the flexible ductwork installation including collars, sleeves, joints and suspension systems shall comply with all requirements of AS 4254. The bulk insulation, the duct care and the duct system (the assembled final product) shall all comply with the fire performance requirements of AS 4254 when tested in accordance with AS 1530.3 and the UL 181 burning test.

Manufacturer's test certificates shall be submitted for approval as part of the equipment schedule.

C.5.6 General Details

C.5.6.1 Trimming Angles

Where ducts pass through walls, floor slabs, ceilings, blanking panels, etc., the space around the duct shall be packed with fibretex blanket and approved 1.6mm GSS trimming angles shall be installed around the ducts to effect a neat finish.

Where penetrations are in view, trim openings with galvanized sheet steel with crimped edges screwed or riveted to the duct, painted to match adjacent surfaces.

All trimming angles shall be sealed airtight with mastic.

C.5.6.2 Weather flashings

Where ductwork penetrates roof structures and external walls and is exposed to weather, the Contractor shall make allowance for the provision of over flashings.

C.5.6.3 Dissimilar Metals

Where dissimilar metals are likely to generate electrolytic, galvanic or corrosive action separate by purpose made fittings manufactured in a suitable compatible material.

C.5.6.4 Flexible Duct Connection

Provide flexible connections wherever ductwork connects to fans and or conditioner casings, as indicated on the mechanical drawings.

Flexible connections shall be fabricated from heavy duty PVC fabric and shall provide a minimum free length of 100mm.

The flexible material shall be fixed to both attachments using galvanized steel strip or other approved methods and seal joints. Ensure that no part of the flexible connection protrudes into the air stream where such protrusion would be detrimental to air flow.

The connection shall be sufficiently slack to ensure free movement and vibration of the item of equipment under operating conditions. Misalignment between duct and equipment openings shall not be allowed.

Where flexible connections are exposed to weather, a weatherproof sheet metal cover that will not restrain the free movement of the flexible connection shall protect the connection.

Flexible connections between smoke spill fans and wall sleeves or ductwork shall be fabricated from woven heat resisting fabric in accordance with the requirements of AS 1668 Part 1. The flexible connections shall conform to the remainder of the notes above.

All flexible connections shall be arranged to permit the easy removal and replacement of the connections without disturbing the ductwork or plant and the easy removal of the equipment without disturbing the ductwork.

Flexible material shall not be painted.

C.5.6.5 Access Panels

Provide access panels where shown on drawings or where required for access to fire dampers. Fan motors, damper motors, etc. Except where prohibited by duct dimensions access panels shall be either manholes having a clear opening of 450mm x 600mm or handholds having a clear opening of 200mm x 300mm. Where this size is not possible, access panels of the side length of which is 50mm narrower than the side of the duct in which the handhold is located, shall be provided, subject to the approval of the consulting engineer.

Access panels shall be so constructed that no part of the access panel or cover shall project into the airstream and the cover when shut shall be flush with the inside surface of the duct.

Access panel shall be made from 1.2mm thick galvanised steel sheet. Panels shall be attached to the duct with self tapping screws, or where the sealing of the panel is designed to avoid cold-bridging, wedge type window sash catches may be used.

Where the duct is insulated the panel shall be insulated to the same thickness and to the same requirements as the duct. Where the insulation is inside the duct the surface of the panel insulation shall be flush with that of the duct.

On ducts carrying cooled air, the panel and the panel seal shall be particularly designed and constructed to avoid cold-bridging which will result in condensing on the outside of the duct. In these cases the particular design shall be submitted to the Engineers for approval.

Access panels shall be provided with rubber or neoprene gaskets fixed to either panel or frame. Panels shall be airtight when latched in the closed position.

C.5.6.6 Access Doors - Conditioners

Provide access doors where shown on drawings, adequately reinforced to prevent distortion, hinged so that internal air pressure holds the door closed.

Doors shall be sized as shown on drawing or if not indicated shall have a clear minimum opening size of 1350mm x 500mm.

Construction of doors shall be such as to prevent cold bridging. Doors shall be provided with matching galvanized steel frames securely attached to the duct ensuring that no part of the doorframe protrudes into the air stream where such protrusion would be detrimental to the airflow.

Provide sufficient clamping type latches and handles which can be operated from both inside and outside of the door.

Mechanically fix rubber or soft neoprene gaskets to either the door or frames. The door shall be airtight when latched in the closed position where fire rating is required use woven ceramic fibre material.

C.5.6.7 Hardware

Handles, latches, hinges and the like shall generally be galvanized or electro-zinc plated except where normally exposed to view or exposed to weather in which case they shall be chrome plated.

Bolts, nuts, washers, drop rods and self-tapping screws shall generally be galvanized or electro-zinc plated steel, or of stainless steel.

Rivets shall be expanding solid end type aluminium based alloy. Open head rivets shall NOT be allowed. Rivets shall be spaced at not more than 75mm centres.

Angles and bracing shall be riveted to ducts and bolted joints shall be made with 8mm diameter galvanized steel bolts at 100mm maximum centres.

C.5.6.8 Sealants Gaskets and Tapes - Ductwork

Sealants including liquid sealants shall be compatible with materials in contact and maintain an effective seal at the service pressure and have permanent elasticity and adhesion. Liquid sealants and mastic are not acceptable for sealing flange joints airtight, but may be used to make drive cleat and slip joints airtight provided the sealant or mastic is held in the joint by lapping metal surfaces or surfaces under compression.

Flange joints and other surface seals shall utilize neoprene gaskets to form an airtight seal. Gaskets shall generally be a minimum of 3mm thick adhesive backed PVC foam tape or rubber, resistant to age, fungi and the elements of weather.

The use of self-adhesive tapes shall be limited to flexible ductwork spigots and joints, in which case worm screw or drawband shall also be used. Where tapes are used they shall be a plasticised pressure sensitive type PVC tape, suitably applied to provide an air tight seal and aluminium foil tape suitably applied to provide the required fire rating.

All sealants, gaskets and tapes shall be non toxic under service conditions. Details of the type of sealants gaskets and tapes intended to be used shall be submitted to the consulting engineer for approval prior to use.

C.5.6.9 Duct Bends and Turning Vanes

All bends shall have an inside radius equal to or greater than 0.75 times the duct width. Where this is not possible, bends having a smaller radius shall incorporate one or more single skin turning vanes made from 1.2mm galvanized sheet steel, with 15mm long hem on the outside of the vane. Where square bends are used they shall incorporate double skinned turning vanes made from 0.8mm galvanized sheet steel. The turning vanes shall have the following spacing and inside radius.

Duct width up to 750mm - 50mm radius and 30mm between tips.

Duct widths Greater than 750mm - 100mm radius to 60mm between tips.

Length of vanes shall be limited to 900mm. Where vane lengths exceed 900mm, two vanes, of equal length shall be fitted incorporating a suitable interim support. Where bends are internally insulated, the vanes shall incorporate an end plate to sit on the face of the insulation being fixed using suitable spacers to ensure insulation is not compressed.

Where duct velocities exceed 7.5m/s all turning vanes shall have individual vanes lined with 1mm thick felt lining, securely fixed to the vanes using an approved sealant.

C.5.6.10 Tapers, Offsets, Obstructions and Restrictions

Where possible, tapers for transitions and restrictions shall be limited to a slope of 1:4 for converging air flow and 1:7 for diverging air flows. Where a change of shape retains the same cross-sectional area, tapers on converging air streams may be increased to 1:4.

Where tapers exceed the above internal splitters shall be positioned to bisect the angle between any side and the centreline of the duct. Tapers shall not exceed an angle of 45°.

Where possible, offsets shall be angled at a maximum of 15°. Where this is exceeded, offsets shall incorporate full radius bends. Where space limits the use of full radius bends, radius bends with turning vanes or square bends with turning vanes shall be used all to the approval of the consulting engineer.

If it is impossible to offset a duct around an obstruction the obstruction may be encompassed with a two-piece streamliner provided the streamliner does not decrease the duct area by more than 20%. An obstruction may pass through a duct and be in contact with the air stream provided it does not decrease the duct area by more than 20% or be subject to cold bridging.

All built in obstruction details are to be approved by the consulting engineer.

Where ductwork is restricted by building structure or limited space, the ductwork may be locally reduced to clear the obstruction provided that the reduction or duct area does not exceed 20%.

C.5.6.11 Ductwork on Site

During installation where ductworks is left more than eight hours without further work and/or awaiting commissioning all ducts and fan openings shall be sealed.

Where ductwork is stored on site for any period of time the ductwork shall be stored in a clean, dry and protective environment. Where ductwork is damaged by weather or other means, the ductwork shall be removed from site to be re-insulated or re-placed as directed by the consulting engineer, at no additional cost to the contract.

Before starting fans, all ducts shall be cleaned inside to the satisfaction of the Engineer.

C.5.7 **Dampers**

C.5.7.1 Volume Control Dampers - Ductwork

Dampers shall generally be of the multi-leaf opposed blade type with extruded aluminium blades inclusive of edge seals.

Volume control dampers shall be free of rattles, fluttering or slack movement and shall be capable of adjustment over the desired range without excessive self-generated noise or the need for special tools.

Dampers shall be fitted with a visible indicator to clearly show the position of the damper.

Blades shall be secured to spindles via locking keys. Spindles shall rotate in neat fitting nylon bushes or ball bearing races.

Mechanical linkages shall be provided for operation by control devices. Such control devices shall be sized and mounted to ensure correct operation of the dampers.

The selected damper actuators shall be submitted to the consulting engineer for approval.

Actuators shall be mounted to ensure maximum mechanical advantage. Mounting of actuators shall be rigid enough to prevent flexing or distortion of the ductwork or actuator mounting during operation.

All outside air intake dampers shall incorporate separate actuators and drives to enable independent operation of the areas of the damper associated with the minimum outside air requirement and the remainder of the damper.

Manually operated dampers shall be located in an accessible position for visual inspection, maintenance and adjustment.

Locking and adjustment to any position shall be provided using a lever and quadrant or adjustment rods. Position of dampers shall be clearly and permanently marked "open" or "closed".

All volume control dampers shall operate over the entire range of positions and affect a positive shut off seal without undue noise.

C.5.7.2 Fire Dampers and Smoke Dampers

Fire dampers shall be of an approved type and installed at all locations where the ductwork passes through a fire rated structure. The general location of all fire dampers shall be as shown on the drawings and/or where

Fire dampers shall be constructed and installed to meet the requirements of the Australian Standard Code AS 1682 and AS 1668, Part 1 and to requirements of Local Authorities. The manufacturer will be required to submit evidence that the dampers conform to the above requirements.

Fire dampers shall be 1.60mm galvanised steel in ducts up to 450mm diameter or greatest width, 2.50mm on diameters up to 900mm or greatest width, and 5.0mm on ducts above 900mm diameter or greatest width. Where multi-blade dampers are used they may be constructed of 1.20mm steel provided the individual blade is not wider than 150mm and is stiffened by formed edges.

Fire dampers shall be arranged to close automatically and remain tightly closed upon the operation of an approved fusible link, located where readily affected by an abnormal rise of temperature in the duct.

Fire dampers shall be installed with access panels located in the ductwork, arranged to provide access to the fusible link and spring locking catch for servicing and inspection.

The damper blades shall have self aligning sintered bronze bearings pivoting on stainless steel stub shafts.

Fire dampers shall be permanently, legibly and indelibly marked in accordance with Australian Standard AS 1682.

A smoke damper shall be a fire damper whose closing action is initiated by the detection of smoke.

Curtain Fire Dampers and Smoke Dampers

Curtain-type fire dampers shall be purpose designed to restore the fire resistance of a wall or floor. The interlocking blades shall be mounted in a guide channel to facilitate ease of installation in ductwork. When in the open position, the blades shall be stored outside the air stream.

Each damper shall be tested for correct operation with the ventilation system running at normal speed to ensure adequate torsion in the coiled spring

Motorised Fire Dampers and Smoke Dampers

Multi-leaf steel dampers shall be employed for the prevention of the spread of fire and/or smoke through ducted air systems, or between plenums. The dampers shall be self contained and externally operable by electric or pneumatic actuator; constructed to comply with AS 1668.1 and AS 1682.1. The actuator shall be of the fail safe (spring return) type with the spring tension capable of returning the damper to the fail safe position with

Low Radiation Fire Damper

Low Radiation (LR) Fire Dampers shall be designed to impede the spread of fire with the building compartments. The dampers shall have low leakage insulated damper blade assembly with blade tip sealing ring forms a solid barrier against flame, smoke and hot gasses. Complying with AS/NZS 1668-1. All LR Fire Dampers shall be certified for a 4 hour rating in a masonry wall and a 2 hour rating in a plasterboard wall.

C.5.8 Conditioner Casings

Conditioner casings include all supply and return air plenum chambers, enclosures, and air passages between the air inlets, heating and cooling coils and fans.

All casings shall be arranged substantially as shown on the drawings but may be modified to the extent required to suit the particular type and size of air handling equipment offered and supplied.

All casings enclosing air handling equipment shall be installed on concrete floors or plinths or floating slabs which serve as the bottoms, as shown on the accompanying drawings. The sides and tops shall be constructed in sheet metal in accordance with the following requirements, unless specifically shown on the accompanying drawings to the brickwork or concrete.

All casings, including doors and other details, shall be of best quality Galvabond steel panels, not less than 2mm thick and rigidly braced with galvanised steel angles.

All casing sheets shall be formed into dished panels with 25mm or 50mm deep stand-up edges (whichever is necessary to fully accommodate the insulation required) and 15mm deep returns. All corners of dished panels shall be welded.

All bracing angles shall be not less than 50mm x 50mm x 50mm thick galvanised mild steel angle.

All panels shall be bolted together with galvanised bolts and nuts at not more than 150mm centres.

Casings shall be fixed to floors and walls with not less than 50mm x 50mm x 5mm thick galvanised sheet metal channel. The channel shall be bolted to the floor at not more than 300mm centres with masonry type anchors. Panels shall be fixed to the channel at not more than 150mm centres with galvanised bolts and nuts.

All joints shall be made airtight with "Tremtape" or approved equivalent sealing strips neatly and accurately installed. Caulking compound shall not be used in any visible or exposed location. Completed conditioner casings shall be airtight and rigid and in all respects satisfy the performance requirements of the specification.

Any excess deflection, rattling, flexibility or other fault shall be corrected to approval.

All necessary penetrations for wiring to the motors and lights etc. within the casing shall be provided in liaison with the appropriate electrical Sub-Contractor and made good after installation of the wiring.

All conditioner panels including doors, discharge plenums and fresh air plenums shall be insulated in accordance with the "Insulation Systems" section of this Specification.

C.5.9 Fire Rated Ductwork – External Wrap

Fire rated ductwork shall be sheet metal ductwork with "FyreWrap" external insulation.

Insulation shall be installed as per manufacturers Installation guidelines for given size, nominally:

Ductwork Less than 600mm	-	Steel Banding
Ductwork 600mm – 1200mm	-	Steel Banding & Pins on bottom edge
Ductwork Greater than 1200mm	-	Pins on all 4 sides

Steel Banding shall be installed 40mm from the edge of the FyreWrap Blanket and on 265mm centres.

Pins Shall be Pre-welded or Cup Head Pins, installed at 200mm centres.

Joins in pieces of ductwrap shall overlap by a minimum of 75mm.

C.5.10 Supply Air Cushion Heads

Cushion heads shall be constructed of Galvanised Sheet Steel (GSS), fully externally or internally insulated to prevent cold bridging minimum internal dimension of cushion heads shall be 500 x 500 in plan, 400 high where clearance permits.

C.6 NOISE AND VIBRATION CONTROL

C.6.1 Noise Criteria & Measurement

The installation shall be supplied, installed and commissioned so as to generate noise levels not exceeding the requirements of AS/NZS 2107.

Noise level measurements shall be recorded and reported with details of sound pressure levels in each octave band mid frequency from 63Hz to 4000Hz inclusive. The locations shall be selected and approved prior to measurement. Provide

calibrated measurement equipment. Measurement of sound pressure levels shall be taken during conditions of peak equipment load when the building is unoccupied.

Noise measurements shall comply with AS 1045, AS 1081.1, AS 1469C, AS 1055, AS 1217. No measurement shall be taken closer than 1500 mm to any outlet or item of equipment, and not closer than 1000mm to any ceiling, wall or floor surface.

C.6.2 Noise Control

In order to maintain the specified noise levels, ensure that sound power levels of equipment shall not exceed the limits defined in the Schedule of Performance, and shall take all necessary precautions in the layout and installation of duct systems and air diffusion equipment to comply with the above requirements.

In addition, supply and install ductwork acoustic insulation, silencers and/or attenuators where shown on the Drawings and as detailed in the "Equipment" and "Schedule of Performance" sections of this Specification.

C.6.3 Vibration Control

All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

All vibration isolation mounts required for equipment, pipe work, ductwork etc shall be as manufactured by Mason Industries, or Embelton. All isolation materials shall be supplied by the same manufacturer.

Make and model of vibration isolators shall be nominated on shop drawings. Static deflection required in Schedules shall be the true static deflection, measured in situ, with true load.

All vibration isolators must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.

Coordinate work with other trades to avoid rigid contact with the building.

Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.

C.6.4 Submittal Data Requirements

The manufacturer/supplier of the installed vibration isolation systems shall provide submittals for products as follows:

- Descriptive Data:

- Schedules of flexibly mounted equipment, referencing drawings by number.
- Catalogue cuts or data sheets of vibration isolators.
- Drawings:
 - Submit details of equipment bases including dimensions, structural member sizes and support point location
 - Submit details of isolation hangers for ceiling hung equipment, piping and ductwork.
 - Submit details of mountings for floor supported equipment, piping and ductwork.

All hanger, mounting or pad drawings shall indicate deflections and model numbers as well as any other requirements in the specifications.

Spring diameters, rated loads and deflections, heights at rated load and closed height shall be provided for all springs shown in the submittals in tabular form.

C.6.5 Spring Isolators

Spring isolators shall be free standing and laterally stable without any housing and complete with a moulded neoprene cup or 1/4"(6mm) neoprene acoustical friction pad between the base plate and the support. Isolators shall provide means of levelling.

All mountings shall have levelling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLF, as manufactured by Mason Industries, Inc or equal and approved.

C.6.6 Neoprene Isolators

Neoprene isolators shall have a minimum static deflection of 9mm. All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment to compensate for the overhang. Mountings shall be type ND or rails type DNR as manufactured by Mason Industries, Inc or equal and approved.

C.6.7 Neoprene Pads

Standard ribbed neoprene pads shall provide a minimum static deflection of 1.5mm. Increased static deflection may be achieved by stacking the pads. All neoprene pads shall be oil and ozone resistant. Loading of ribbed neoprene pads shall be within the manufacturer's ratings and in any case shall not be greater than 400kPa.

C.6.8 Pipe Vibration Isolation

All piping in plant rooms shall be supported with pipe hangers using approved neoprene rubber vibration isolators.

C.6.9 Double Deflection Neoprene Rubber Isolators

Double deflection neoprene, rubber isolators shall be "Mason Industries" or "Embelton" or approved equivalent.

Neoprene isolators shall have a minimum static deflection of 9mm. All metal surfaces shall be neoprene covered to avoid corrosion complete with friction pads both top and bottom. Bolt-holes shall be provided as required.

C.7 PIPEWORK, VALVES AND FITTINGS

C.7.1 Description of Piping

C.7.1.1 General

Provide complete operating pipework systems as described as follows and as shown on drawings complete with all necessary fittings, supports, sleeves, valves, etc.

Provide all minor components required for a complete installation, unless specifically excluded.

All pipework systems shall be suitable for its respective service under the actual operating conditions of temperature and pressure.

Piping shall be arranged in a workmanlike manner, true to alignment and grade. Misaligned or sagging pipes will not be accepted.

C.7.1.2 Reference Standards

All pipework systems shall comply with the following standards:

- AS 1074 Steel Tubes And Tubulars For Ordinary Service
- AS 1167.1 Welding And Brazing - Filler Metals - Filler Metal For Brazing And Braze Welding
- AS 1260 PVC-U Pipes And Fittings For Drain, Waste And Vent Applications
- AS 1345 Identification Of The Contents Of Pipes, Conduits And Ducts
- AS 1477 PVC Pipes And Fittings For Pressure Applications
- AS 1769 Welded Stainless Steel Tubes For Plumbing Applications
- AS 1796 Certification Of Welders And Welding Supervisors
- AS 2032 Installation Of PVC Pipe Systems
- AS 2566 Buried Flexible Pipelines – Structural Design
- AS 3500 Plumbing And Drainage
- AS 4041 Pressure Piping
- AS 4130 Polyethylene (PE) Pipes For Pressure Applications

C.7.1.3 Insulation and Sheathing Schedule

Insulation details are specified in the "Insulation Systems" section of this Specification.

Chilled water and heating water:

- Insulate all pipework, valves, fittings, excluding pumps.
- Metal clad all insulation where exposed to view in plantrooms, accessways. Metal clad all valve boxes.

Condenser Water, Mains Water, Drains, Vents:

- Insulation not required.

Refrigerant Piping:

- Insulate all suction pipework, on reverse cycle units insulate suction and liquid lines.
- Metal clad all insulation where exposed to view in plantrooms, accessways. Metal clad all valve boxes.

Drains:

- Insulation not required except in ceiling spaces.
- Insulation shall be foam type 13mm thickness.

C.7.2 Pipework Design and Installation

C.7.2.1 Design

The drawings indicate the sizes of pipes and the manner in which the various systems are to be run. They do not necessarily show all the minor pipework bends and offsets included in the contract.

The final design shall be co-ordinated with other trades and services, measured on site where possible, and ascertained from architectural and trade drawings of the project.

Where possible, the Contractor shall adhere to the piping layout indicated. Where this is not possible, due to the type and arrangement of the particular equipment to be installed, approval shall be obtained to manufacture or installation.

Pipework shall be installed to approval to suit the building structure and to avoid interference with other trades.

The piping installation shall be in accordance with best modern practice, taking into account grading, venting, safety, thermal expansion stresses, expected movement.

C.7.2.2 Refrigeration Pipework

The drawings indicate the piping routes for the various refrigeration systems. Refrigeration pipework shall be sized to suit the equipment offered allowing for pressure drops as follows:

Liquid line	0.5°K
Hot gas line	1.0°K
Suction line	1.0°K

Refrigerant piping, valves and accessories shall conform to the equipment manufacturer's requirements.

Isolating valves shall be provided to permit dismantling and removal of the plant without disturbing piping layouts.

C.7.2.3 Installation Drawings

Pipework installation drawings shall be prepared and submitted for approval prior to purchase of equipment, and installation of pipe systems.

Drawings shall show all minor components, drains, vents, oil traps, gradients, supports, and co-ordination/interface items. All proprietary brand components shall have make/model shown. Valve schedules shall be provided with the drawings or incorporated on the drawings.

C.7.2.4 Installation

Provision shall be made for the expansion and contraction of pipes so that they will remain aligned and will not be damaged due to build up of stresses or cause damage to other equipment or structures.

Where pipes run close to walls, floors or ceilings, a minimum distance of 50mm shall be maintained between the pipes or their insulation and the nearest surface.

Pipes shall be positioned such that all valves, controls, etc. installed are readily accessible and can be easily and properly operated.

Piping shall be site stored in a manner to prevent penetration of moisture and foreign matter and shall be thoroughly cleaned of all burrs, fur and scale before erection.

All connections to equipment shall be installed with flanges or unions to facilitate installation and maintenance, and to comply with the requirements of the equipment manufacturer.

C.7.3 **Pipework Types**

C.7.3.1 Copper Pipework – Water

Pipes

Copper pipework shall be of "as drawn" seamless copper tube complying with the requirements of AS 1432 and AS 1571.

Pipe wall thickness to AS 1432, TYPE B tube.

Jointing

Select from the following except where a specific jointing method is documented:

- Silver brazed capillary joints (no size limitation).
- Brass flanges with brass nuts and bolts (no size limitation).
- Screwed brass unions: $\leq$ DN 50.
- Flare compression joints: $\geq$ DN 20 and only where visible and where no vibration occurs.
- Proprietary grooved joints Victaulic or approved equivalent (no size limitation).

Silver soldering shall be carried out in accordance with SBA 115. Flux shall be thoroughly washed off after soldering.

Fittings

Capillary fittings including adaptor capillary fittings with threaded ends or compression-type connector ends: To AS 3688, of copper or dezincification-resistant copper alloy.

Compression fittings including adaptor compression fittings with connector-ends for screwed or capillary joints: To AS 3688, flared type, of copper or dezincification-resistant copper alloy.

Unions: Bronze, proprietary manufacture, with ground or accurately machined face joints.

Flanges: Brazing metal to AS 2129. Expand pipes into flanges and braze.

Bends and tees: Provide sweep tees and long radius type bends. Centreline radius of bend or tee branch: ≥ 1.5 times the pipe diameter.

All connections to equipment on piping over 50mm diameter shall be flanged. Flanges shall be to Table E dimensions, fitted with ring gaskets.

Flanges on piping shall be of bronze and all flange bolts shall be cadmium plated. All connections to equipment on piping 50mm diameter and below shall be made using approved heavy duty compression union fittings.

All reductions in pipe shall be made using standard fittings. No reducing flanges, bushings, etc. will be permitted without approval.

Pipe branches from main lines shall be radiused into the main lines. Standard tees shall be avoided.

Pipe bends in the main plant area where limited space is available may have a throat radius equal to the pipe diameter. Pipe bends in other areas shall, where possible, have a throat radius equal to 2.5 times the pipe diameter.

Permanent joints

General: Provide brazed slip joints. Provide either capillary fittings, or expand one pipe over the other leaving a minimum clearance and an effective overlap.

Slip joint overlap table

Nominal pipe size, DN	Overlap (mm)
$\geq 15, < 20$	12
$\geq 20, < 32$	15
$\geq 32, < 50$	25
$\geq 50, < 80$	30
$\geq 80, < 125$	35
$\geq 125, < 200$	40

C.7.3.2 Copper Pipework - Refrigerant

Pipes

Copper pipework shall be of "as drawn" seamless copper tube complying with the requirements of AS 1432 and AS 1571.

Pipe wall thickness to AS 1432, TYPE A tube.

Fittings

Fittings in copper piping shall be capillary fittings of copper alloy to AS 3688.

Jointing

Joints in copper piping, unless otherwise noted, shall be silver soldered.

Silver soldering shall be carried out with SBA 115 or approved equivalent. Flux shall be thoroughly washed off after soldering.

C.7.3.3 Steel Piping

Steel pipe for closed systems

If water in the system does not come into contact with the atmosphere while circulating, provide pipe to one of the following standards:

- AS 1074.
- BS EN 10216-1.
- BS EN 10217-1.
- API Spec 5L.
- ASTM A53/A53M.

Pipe for aerated systems

If water in the system comes into contact with the atmosphere while circulating, provide seamless pipe, or welded pipe to API Spec 5L Grade B.

Jointing

Select from the following except where a specific jointing method is documented:

- Black steel pipe:
 - Butt welded.
 - Welded-on flanges.
 - Proprietary grooved joints.
- Galvanized steel pipe:
 - Screwed and socketed up to 50 mm size.
 - Galvanized screwed flanges.
 - Proprietary grooved joints.
 - Underground pipe: Welded and hot dip galvanized after fabrication to AS 4680.

Fittings

Welded pipe: Butt weld fittings (e.g. bends and tees).

Bends and tees: Provide sweep tees and long radius type bends.

- Centreline radius of bend or tee branch: ≥ 1.5 times the pipe diameter.

Type: Provide sweep tees and long radius type bends.

Steel for fabricated pipe fittings: Same grade and wall thickness as the pipe.

Non-vertical lines: Provide eccentric reducing fittings installed to avoid gas binding, liquid retention or both.

C.7.3.4 Stainless Steel Piping

Pipe to ASTM A312/A312M, or spiral butt welded from stainless steel sheet. Grade 316L.

Wall thickness:

- Piping $\leq$ DN 150: At least 1.6 mm.
- Piping $>$ DN 150, $<$ DN 305: At least 2 mm.

Outside diameter tolerance: ± 1.5 mm.

Joining

General: Select from the following except where a specific joining method is documented:

- Butt welded.
- Welded-on flanges.
- Proprietary grooved joints.

Fittings

Material: Stainless steel of the same grade and wall thickness as the pipe.

Unions: Grade 316 stainless steel, proprietary manufacture, with ground or accurately machined face joints.

Flanges: Angle face rings, galvanized steel backing flanges and reinforced neoprene gaskets. Fabricate so that only stainless steel or the gasket material is in contact with the fluid within the pipe.

Bends and tees: Provide sweep tees and long radius type bends.

- Centreline radius of bend or tee branch: ≥ 1.5 times the pipe diameter.

Hardware: Provide stainless steel nuts bolts and washers of the same grade as the pipe.

Welding

General: Fully butt weld using gas tungsten arc welding process. Passivate joints after welding.

C.7.3.5 ABS Piping

Pipes and fittings to AS 3518.

Installation to AS 3690.

Solvent cement and priming to AS 3879.

Joining

Permanent joints: Solvent cement.

Demountable joints:

- Piping $\leq$ DN 50: Threaded fittings.
- Piping $>$ DN 50: Flanges with backing rings.

C.7.3.6 PVC Piping

Unplasticised pipes and fittings (UPVC): To AS 1477.

Solvent cement to AS 3879.

Installation to AS 2032.

Jointing

Permanent joints: Solvent cement.

Demountable joints:

- Piping $\leq$ DN 50: Threaded fittings.
- Piping $>$ DN 50: Flanges with backing rings.

C.7.3.7 High Density Polyethylene (HDPE) Piping

Pipes to AS 4130.

Fittings to AS 4129.

Components to AS 4131.

Installation to AS 2033.

Jointing

Permanent joints:

Electrofusion welded to Plastics Industry Pipe Association of Australia "POP001: Electrofusion Jointing of Pe Pipe and Fittings for Pressure Applications" and to AS 4129.

Demountable joints:

- Piping $\leq$ DN 50: Threaded fittings.
- Piping $>$ DN 50: Flanges with backing rings.

C.7.4 Pipe Supports

C.7.4.1 General

Provide support systems including hangers pedestals, saddles, anchors, and guides to adequately secure and align pipes, restrain internal forces and expansion/contraction stresses.

Steel supports shall be hot dipped galvanised after fabrication. Proprietary systems of supports may be utilized. Bolts shall be galvanised for applications exposed to the weather, and may be cadmium plated for internal applications. Fabricated supports shall be detailed on the installation drawings. All pipe supports to be approved by heritage consultant where the support are fixed to timber structure.

Parallel groups of pipes shall be run on common supports in neat groups.

Pipework shall have spring hangers on at least the first two (2) hangers from any item of rotating/reciprocating machinery.

C.7.4.2 Support Spacings

Pipe support spacing shall not exceed:

PIPE SIZE Nominal (mm)	SUPPORT SPACINGS (mm)		
	Copper Pipe	Steel Pipe	Non-Metallic Pipe
10 and 12:	1200	1500	800
15 to 40:	1500	2000	1200
50 to 65:	2500	3000	1500
80 to 125:	3000	4000	2000
above 125:	4000	5000	2500

Support spacing shall be sufficiently close to enable pipe systems to have continuous fall to vents/drains.

Provide hangers and brackets within 300 mm of changes in direction.

Hanger rods shall be 10mm for pipe up to 50mm diameter, 12mm for pipe up to 100mm pipe diameter and 15mm for pipe above 100mm diameter.

C.7.4.3 Support Details

Where pipe lines are insulated, pipe clamps shall be placed on the outside of the insulation. At each clamping point a suitable ferrule shall be provided, ferrule size to match insulation thickness.

Where pipes are not insulated, direct contact between dissimilar metals shall be prevented by means of approved separating gaskets. Refer to typical detail drawings as the reference for typical pipe support detail.

C.7.5 **Vents, Drains, Minor Fittings, Sleeves**

C.7.5.1 Penetrations, Sleeves

Provide pipe sleeves at all wall, floor or roof penetrations. Sleeves shall be type A copper where pipes pass outside the building, and may be 3mm thick PGI for internal penetrations.

Insulation shall be continuous through the sleeve. The gap between the outside of the insulation (or pipe, if bare) shall be sealed airtight with high density insulation. Where fire rating is required, high temperature mineral wool packing shall be used.

Where pipes penetrate floors, the sleeves shall extend 75mm above the floor level, for waterproofing.

Suitable trimming collars shall be installed around all pipes where they pass through walls, ceilings or concrete slabs.

C.7.5.2 Vents and Drains

Pipework shall be installed to grade to air vents and drains to enable complete pipework systems to be rapidly vented on commissioning, and fully drained for maintenance.

Gradients shall be 1:500 minimum, with pipes rising in the direction of flow where compatible with other requirements.

Provide air vents to all high points in water systems and drains at all low points so that there can be no possibility of air locks and the system can be drained easily.

Air vents shall be of the "Spirax" automatic float type. Isolation gate valves shall be installed between each air vent and the main pipe and 15mm drain lines shall be run from each vent to nearest drain point.

Drains in the water circulating systems shall consist of 20mm valved drain-offs with hose bib attachment threads.

Drain lines shall be run to waste in 20 diameter copper and shall be provided with screwed unions to facilitate cleaning.

C.7.5.3 Gauge Cocks and Thermometer Pockets

The Contractor shall supply and install all thermometer pockets and gauge cocks as shown on the drawings and as further required for adjusting and setting the controls.

Gauge cocks shall be brass bodied 13mm ball valves with stainless steel ball

Thermometer or sensor pockets in piping 38mm diameter or less shall be installed in a 300mm long expanded section of pipe shall (to avoid excessive pipe velocities around the pocket), with eccentric reducers.

Pockets shall be installed at an angle of 30 degrees to the pipe axis trailing in the direction of flow.

Pockets shall project a minimum of 44mm beyond any pipe insulation and shall be threaded to suit.

C.7.6 **Valves**

C.7.6.1 Refrigeration Service Valves, General

All valves shall be of Heldon or equivalent approved manufacture.

Valves shall be of brass construction suitable for the specified refrigerant, as appropriate.

Valves shall be suitable for operation at the test pressures specified in the SAA Refrigeration Code.

C.7.6.2 Refrigeration Services Valve Types

Permitted valve types for the refrigeration services shall be as follows:

Isolating Valves -	All Sizes	Packed back seating key operated type.
Solenoid Valves -	All Sizes	Low pressure drop type.
Pressure Relief Valves -	All Sizes	Bursting disc or fusible plug type.

C.7.6.3 Refrigeration Service Liquid and Moisture Indicators

Liquid and moisture indicators shall be installed in each refrigerant system and/or prior to each expansion valve. Liquid and moisture indicators shall be of Hudson or approved equivalent make.

C.7.6.4 Refrigerant Expansion Valves

Refrigerant expansion valves shall be of "Danfoss" or approved equivalent make.

C.7.6.5 Refrigerant Dryers

Refrigerant dryers shall be installed in each refrigerant system.

Dryers shall be of the Hudson in line type. And shall be installed parallel to a valved bypass line to facilitate renewal of the dryer.

C.7.6.6 Refrigerant Strainers

Refrigerant strainers shall be Heldon Y full flow type or approved equal.

Isolating valves shall be located on either side of the strainer.

Screens shall be readily removable.

C.8 INSULATION SYSTEMS

C.8.1 Description

C.8.1.1 General

Provide complete systems of acoustic and thermal insulation where required in the drawings and other sections of this Specification.

Insulation shall be applied by skilled trades persons. Materials shall be protected from dust and moisture on site, and shall be selected to be compatible to adjacent surfaces, and shall not promote corrosion.

Insulation systems shall be protected from deterioration due to exposure to moisture and sunlight.

Insulating materials used within buildings shall comply with all requirements of AS 1668 Part 1, and shall particularly have:

- A spread of flame index number no greater than 0.
- A smoke developed index number not greater than 3.

Both as determined in accordance with AS 1530 Part 3.

C.8.1.2 Extent of Ductwork Insulation

Refer "Ductwork Systems" section of this Specification for insulation requirements and thickness and refer also system drawings.

C.8.1.3 Extent of Pipework Insulation

Refer "Pipework Systems" section of this Specification for insulation requirements, thickness, and cladding.

C.8.2 Ductwork Insulation

C.8.2.1 Internal Insulation

Internal insulation shall be "Bradford Supertel" semi-rigid fibreglass batt of 32kg/m³ density or approved equivalent.

The insulation shall be placed on the inside of the duct with adjacent sides overlapping at all corners and with all joints tightly butted. All joints in insulation panels shall be made with a minimum 50mm lap of foil in the direction of air flow to prevent the air stream lifting the leading edge.

All raw edges of insulation shall be covered with "Sisalation 450", wrapped around and glued on with an approved adhesive.

Insulation shall be held in position by means of studs spot welded to the inside of the ducts and plastic coated speed clips at approximately 300mm centres. At all duct corners, insulation shall be held in position by means of longitudinal 50mm x 50mm x 1mm GSS corner angles.

All joints in insulation shall be covered with a 100 mm wide strip of sisalation 450 glued on with a suitable adhesive.

The following table sets out minimum internal insulation performance:

Minimum R-Value (m ² kW)	Nominal Thickness (mm)
0.8	25
1.0	38
1.5	50
2.0	75

C.8.2.2 External Insulation

External insulation shall be “Bradford Multitel” semi-rigid fibreglass batt of 18 kg/m³ density or approved equivalent.

Insulation shall be fixed with adhesive to ductwork, and held in place with aluminium band strapping at 450mm centres.

Insulation shall be applied with edges tightly butted up against adjoining insulation to form a final continuous blanket around the duct. Joints shall be sealed with 100 mm wide “Sisalation 450” tape, fixed with an approved adhesive.

The following table sets out minimum external insulation performance:

Minimum R-Value (m ² kW)	Nominal Thickness (mm)
0.7	25
1.0	38
1.5	55
2.0	75

C.8.2.3 Insulation Facing

Where nominated as “**Perforated Foil Faced**”, the insulation shall be faced with “Bradford Thermfoil HD Perf” factory bonded, double sided, fire resistant, perforated, reinforced aluminium foil or approved equivalent. Maximum air velocity: 18 m/s.

Where nominated as “**Foil Faced**”, the insulation shall be faced with “Bradford Thermfoil HD” factory bonded, double sided, fire resistant, perforated, reinforced aluminium foil or approved equivalent. Maximum air velocity: 18 m/s.

Where nominated as “**Matt Faced**”, the insulation shall be faced with “Bradford Ultraphon” factory bonded fibreglass tissue or approved equivalent. Maximum air velocity: 22 m/s.

Where nominated as “**Perforated Metal Faced**”, the insulation shall be sheathed internally with 0.6 mm thick galvanised perforated steel, securely fixed by means of approved metal clips, screws and bolts. All edges of the

perforated metal shall be covered with corner angles, channels, etc. to eliminate rough edges and present a smooth surface to the air flow. Perforated metal shall incorporate 3 mm diameter holes occupying not less than 14% of the surface area

C.8.2.4 Internal Insulation - Acoustic Requirements.

Acoustic properties of the insulation systems shall be as follows:

Reverberation room method to AS 1045:

Insulation:	Nominal Absorption Coefficients at:				
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz
Matt faced:					
- 25mm thick:	0.10	0.39	0.79	1.00	1.05
- 50mm thick:	0.30	1.01	1.31	1.20	1.05
Perforated foil faced:					
- 25mm thick:	0.12	0.28	0.68	0.94	0.81
- 50mm thick	0.23	0.71	0.99	1.09	0.97
Perforated metal clad:					
- 25mm thick:	0.14	0.29	0.71	0.99	0.81
- 50mm thick:	0.20	0.73	1.00	0.99	0.89

C.8.2.5 Conditioner Casings, Air Handling Rooms, and Masonry Shafts

Conditioner casings shall be internally insulated throughout with 25mm or 50mm thick insulation: Refer "Ductwork" section for insulation thickness and facing material.

Air handling rooms and Masonry shafts shall be insulated where specified, with 25mm or 50mm thick insulation. Refer "Ductwork" section for extent of insulation, thickness and facing material.

Insulation shall be semi-rigid fibreglass or mineral wool batts of at least 32 kg/m³.

Batts shall be faced with either:

- Perforated metal: 0.6mm thick perforated PGI with 3mm holes giving 14% free area, over black scrim faced batts;

OR

- Aluminium foil faced: perforated, factory bounded, double sided, "Sisalation 450" or approved equivalent.

Note that foil faced insulation shall be lined with perforated PGI to a height of 1500 mm AFL to prevent mechanical damage.

Batts shall be held in place by 0.8mm thick PGI angles and channels. Channels shall be spaced at no greater than insulation sheet width (i.e. 1200mm or 1500mm) and shall also be provided at all edges and corners.

Foil faced batts shall be fixed with adhesive and with proprietary drive pins.

No insulation shall be fitted closer than 100mm above floor level to avoid contact with moisture.

C.8.3 Pipework Insulation

C.8.4 Flexible Elastomeric Foam Insulation

Flexible foam insulation may be utilised where specifically permitted on the insulation schedule (refer "Pipework" sections).

Insulation shall:

- Be compliant with R values outlined in BCA Volume 1 Spec J5.4.
- Have closed cell construction inherently vapour sealed type.
- Be "Armaflex", "Bradflex", "Aeroflex" manufacture.
- Be slip-on style (not slit).

Have butt joints fully glued to each face and the pipe. Adhesive shall be as recommended by insulation manufacturer. Taped joints not allowed.

- Be applied in lengths 10% greater than pipe length to allow for shrinkage.
- Have cork ferrules at supports, glued as for insulation.

Metal sheath or paint as specified for conventional insulation.

Insulation bends over short radius pipe fittings shall be made using oversize insulation, mitre cut.

Insulation run externally shall be painted and provided with sheet metal weather covers, or shall be fully metal sheathed and silicone mastic sealed.

C.8.5 Metal Cladding of Pipe Insulation

Sheet metal cladding shall be fabricated from either of the following materials:

- 0.6 thick or greater galvanised steel sheet, from full size standard sheets. Cladding shall be finish painted as per section "Painting and Finishes".
- 0.8 thick or greater best quality bright aluminium from full size standard sheets. Surface of aluminium need not be finish painted if clean bright finish is maintained throughout construction, and cleaned after commissioning.

Sheet metal shall be neatly cut and rolled to the required sizes with beaded transverse joints and applied to provide tight fitting jackets with not less than 30 wide lap joints. Longitudinal joints shall be staggered and faced away from view. All joints shall be made with self-tapping screws spaced at not more than 100 intervals, such that they do not impair the vapour sealing of the insulation.

Metal sheathing for pipe bends and curved equipment surfaces shall be in the form of lobster back segments joined together with self-tapping sheet metal screws spaced at frequent intervals.

All joints exposed to weather or located in moist locations, shall have all joints fully soldered or sealed with a silicone mastic of suitable grade.

Where protruding through external walls or floor slabs all metal cladding shall be double flashed with fully soldered joints.

All flanges, valves and associated pipe fittings shall be insulated as for the particular pipework system involved and shall be complete with readily accessible covers suitable for maintenance purposes, manufactured from sheet metal of the same type as that used for cladding of adjacent pipework.

Covers shall be made in two halves and shall be completely removable and fastened with quick release catches. Line with pre-formed insulation having same thickness as specified for adjacent piping and shall be completely vapour proofed where required for the system.

C.9 AUTOMATIC CONTROLS

C.9.1 General

Controls shall be generally of the electronic type, as manufactured by Satchwell, Staefa, Honeywell, or approved equivalent, interconnected by electric relay logic.

All control systems shall be designed to optimise simplicity of each control loop, and facilitate maintenance and fault-find procedures.

Controls shall in general be of one make throughout and installed in full conformance with the manufacturers instructions.

C.9.2 Control Systems

- Supply, install and commission all automatic and manual controls for the control systems listed below:
- VRV/VRF systems including external condensers and associated single zone fan coil units complete with supply air fan, valves, cooling coils, heating coils, filters and modulating economy cycle control dampers.
- Toilet exhaust systems.
- Fresh air supply systems
- Kitchen exhaust systems.
- Kitchen makeup air systems
- Temperature indication.
- Miscellaneous works.

C.9.3 Control Sequence

The air conditioning plant has been designed to operate on a 12 hour daily cycle during week days with the provision for late night trading and Saturday morning trading.

C.9.3.1 VRV/VRF Systems serving multiple single zone fan coil units

The fan coil units shall be operated from room mounted controllers and A/C manufacturers central controller and adjustable to suit the tenant's normal operating hours.

One space temperature sensor in the zone shall be wired to a controller which shall modulate the heating and cooling capacity.

A maximum temperature set point of 24°C and a minimum temperature set point of 21°C shall be required. In order to maintain these conditions the controls system shall initiate heating/cooling in order to maintain these conditions. Priority should be given to maintaining temperatures below 25°C where a conflict arises.

If the temperature is within the 21-25°C degrees band and relative humidity is below 50%. The FCU shall shut down. If the temperature is out of the band or humidity has increased above 50% the FCU shall start up for a period of 20min (adjustable).

Morning warm up cycle shall be initiated by the central time schedule 30min(adjustable) prior to the ventilation system starting up.

C.9.3.2 Toilet Exhaust Systems

Toilet exhaust systems shall operate under the dictates of a time clock. Toilet exhaust systems shall be arranged to change-over to the standby motor in the event of a failure of the duty motor. The exhaust systems shall be linked to the central AC controller.

C.9.3.3 Fresh Air supply Systems

Fresh Air systems shall operate when the associated air handling unit or supply air fan operates. Fresh air systems shall be arranged to change-over to the standby motor in the event of a failure of the duty motor. The supply systems shall be linked to the central AC controller.

C.9.3.4 Temperature Indication

The following temperature sensors are required to input multi-point temperature indicator/s. The multi-point temperature indicator/s shall be mounted in the MSSB.

The following temperature indication points are required:

- Supply air temperature (off coil) for each SAF and FCU.
- Return air temperature for each SAF and FCU.
- Zone temperatures one point for each zone of each SAF and FCU in an approved location.
- Ambient temperature.
- 4 spare indication points.

C.9.4 **Fixed Speed Fan Coil Unit Sequence**

The fan coil unit sequences shall be enabled under time schedule control and/or interlocked via tenancy local A/H switch.

C.9.4.1 Valve Control

Room temperature shall be maintained via sequencing of CHW and HHW control valves to maintain supply air temperature necessary to offset room load. Cascaded P-PI control loops shall be employed for control of room temperature and duct temperature respectively.

C.9.4.2 Outdoor Air Flow Rate Control

Outdoor air quantities are to modulate to maintain AS 1668.2 requirements under part load conditions. Each air-handling unit is to be fitted with a separate modulating minimum outside air damper with velocity probe. The BMCS shall modulate the damper to maintain constant outside air quantities into each system. The outdoor air quantity control sequence shall be disabled in economy cycle and overridden by CO₂ mode operation.

Outdoor air quantities are to modulate to maintain CO₂ concentration at less than 600ppm nominal. CO₂ sensors in the return air duct will modulate R/A and O/A dampers of each Air Handling Unit.

C.9.4.3 Warm Up Cycle

The warm up cycle sequence shall be energised when space and return air temperatures are below 20°C and ambient temperature is below 17°C. The sequence shall operate as follows:

- The economy cycle outside air and relief air dampers closed and return air damper open.
- The chilled water valve closed.
- VAV boxes shall operate in a reverse acting mode during warm up and shall modulate the VAV box air quantity based on set point deviation.
- Fan coil heating valve modulates to provide fixed leaving temperature.

The warm up mode shall be de-energised when space and return air temperature is at set point.

C.9.4.4 Tuning Items:

- Supply Air Temperature Max & Min
- CO₂ Setpoint

C.9.5 **Supplementary outside air fan sequence**

The control sequence shall be as follows:

- Outside-air fan system energised by terminals provided to each floor. Terminals to be located in control panel adjacent duct riser.
- Outside air variable speed fan motor to modulate speed fan motor to modulate to control duct static pressure at set point (nominally 50Pa) via input from duct static sensor.

C.9.6 **Fire Mode Control - Shutdown**

The basis of the building's fire mode control is system shutdown.

To this end a fail safe fire signal is hard wired to each MSSB to interrupt the control circuit power.

All actuators associated with motorised dampers are to be spring return type and are to close on power failure.

In addition, the BMCS is to be programmed to shutdown all Mechanical Services plant on receipt of a fire signal. Actuators associated with motorised dampers are to be driven shut.

C.9.7 Proprietary Controls – Air Conditioning Units

Each fan coil unit is to be provided with a proprietary wired controller mounted within the space served. Controllers are to provide as a minimum:

- Temperature Control
- Mode Control
- On/Off Control
- Temperature Indication
- Fault Indication

C.9.8 Proprietary Controls – Centralised Controller

A centralised controller is to be installed with the following functionality:

- All on/off – except comms room unit
- Group Temperature Control
- Time Schedules
- Fault Indication

Central controller is to provide 1 hour run timers outside of normal operating hours.

Contractor is to allow to reprogram controller twice to suit client's requirements.

C.9.9 Local Push Button A/H Control Sequence

Provide a standard switchplate for local pushbutton after hours switches (2 per floor). Switchplate to be appropriately labelled with engraved lettering and be complete with neon indicator to indicate unit running (including during normal operation). Switchplate to match Electrical Services switchplates.

Activation of the push button outside of normal hours runs the related ventilation or air conditioning system for a programmed time until the end of that selected period. Further activation of the push button switches the system off.

C.9.9.1 After Hours Request Log

The building management system shall record and log all calls for after-hours air conditioning. Each call for air conditioning shall record:-

- The floor and zone of air conditioning requesting air conditioning.
- The time of the call.
- The duration of the plant run engaged.

The system shall recognise and log multiple simultaneous requests for cooling.

A monthly report on the extent of after-hours cooling should be easily output from the BMS system.

C.9.10 Alarms

Alarms shall have individually adjustable time delays. The alarm must be present for the delay period before being registered. User ID and Rectification actions must be recorded with each alarm disable/acknowledgement.

- Fan(s) started and status not confirmed.
- Pump(s) started and status not confirmed.
- Chiller(s) started and status not confirmed (to be ignored if the chiller is on recycle).
- Chiller failure.
- Space temperature at 5°C above set point.
- Any fire alarm.
- All other alarms specified.

C.9.11 Variable Speed Drives

Provide high level interface to each variable speed drive to provide monitoring and control of:

- Start/stop.
- System static pressure.
- kW.
- Speed.
- kWh.
- Hour run.
- Run status
- Alarm and fault history.
- Number of starts

C.9.12 Spare Points

Allow for 10% spare points on each device for future expansion.

C.9.13 Specific Items and Control Functions

The following specific control items and functions, together with minor components necessary to meet the intent of the Specification, shall be included in the tender.

C.9.13.1 General

- Power failure and fire alarm restart time delays for all plant ensuring correct sequence starting and adequate time delays between large motor starts.
- Phase failure under voltage protection relays for each switchboard.

- Energy Meters complete with digital display for switchboards.
- Manual-off-auto (MOA) switches for each item of plant.
- Air flow proving switch/s connected across the suction and discharge of all the exhaust fans, supply air fans and fan coil units to provide fan "run" and "fault" status and control interlocks.
- Run and fault lights to all items of plant.
- Provision of all control cabling to Hydraulic Services meters.
- Provision of variable frequency fan drives complete with 4-20mA (or 0-10V) input signal for speed control.
- Direct wired electric controls to MSSB's for fire alarm shutdown (refer fire mode control).
- Installation of all controls actuators, controllers, velocity probes etc., on all VAV boxes.
- Installation of pressure tapings, temperature sensor pockets and minor piping for sensors.
- Installation of all control valves, damper actuators, limit switches, etc.
- Interlocks to shut down all plant and equipment on receipt of a fire shut down signal.

C.9.14 Principal Instruction and Training

Provide the Principal with a terminal, standard software and software instructions as soon as possible for familiarisation.

Provide a training course for the Principal nominated representatives, run by experienced and competent training personnel familiar with this specific installation.

Three courses shall be run, one immediately prior to Practical Completion, two after Practical Completion, run at times suitable to the Principal. Each training course shall be of sufficient duration and content to enable personnel not familiar with the BMCS to become competent in all aspects of its operation. Each course shall consist of at least 4 x 4 hour sessions and shall include extensive hands on operation by the Principals representatives.

Respond promptly to any queries from the Principals personnel on operation and programming of the BMCS and allow for revisions/upgrade etc to programming during the Defects Liability Period.

C.10 ELECTRICAL FOR MECHANICAL SERVICES

C.10.1 Standards

The electrical works form mechanical services shall comply with Local Authority requirements, AS/NZS 3000 and the recommendations of SAA HB301.

Fire and mechanical performance classification: To AS/NZS 3013.

Selection of cables: To AS/NZS 3008.1.1.

Distribution cables: To AS/NZS 4961.

Testing: To AS/NZS 3017.

Low-voltage switchgear & control gear: To AS 60947.

C.10.2 Extent of Work

Supply and install all switchboards, switchgear, protective devices, control equipment, motors, wiring, cabling, cable enclosures and supports as necessary for the safe, convenient and efficient operation of the air conditioning, heating and ventilation installation.

This section should be read in conjunction with the "AUTOMATIC CONTROLS" Section of this specification.

C.10.3 Power Supply

Power supply to the installation will be three phase, four wire, 415/240V, 50Hz Multiple-Earthed Neutral (MEN) System. All equipment supplied as part of this Contract shall be suitable for the actual voltage and frequency available.

The load on each switchboard and sub-main cable shall be balanced as far as possible over the individual phases of the supply.

C.10.4 Mechanical Services Switchboards

C.10.4.1 General

Supply and install Mechanical Services Switchboards (MSSB's) as specified and/or listed in equipment schedules and/or shown on drawings.

The Contractor shall advise his switchboard manufacturer of the size of sub-mains being run to each board and whether top or bottom entry in order that adequate space and provision for termination is made.

C.10.4.2 Construction

Switchboards shall be sized to accommodate any physical restraints such as cupboard size or clearance from adjacent equipment.

Switchboards shall be of modern design manufactured using current techniques and practices.

The power distribution and control sections shall be separate compartments within the common enclosure with separate escutcheons and doors.

The power distribution section shall contain all fuses, circuit breakers, bus-bars, contractors, starter switches, relays, etc.

The control section shall contain all electric controllers, relays, gauges etc.

Essential services distribution and control equipment shall be located in a separate section of the switchboard incorporating a solid fire resistant sheet metal barrier between the essential and non-essential sections.

Ammeters, indicating lights, hour meters, MOA switches and similar manual controls and indication equipment shall be mounted on fixed head panels across the top of the switchboard.

All sections of the switchboard except the head panels shall be provided with hinged access doors.

All switchboards shall have spare space to accommodate at least 15% additional future equipment, that is, 15% spare space shall be provided for additional power distribution equipment, control equipment and head panel equipment.

Switchboards shall be adequately ventilated.

Sheetmetal cubicles, frames, brackets, door escutcheons, etc. shall be of machine folded and welded construction, from first class quality furniture steel mounted upon a fully welded channel iron base with "toes" turned outwards.

Unless otherwise specified, all switchboards shall not exceed 2100mm in height when fixed into position on site.

All metal work shall be rigid, symmetrical and neat in appearance with all visible joints filed and ground smooth.

Doors, escutcheons and panels shall be of not less than 1.6mm and shall have double turned edges for rigidity. Cubicles and brackets etc. shall be of not less than 2mm.

All hinged panels and removable sections shall close onto resilient full hollow perimeter rubber seals to exclude dust - such seals being fixed within deep channel frames around the perimeter of all openings and arranged so as to be reasonably compressed at all points when the panel is secured.

Doors shall have lift off type 135° swing hinges and shall be fitted with lever type handles fitted with barrel locks. All locks shall be keyed alike. Hinges shall be chrome plated brass with steel pivot pins and plastic bearing washers.

Where lift-off access panels are provided they shall incorporate two lifting handles and a centrally located (on vertical centre line of panel) dowels and receptacles to assist in locating the panel on the main frame of the cubicle.

Any exposed screw fixings on front panels, doors or covers shall be terminated with chrome plated "acorn" nuts or knurled headed captive screws depending upon the necessity or otherwise for ready access.

Escutcheons shall be fitted with knurled captive thumb nuts with screwdriver slot and fibre washers and with two "D" type handles located centrally top and bottom of each escutcheon.

Cable, ducting and covers shall be fabricated and finished as for, and to match switchboard cubicles. All hardware shall be chrome plated externally and chrome or cadmium plated internally. After fabrication metal work shall be cleaned of rust, scale, oil, etc., primer etched, undercoated and painted with two coats of good quality enamel, colour to be advised upon request.

Note: Internal surfaces shall be finished in white, high gloss only.

The final finish shall be free from blemishes, orange peel effect, weld and metal finishing marks.

The Contractor shall take all necessary precautions to ensure that paintwork is not damaged.

At Practical Completion any scratches or damage shall be properly rubbed down and repainted to a finish and appearance as good as the original.

C.10.5 Equipment in Air Conditioning Switchboards

C.10.5.1 Fuses

Only where specified shall, circuits shall be protected by fuses. Fuses shall be of the HRC type, fitted with HRC fuse cartridges of the correct size. Fuses shall be "English Electric" Red Spot Series or similar approved.

Fuses shall be sized to provide discrimination.

Six spare cartridges for each fuse cartridge size used shall be provided in each switchboard in a fuse cartridge box fixed to the inside of the switchboard door.

C.10.5.2 Motor Protection and Starting

All motors shall be protected from low voltage, single phasing and overload on any phases.

This shall generally be achieved by means of motor starters with correct size thermal overloads and appropriate auxiliary contacts. Motor starters shall be Sprecher and Schuh, Telemecanique, Siemens or similar approved and shall be of one make and type throughout.

In addition all motors larger than 20kW shall incorporate thermistor type protection with thermistor sensors buried in the motor windings and connected so as to de-energise the motor if winding temperatures get too high.

Additional protection shall be provided for special motors as recommended by the equipment manufacturer (eg., 3 pole inverse time magnetic overload relays for refrigeration compressor motors).

Operation of any motor protection device shall initiate illumination of the appropriate fault indicating light.

Electric motors may be started direct on line (DOL) except where indicated otherwise or as required by the Supply Authority. All motors over 4.0kW shall have reduced voltage starting conforming with the requirements of the local electrical Supply Authority.

Auto transformer starters shall be of the 2 stage closed transition Korndorfer type with definite time/acceleration control and shall be fitted with an extra time relay which shall disconnect the starter in the event of the unit failing to complete the starting sequence within a pre-set time.

Transformer windings shall be fitted with over temperature sensing units arranged to disconnect the appropriate starter in the event of the transformers over-heating.

Closed transition Star Delta starters shall be complete with transition resistors, timers, contactors and control all complying with the requirements of AS 3947.1:2001. Starters shall be rated for a minimum of 4 starts per hour and shall include anti-short cycle timers.

Part winding starters shall be rated to suit the refrigeration compressor requirements and shall incorporate the following items:

- Start-run delay timers.
- Thermistor protection to motor windings.
- Magnetic overload protection.
- Start-run changeover failure protection.
- Further safeties previously specified.

Accept responsibility for selection of the correct type and for correctly setting all motor starting and protection equipment.

C.10.5.3 Rotary Switches

All automatically operated equipment, including air handling fans, exhaust fans, pumps, refrigeration compressors and the like shall be provided with a Manual-Off-Automatic (MOA) rotary switch on the relevant switchboard's head panel.

Rotary switches shall be cam-operated type with switch positions arranged with displacement of 60°. The "Off" position shall be located at the 12 o'clock position. Test positions must spring return to off position.

Rated operational current: At least 6 A at 230 VAC.

Escutcheon plates: Provide rectangular plates securely fixed to the assembly panel. Identify switch position and function.

Rotary switches shall be Draus and Naimer, Telemechanique or similar approved.

C.10.5.4 Indicating Lights

Standard: To AS 60947.5.1.

Indicating lights shall be of the Light Emitting Diode (LED) type mounted on the switchboard head panel; colour generally as listed below (unless colour notations listed elsewhere - e.g., "Controls"):

Green	-	Equipment on.
Amber	-	Fault.
Red	-	Equipment Off or Auxiliary functions (as specified)

All equipment supplied from each switchboard shall be provided with Red (on) and Amber (fault) indicating lights.

The amber light shall be illuminated in the event of any fault such as operation of protective devices, failure to start and the like occurring for the relevant piece of equipment.

Provide LED indicators (12 or 24 Volt as necessary) in corrosion-resistant bezel, nominal 25 mm diameter.

Provide a common press-to-test lamp push-button on all MSSB's.

C.10.5.5 Ammeters

An ammeter with an associated phase selection switch shall be provided for each piece of equipment rated in excess of 50kW.

Selector switches: 4-position type with positions designated R/W/B/OFF. Mount under or beside relevant ammeters.

Ammeters shall be of the moving iron type, oil dampened for motor starter circuits, 100mm square, Crompton Parkinson "Inifax" or similar approved with appropriate scale.

Ammeters shall be connected via current transformers, and shall be marked with a red line to indicate the normal maximum running current as determined during commissioning.

C.10.5.6 Time Switches (Where BMS Not Installed)

Time switches shall be of digital type, 365 day, multi-channel with at least 24 hour battery reserve, Digi Model SC150 or similar approved.

Programme the time switch to control equipment as directed.

Provide instructions for the time switch mounted in a suitable holder in the switchboard.

C.10.5.7 Wiring

The line side connections to all protection equipment shall be made with high conductivity, hard drawn copper bus-bar.

Each bus-bar shall have sufficient capacity to carry the full connected load plus 50% without exceeding a temperature of 40°C.

All bus-bar work shall comply with BSS 159-1957.

Circuit wiring through switchboards shall be contained in slotted side PVC duct.

Elsewhere PVC cables shall be neatly laid up, laced and fixed where necessary.

Cables terminating on bolts or studs shall be fitted with compression type cable lugs.

Adequate provision shall be made on all switchboards for the neat termination of all incoming and outgoing cables, conduits and troughing.

Crimp type solderless lugs shall be used for all main, sub-main and neutral cable terminations.

All main and submain connections made electrically within the switchboards shall incorporate anti-vibration "Belleville" washers or approved equal to prevent bolted connections and termination from working loose.

Switchboards shall be fitted with multi-way, neutral link bar and shall incorporate an earth bonding bar.

Switchboards shall be completely wired in the factory with outgoing and incoming control cabling terminating at a multi-gang Wieland terminal block, and with all wiring clearly identified in accordance with "as installed" drawings.

C.10.5.8 Labelling

A typewritten schedule showing the phase and number of each fuse and the equipment supplied by each shall be fitted in a clear plastic fronted metal frame fixed on or near each switchboard.

All equipment in head panels (indicating lights, rotary switches and the like) shall be identified by engraved traffolyte labels.

All remaining equipment, including motor starters, contactors and the like shall be identified with appropriately engraved traffolyte labels fixed to panels using screws.

Labelling external and internal shall be standard lettering on white background using laminated traffolyte with bevelled edges. The labels shall be fixed to the sheetmetal panels using screws. Adhesive labels are not acceptable.

Any equipment, fitting or accessory on a particular board which is energised or controlled by equipment on another board shall be permanently labelled to that effect in an approved manner.

All incoming and outgoing circuit and control wiring and cabling shall be identified WITHOUT EXCEPTION using clip-on type ferrules. Identification shall be in accordance with the final approved "as installed" wiring diagrams and/or drawings.

C.10.6 **Wiring**

C.10.6.1 General

All cable shall be unconditionally guaranteed and such guarantee shall cover replacement of faulty cable and full reimbursement of all costs involved.

Unless otherwise specified all cable shall have copper conductors and V75 grade PVC insulation, and sheathed where required as set out below.

TPS (Thermoplastic Sheathed) cables shall be used in the following situation:

- In accessible ceiling spaces.
- In underground conduits.
- In wall cavities, stud walls and door mullions.
- In skirting ducts, floor ducts and other cable duct systems.

- Where required by the Supply Authority.

In ceiling spaces, TPS cables shall be clipped to the roof structure or slab at a maximum distance of 900 between clips.

Elsewhere, unless otherwise specified, TPS or PVC insulated cable shall be installed in conduit.

In all cases every cable shall be installed in a manner such that it is replaceable at any time without damage to the building. Any wiring installed with kinks or abrasions shall be replaced. No joints shall be permitted in cables between terminations.

Cables shall be sized in accordance with AS 3008.1.1:1998 including allowance for voltage drop and derating factors as applicable.

The minimum size conductors for power supplies shall be 2.5mm² and for control cabling 1.5mm².

Groups of cables shall be installed on approved zincanneal cable trays.

C.10.6.2 Cable

MICS cable shall be used for all essential and emergency power and control cabling.

MICS cables shall be fixed by means of brass or copper clips or saddles secured by brass pins or screws which will not cause electrolytic corrosion with the cable or the support to which it is fixed.

MICS cables shall be properly dressed into neat and symmetrical runs.

Ensure that an adequate spacing is maintained between MICS and PVC/PVC cables for heat dissipation.

One full loop of MICS cable neatly formed and supported shall be provided adjacent to termination at a piece of equipment.

C.10.7 **Conduiting**

Generally class B rigid PVC conduit shall be used except where exposed to mechanical damage or sunlight, such as externally and in plant rooms, where galvanised screwed steel conduit or GWP shall be used.

PVC sheathed flexible Kopex conduit shall be used to enclose final connections to equipment.

The minimum size conduit shall be 20. Except where conduit size is specified, conduits shall have capacity for one additional circuit.

Conduits, unavoidably exposed shall be run square and plumb with building lines and as directed by the Engineer.

All conduit ends and boxes shall be plugged in an approved manner until permanent fittings are installed. The Contractor shall be present at all times when concrete containing conduit is being poured.

Conduit in concrete shall be installed in accordance with AS 14800-1974 Section 5.4.

Unless otherwise specified, no conduit fittings other than deep conduit boxes, couplings and unions shall be installed in concrete.

To change direction conduits shall be set.

Flexible joints shall be made at right angles across concrete expansions joints. The ends of the conduit shall be kept 19mm apart (across the joints) and belled to form a firm sliding fit inside a larger size conduit sleeve (200mm long

minimum). The sleeve shall be taped to conduits with "Scotchrap" to prevent ingress of slurry to the expansion joint. PVC accessories shall be used wherever possible.

Unless otherwise specified all joints in PVC conduit shall be welded.

One make of conduit, fittings and welding solution shall be used throughout.

Conduit boxes shall be proprietary units with conduit access facilities.

All joints in galvanised conduits and water pipe installations shall be made waterproof by use of "Thread Seal Tape" or similar.

The ends of conduits shall be internally reamed clear of sharp edges and projections.

C.10.8 Equipment Isolating Switches

All items of equipment containing motors, including motors themselves shall be connected via an isolating switch located adjacent to the equipment in an accessible location.

Isolating switches shall be of Clipsal manufacture or similar approved.

C.10.9 Motors

All motors, unless otherwise specified, shall be three phase, squirrel cage, induction type and shall comply with AS 1359 and AS 1360.11:1980.

All motors shall be designed to operate on the power supply available and shall be suitable for operation without overloading or overheating in ambient temperatures up to 43°C.

Where motor sizes are specified herein these are minimum sizes only except where indicated otherwise.

Motors shall be MEPS certified.

C.10.10 Variable Speed Drives

The preferred fully compliant VSD is the VLT HVAC Drive FC102 manufactured by Danfoss. Alternative VSDs, fully compliant with the following specification may be considered.

The VSD shall be contained within a minimum IP54 fully integrated enclosure incorporating all the accessories necessary to meet this specification without using a secondary enclosure.

The VSD shall be selected based on operating in a maximum peak ambient temperature of 50°C at its nominal current rating. To ensure continued operation of the plant during times of extreme ambient temperature conditions it shall be capable of operation at reduced performance in temperatures from -10°C to +55°C.

C.10.10.1 Electromagnetic Compatibility

Harmonics – The VSD shall incorporate a dual DC link choke harmonic filter. VSDs with AC input chokes, swinging DC chokes or small DC link capacitance designs are not acceptable alternatives.

Radio Frequency Interference - The VSD shall be CE marked in accordance with the European Union EMC Directive legislation and C-Tick marked in accordance with Australian Communications Authority (ACA) regulations. Within its enclosure the VSD shall include a radio frequency suppression filter to ensure compliance with the conducted emission requirements of IEC 61800.3 2nd Edition 2004 with 50m motor cable as below:

Category C1 for powers ≤90kW

Category C2 for powers >90kW

C.10.10.2 High Level Interface

The VSD shall have proven high level interface capabilities with BMS systems to include Johnson Controls Metasys N2, Siemens Apogee FLN (P1), Modbus RTU, LonWorks FTP and BACnet MSTP.

As standard the VSD shall provide the following minimum programmable I/O points:

- 6 x digital inputs
- 2 x digital outputs (provided by relays with changeover volt free contacts (rated for 240V AC) and on/off delay timers)
- 2 x analogue inputs (each selectable for voltage or current signals, direct or reverse acting, with the minimum and maximum range independently scaleable from 0-10V DC and 0-20mA)
- 1 x analogue output (0/4-20mA)

The VSD shall have the facility to expand its I/O capability through the addition of option modules including the facility to provide Pt1000/Ni1000 temperature sensor inputs and 0-10V DC analogue outputs.

It shall be possible to read the status of all digital and analogue inputs (including those on I/O expansion modules) via the high level interface making them available as remote inputs for the BMS.

It shall be possible to control all digital and analogue outputs (including those on the I/O expansion modules) via the high level interface making them available as remote outputs for control by the BMS. When controlled by the BMS in the event of the high level interface network failing the digital/analogue outputs shall override to a programmable default condition/value.

C.10.10.3 Controls

The VSD shall include a full 3-zone, 3 setpoint, 3 feedback PID controller as standard with the ability to auto-tune the PI terms and shall incorporate a flow compensation function to dynamically adjust the setpoint based on flow.

The VSD shall have three additional auto-tune PID controllers which can provide setpoint reset or control damper and valve actuators in the system.

The output voltage to frequency ratio shall be suitable for fan and centrifugal pump control. An automatic energy optimization function shall be incorporated to dynamically optimize the voltage to the motor throughout the operating range.

C.10.10.4 Chiller Variable Speed Drives

Where there is a requirement for variable speed chillers elsewhere in this specification the VSD supplied for chiller control shall comply with all paragraphs of this Variable Speed Drives section. The VSD shall have the capability to run the compressor type used in the chiller, be programmable for an output voltage to frequency ratio suitable for the compressor type and include an automatic energy optimisation function to dynamically optimise the voltage to the compressor motor throughout the operating range.

C.10.10.5 Auto Tune

The VSD shall be able to automatically tune itself to the motor to optimise motor performance and efficiency, improve start capabilities and compensate for motor cable variances. This function shall be carried out with the motor at standstill (i.e. without spinning the motor) and without the need to decouple the motor from the driven load.

C.10.10.6 PC Connection

The VSD shall have a standard USB port for direct connection of a PC to the VSD. The manufacturer shall provide PC software to enable the as commissioned configuration of the VSD to be simply saved and documented through the USB port. It shall be possible to communicate to the VSD through this USB port without interrupting VSD communications to the BMS via the high level interface.

C.10.10.7 Keypad & Display

The VSD shall incorporate a keypad with LCD alpha-numeric and graphical backlit display providing the following:

- Hand-Off-Auto keys to start and stop the VSD and determine the source of control. It shall be possible to disable these keys or password protect them from undesired operation.
- Reset key to enable local/manual resetting of alarms.
- "Info" key to provide "on-line" context sensitive assistance for programming and troubleshooting.
- Password protected keypad providing two levels of password protection.
- Display five simultaneous meter displays/operating variables.
- Display setpoints and feedbacks (e.g. static duct pressure or condenser water return temperature) in appropriate engineering units (e.g. Pa, kPa, bar, mbar, in WG, psi, °C, °F).
- Display the value of each analogue input and output for system setup and troubleshooting.
- Display the status of each digital input and output for system setup and troubleshooting.
- Display of plant equipment identification name/number (e.g. AHU-B-4, SCHWP-3)

C.10.10.8 Fire Mode Control

Fire safety function. The VSD shall have a digital input which can be used to override all other local or remote commands in the event of a fire command from the fire safety system.

The VSD shall display Firemode whenever this input is active.

The VSD should be programmable such that depending on the application and system design the fire command should force the VSD into one of the following operating states:

Start and run, or continue to run, at a speed in the forward direction.

Start and run, or continue to run, at a speed in the reverse direction.

Stop

The speed/setpoint at which the VSD shall run when the fire command is active should be set by either a dedicated programmable preset reference or defined analogue input signal. All other preset references or analogue input signals should be ignored.

The VSD should be programmable to allow operation in either open loop or closed loop, using its internal PID controller, when the fire command is active.

When the fire command is active the VSD should operate as per the programmed function above overriding all of its warnings and alarms and motor protection features in order to secure continued operation until such time that the fire command is manually overridden or that a fire has rendered the VSD inoperable.

C.10.10.9 Fault Conditions

To meet different application and system design requirements the reaction of the VSD to serious fault conditions, such as earth fault or short circuit fault on the VSDs output, should be programmable to the following:

- The VSD should trip but then continuously attempt to automatically reset and restart, even if that risks potential damage to the VSD
- The VSD should trip but require a manual reset

To enable testing of the fire system without overriding the VSDs warning and alarm protection systems, it shall be possible to programme the VSD to temporarily respond to alarms as per normal operation when the test fire command is active.

C.10.10.10 Password Protection

All VSDs used as part of the fire safety system shall be configured to require a password before any parameter changes can be made.

C.10.11 **Conditioner Lighting**

Provide conditioner lighting as shown on the drawings. Light fittings shall be of a weather proof type, similar to "Vandalite" or approved equivalent.

Light fittings shall be surface mounted with spacers to allow for insulation thickness.

Lighting shall be controlled via weather-proof heavy duty switches fitted with neon indicators. Each compartment door shall be provided with a switch.

C.10.12 **Wiring Diagrams**

Wiring diagrams for the complete installation and shop drawings for each switchboard shall be submitted to the Engineer for approval prior to any manufacture of installation.

After the installation is complete, the Contractor shall prepare "As Constructed" wiring diagrams.

The non-fading print of each wiring diagram shall be neatly backed with 9mm chipboard and framed under glass and shall be mounted in an approved position in the chiller plantroom.

Additional non-fading prints of the wiring diagram shall be provided with the Operating and Maintenance Instructions covered elsewhere in this Specification.

Wiring diagrams shall be prepared by experienced and competent draughtsmen.

C.10.13 **Conformity**

The standard and type of electrical work shall generally be in conformity with the electrical work carried out by the Contractor in the remainder of the building.

The Electrical Contractor employed by the Mechanical Services sub-contractor shall issue certificates covering his work independent of the general electrical contract for the building.

C.10.14 Testing

The complete installation shall be tested to ensure that it complies with the specification and that it operates correctly under normal, emergency and fault conditions.

All control, protection and indicating equipment shall be tested for correct operation.

Test the complete installation in compliance with SAA Wiring Rules "Testing of Installation" and other relevant clauses.

Such tests shall include:

- Insulation between conductors.
- Insulation between conductors and earth.
- Continuity resistance of conduit systems.
- Earth resistance of connected equipment.

The Contractor shall provide all necessary testing equipment and any costs involved shall be borne by the Contractor.

C.10.15 Switchboards

C.10.15.1 Switchboard General Details

All MSSB's	
Fault Levels (These are minimum ratings. High rating may be applicable as noted in the 'Schedules of Performance' section of this specification.	Chiller MSSB: 15 kA All other MSSBs: 10 KA
Form of separation	Chiller MSSB: Form 3b minimum Other MSSBs: Form 2
IP Rating:	IP51 (unless noted elsewhere in this specification)
Mounting:	Wall (max 1.5 square metres) or floor mounted to suit space available.
Maximum voltage drop on final sub-circuits:	2%
Indicator Light Type:	Extra low voltage high brightness cluster type LED
Indicator Lights Required:	Green (on) and red (fault) for all motors and heaters including each on stage for 2 speed motors and each stage of heating Amber for fire alarm relay operation where applicable
Indicator Light test facility	Common press-to-test button operating via relays
Manual-off-auto rotary switches	Required for all motors and heaters including each on stage for 2 speed motors and each stage of heating. Heater "manual" positions to spring return to "off" position
Open-Closed-Auto rotary switches	Required for smoke exhaust air make-up motorised dampers. Ensure fire signal overrides switch control.
Phase failure relays	Required for all MSSBs with 3 phase motors
Power monitor	Required for chiller MSSB only

All MSSB's	
Volt meters, ammeters, hours-run meters	Required. Meters may be substituted with a smart meter system.
Future circuits required	Minimum 20%

C.11 PAINTING, FINISHES, AND IDENTIFICATION

C.11.1 Extent of Work

C.11.1.1 General

The Mechanical Services installation where specified shall be painted to present a neat finished appearance.

Provide identification labels to all items of plant and all pipework systems.

Equipment, components and pipework exposed to the weather shall be provided with corrosion protective treatments.

All finishes shall be applied by qualified tradesmen or under their direct supervision. All paint systems shall be the products of one manufacturer wherever possible. Application shall be entirely in accordance with the manufacturer's instructions, in particular with regard to preparation and coating times. Colours are to be submitted for approval.

Items of equipment and valves shall be identified and numbered in accordance with the approved "As Installed" drawings and as scheduled in the Operating and Maintenance Manuals.

Equipment on switchboards and control panels shall be similarly labelled.

Incoming and outgoing circuit wiring shall be identified.

Main valves in the plantroom shall be identified with a label indicating the service and/or equipment controlled and the normal position of the valve (eg. NC or NO).

Pipework and ductwork exposed to view, occupied spaces and access ducts shall be labelled to identify the type of service and the direction of flow.

C.11.2 Metal Components

Metal surfaces of stainless steel, chrome plated, bright aluminium or anodised aluminium shall be carefully protected and cleaned at commissioning to the original bright metal surface as the required finish.

All pipes and ducts shall be hot dip galvanised after fabrication for locations exposed to the weather, zinc electroplated or finished in zinc rich paint finish for weather protected applications. In each case, paint these surfaces where exposed to view.

C.11.3 Painting

Surfaces to be painted shall be suitably prepared (cleaned, etched, etc.), and then given one appropriate priming coat, one undercoat and two finishing coats of paint of Dulux or approved equal manufacture with dark grey to Architect's specification.

Where necessary, surfaces shall be filled and/or lightly sanded between coats to obtain a smooth surface.

Finishing coats generally shall be of hard gloss enamel in a high gloss finish. Paint colours nominated will be in accordance with AS 2700 and AS 1345.

All services where exposed in plant areas shall have the base identification colour applied throughout the entire length.

Insulation sheathing and blanking panels in AHU rooms shall be painted with a matte finish enamel.

Ductwork, piping, etc., in roof or ceiling spaces need not be painted, other than to provide the required vapour seal.

Flexible joints in pipework and ductwork shall not be painted.

C.11.4 Colour Samples

Samples of finish treatments are required of visually aesthetic items, e.g. door grilles, air outlets, items within occupied spaces to TKD Architect's specification.

C.11.4.1 Identification

C.11.4.2 Labels

Generally, all labels shall be of laminated white - black - white "traffolyte" (i.e., black lettering on a white background).

For "urgent" alarms or applications, labels shall be of laminated "traffolyte" with white letters on a red background.

For fire applications, labels shall be of laminated "traffolyte" with red letters on a white background.

The minimum acceptable size for labels shall be 63mm x 12mm. The labels shall have bevelled edges. Lettering must be upper case and 4mm as minimum size.

Labels shall be screwed to sheetmetal work by means of cadmium plated screws into drilled and tapped holes. Self-tapping screws are not acceptable. Labels shall be fixed to masonry using "Rawl" fittings. Labels shall not be mounted on removable covers on the items of equipment.

Switchboard and control panel equipment identification shall be provided on the panels to which the equipment is mounted both labels preferably being fixed by means of common fixing screws and/or nuts.

Incoming and outgoing circuit wiring shall be identified using "Critchley" clip-on ferrules.

All main valve labels shall be located under the hand wheel nut, except where valves are located overhead, where labels are to be suspended on a 75mm length of brass or stainless steel chain attached to the valve spindle.

All labels shall be of non-ferrous material - preferably brass - or stainless steel - with easily identifiable 63mm minimum sized lettering - "filled" (if stamped) or otherwise engraved.

C.11.4.3 Pipe Marking

Pipe markers to indicate type of service and direction of flow shall be "SAFETYMAN" or approved equal to comply with AS 1345 (NZS 2257).

Samples of pipe markers for all services are to be provided upon request.

Pipe markers shall be installed in all plantroom areas and wherever access is available in service areas.

The maximum suitable size of pipe-markers shall be selected and applied at intervals not greater than quoted in AS 1345. At all wall or floor penetration, branch take-offs or where service access is provided, positive pipe identification must be clearly visible.

All services in plantrooms shall have the base identification colour applied throughout the entire length where exposed.

C.11.5 Details Pertaining to Quality of Associated Minor Works

C.11.5.1 Maintenance of Fire Rating

Fire separation and integrity of the building elements shall be maintained at all times. Pipes, ducts and conduits passing through fire and/or smoke rated walls, floors, bulkheads etc. shall be suitably sealed utilising Building Code of Australia approved materials, refer to Architectural drawings for the location of all fire rated building elements.

Install fire stopping products around all service pipe penetrations through masonry floors, walls, ceilings, ducts and other fire rated elements. Product used shall be of approved manufacture compatible with materials being used in the installation.

PVC and polyethylene pipes - fire stop collars and fire wrap applicable to the type and circumstance.

Insulated pipes - sleeved through fire barrier and then filled with fire caulking product.

Metallic pipes - sleeved through fire barrier and then grouted around with fire retardant product.

Where conduits pass through a fire rated barrier they shall be metal. The metal conduit shall extend for a length 500mm clear of both sides of the barrier, provide as per metallic pipe.

C.11.5.2 Underground Conduits & Piping

Install conduits and piping 600mm below finished ground level, except where shown otherwise.

Excavate trenches straight and true and to an adequate depth to provide the required cover for conduits and piping.

Ensure the bottoms of trenches are flat and clear of protrusions such as rocks, tree roots and the like, prior to installation of conduits and piping.

Cover conduits and pipes with 150mm depth of rubble free sand and place an identification tape, 150mm above the conduit or pipe along the entire length of the installation. Use underground marking tape in accordance with AS 2648.

The following items are part of the Mechanical Services works:

C.12 TESTING AND COMMISSIONING

C.12.1 Extent

C.12.1.1 General

Testing and commissioning shall be in exact accordance with the latest CIBSE (Chartered Institute of Building Services Engineers) Commissioning Codes, which satisfies the requirements of Green Star. Building Tuning will also form part of the commissioning scope of works, executed during the twelve month period following practical completion.

The Mechanical Contractor shall include acquiring and making themselves fully aware with the requirements of the CIBSE Commissioning Codes.

The entire commissioning, performance testing and documentation of the Mechanical Services Works shall be undertaken by a commissioning specialist employed by the Mechanical Contractor. The Mechanical Contractor shall be responsible at all times for the supervision of the commissioning specialist and providing all necessary attendances.

The Mechanical Contractor shall undertake all testing, pre-commissioning checks, commissioning and regulation necessary to render the installation fully operational together with the recording of results and co-ordinate the activities of all specialist personnel, including manufacturer's representatives.

All equipment used in the testing and commissioning of services shall be accurately calibrated and in good working order. Certificates of currency of calibration shall be submitted to the Engineer for all equipment to be used, prior to commencement of testing or commissioning.

The Mechanical Contractor shall undertake the following:

- Prepare commissioning methodology statements, pro forma commissioning test result sheets for all items of equipment, method statements and procedures supported by risk assessments for approval by the Engineer prior to commencement of the pre-commissioning checks, commissioning, system proving and environmental testing.
- Prepare comprehensive programmes (refer clause A1.2 for further requirements) and nominate in the Mechanical Services Construction Schedule the proposed commissioning period, with separately nominated periods for verification tests required. Convey these dates and programme requirements to the Builder for inclusion in the main Construction Programme. Allow for delays between notification and verification by Authorities and Consultants.
- Monitor progress against the program of works and provide weekly reports detailing progress of testing and commissioning activities.
- Maintain a diary/log of all significant activities and document any faults, snags or queries and works executed in resolving any such issues. The diary/log shall be fully noted and kept available for inspection at any time.
- Provide at least three (3) working days notice in writing to the Engineer prior to carrying any of the specified tests, or such other period of notice as may be reasonable under the prevailing circumstances. Advise the Engineer as to the time and type of test to be carried out.
- Co-ordinate, give notice and obtain all agreements from the necessary authorities.
- Carry out tests in the presence of the Engineer unless otherwise agreed.
- Provide all tools and equipment required to accurately confirm test readings.
- Undertake to repeat such operations of full load or a simulation where it is not possible at the particular time of commissioning and testing for full load conditions to be obtained or simulated.
- Approval of commissioning data will not be given until results are submitted in typed form on the respective pre-approved commissioning data sheets. Compile and submit a report to the engineer for every test, demonstration, balance or commissioning activity, together with an engineering appraisal on the performance. Two copies of each data sheet shall be forwarded for approval. After approval, copies of the commissioning data sheets shall be incorporated into the maintenance manuals.
- Demonstration and witnessing, the object of the witnessing stage is to enable the Engineer to establish a level of confidence in the commissioning results being presented. The extent and proportion of results to be witnessed will be at the discretion of the Engineer.

The Engineer will only witness test proceedings; confirm recorded results and determine if the specified requirements have been satisfied. If the tests fail to demonstrate that the plant and equipment are properly installed and functioning correctly, the cause of the failure shall be investigated. Should the failure be due to incorrect or faulty work then without delay, the Mechanical Contractor shall carry out such remedial measures and adjustments as may be necessary and repeat the commissioning and testing procedure to the satisfaction the Engineer.

C.12.2 Testing and Commissioning Programme

Within one month of appointment, unless stated otherwise, submit the Engineer and Principal Consultant a preliminary commissioning programme. The programme shall be of the itemised bar chart format and shall clearly indicate the proposed approach and all key activities.

The Mechanical Contractor and commissioning specialist shall together produce the detailed and final commissioning programme. This document shall amplify and expand upon the preliminary commissioning programme and include all necessary detailed method statements, risk assessments and procedures.

The programme shall be fully integrated with the main contract programme and other site activities envisaged to be occurring during the period of commissioning and shall also indicate all necessary witnessing and acceptance dates.

C.12.2.1 Reports

Submit to the Engineer and Principal Consultant written reports signed by a qualified person to confirm that:

- Prior installation - all system designs can be commissioned.
- Post installation - installation complete and ready for commissioning.
- System cleanliness - specified cleanliness has been achieved.
- Pre-commissioning checks - completion of pre-commissioning checks.
- Commissioning and testing - to demonstrate compliance with specified requirements and confirm that each installation has been correctly tested and commissioned and is achieving the specified performance.

The final documentation of reports and completed record sheets shall be compiled in system and date order within the Systems Commissioning Manual for inclusion in the Operating and Maintenance documentation.

C.12.3 **Inspection by Client's Insurance Company**

Where specified elsewhere installations, equipment, plant or materials are to be inspected by the Client's insurers.

The installations, equipment, plant or materials shall satisfy the insurance company's requirements in all respects.

Provide a programme for the inspection and certification and inform the Client when the installation or equipment is ready for examination.

Arrange for the attendance of the insurance company's representative as required at agreed stages of manufacturer and installation and provide all necessary attendance, access and facilities for inspecting and testing as is required.

No equipment or installation subject to inspection and certification will be accepted on behalf of the Client unless a satisfactory certificate has been received from the insurers.

All costs associated with such inspections shall be agreed prior to works commencement unless stated otherwise.

C.12.4 **Fuel for Testing**

Unless stated otherwise, fuel for testing and operating works will be provided by the Client, refer to Head Contract conditions.

C.12.5 **Manufacturer's Off Site Testing**

Equipment shall be tested for duty and performance at works prior to despatch. Test to the appropriate Australian Standard or the requirements stated elsewhere if these exceed the Australian Standard.

Testing shall be to the satisfaction of the Engineer and the insurance representative.

Duplicate certificates of all such tests shall be provided to the Engineer and Principal Consultant within 3 days of testing and copies included in the Operating and Maintenance documentation. All certificates shall be signed by a competent person and witnessed.

For certain equipment, as specified manufacturer's tests will be required to be repeated on site to prove the operating performance.

Each item of equipment tested at works shall be stamped or fitted with a plate to provide the following minimum data:

- Normal working conditions
- Test conditions
- Individual equipment reference
- Australian Standards applicable
- Date of test
- Manufacturer's details

The above information shall be included on the test certificate for each item of equipment together with details of the test location.

- Items of equipment indicated below shall be load, duty and performance tested at works under simulated conditions.
- Simulated conditions and testing procedures shall be agreed by the Engineer prior to testing. Ensure that the tests prove the performance of the equipment when finally installed onsite.
- Where manufacturers work facilities are not available for the simulated tests, the Mechanical Contractor shall arrange for testing to be undertaken at an agreed laboratory, research establishment or other suitable and agreed location at no additional costs.
- All costs, including the expenses of the Engineer, shall be included in the contract price.
- Simulated tests shall be carried out on the following equipment:
 - Air handling units
 - Chiller units
- The results of such tests shall in no way relieve the Mechanical Contractor of his responsibilities to ensure that all materials and equipment used in the works are suitable for the applications and conditions of operation.

C.12.6 Ductwork Pressure Testing

C.12.6.1 Visual Inspection

All ductwork shall be visually inspected for potential leakage paths. Any areas where leakage is possible shall be checked with a smoke pencil in the presence of the Engineer. Airflow shall be measured at all inlets and outlets to verify ductwork integrity.

C.12.6.2 Leakage Rate Testing

Prior to carrying out the works the Mechanical Contractor shall ensure that all safety precautions detailed in the necessary OHS requirements are adopted.

All low pressure ductwork as defined in the "Ductwork Systems" section of this Specification shall be tested by the following method:

Test Stage 1 - Use of an external supply air fan and differential pressure gauge. Prior to the installation of any ceiling structure, individual ductwork systems shall be pressurised to range of pressures - from 100Pa below to 100 Pa above the anticipated operational static pressure. At 25Pa intervals, the supply air quantity entering the ductwork whilst the fan maintains the respective pressure shall be noted.

The noted air quantities shall then be checked to ensure that they are within the specified range of acceptable leakage.

This stage of the test shall be applied to both supply and return air ductwork systems.

If the leakage rate at the anticipated system operational static pressure does not exceed 5% of the design air flow for that system, installation of the ceilings can proceed.

Test Stage 2 - Following proportional air balance, the operational system static pressure shall be ascertained. This figure shall be checked against the figures obtained during Test Stage 1 to ascertain the exact leakage rate.

Provided the leakage rate for the supply air and return air ductwork associated with each system is within the specified range, the system will be deemed to be acceptable.

Should the actual leakage rate fall outside the acceptable range, the Contractor shall rectify the leakage to the full satisfaction of the Engineer and the Client.

C.12.7 **Testing of Refrigeration Systems**

Prior to carrying out the works the Mechanical Contractor shall ensure that all safety precautions detailed in the necessary OHS requirements are adopted.

Refrigerant pipework shall be pressure tested to 1.25 times the design pressure as defined in Table 10.1 of the SAA Refrigeration Code.

The gas used for the pressure test shall be an approved dry inert gas.

Detect for leaks with a film of soapy water on all joints. Eliminate all leaks and repeat process until the system sustains the test pressure for 10 hours.

On satisfactory conclusion of the pressure tests, the pipework shall be evacuated to a pressure equivalent to that not exceeding 1.7 degrees C. wet bulb temperature and then closed off for a further period of not less than 10 hours.

During this period, no sensible change in wet bulb temperature should be observed.

The whole dehydration process shall be repeated until identical readings are obtained at the beginning and end of a 10 hour shut-down period.

Finally, the whole system shall be charged with refrigerant and again tested for leaks.

C.12.8 **Electrical Services Testing**

Inspection and testing shall be carried out during installations and after completion of the works with due consideration to ensure all safety precautions are adhered to.

Tests shall be carried out on site after completion to ascertain the insulation resistance of the conductors, cable and accessories and fittings to earth and between poles, the electrical continuity of metal sheaths surrounding conductors, and the polarities of all accessories and fittings, complying with the latest edition of the SAA wiring rules "Testing of Installation" and other relevant clauses.

C.12.9 Pre-Commissioning Checks

The Installer shall undertake all necessary pre-commissioning works and checks as detailed in the CIBSE Commissioning Codes and as stated elsewhere.

The Installer shall submit to the Engineer a written report, including record sheets, for each system indicating completion of the pre-commissioning works and checks.

System commissioning shall not commence until the pre-commissioning works and checks have been completed and accepted as satisfactory by the Engineer.

C.12.10 Commissioning

C.12.10.1 General

Commissioning provisions and procedures shall follow the guidance and recommendations contained within the following documentation unless stated otherwise:

- Current CIBSE Commissioning Codes
- Series A – Air Distribution Systems – High and Low Velocity
- Series C – Automatic Control Systems
- Series R – Refrigerant Systems

Particular attention shall be given to the permitted tolerances in the above documentation.

In addition to the requirements stated elsewhere, the Mechanical Contractor shall perform and record the following:-

- Test all equipment in accordance with manufacturer's recommendations, checking rotation, revs, running current on each phase of electrical motors, etc., and recording.
- The ventilation and air conditioning systems shall be run without air filters to disperse all dust, etc, and commission the system before the introduction of the filters.
- Check air volumes, sound levels, speeds, running currents and pressures generated of fans.

C.12.11 Performance Testing

Upon completion of commissioning, the Contractor shall fully test and demonstrate the operation of the equipment and systems specified herein, in the presence of the Engineer.

Any defects or deficiencies in the equipment or systems identified as a result of such tests shall be made good, to the Engineer's satisfaction, at the Contractor's own cost.

Performance testing shall include the following:

- Measurement of airflow rate, fan static or total pressures, fan and motor rpm, motor power consumption for each fan.

- Measurement of water flow rate, pump head, pump rpm, motor power consumption for each pump.
- Measurement of water flow rates through all equipment items.
- Measurement of air distribution and ventilation systems terminal and branch air volumes, on a sample basis, to the Engineer's satisfaction.
- Measurement of system air temperature.
- Demonstration of functional operation and calibration of control systems.
- Measurement of packaged plant head pressure, low pressure, air off, temperature, air on temperature, ambient temperature and condenser air on and off temperature.
- Thermal performance testing of all chilled water plant, heating water plant, and air handling units to verify compliance with the specified requirements. Such thermal testing shall take place under near-design ambient conditions for a period of up to 5 days at an appropriate during the warranty period, to be nominated by the Engineer. Provide data logging equipment to log at hourly intervals the following.
 - Ambient wet and dry bulb temperatures.
 - Internal wet and dry bulb temperatures per zone.
 - Estimates of people and lighting loads.
 - Fresh air quantities.
 - Temperature splits and flow readings for major items of plant.

C.12.12 Commissioning Records

Provide written records of the preliminary airflow, water, and performance test data, prior to the verification tests. Data shall give design quantity, site test reading and percentage deviation from design.

The Mechanical Contractor shall prepare and submit to the Engineer the complete commissioning records for the installation bound in the Operating and Maintenance manuals.

The commissioning records shall contain all test and commissioning results relating to the final, commissioned installation, derived from the tests and procedures specified in this Section.

C.12.13 Equipment Statutory Inspection and Registration

Arrange inspection and registration of all plant as required by the applicable authorities or statutory body.

Inspection certificates are to be laminated and mounted in a rigid frame adjacent to the plant. Copies of inspection certificates are to be included within Operating and Maintenance Manuals.

Provide a re-inspection schedule as part of the operating and maintenance manual detailing the inspection period, the type of inspection required and the inspector contact details.

Pay all fees and costs associated with the inspection and registration.

C.12.14 Post Practical Completion Building Tuning

During the twelve months after Practical Completion and in consultation with the Building Manager the Mechanical Contractor shall undertake the Building Tuning procedure, comprising:

- Ensure the requirements for fine tuning are incorporated in the commissioning specification.
- Ensure that fine tuning activities are programmed, planned in advance and agreed with the Building Manager prior to commencement.
- Arrange that the relevant parties are retained and appointed to provide input to fine tuning activities.
- Ensure that fine tuning activities are planned with regard to the health and safety of occupants and such that any disturbance to them is minimised.
- Monthly monitoring with outcomes reported to the Building Manager.
- Provide a mechanism by which the Building Manager can provide feedback on the performance of the building both before and after fine tuning.
- Attend meetings as requested by the Building Manager to deal with issues arising from fine-tuning of the works.
- Full recommissioning twelve months after practical completion. Recommissioning refers to the process of undertaking a review of all systems to the scope of the initial pre-occupancy commissioning. Re-commissioning is intended to incorporate any modifications identified as necessary or beneficial during the building tuning period and to improve the performance of building operation. The term does not refer to the re-setting of the systems to the initial commissioning settings.
- A Building Tuning Report on the outcome of the tuning process is provided to the building owner and made available to the design team.

The purpose of the Building Tuning process is to verify that systems are performing to their design potential during all variations in climate and occupancy and that time schedules are optimised to match occupant needs and system performance.

C.13 OPERATING AND MAINTENANCE MANUAL

C.13.1 General

The Contractor shall provide, **before** the Practical Completion of the installation, **five copies** of an Operating and Maintenance Manual set out with the following headings and containing all listed information:

- Index
- Description of plant
- List of all equipment giving manufacturer's and agent's and name plate details and parts lists.
- Installation instructions.
- Maintenance instructions for each item of equipment.
- Certified equipment performance data, e.g., pump and fan curves, etc.
- List of settings for all major control instruments.
- Instructions for operating plant including starting and stopping outside of normal working hours.
- Quality Assurance Certificates.
- All testing and commissioning data.

- “As Constructed” Wiring and Control Diagrams.
- Drawing List.

The Manual shall be professionally bound in a grey vinyl ring binder with stamped blue lettering in the following format:

OPERATING AND MAINTENANCE MANUAL

FOR

MECHANICAL SERVICES

AT

.....

Engineer:
Wood & Grieve Engineers

Architect:
.....

Contractor

The spine of the ring binder shall be similarly stamped with the Job Name and the words "Operating and Maintenance Manual".

The Mechanical Contractor shall provide **five copies** of the "As Constructed" drawings of all plant, equipment, ductwork, etc. These drawings shall have been prepared by a competent and experienced draughtsperson and shall be folded and inserted in individual pockets with the manual.

The Mechanical Contractor shall provide a compact disc containing all "As Constructed" shop drawings in AutoCAD format.

C.13.2 As Constructed Drawings

Where the project is a “Government” project, all drawings are to be drawn to the current version of the Government’s drafting standards. It is the responsibility of the Mechanical Contractor to be informed of these standards.

Drawings may be checked for conformity at Practical Completion and failure to comply may cause delays.

C.13.3 Revit

As-Constructed Drawings shall be submitted in PDF, .rvt and .ifc format.

Model shall be detailed in accordance with the Building Information Modelling (BIM) Execution Plan. Where a BIM Execution Plan is unclear modelling shall be in accordance with the American Institute of Architects (AIA) and BIM Forum LOD Specification, to LOD500.

C.14 MAINTENANCE

C.14.1 General

The twelve month defect warranty and maintenance liability period (Maintenance Period) shall commence on the date of Practical Completion.

Provide for corrective maintenance and repair to all equipment and systems which become defective, or is found to be defective, during the Maintenance Period, including the making good of any resulting damage.

In addition, allow for preventative maintenance of the entire plant for the full duration of the Maintenance Period, in accordance with this section.

Submit to the Engineer detailed monthly service reports, including details of all preventative and corrective maintenance work carried out during the preceding month. Copies of log book entries shall also be provided.

C.14.2 Maintenance Log-Book

The Mechanical Contractor shall supply to the Proprietor at the Date of Practical Completion a Maintenance Log Book which shall be kept in the Chiller Plantroom or the Facility Manager's Office with one copy of the Operating and Maintenance Manual.

The Maintenance Log Book shall clearly identified and of a similar format to the Operating and Maintenance Manuals.

The Mechanical Contractor shall ensure that all employees, sub-contractors and other personnel shall enter all relevant details of work carried out, together with names of personnel and times of arrival and departure, in the log-book at each service visit, whether for preventative or corrective maintenance calls.

A copy of the maintenance inspection reports shall be supplied, for record purposes, to verify the maintenance. Where such records are not provided, it shall be deemed that the work was not performed. The Proprietor shall be entitled to deduct the value of such service from the final payment.

C.14.3 Preventative Maintenance

Generally, the routine preventative maintenance shall include the inspections, lubrications and cleaning of equipment, checking and adjustment of controls, refrigerant leakage test and such other checking as may be considered necessary at the time.

Notify the Facility manager on arrival and log details of all visits.

Routine maintenance shall include the following:-

C.14.4 One Monthly Services (12 off)

C.14.4.1 General

- Check all dirty components.
- Check all equipment for abnormal noise.
- Record readings on all temperature and pressure gauges.
- Record running amps for all major equipment.

C.14.4.2 Fan Coil Units

- Check and clean filters as necessary.
- Check general operation.
- Check drains for blockages.
- Visually check control operation.

C.14.4.3 Air Conditioning Units

- Thoroughly clean the condensing units twice during the warranty period at six monthly intervals.
- Casing shall be removed, all debris cleaned from the unit and using suitable detergent clean the coil and casing and wash down.
- Provide additional 'laotrol' spray as required.
- Include comprehensive instructions for ongoing maintenance in operating and maintenance instructions.
 - Check, clean and record pressure drops of filters.
 - Check general operation.
 - Check drains for blockages.
 - Check fans for vibration and excessive noise; rectify as required.
 - Check belts, bearings, wheels and pulleys for tightness on shafts.
 - Check operation of all safety controls.
 - Check system dryness and replace dryers as required.
 - Check thermostat set points and operation.
 - Clean down all equipment and touch up paint as required.

C.14.4.4 Fans

- Check for vibration and excessive noise.
- Check flexible connections.

C.14.5 **Three Monthly Serviecs (4 off)**

C.14.5.1 Cleaning

Apply rust proofing agent such as water repelant grease, wax, etc. at installation and every three (3) months thereafter

C.14.6 **Six Monthly Services (2 off)**

C.14.6.1 Controls

Service by controls sub-contractor to clean, adjust, calibrate (and record settings) all controls, control valves, pneumatic relays, pressure switches, etc.

C.14.7 **Twelve Monthly Service (1 off)**

C.14.7.1 Electrical

- Switchboard service by electrical sub-contractor to clean adjust and check all terminals, overloads, contacts, relays, timers, switches, indicator lights, etc.

- Thermographic survey of all electrical services switchboards (to be conducted during a period of high demand and not outside of the facilities normal operating hours).

C.14.7.2 Motors

- Check motor winding continuity and insulation.

C.14.7.3 Fans

- Lubricate as necessary.
- Check motor amps.

C.14.7.4 General

- Check all wheels, pulleys, bearings for tightness on shaft.
- Check all mounting bolts for tightness.
- Check all hangers supports, etc.
- Check calibration of gauges.
- Check and clean all drain connections.
- Clean down all equipment and touch-up paint where required.

PART D. APPENDICES

D.1 APPENDIX A - SCHEDULE OF INFORMATION REQUIRED

1. Previous Experience for Similar Projects.

Project:

Value:

Date Completed:

Project:

Value:

Date Completed:

2. Personnel Details:

Project Engineers: Name:

Qualifications:

Experience:

Project Supervisor: Name:

Qualifications:

Experience:

Project Foreman: Name:

Qualifications:

Experience:

3. Sub Contractor's Name

Section

..... Sheet Metal

..... Piping

..... Insulation

..... Painting

..... Controls

..... Electrical

D.2 APPENDIX B - SCHEDULE OF LABOUR RATES

Complete the following Schedule of Labour Rates and submit together with the tender. Failure to complete these schedules may invalidate the tender.

The Schedule will be applicable for the addition or deletion from the Contract of any work with labour content.

Trade	Labour Rate (\$ per hour) excluding GST		
	Normal Time	Time and a Half	Double Time
Supervisor			
Foreman			
Welder			
Plumber			
Fitter			
Electrician/Fire Services			
Controls Technician			
Builder			
Apprentice			
NEBB Certified Commissioning Specialist			
Maintenance Call Out			
Crane Hire including operator			
Others (please specify)			

Tenderer's Signature:

Date:

Name of Tenderer:.....

Company:.....

Witness:.....

Name of Witness.....

D.3 APPENDIX C - SCHEDULE OF UNIT RATES

Complete the following Schedule of Unit Rates for Variation and submit together with the tender.

The following unit rates shall be applicable for the addition or deletion of any work from the Contract and includes the cost to supply, deliver, install, test and commissioning unless otherwise stated including any mark-up. All prices to exclude GST.

D.3.1.1 Piping

Unit rates for the supply and installation of piping, for works to be carried out before the erection of ceilings/installation of raised floor tiles, and include all pipe supports and pipe identification.

Piping – Refrigeration (Including fittings)

Pipe Size (mm)	\$/m installed	\$/m installed & insulated
1/4" Ø		
3/8" Ø		
1/2" Ø		
5/8" Ø		

Drain Piping, including fittings.

Pipe Size (mm)	\$/m installed	\$/m installed & insulated
20 Ø		
25 Ø		
32 Ø		
40 Ø		
50 Ø		

D.3.1.2 Ductwork

Unit rates for the supply and installation of ductwork, for works to be carried out before the erection of ceilings/installation of raised floor tiles, and include all duct supports.

Rigid Ductwork – Rectangular Sheet metal.

Duct Girth (mm)	\$/m installed (bare)	\$/m installed (25mm internal)	\$/m installed (38mm external)	\$/m installed (38mm internal)	\$/m installed (50mm external)	\$/m installed (50mm external)
500						
1000						
1500						
2000						
2500						

Duct Girth (mm)	Bend with turning vanes	Radius bend	Branch spigot with splitter in duct	Stop end in duct	Transition in duct (largest size)
500					
1000					
1500					
2000					
2500					

Rigid Ductwork – 2hr Fire Rated.

Duct Girth (mm)	\$/m installed
500	
1000	
1500	
2000	
2500	

Flexible Duct

Duct Diameter (mm)	\$/m installed (bare)	\$/m installed (insulated)	Spigot with balance damper to suit
150			
200			
250			
300			
350			
400			
450			
500			
550			
600			

D.3.1.3 Diffusion

Ceiling Diffusers

Unit rates for the supply and installation ceiling swirl diffuser, including connection box, 3m of flexible duct and take-off spigot with balance damper connected to supply duct.

Face size DN (mm)	Installed in plasterboard ceiling
250	
350	
400	
450	
500	

Linear bar Grilles (Supply and Return Air)

Unit rates for the supply and installation of linear bar grilles, including plenum connection box, mounting frame, 3m of flexible duct and take-off spigot with balance damper connected to supply duct. Per 1m Section of grille.

Grille Height (mm)	Amount \$/lm
150mm	
200mm	
300mm	
400mm	

D.3.1.4 BMS Controls

Unit rates for the supply and installation, commissioning and programming of points or equipment as listed below.

Description	Amount \$
Supply and install control wiring (\$/m)	
Supply and install a temperature sensor c/w wiring, analogue input hardware, programming, etc. (\$/point)	
Supply and install a duct pressure sensor c/w wiring, analogue input hardware, programming, etc. (\$/point)	
Supply and install a duct velocity sensor c/w wiring, analogue input hardware, programming, etc. (\$/point)	

D.4 APPENDIX D - TENDER SUMMARY

Tenderers shall submit a breakdown of the total tender price including administration cost and profit for each section of the works as follows:

The amounts included in the Total Tender sum including overhead costs and profit margins are as follows:

(a)	Air Conditioning System:	
-	Ductwork	\$ _____
-	Insulation	\$ _____
-	Grilles and Diffusers	\$ _____
-	Installation of Air Conditioning Systems	\$ _____
-	Filters	\$ _____
-	Refrigeration Pipework, Valves and Fittings	\$ _____
(b)	Ventilation Systems:	
-	Fans	\$ _____
-	Ductwork	\$ _____
-	Grilles	\$ _____
-	Installation	\$ _____
(c)	Automatic Controls (Including Installation):	\$ _____
(d)	Electrical:	
-	Switchboards	\$ _____
-	Cabling and Installation	\$ _____
(e)	Demolition Work	\$ _____
(f)	Shop Drawings	\$ _____
(g)	Commissioning and Testing	\$ _____
	Note: shall equal or exceed 2 % of total tender	
(h)	Maintenance Manuals	\$ _____
(i)	Contingency & Provisional Sums	\$ _____
(j)	Site Allowance	\$ _____
(k)	Maintenance during The Defects Liability Period	\$ _____
	Note: shall exceed 0.5% of total tender value	

TOTAL TENDER AMOUNT (EXCLUDING GST) \$ _____

GOODS & SERVICES TAX (10%) \$ _____

TOTAL TENDER AMOUNT (INCLUDING GST) \$ _____

Tenderer's Signature:

Date:

Name of Tenderer:.....

Company:.....

Witness:.....

Name of Witness.....

D.5 APPENDIX E - CONTRACT DRAWINGS

DRAWING NO	DESCRIPTION	REVISION

D.6 APPENDIX F - PROVISIONAL SUMS/CONTINGENCY SUM

D.6.1 Provisional Sums

Description	Cost	GST	Total

D.6.2 Contingency Sum

Contingency Sum : \$_____

D.7 APPENDIX G – QUALITY ASSURANCE

PROJECT SPECIFIC QUALITY ASSURANCE ITEMS

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE -SHOP DRAWINGS

Client:

Project:

Project No:

Contractor:

Drawing No:

Contractor's Verification Signature: _____ Date:
(Project Engineers)

1. Equipment

- 1.1 Adequate access for equipment service and maintenance.
- 1.2 Filters installed in accessible positions.
- 1.3 Door grilles provided and coordinated with doors supplier.
- 1.4 Selected air diffusion equipment gives adequate room coverage.

YES NO

2. Ductwork

- 2.1 Ductwork fits into the ceiling space less beams and lights.
- 2.2 Access panels provided in ductwork where required and in ceilings as on WGE drawings or to the approval of the Superintendent.
- 2.3 Sunshades provided on external ductwork.
- 2.4 Work by other building trades coordinated and clashes avoided.
- 2.5 Drip trays provided under all ceiling mounted fan coil units.
- 2.6 Fire dampers provided through all fire rated separations unless otherwise approved by the Superintendent.
- 2.7 Duct sizes are at least as large as on WGE drawings.
- 2.8 Supply/exhaust/ outside air quantities as specified.
- 2.9 System has sufficient dampers and is in a configuration that promotes ease of balancing.
- 2.10 Static pressures for equipment calculated.

		<u>YES</u>	<u>NO</u>
3.	Pipework		
3.1	All pipework, valves and fittings required by equipment provided.		
3.2	Condensate drains run to floor wastes or tundishes and plumber informed.		
4.	Insulation		
4.1	All insulation as specified.		
5.	Controls		
5.1	Thermostats located as specified or to the approval of the Superintendent.		
6.	Associated Electrical		
6.1	Electrical Trade advised of the actual electrical requirements of mechanical services.		
6.2	Mechanical switchboards located as specified.		
6.3	Mechanical electrical wiring and control logic diagrams.		
7.	Noise and Vibration Control		
7.1	Equipment noise levels as specified or less.		
7.2	All other equipment selected so as to comply with the room noise levels specified.		
7.3	Vibration isolation of equipment as specified or to the approval of the Superintendent.		

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE -SUPPLY

Client:

Project:

Project No:

Contractor: _____

Equipment/System Item Identification: _____

Does the equipment meet the requirements of the specification?

YES

NO if so, why?

Contractors Signature: _____

Suppliers Signature: _____

Date: _____

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE-INSTALLATION

Client:

Project:

Project No:

Contractor:

Date:

Has the equipment/system been installed in accordance to the manufacturer's recommendations and the requirements of the specification?

YES

NO if so, why?

Contractors Signature:

Suppliers Signature:

Date:

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE -ENGINEERING

Client:

Project:

Project No:

Contractor: _____

System/Sub-System Component Description:

Calculation Type:

Attached are my calculations which certify that the above system/system component meets the performance requirements specified.

Contractor's Chartered Professional Engineers: _____

IE AUST. Corporate Membership No: _____

Date: _____

(*) Acoustic only when requested by Superintendent.

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE

(PRACTICAL COMPLETION)

Client:

Project:

Project No:

Contractor: _____

All mechanical building services have been installed in accordance with the shop drawings and with the equipment as certified in the relevant Quality Assurance Certificates.

Contractor's Verification Signature: _____

(Principal or Managing Director)

Date: _____

The overall installation complies with the performance requirements of the tender documents and subsequent variations.

Contractor's Chartered Professional Engineers: _____

IE AUST. Corporate Membership No: _____

Date: _____

MECHANICAL SERVICES

QUALITY ASSURANCE CERTIFICATE

(FINAL COMPLETION)

Client:

Project:

Project No:

Contractor: _____

All mechanical building services have been installed in accordance with the shop drawings and with the equipment as certified in the relevant Quality Assurance Certificates.

We confirm that:

All Mechanical Services defects brought to our attention have been rectified **YES/NO**
If no, attach details of any defects that have not been rectified.

We have recently inspected the Mechanical Services installation and it is in efficient working order. **YES/NO**

Date of inspection: _____

Mechanical Services maintenance has been carried out in accordance with the specification and we have retained copies of records of all preventative and corrective maintenance work. **YES/NO**

Contractor's Verification Signature: _____

(Principal or Managing Director)

Date: _____

The overall installation complies with the performance requirements of the tender documents and subsequent variations.

Contractor's Chartered Professional Engineers: _____

IE AUST. Corporate Membership No: _____

Date: _____

ASN Co Bay 4-5 Commercial Use 1-3 Hickson Road – The Rocks

Electrical Specification

Prepared by:

Peter Mizza

Project No. 33307

\\WGE-SYD-FS-01\PROJECTS\33307\PROJECT DOCUMENTATION\ELECTRICAL\DESIGN\SPECIFICATION\EL-SP_003.DOCX

REVISION

Revision	Date	Comment	Prepared By	Approved By
001	15-12-2017	Preliminary	PGM	PGM
002	30-01-2018	Preliminary	PGM	PGM
003	13-02-2018	Tender	PGM	PGM

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: Peter Mizza

CONTENTS

PART A.	PRELIMINARIES.....	1
PART B.	PROJECT SPECIFIC INFORMATION	2
B.1	GENERAL	2
B.2	DEFINITIONS	2
B.3	SCOPE OF WORKS	3
B.4	POSITION OF EQUIPMENT	4
B.5	SAMPLES AND DETAILS	4
B.6	SHOP DRAWINGS	5
B.7	POWER SUPPLY	6
B.8	SWITCHBOARDS	7
B.9	EARTHING	7
B.10	ACCESSORIES	8
B.11	LIGHTING INSTALLATION	8
B.12	POWER INSTALLATION	10
B.13	COMMUNICATIONS INSTALLATION	11
B.14	ACCESS CONTROL	12
B.15	COMMISSIONING AND TESTING	15
B.16	PRINCIPAL INSTRUCTION	16
B.17	AS CONSTRUCTED DRAWINGS SUPPLIED BY CONTRACTOR	16
B.18	MAINTENANCE AND OPERATING INSTRUCTIONS	17
B.19	MAINTENANCE	17
PART C.	TECHNICAL.....	1
C.1	COORDINATION WITH OTHER TRADES	1
C.2	MATERIALS AND WORKMANSHIP	1
C.3	SHOP DRAWINGS	1
C.4	SAMPLES	2
C.5	INTERFACES	2
C.6	MAINTENANCE	4
C.7	OPERATION & MAINTENANCE MANUALS	4
C.8	AS-CONSTRUCTED DRAWINGS	11
C.9	SPARES	12
C.10	TRAINING	12
C.11	WARRANTY	13
C.12	TESTING AND COMMISSIONING	13
C.13	CERTIFICATIONS	14
C.14	FIRE RATING	14
C.15	SEISMIC RESTRAINTS	15
C.16	ACOUSTIC TREATMENTS	16
C.17	EARTHING AND BONDING	16
C.18	SWITCHBOARDS	20
C.19	CABLE ENCLOSURES AND MATERIALS	45
C.20	LOW VOLTAGE (LV) INSTALLATION	48
C.21	LIGHTING INSTALLATION	53
C.22	LIGHTING CONTROLS	57
C.23	EMERGENCY AND EXIT LIGHTING	61
C.24	TELEPHONE BACKBONE CABLING	65
C.25	ACCESS CONTROL SYSTEM	67
PART D.	TENDER RETURN.....	71
D.1	APPENDIX C - TENDER SUMMARY	71
D.2	APPENDIX D - SCHEDULE OF CONTRACT RATES	72
D.3	APPENDIX 3 - SCHEDULE OF CONTRACT RATES	73

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

PART B. PROJECT SPECIFIC INFORMATION

B.1 GENERAL

Carry out work as detailed and in accordance with This Specification and accompanying drawings, the whole of which shall be deemed to constitute one document.

Whether or not the words "supply and install" appear in the instructions, drawing and schedules of This Specification, understand that, unless clearly excluded, materials and labour for the complete installation is required and shall be supplied, delivered to site and installed.

All electrical components and systems shall be fully operational and fit for the intended function as described within this Contract, and to the Superintendent and Superintendent's satisfaction. Where a system is not operational or fit for the intended function, the Electrical Contract is deemed to be incomplete and payment of the final progress claim shall be withheld until such time that the remedial works are completed.

The installation shall be completed by a suitably qualified and licensed Electrical Contractor who is familiar with the specified lighting products and with proven capability of similar project installations.

The work covered by this Specification includes for the manufacture supply installation testing and commissioning of complete operating systems of electrical services inclusive of all minor components necessary whether depicted or otherwise.

B.2 DEFINITIONS

The following definitions shall apply to This Specification.

The "Architects" shall mean Tanner Kibble Denton.

"Approved" shall mean approval granted in writing by the Superintendent, Superintendent or Consulting Engineer.

The "Builder" shall mean the Building Contractor carrying out the work of the Main Building Contract.

The "Power Supply Authority" shall mean Ausgrid

The "Principal", or *Client" or "Principal" shall mean Property NSW

The "Consulting Engineers" shall mean Wood and Grieve Engineers who are authorised by the Superintendent to assist the Superintendent with the carrying out of this Contract on their behalf.

The "Contract", "Electrical Contract" or "Documentation" shall mean and include This Specification and accompanying drawings which are a Sub-Contract to the Building Contract.

The "Fire Services Authority" shall mean FRNSW

The "Sub-Contractor" or "Electrical Sub-contractor" shall mean the Electrical Services Contractor performing the work as specified in This Specification and accompanying drawings.

The "Superintendent", "Superintendents' Representative" or "Clients' Representative" shall mean The Project Studio.

"This Specification" shall mean Part A, Part B and Part C of this document which forms part of the Contract.

B.3 SCOPE OF WORKS

B.3.1 General

This objective of this project is to create a new space of five floors of base building Class 5 commercial office to allow the Client to lease to one or two tenants. Ground and first floor shall consist of one tenancy, with their own electrical meter covering the two floors. Second, third and fourth floors will consist of a second tenancy, with one electrical meter covering three floors.

The lifts in Bay 4 will be replaced and the existing lift motor room repurposed. Egress between Bays 4 and 5 will be created through the demolition of the wall where the existing Bay 4 distribution board and communications frame is located. This contract includes the relocation of the distribution boards for Bay 4 and the relocation of the existing cabling. The Contractor is required to undertake a site visit during the tender to ensure all costs are allowed for in order to have the existing boards and frames moved. Staging of these works shall be managed by the Superintendent, the Contractor shall ensure all programming for works is reviewed and confirmed.

B.3.2 Work Included

The work includes but is not limited to the following main elements:

- Submains
- Switchboards
- Conduiting, Cable Trays and Cable Ducts
- Accessories
- Lighting Installation
- Emergency Lighting and Exit Signs
- Power Installation
- Fire Detection and Alarm Installation
- Telephone Installation
- Structured Cabling System
- Commissioning and Testing
- Principal Instruction
- As Constructed Drawings
- Maintenance and Operating Instructions
- Maintenance and warranty
- Demolish and remove of all redundant existing electrical services including but not limited to lighting, power & controls, communication, cabling, conduit.
-

B.3.3 Co-ordination with other Trades

Prior to purchase, installation or fabrication of any electrical equipment associated with switchboards or equipment to be installed by other trades check the actual requirements with the other trade and advise the Consulting Engineer if there are any discrepancies.

The following work associated with the electrical services will be carried out by other trades. The descriptions below are not intended to be a full specification of the work involved and indicate the general extent of work only. Liaise with the contractors and sub-contractors indicated to ensure that the work is properly co-ordinated.

B.3.3.1 Work by the Building Contractor

Provision of temporary light and power facilities for construction purposes.

Filling in with mortar and making good of conduit chases.

Cutting for wall boxes when necessary.

Builder's work associated with relocating Bay 4 distribution boards and communication frames.

Supply and fitting of automatic sliding door(s), roller door(s) and sliding grille and associated motor and control gear.

Position ceiling hangers to suit lighting layout.

B.3.3.2 Work by the Mechanical Service Sub-Contractor

Electrical work associated with the mechanical services installation apart from the work specified herein.

Provision of Mechanical Services Switchboard. Submains cable, reticulation and termination by the Electrical Contractor.

B.3.3.3 Work by the Lift Services Sub-Contractor

Supply and installation of cabling from access control system interface panel to the lift control equipment and trailing cabling in lift shafts for card readers.

B.3.3.4 Work by the Principal

Final fitout of communications rack with active equipment.

B.4 POSITION OF EQUIPMENT

The position of all equipment shown on the drawings is indicative and shall be subject to the finalised architectural layouts. Unless dimensioned details are specified, the exact position shall be determined on site to the approval of the Architect. Location of equipment shall suit site requirements and comply with the requirements of relevant standards and authorities.

Where practical, locate equipment to conform to the pattern formed by columns, beams, battens and other services.

B.5 SAMPLES AND DETAILS

Samples of the items listed below shall be submitted for approval prior to purchase, at least 2 weeks before approval is required. Samples shall be clearly marked with the manufacturer's name and catalogue number.

After approval, samples will be available for incorporation in the works:

- One working sample of each luminaire.
- Switches & outlets (GPO, Data, etc) complete with flush plate.
- Detail technical sheets of proposed lighting control system.
- Detail technical sheets of proposed communication cable and equipment.

Manufacturer's literature giving detailed specification, physical appearance and size for the following equipment shall be submitted for approval prior to purchase. Information shall be submitted at least 2 weeks before approval is required.

- Fire Indicator Panel

B.6 SHOP DRAWINGS

Prepare, and submit for review, shop drawings before commencing manufacture or installation.

Drawings shall be prepared using AS 1102 drafting standard symbols.

Drawings shall be provided with a legend of symbols, where applicable.

Shop drawings shall all be on the same size drawing sheets and shall be to the scale of not less than 1:100 and larger where necessary.

Shop drawings shall be of the same size as the project drawings.

Shop drawings shall cover the following parts of the work:

- All switchboards
- Communications Rack
- Security/Access Control system

Electronic copies of shop drawings shall be submitted in .pdf format. Allow 2 weeks for return of shop drawings. When requested amend shop drawings and resubmit.

Note that shop drawings are reviewed for general principle of design only and review of shop drawings by the Consulting Engineer in no way relieves the Contractor of his responsibility to comply with the requirements of this specification and associated drawings.

On completion of the works and prior to the issue of the Certificate of Practical Completion, provide as-installed drawings and manuals.

Draft copies shall be submitted for review by the Consulting Engineers prior to final issue of the originals plus two (2) prints of the drawings and two (2) copies if the manual.

B.6.1 Demolition

The existing fitout of the theatres and lobby space shall be demolished and reverted back to base building layout suitable for fitout installation. All redundant electrical equipment shall be isolated, made safe and removed prior to any demolition in the area.

The Contractor will remove redundant lighting fittings, skirting duct, all exposed conduits, ceiling mounted detectors, and cabling in ceiling spaces in the main office areas.

The Electrical Contractor shall remove all other redundant electrical equipment including cabling in conduits and accessories in office areas, typical floor switchboards, redundant fire detection equipment, redundant cabling in the electrical riser and the like.

Allow to trace existing cabling as necessary and retain a tradesman on site during all demolition work to immediately reinstate any services required that are accidentally damaged.

Allow to fill in with mortar and making good of redundant light fittings holes in the concrete slab on level 3.

The relocation of Bay 4 distribution boards shall be undertaken during the demoltion phase. Allow for a full liaison with the Builder on site prior to tender to ensure the proposed methodology of relocating the existing equipment, communication frames and distribution boards are understood and accounted for in the tender return.

The existing Bay 5 main distribution board on level 2 shall be disconnected, removed and parts salvaged where appropriate. The existing theatre distribution boards on levels 3 and 1 shall be demolished and removed from site.

Particular care shall be taken to prevent the occurrence of false fire alarms. Any costs associated with false fire alarms occurring due to building works will be charged to the Contractor.

B.7 POWER SUPPLY

B.7.1 General

Power supply to the installation will be three phase, four wire, 415/240V, 50 Hz. All equipment supplied as part of this Contract shall be suitable for the actual voltage and frequency available.

The Electrical Services Sub-Contractor shall ensure that all equipment supplied conforms to the following requirements:

- Phases shall be balanced on all boards to within 10% of each other.
- Power quality, including a full harmonic study, shall be checked prior to occupation and afterwards to confirm that this conforms to AS 61000 and Supply Authority's requirements.

B.7.2 Interruption to Supply

Any interruption to the power supply during the course of construction shall be kept to a minimum and shall be at a time to suit the Principal. Three weeks notice shall be given prior to any shutdown and allowance shall be made to perform the work associated outside of normal working hours.

B.7.3 Main Switchboard Works

The existing main switchboard within Bay 4 Ground Floor shall be retained within minimal alterations to be undertaken. The existing circuit breaker that feeds the existing Bay 5 shall be assessed for suitability for reuse. Allow for a new circuit breaker to be installed and new submains cable to be reticulated to DB-B51 for power reticulation to Bay 5.

B.7.4 Supply Authority Metering

Provide metering panel for house and tenant energy meters as shown on the drawings within each of the electrical cupboards. Energy meters shall be EDM1 Mk10A. Alternative meters must be submitted to Superintendent prior to installation. Provide a mounting board for meter installation and ensure the meters are labelled in a neat and indelible fashion.

B.8 SWITCHBOARDS

B.8.1 General

The Contractor shall supply and install the following switchboards:-

ID	Description	Size	Width	Location
DB-B5G	New tenant distribution board.	100A	1500	Ground Floor
DB-B51	New Bay 5 main distribution board, tenant distribution board and electrical meter panel.	400A	1800	First Floor
DB-B52	New tenant distribution board and electrical meter panel.	100A	1800	Second Floor
DB-B53	New tenant distribution board.	100A	1500	Third Floor
DB-B54	New tenant distribution board.	100A	1500	Fourth Floor

The Electrical Sub-Contractor shall take care to advise his switchboard manufacturer of the size of sub-mains being run to each board and whether top or bottom entry in order that adequate space and provision for terminations is made.

Construction of switchboards is to ensure that at the completion of the contract that a minimum of 30 per cent spare pole space is available to each switchboard. Remaining poles on final sub-circuit chassis are to be filled with 20A 30mA circuit breakers of same type specified.

All switchboards shall be labelled as to their designation. Descriptors are to be approved before manufacture.

Detailed requirements specific to each switchboard are described on the single line diagrams within the drawing set and are to be included as part of the contract documents.

Relocate existing Bay 4 distribution boards as shown on the drawings.

B.8.2 Approved Switchboard Manufacturer

The Switchboard Manufacturer is to be a member of the National Electrical Switchboard Manufacturer's Association (NESMA). The Switchboard Manufacturer is responsible for manufacture, assembly, testing and commissioning of all switchboards.

B.9 EARTHING

B.9.1 Main Earth

Confirm the suitability of the existing main earth to the building and advise the Superintendent if there requires any maintenance to the earthing arrangement.

B.9.2 Earthing and Bonding

The earth pin of all power outlets and the metalwork associated with all light fittings shall be directly earthed. Bare earth wire in close proximity to all live metal i.e., behind accessories and switchboard, etc. shall be covered with green plastic sleeving.

Metallic piping of a water supply system, any portion of which is underground installed within a building containing an electrical installation shall be bonded to the main earthing conductor.

All metallic trays, conduits, ducts, skirting ducts and equipment enclosures shall be earthed in accordance with AS 3000 and Austel Customer Premises Cabling Manual.

B.10 ACCESSORIES

Unless otherwise specified all accessories shall be flush mounted polycarbonate (Electric White). Accessories shall be of Clipsal 2000 series manufacture, one make and style throughout. Accessories on concrete and masonry walls, etc. shall be mounted over wall boxes.

Flush plates shall be plumb and fit hard against wall surfaces. Heights as specified or shown on drawings shall be from finished floor level to the centre of the accessory.

Light switches shall be at 1200 unless otherwise shown. The exact position of all accessories, light fittings, etc. shall be decided on site by the Architect.

The Contractor shall ask for these positions not less than ten (10) days before positions are required. Regardless of positions shown, accessories on wall tiling shall be located centrally over the nearest tile course intersection.

Light switches generally, shall be 15 amp miniature rocker action mechanism in miniature flush plates to partitions and vertical standard size flush plates elsewhere. Mechanisms shall be "X" rated for use with fluorescent fittings.

Socket outlets shall be 10 or 15 amp (as required) switch socket combinations with miniature flush plates on skirting and standard size horizontal flush plates elsewhere.

Each socket outlet shall be fitted with an IPA marker of appropriate phase, colour and circuit number.

Time delay switches shall be HPM Cat XLTX770/1 or approved equivalent, plus capacitor and shall be time adjustable without needing to remove the switch from the wall box.

B.11 LIGHTING INSTALLATION

B.11.1 General

Supply and install all light fittings as specified herein and indicated on attached drawings.

All fittings must be installed square to the building lines.

All fittings shall be rigidly secured to the building structure either directly or with suitable trimmers.

Fluorescent lamp ballasts and starters shall be approved by an Australian Approved Authority.

Fluorescent fittings shall be complete with tubes white in colour unless otherwise specified and of one make. Fluorescent lamp ballasts and starters shall be approved by an Australian Approval Authority.

All light fittings in external areas shall be black in colour.

All light fittings shall include an integral fuse in a fuse holder suitable for the temperatures expected.

B.11.2 Luminaire Substitutions

If an alternative luminaire schedule is proposed by the Contractor, prior to review by the Principal's Authorised Representative the Contract shall supply the following as part of the review for each proposed substitution for the Principal's Authorised Representative to deem equivalent:

- Data sheets
- Light distribution calculation files (.ies or .uld file)
- Layout illumination calculation
- Any test certificates required (LM 79, LM 80 or AS 2293 compliance)
- Cost comparison between specified and substitute

B.11.3 Lighting Control

Lighting control shall be provided via local switches, motion detectors or through manual switch control as denoted on the circuit schedules on the drawing. Provide within each switchboard cupboard a master lighting control panel to switch all lighting circuits supplied by the switchboard.

If not shown on the drawings, for each switchboard allow for 6 off circuits of general wall switch lighting control, six off circuits of security lighting control and six off circuits time switch lighting control.

For each enclosed space allow for a motion detector and a wall mounted lighting switch.

Motion sensors within plaster and tiled ceilings shall be Clipsal 753R-WE or approved equivalent.

Motion sensors within surface mounted areas shall be Clipsal 753SSR-WE or approved equivalent.

The construction documentation drawings shall have the lighting control methodology shown.

B.11.4 External Lighting

All external lighting circuits shall be controlled by an astronomical time clock which shall be installed adjacent to the lighting chassis. Provide a manual switch for the external lighting on the front face of each switchboard which feeds external lighting to switch the time clock.

B.11.5 Cabling in Galvanised Conduit

Allow for cabling run on the underside of the heritage floor and the underside of the new concrete floor to be within galvanised metal conduit. No plastic conduit shall be installed in a visible area.

B.11.6 Time Switched Lighting

Time switched lighting shall be turned on by separate contactors operated by the photo-electric relay but shall be turned off by a time switch. The time switch shall have 9 hours spring reserve.

A manual override switch for the contactor shall be provided on the switchboard unless otherwise specified.

B.11.7 Emergency Light Fittings

Where shown, supply and install self contained proprietary kits to convert one tube of the fitting nominated to being a maintained emergency light as a "single point system" all in accordance with AS 2293. Supply and install surface mounted and recessed emergency light fittings as shown on the drawings.

These kits shall be complete with Lithium Ion batteries.

Where such fittings are switched, supply an active feed from the line side of the switch to each emergency fitting for supply failure sensing.

Provide a control card within each exit sign for future connection to a site wide electronic monitored testing system.

B.11.8 Exit Signs

Exit signs shall be maintained "single point systems" in accordance with AS 2293.

Exit signs shall be unswitched remaining permanently on.

These kits shall be complete with Lithium Ion batteries.

Where such fittings are switched, supply an active feed from the line side of the switch to each emergency fitting for supply failure sensing.

Provide a control card within each exit sign for future connection to a site wide electronic monitored testing system.

B.12 POWER INSTALLATION

B.12.1 General

Supply and install and wire all socket outlets and power fittings as specified herein and shown on the attached drawings.

B.12.2 RCD Protected Socket Outlets

Provide residual current device (RCD) protection to the socket outlets in accordance with the requirements of AS/NZS 3000, wiring rules and with the requirements of regulation 3.60 of the Occupational Safety and Health Regulations.

RCD protection shall be provided via combined MACB/RCD units installed at the switchboard with a separate MACB/RCD unit for each socket outlet circuit.

B.12.3 Galvanised Conduit

Allow for cabling run on the underside of the heritage floor and the underside of the new concrete floor to be within galvanised metal conduit. No plastic conduit shall be installed in a visible area.

B.12.4 Soft Wiring

The soft wiring installation shall be as specified in the architectural documents and the desk equipment shall be supplied by the Contractor (Builder). Supply and install a power supply to each of the starter sockets located at desk level as shown on the drawing. Liaise with desk installer for exact locations.

Supply and install umbilical cords in locations shown on the drawing, colour is to be confirmed by the Superintendent. Supply and install cable tray to these drop down locations. For umbilical cords labelled 'future' provide the power supply coiled in the ceiling or cable tray and supply the umbilical cord for future installation.

B.12.5 Hand Dryers

Provide hand dryers within the amenities as shown on the drawings. Hand Dryers shall be Dyson Airblade DB. Confirm exact location of hand dryer location with architectural elevations prior to roughing in supply cable.

B.12.6 Power Operated Automatic Door

Power operated automatic door will be supplied and installed by the Head Contractor.

Cable and connect the control unit/s for the roller door/s as shown on the drawings. Supply and install all wiring between motors, limit switches, push buttons, key switches etc. and the control unit to enable operation of the roller door.

All wiring shall be strictly in accordance with the manufactures recommendations.

Adjust limit switches to suit travel.

B.12.7 Hot Water Units

Hot water units will be supplied and installed by the hydraulic services trade.

Hot water units shall be direct connected via a local isolator. Allow for all final connections of unit to the isolator.

B.12.8 Lifts

Provide a power supply to each lift installation consisting of a fire rated submain cable (WS52 minimum) installed in steel conduit, and terminate and connect the cable at the building main switchboard and at the lift controllers (include any fire rated termination boxes as required by the Lift Services Trade). The lift controller for passenger lifts is on the top level served. Liaise with the lift sub-contractor and obtain the final location and method of connection. Final termination to lift controller to be by the Lift Services Trade Contractor.

Provide all required waterproofing and all accessories (sump pump, submersible pump etc) required in pit of lift shaft in the event of water ingress. Liaise with Lift Services Trade Contractor for all required accessories.

B.13 COMMUNICATIONS INSTALLATION

B.13.1 General

The communications installation shall be carried out by an approved Specialist Communications Installer. The complete installation shall comply with the requirements of the Client.

B.13.2 Telephone Backbone Cabling Installation

- General

Supply and install the telephone backbone cabling installation including the following main items:

- Intermediate (IDF), boxes and blocks.
- Telephone backbone cabling.
- Telecommunication reference conductor system.
- All miscellaneous items such as insulating crossings and cable and covers, cable trays, conduits, ducts, battens and sundries such as clips, screws, masonry anchors, fasteners, etc. as required for a complete concealed re-wireable installation.

All telephone cabling shall be carried out by an approved General Premises Cabling Contractor.

All work shall be carried out in accordance with the current issue of "Customer Premises Cabling Manual" issued by Australian Communications Authority (ACA) and in accordance with all other requirements of AS 3080.

- Lead-in Cable

The lead-in cable shall be existing, terminated in the MDF as shown on the drawing..

- Intermediate Distribution Frames

Supply and install patch panels for the intermediate distribution frames (IDF), mounted in the electrical cupboard on each floor in Bay 5.

- Telephone Backbone Cabling

Supply and install 50 pair backbone telephone cable from the MDF to each IDF, terminate each cable at Krone Highway (or equivalent) communications frame.

- Provide cable record book at the MDF location.

B.14 ACCESS CONTROL

B.14.1 General

Engage an approved specialist security system installer to provide an addition to the Access Control System (ACS) as specified and shown on the drawings.

- The system shall be compatible with the existing base building security system.

Refer to the Technical Section of This Specification for the general information.

The ACS shall provide:

- Card authentication of nominated personnel;
- Photographic identification of personnel embedded on proximity cards;
- Keypads to nominated locations;
- Controlled door (including lifts) authentication;
- Hardware and connectivity to support the ACS;

System programming, scheduling, access card validation and other system set up shall be carried out from the Security Control Room workstation.

B.14.2 Operation of System

B.14.2.1 General

The ACS shall control the access and egress of personnel at the entrances to and within the building.

It is intended that the system shall operate generally as described below however all control functions shall be capable of being adjusted by reprogramming as required.

B.14.2.2 Building Perimeter Controlled Access Points

Ground Floor Main Entry

During hours of normal occupancy these access points shall not be secured i.e. Outside normal hours these doors shall be locked and shall open when a valid proximity card is presented to the associated card reader. The associated door shall be released allowing free access and egress. The controlled access point shall also open to allow egress from the building whenever the associated push-button is operated.

Entry door in Bay 4 level 2 will be key locked and allow egress from the building whenever the associated push-button is operated.

All other Perimeter Entries

These doors shall be locked and shall open when a valid proximity card is presented to the associated card reader.

The controlled access point shall also open to allow egress from the building whenever the associated push-button is operated.

Capacity shall be provided for reprogramming to allow the access points not to be secure for a single regular time period each working day.

B.14.2.3 Building Internal Controlled Access Points

General

Internal controlled access points shall normally be locked during all hours and shall open when a valid proximity card is presented to the associated card reader.

Egress from the secure area shall be permitted by operation of the push-button.

Capacity shall be provided for reprogramming to allow the access points not to be secure for a single regular time period each working day.

All fire doors in the link between bay 4 and 5 will have a push (REX) button to automatically open for disabled access from bay 4 lobby to bay 5.

Fire Alarm Fail Open

The following doors shall be fail open on receipt of an alarm from the Fire Indicator Panel:

Ground Floor 4GD/D03

Level 2: 5L2/XD2

B.14.3 Equipment

B.14.3.1 Access Cards

Provide one hundred (100) access control cards, programmed for cardholder database information for a minimum of two hundred (200) card holders.

The access cards shall be proximity cards compatible with MIFARE 26 bit Wiegand format.

B.14.3.2 Card Readers

Card readers shall be Gallagher TIRIS series.

B.14.3.3 Door Lock Control and Monitoring Devices

All electric locking devices shall be configured for power ON to lock (fail secure).

B.14.4 **Power Supply**

The power supplies shall be connected to the normal supply mains.

Provide all eight hours battery backup to all power supplies.

B.14.5 **Interfaces**

B.14.5.1 Human Resources (HR) Interface

The ACS shall be interfaced into the HR database to provide a single source database for automated user information replication.

B.14.5.2 Fire Detection and Alarm System Interface

Provide an interface to the fire detection and alarm system such that any secured access controlled doors automatically unlock in the event of a fire alarm.

B.14.5.3 Lift Interface

Provide security cabling to each lift well for access control to car buttons and card reader to each car.

Provide a termination box, complete with terminal strips, and mount on the external wall of the lift well, and connect all security and lift trades cabling.

Provide to the lift trades the required specifications for cables required to be installed in the trailing cable harness of each lift car for card readers.

Connect security trailing cables, provided by the lift trades, to the termination box.

Advise the lift trades of the required mounting details for card readers in each lift car.

Install card readers and make all cable connections.

Carry out testing and commissioning of access control to car buttons and card reader to each car each lift.

B.14.5.4 Automatic Door Interface

Access controlled automatic doors shall be interfaced to the ACS.

Each automatic door shall include an external four (4) point override switch. The switch shall include the following modes:

- Auto;
- Open;
- Exit; and

- Lock.

The ACS shall control the door when in “Auto” mode.

Each access controlled automatic sliding door shall be connected to a ACS controller via a four (4) core cable. Two (2) cores shall be connected to the day/night input of the automatic door controller and two (2) cores shall be connected to the pulse input of the automatic door controller control.

When in auto mode the door shall either in in “Day” or “Night” mode.

- **Day Mode**
 - The door shall on command from the ACS unlock into “Day mode”. This allows free access and egress during this period.
- **Night Mode**
 - The door shall on command from the ACS, lock into after hour’s operation. The door controller closes and locks the door, and the door does not respond to the door PIR sensors. Access will occur only by use of a valid access card presented to the associated door card reader.
 - Egress in the After Hours Mode is allowed when the Press to Exit button is activated.

B.14.6 Spares

Required - Refer to Section C.9 of This Specification for the generic requirements for spares.

Provide 5% of the total installed quantity of each of the following devices spares to the Principal:

Supply as spares to be stored on site with:

- Card readers
- Electric strikes or locks
- Maglocks

B.14.7 Training

Required - Refer to Section C.10 of This Specification for the generic training requirements.

B.15 COMMISSIONING AND TESTING

B.15.1 General

The installation shall be tested to the satisfaction of the Consulting Engineer and the Statutory Authorities prior to Practical Completion.

The installation shall be tested progressively as areas of work are completed and the whole installation shall be tested when complete in sufficient detail to ensure the following:

- Installation is mechanically and electrically safe.
- Installation operates correctly under normal, emergency and fault conditions.
- Phases shall be balanced on all boards to be within of 10% of each other.
- Power quality audit, which includes a full harmonics study, shall be carried out prior to occupation and afterwards to confirm that this conforms to AS/NZS61000 and Supply Authority's requirements. This includes the Mechanical and Hydraulics Services switchboards. Any non-conformance prior to occupation shall be rectified by the relevant Electrical, Mechanical or Hydraulic Services Trade.

Any equipment or materials found to be faulty during testing shall be repaired or replaced to approval and retested.

Carry out specific commissioning procedures as set out in the following clauses and allow all costs of materials and labour required.

Within the construction programme allow adequate time for carrying out all commissioning prior to practical completion.

Record results of all commissioning and testing, including date of test and provide copies of test results to the Consulting Engineer when requested.

As each area of the installation has been satisfactorily tested/commissioned, advise the Consulting Engineer in writing. Repeat the tests when requested to be witnessed by the Consulting Engineer.

Where Statutory Authorities require to witness commissioning/testing procedures, the Contractor shall advise them in writing of the test results and repeat the tests as required by that Authority.

It shall be the Contractor's responsibility to obtain the approval of the Statutory Authority prior to practical completion.

B.15.2 Time Switches

Adjust the setting as instructed. Prove that the time switch controls the correct circuits as specified and show that the manual override switch is operative.

B.15.3 Photocells

Check the operation of the photocell and check that the correct circuits are controlled. Check that manual override switches operate correctly for external light fittings

B.15.4 Emergency Lights and Exit Signs

Check that each emergency light operates correctly when the appropriate normal power circuit voltage fails.

For fittings with maintained operation, check that the manual switches energise the appropriate fittings.

Check the power available light and the test switch on single point fittings are operative.

Conduct commissioning tests in accordance with AS 2293.

B.16 PRINCIPAL INSTRUCTION

Provide experienced personnel to instruct the Principal's nominated representatives in the operation of the electrical service equipment and systems.

B.17 AS CONSTRUCTED DRAWINGS SUPPLIED BY CONTRACTOR

Approaching Practical Completion, the Electrical Sub-Contractor shall, at his request, be supplied with a copy of the CAD drawings (format shall be in accordance with Wood & Grieve Engineers current software).

He shall record the positions and sizes of all conduits, boxes, cable trays, cables, and cable pits to produce "as constructed" drawings.

Drawings shall be amended by a competent draftsman with CAD experience.

The Electrical Sub-Contractor shall sign these drawings and mark each one "as constructed" and return same to the Superintendent.

The Electrical Sub-Contractor shall provide the following copies of the "as constructed" drawings:

- One complete set of all drawings in reproducible format.
- One copy of CAD drawings on disk.
- Three sets of reduced A3 prints of all drawings to be included in the maintenance and operating instructions.

B.18 MAINTENANCE AND OPERATING INSTRUCTIONS

Provide 1 hard copy of the maintenance and operating instructions. The instructions shall be bound in a hard cover, plastic covered, ring binder. The cover and spine shall be labelled in block lettering. The binder shall come complete with three optical discs (CD or DVD) with all contents of the manual in .pdf and .dwg format files.

A draft copy of the manual must be submitted to the Superintendent in electronic form two weeks prior to practical completion for Client review.

The instructions shall include the following sections:

- Description of System
- Operating Instructions
- Maintenance Instructions
- Warranty Maintenance
- Fault Finding
- Equipment Schedule (including lamps and globes)
- Control Schedule
- Name plate Details
- As Constructed Drawings.

B.19 MAINTENANCE

Provide corrective maintenance and repair to all electrical equipment and systems which become defective, or is found to be defective, during the Defects Liability Period, including the making good of any resulting damage.

In addition, provide preventative maintenance of the electrical services for the full duration of the Defects Liability Period, in accordance with this section.

Prepare and retain copies of all service reports, including details of all preventative and corrective maintenance work carried out and copies of log book entries. At the completion of the maintenance period or at any other time when requested submit a copy of all records to the Superintendent.

B.19.1 Preventative Maintenance

Generally, the routine preventative maintenance shall include the inspections, testing and such other checking as may be considered necessary at the time.

Notify the Building Engineer on arrival and log details of all visits.

Preventative maintenance shall include the following:

B.19.1.1 One Monthly Services (12 off)

- Low Voltage Installation:
 - Nil
- Emergency Lighting Installation:
 - Nil

B.19.1.2 Six Monthly Services (2 off)

- Low Voltage Installation
 - Check operation of all earth leakage circuit breakers.
- Emergency Lighting Installation
 - Six monthly inspection and maintenance procedures in accordance with AS 2293.2.

B.19.1.3 Yearly Service (1 off)

To be carried out 4 weeks prior to end of defects liability period.

- Low voltage installation
 - Use RCD tester to test all outlets connected to earth leakage protected circuits
 - Thermographic survey of all electrical services switchboards.
- Emergency Lighting Installation
 - Twelve monthly inspection and maintenance procedures in accordance with AS2293.2.

PART C. TECHNICAL

C.1 COORDINATION WITH OTHER TRADES

It is the Contractor's responsibility to coordinate all elements of the Electrical Contract with the other trades. All coordination undertaken shall be documented in writing to demonstrate that coordination has been performed on site prior to the works being undertaken.

Any remedial, abortive or additional works required on site due to the lack of coordination shall be at the Contractor's expense at no additional cost to the Superintendent.

Prior to purchase, installation or fabrication of any electrical equipment associated with other trades, check the actual requirements with the other trade and advise the Consulting Engineer if there are any discrepancies prior to works being undertaken.

C.2 MATERIALS AND WORKMANSHIP

All materials shall be new and free from all defects.

Any workmanship, materials or installation, which on inspection by such authorities, is found to require modification to be acceptable to the authority concerned shall be replaced, changed, modified, or otherwise put in a form to pass the relevant regulations. Such modifications shall be at the expense of the Contractor.

Take all necessary precautions with the supply and installation of equipment specified to prevent corrosion. If, in the opinion of the Contractor, equipment specified cannot be adequately protected against corrosion they shall request an instruction regarding same from the Superintendent.

Any component or accessory showing signs of rust or corrosion during the defects liability period shall be renewed or otherwise made good in an approved manner.

All materials, labour and plant shall be provided unless otherwise specified. All materials shall be new and the best of their respective kinds and free from all defects.

All materials, equipment and work shall comply with the appropriate Australian Standard Specification or Code, or if such have not been prepared with the appropriate British Standard.

C.3 SHOP DRAWINGS

Prepare, and submit for review shop drawings before commencing installation. Shop drawings shall be reviewed by the Consulting Engineer for comment and approval; however any approval does not negate the Contractors responsibilities to comply with the requirements of the contractual documentation.

Design drawings shall be submitted to the Superintendent for approval prior to the order of any equipment, allow two weeks for drawing return.

Drawings shall be prepared using AS 1102 drafting standard symbols.

Drawings shall be fully documented in accordance with the project Cad protocols. A copy of which shall be provided upon request.

Drawings shall be provided with a legend of symbols, where applicable.

Shop drawings shall all be on the same size drawing sheets and shall be to the scale of not less than 1:100 and larger where necessary.

Shop drawings shall be of the same size as the project drawings.

An electronic (PDF) copy of shop drawings shall be submitted. Allow two weeks for return of shop drawings. When requested amend shop drawings and resubmit.

Note that shop drawings are reviewed for general principle of design only and review of shop drawings by the Consulting Engineer in no way relieves the Contractor of their responsibility to comply with the requirements of This Specification and associated drawings.

Shop drawings shall be reviewed and signed as being correct by the electrical services trades prior to being submitted to the Consultant.

Shop drawings shall be included within the O&M manuals.

The detailed system specific requirements for shop drawings are further covered within the discipline specific specification section.

C.4 SAMPLES

Samples of the items listed in part B.5 shall be submitted for approval prior to purchase, at least two weeks before approval is required. Samples shall be clearly marked with the manufacturer's name and catalogue number.

After approval, samples shall be available for incorporation in the works.

Manufacturer's literature giving detailed specification, physical appearance and size for the following equipment shall be submitted for approval prior to purchase. Information shall be submitted at least two weeks before approval is required.

Samples shall be clearly marked with the manufacturers' name and catalogue number.

After approval, samples shall be available for incorporation in the works.

The detailed system specific requirements for samples are further covered within the discipline specific specification section.

C.5 INTERFACES

C.5.1 General

Provide middleware devices capable of being the consolidation point for various third party systems. The systems requiring integration shall generally be dependent on a messaging output for any alarm or changes of state conditions.

Provide any required TAP, AIM, ADM, POCSAG, PBX, Generic Input, Script, proprietary protocols (or similar) gateways/interfaces as required to achieve the over-arching functionality required.

Provide industry Standard API certification, where applicable to validate their integration capabilities with the third party systems as indicated above.

Provide references to validate the customisation and integration of the overall solution in an existing facility.

The following interfaces are only required where specifically referred to by other specification clause (or any other documented references such as on the drawings).

C.5.2 Alarm Management System Interface

Provide the system with Ethernet IP enable outputs to interface to an alarm management system(s) so that all alarms are transmitted as messages to the alarm management system(s).

The system shall be capable of generating and directly transmitting appropriate messages in response to at least:

- Events within the system (including alarms)
- Timed schedules
- Adhoc / administrative queries

To any Internet Protocol v4 (IPv4) addressable endpoint at the Facility using:

- Extensible Markup Language Version 1 (XMLv1); and
- Any of the following protocols:
 - Simple Network Management Protocol Version 3 (SNMPv3)
 - Simple Mail Transfer Protocol (SMTP)

With any such messages containing information which is:

- In line with a standardised, understood and agreed messaging format / schemata
- Functionally useful, including at least:
 - The system from which the message originated
 - A standardised code (within the context of the originating system) representing the nature / purpose of the message
 - A standardised code (within the context of the originating system) representing the priority / urgency of the message

The maximum time duration from the alarm being raised to the alarm being transmitted onto the IP network shall not exceed three seconds.

C.5.3 Building Management System Interface

Liaise with the BMS Trades and coordinate the installation prior to purchase or ordering of any electrical equipment associated with inputs to and outputs from the BMS. Participate in coordinated 'end-to-end' commissioning of Electrical Services BMS points and control sequences including troubleshooting as necessary and ensure that all control drawings and switchboard drawings are properly reviewed and coordinated to ensure compatibility of designs and control interfaces.

Inputs and Outputs to/from the BMS shall be as follows:

- Digital High Level inputs to BMS - RS485 or equal as required.
- Digital Inputs to BMS at 24V DC - Voltage free relay contacts rated at 5amps.
- Digital Outputs from BMS - 24V DC or 24V AC Voltage free relay contacts rated at 5amps.

- Analogue Inputs to BMS - Either 0 - 10V DC or 4 - 20mA.
- Analogue Outputs from BMS - Either 0 - 10V DC or 4 - 20mA.

C.5.4 Synchronized Time/Clock

Provide an interface so that the system is synchronized with the site Network Time Protocol (NTP) server clock.

C.6 MAINTENANCE

C.6.1 General

Unless specified otherwise the Maintenance Period is the Defects Liability Period under the contract.

During the Maintenance Period:

- Provide corrective maintenance and repair to all electrical equipment and systems which become defective, or is found to be defective, including the making good of any resulting damage.
- Carry out periodic inspections and maintenance work as required by statutory regulations and recommended by manufacturers of supplied equipment, and promptly rectify faults.
- Provide preventative maintenance of the electrical services.

Prepare and retain copies of all service reports, including details of all preventative and corrective maintenance work carried out and copies of log book entries. At the completion of the maintenance period or at any other time when requested submit a copy of all records to the Superintendent.

Update the maintenance section of the Operating and Maintenance manual at the end of Maintenance Period to include all changes and upgrades to services.

C.6.2 Preventative Maintenance

Generally, the routine preventative maintenance shall include the inspections, testing and such other checking as may be considered necessary at the time.

Notify the Superintendent or Principal on arrival and log details of all visits.

C.7 OPERATION & MAINTENANCE MANUALS

C.7.1 General

The Operation and Maintenance Manuals shall be set up with the following headings and include the associated information:

- Introduction and Guide
- Assets Register
- Manufacturers' literature for all parts (including technical data)
- Maintenance
- Operating Procedures

- Warranties, Licences and Certificates
- Testing and Inspection, Commissioning Results
- Spare Parts
- Help and Contacts
- As-Constructed and Shop Drawings
- Health and Safety

C.7.2 Hard Copies

Hardcopies of the O&M manuals shall be:

- A4 size
- loose leaf
- Commercial quality lever arch files with compressor bars and hard covers
- Indexed, divided and titled
- Number all pages consecutively
- Identify each binder with printed title to spine and front cover and identifying the title of the project, the volume number, the volume subject matter and the date of issue
- Provide manufacturer's printed data as is specifically appropriate to the project. Where more than one possibility is covered in the data, indicate clearly the appropriate equipment or model
- Text/content shall not be hand written
- Printing shall be on bond quality paper
- Provide durable dividers for each separate element. Label dividers using laminated tabs
- Provide drawings folded to A4 size and bound to enable unfolding without detachment from the binder
- Any Memory sticks or discs included shall be securely held in resealable envelopes or pockets

C.7.3 Electronic Copies

Electronic copies of the O&M manuals shall be:

- Sized and set to print on A4 paper
- Be provided in two formats:
 - Adobe Portable documents format, PDF
 - The original source file

- Be produced to suit electronic on line documentation as defined within the Preliminaries (such as BIM PLAN or equivalent);
- Be produced in a form suitable for use with Adobe Acrobat 5.0 software or higher;
- For pre-formatted documents produced by other software products for inclusion in the manuals, be provided in Adobe Portable Document Format, PDF; and
- Be provided in electronic format with the following information:
 - Project name
 - Services
 - Drawing numbers
 - File type/s
 - Date
- Electronic documents shall be provided on memory stick or disc and shall be stored as below
 - Individual folders indexed with xx number followed by titled with folder as per the general requirements part of this section;
 - All files inside directories to be numbered consecutively with clear description of contents of file;
 - Memory Device/CD shall be identify with printed title on cover identifying the title of the project, the volume number, the volume subject matter and the date of issue;
 - Provide manufacturers' printed data that is specifically appropriate to the project. Where more than one possibility is covered in the data, indicate clearly the appropriate equipment or model.

As-constructed drawings shall have:

- PDF Versions of DWG drawings be named the same with the file type extension providing differentiation of files (include short descriptor such as elec,-power, lighting etc in all file names);
- DWG files be supplied with all XREFs bound into a single file. This is inclusive of all images, shapes and fonts. Providing XREFs with main drawing will NOT be accepted; and
- Each drawing shall be provided as a separate file. A tabbed suite of drawings will NOT be accepted.

C.7.4 Introduction and Guide

This section shall include the following:

- **Table of contents:** Table of contents, overall and for each volume
- **Introduction:** provide information on what the project is about, where on the site or building the works has been completed etc.
- Description and details of each system:
 - Description and details of each system.

- Complete sets of Installation Instructions for all components of each system
- Complete sets of User Instructions and Manuals for each system.
- Any photographic records (appropriately identified) shall be included.
- **How to use guide:** Information on where certain information can be found to reduce the amount of time a person is required to read and find information
- Contractual and Legal Information

C.7.5 Assets Register

Refer to the Head Contract conditions for asset registration requirements. Examples of the items to be registered include, but are not limited to, the following:

- Main Switchboard
- Distribution Boards
- Power factor correction cabinets
- UPS's
- Luminaires
- Lighting poles
- Communications frames, racks, cabinets
- Clocks
- Security equipment (NVR's, PC's, servers, displays and the like)
- Generating Sets, control cabinet and fuel tank system
- Alternate power systems
- Transformers
- Battery Charger Rectifier Units
- Emergency Lighting System
- Combined Earthing System

C.7.6 Technical Data

Manufacturer's technical literature assembled specifically for the project and excluding irrelevant matter. Each product data sheet marked to clearly identify the specific products and components used in the installation and data applicable. Additional instructions and illustrations as required to identify any changes to the manufacturer's data or to illustrate the function of each component in the installation.

C.7.7 Maintenance

Provide the following information in the section:

- Maintenance instructions
 - Emergency procedures, including telephone numbers for emergency services, and procedures for fault-finding
 - Manufacturers technical literature as appropriate
 - Detailed recommendations for the frequency of performance of routine maintenance tasks
 - List of procedures and tasks associated with preventive (routine) maintenance
 - Procedures for safe trouble shooting, disassembly, repair and reassembly, cleaning, alignment inspection and adjustment, including a logical step-by-step sequence of instructions for each procedure.
 - Provide detailed cleaning regimes for each major system (and individual equipment) in accordance with the manufacturer's requirements and warranties.
- Maintenance schedules
 - A schedule of the frequency of the required or recommended maintenance, testing or inspection for each type of equipment. This schedule is to include weekly, monthly attendance times
 - Provide separate maintenance schedules for each type of equipment with the minimum details as shown below:
- Information/data name
- Location of the equipment
- Description of the equipment
- Unique ID
- Inspection type/frequency
- Maintenance required
- Inspection results
- Comments on each inspection
- Inspection date
- Inspector name, title and address

Update the maintenance section of the O&M manuals at the end of defects liability period to include all changes and upgrades to services.

C.7.8 Operating Procedures

Include the following information in this section:

- Manufacturer's technical literature as appropriate. For other than common accessories, where no manufacturer literature is available, a precise and concise description of the operation procedure in plain English shall be provided.
- Safe starting, running, operating and shutting-down procedures for the equipment installed including logical step-by-step sequence of instructions for each procedure.
- Control sequence and flow diagrams for the systems installed.
- A legend for colour-coded services. A legend of the symbols used on the drawings, unless included on the drawings.
- Schedule of the parameter setting of each protective device, including fixed and adjustable circuit breakers, protective relays, adjustable photoelectric switches, pressure switches, and any other control and monitoring device, as established during commissioning and maintenance.
- Provide all procedures that may be utilised to identify and rectify common system/equipment faults.
- First Aid.

C.7.9 Warranties, Licences and Certificates

Include the following information in this section:

- Copies of manufacturers warranties.
- Copies of any relevant licences (manufacturers, system, and/or authority).
- All guarantees.
- Certificates from authorities.
- Individual certificates (from the installing/specialist trades) of compliance for each and every system to be provided.
- If installation is not by the manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's approval of the installing firm.

All Warranties shall name the equipment owner.

C.7.10 Testing and Inspection, Commissioning Results

Include the following information in this section:

- Records of Electrical test results.
- Records of Communication test results.
- Records of commissioning plan and program.
- Records of certified testing equipment.
- Records of portable appliance testing results (where required).

C.7.11 Spare Parts List

Include the following information in this section:

- Schedule of spares with an expected operating life less than 60,000 hours, including item label manufacturer name, address and telephone number, catalogue number, name and address of local distributor, and the expected replacement frequency.
- Schedule of consumable items (oil, grease, belts, bearings etc.) to be used during servicing.
- The cost of such spares shall include, supply, individual packing and identification of each item, and delivery to site.
- Spares and service expertise shall be available for at least 15 years after Completion.
- Spares and Consumable Register including the following information for each product:
 - Product
 - Manufacturer Name
 - Address and Telephone Number
 - Catalogue Number
 - Local Distributor Name, Address and Telephone
 - Replacement Frequency
 - Comments
 - Imported Equipment: Where the Contractor has imported equipment from outside of Australia then the following additional information in a separate table":
 - i. List of all imported equipment
 - ii. Country of origin
 - iii. Importer details
 - iv. Australia servicing contact details

C.7.12 Help and Contacts

Provide all help and contact details for each service contract (including specialist installers). Minimum contact details are as follows:

- Discipline/Service (i.e. Electrical, Security, Structured Cabling, Assistance Call etc)
- Name of Contractor
- Address
- Daytime telephone contact

- Afterhours telephone contact

C.7.13 As-Constructed and Shop Drawings

Include the following information in this section:

- Index list of all drawings in numerical order including full title and revision date;
- Copy of all As-Constructed Drawings; and
- Copy of all As-Constructed Shop drawings.

All hard copies shall be provided on the same size print sheet for uniformity of all drawings.

C.7.14 Health and Safety

Include the following information in this section:

- Guidance to relevant legislation
- Control of workplace hazardous substances
- Risk Assessments
- Disposal Information

C.8 AS-CONSTRUCTED DRAWINGS

Maintain a set of full size electrical contract drawings on site during the entire duration of construction and mark-up the exact locations of all electrical equipment installed.

Approaching Practical Completion, request (the Superintendent) for an electronic copy of the Electrical Contract Drawings (format provided shall be in accordance with the Consulting Engineers software used to design the project – typically Autocad or Revit).

Drawings shall be fully documented in accordance with the project Cad protocols. A copy of which shall be provided upon request.

Produce an “As-Constructed” set of electronic drawings based on the drawings kept on site. The “As-Constructed” drawings shall be amended by a competent draftsman with experience in reproducing electronic drawings.

Sign these drawings and mark each one "As-Constructed" and return same to the Superintendent for Consulting Engineer review and comments.

Upon acceptance from the Consulting Engineer and the Superintendent insert the “As-Constructed” drawings to the O&M manuals.

The As-Constructed drawings shall:

- Include GPS coordinates to identify the exact locations (within 1m) of all pits, major building entry points and changes of direction of underground conduits;
- Have all design related notes removed (unless they are still relevant to the as-constructed installation);
- Show the position of all installed services;

- Have the circuiting and circuit schedules updated and complete;
- Have all equipment schedules (particularly lighting) updated to reflect the actual products installed.
- Include circuit breaker types and trip unit settings on the single line diagrams (schematics);
- Include any changes to any single line diagrams;
- Include any submains cable substitutions (size and type);
- Include any other modifications conducted on the site during the installation; and
- Include the electrical trades business name, electrical licence number and contact details;

C.9 SPARES

Spares (where specified within the contract documentation) shall be handed over the Superintendent prior to Practical Completion. Spares shall be complete with the original manufacturers packaging and include the part make and model.

Please note that system specific requirements for spares are also located in the system specific specification sections.

Submit a separate list with individual prices of spare parts recommended for 5 (five) years of normal operations. The cost of such spares shall include, supply, individual packing and identification of each item and delivery to site.

All or any of the spares offered may be ordered at the discretion of the Superintendent separately from the Contract, or an appropriate sum may be added to the Contract.

Any spare parts ordered shall be delivered to the Superintendent's site representative, suitably protected and packaged to prevent deterioration during delivery and storage, and with clear indelible markings to identify the contents of each package. Such identification marks shall include and tally with the description and part number shown in the manufacturer's drawings and/or handbooks.

The spares offered shall include for the following:

- Spare fuses
- Equipment and/or devices necessary for earthing and testing
- Any other spares recommended by the manufacturer
- Any special tools or handling equipment required for maintenance

C.10 TRAINING

Provide onsite training for staff nominated by the Superintendent. Supply all equipment, instruments and training aids.

Supply a copy of the Operators Instruction Manual one week before the training to allow staff to be familiarised with the relevant system.

Onsite training shall include basic theory of operation of the systems, routine maintenance, identification of faults and recommended course for rectification.

Submit a program of the training three months before the proposed date of the training. This program shall include the contents of the training and the minimum time necessary for the formal instruction.

Training sessions shall be arranged at times to suit the Principals' nominated representatives and shall be of sufficient duration and content to train staff unfamiliar with the equipment or systems to a level allowing them to operate the equipment or systems competently.

Respond to queries and provide additional advice and support to the Principals' representatives throughout the Defect Liability Period.

Provide a schedule of completed training including evidence of original attendee lists and content covered during the respective training session.

Please note that system specific training requirements are also included in the system specific specification sections.

C.11 WARRANTY

Warrant all equipment and systems installed from the time of arriving on site, through to the date for Practical Completion and for the defect liability period unless otherwise specifically specified as a longer period.

C.12 TESTING AND COMMISSIONING

Provide full testing and commissioning to all relevant statutory requirements including, but not limited to, the:

- Relevant Australian Standards
- Manufacturers requirements
- Supply Authority requirements

Commissioning schedules, operational flow charts, functional prerequisites shall be supplied for approval prior to commissioning.

Undertake the adjustment of controls, commissioning and testing of all equipment installed.

The installation shall be tested progressively as areas of work are completed and the whole installation shall be tested when complete in sufficient detail to ensure the following:

- Installation is mechanically and electrically safe
- Installation operates correctly under normal, emergency and fault conditions

Any equipment or materials found to be faulty during testing shall be repaired or replaced to approval and retested.

Carry out specific commissioning procedures as set out in the contract documents and allow all costs of materials and labour required.

Whilst indicative commissioning information has been provided on the drawings all systems shall be setup and commissioned to the requirements of the Superintendent.

Request any and all commissioning information from the Superintendent at least two months prior to commissioning being conducted.

Commission and programme all systems to the requirements of the Consulting Engineer and Superintendent.

Within the construction programme allow adequate time for carrying out all testing and commissioning prior to Practical Completion.

Record results of all testing and commissioning, including date of test and provide copies of test results to the Consulting Engineer when requested.

As each area of the installation has been satisfactorily tested and commissioned, advise the Consulting Engineer in writing. Repeat the tests when requested to be witnessed by the Consulting Engineer.

Where Statutory Authorities require witnessing testing and/or commissioning, advise them in writing of the test results and repeat the tests as required by that Authority.

It shall be the Contractors responsibility to obtain the approval of the Statutory Authority prior to Practical Completion.

The day prior to Practical Completion (or otherwise as approved by the Project Superintendent):

- Clean and re-lamp all fittings used during construction
- Clean the interior and exterior of all switchgear and control gear assemblies
- Clean switchgear, contactors and other electrical contacts which may have been affected by the dirt and dust either before or during construction works

Inspection and test reports shall be submitted to complete the certification of the system.

Please note that system specific testing and commissioning requirements are also included in the system specific specification sections.

C.13 CERTIFICATIONS

Provide written certifications (as follows) for the installation and each system (and include within the O&M manuals):

- Installing contractors' certifications that the installation complies with the relevant Australian Standards, statutory/regulatory authority and manufacturers' requirements.
- Arrange all necessary site inspections and approvals required for controlling Authorities and provide certificates of those approvals and inspections as being satisfactory to those Authorities.
- A written manufacturer's certification that the installation complies with their requirements.

C.14 FIRE RATING

C.14.1 General

All penetrations of smoke or fire rated walls, slabs and ceilings shall be constructed and sealed after installation of cables or equipment, in accordance with the NCC Deemed-to-Satisfy Provisions and the applicable state amendments to preserve the integrity of their fire/smoke rating.

Any and all penetrations through fire or smoke rated walls shall be appropriately labelled in accordance with the Australian Standards and identified and inserted into the O&M manuals (i.e. penetrations schedule).

Fire rated wall boxes (adequately sealed to ensure the fire rating of the wall is maintained) shall be utilised for all services that are installed within fire walls, and comply with the fire/smoke wall system manufacturers' construction requirements.

C.14.2 Australian Standards and Regulatory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS 1851 Routine service of fire protection systems and equipment
- AS/NZS 3013 Electrical installations - Classification of fire and mechanical performance of wiring system elements
- AS 4072.1 Components for the protection of openings in fire-resistant separating elements - Service penetrations and control joints

C.14.3 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition:

- Include drawings and a penetrations schedule detailing all penetrations through fire or smoke rated walls.

C.14.4 Certification

Required as per section C.13 of This Specification.

In addition:

- Independent certification shall be provided to confirm that all penetrations under this scope of works have been carried out in accordance with the BCA/NCC and to the requirements of the relevant statutory authorities.

C.15 SEISMIC RESTRAINTS

C.15.1 General

Engage a structural engineer to design and certify the seismic restraints for all systems and equipment in order to comply with the statutory requirements and Australian Standards.

C.15.2 Australian Standards and Regulatory Requirements

Seismic restraints shall be designed in accordance with AS 1170.4: Structural Design Actions - Part 4: Earthquake actions in Australia.

C.15.3 Design of Seismic Restraints

Buildings designated by the structural engineer as being either Earthquake Design Category II or III require the parts and components listed below to be restrained against seismic horizontal & vertical forces as detailed in AS 1170.4.

Where flexible mounting devices (such as spring mountings) are used, they shall be fitted with restraining devices to limit the horizontal and vertical motion, to inhibit the development of resonance in the flexible mounting system, and to prevent overturning.

Determine the horizontal and vertical earthquake forces for each component in accordance with section 8 of AS 1170.4 and size all mounts and restraints accordingly.

C.15.4 Coordination with other Trades and Services

All parts and components that are connected to walls, ceilings and partitions shall be coordinated with the relevant trade. This includes providing connection details and the mass of these parts and components to allow for the seismic support design of the walls, ceilings and partitions to be undertaken.

C.15.5 Maintenance

Required - Refer to Section C.6 of This Specification for the general maintenance requirements.

C.15.6 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition:

- Provide a copy of structural engineer's written certification.

C.15.7 Certification

Required as per section C.13 of This Specification.

In addition:

- Engage a suitably qualified structural engineer to provide written certification of compliance to AS/NZS 1170.4.

C.16 ACOUSTIC TREATMENTS

C.16.1 Cable Penetrations through Masonry Wall:

Any gaps between cable penetrations and the opening in acoustic surfaces shall not be greater than 20mm. Pack the void with fibre glass insulation to a density of 30 Kg/m³ density. Seal the opening on both sides of the wall with a flexible sealant, minimum 15mm thickness.

C.16.2 Cable Penetrations through Stud Frame Wall:

Any gaps between cable penetration (up to three twin flex) and the opening in the acoustic wall shall not be greater than 20mm. Ensure minimum thickness of plasterboard at penetration is 26mm. Provide additional overlapping face board if required. Seal the opening on both sides of the wall with a flexible sealant, minimum 15mm thickness or to the size of the gap whichever is the greater.

Back to back switches/outlets shall be avoided in frame stud walls. The minimum offset between outlets on either side of the wall shall be 300mm horizontally and 600mm vertically. In addition, it is also recommended that the stud be located between the two outlets. All wall boxes installed in noise sensitive areas (i.e. $R_w > 48$) shall be fire rated wall boxes rated at STC 50.

C.17 EARTHING AND BONDING

C.17.1 General

Supply, install and commission a complete earthing as specified within This Specification. Refer to Section B of This Specification for the specific information.

C.17.2 Australian Standards and Regulatory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 1768 Lightning Protection
- AS/NZS 2067 Substations and high voltage installations exceeding 1 kV ac.
- AS/NZS 3000 Wirings Rules
- AS/NZS 3003 Electrical installations – Patient areas
- AAS/NZS 3008 Electrical installations – Selection of cables
- AS/NZS 3017 Electrical Installations – Verification Guidelines
- AS/NZS 3835 Earth potential rise - Protection of telecommunications network users, personnel and plant
- AS/NZS 4853 Electrical hazards on metallic pipelines
- AS/CA S009 Installation requirements for customer cabling (Wiring Rules)
- HB219 Earth potential rise – Protection of telecommunications network users, personnel and plant

C.17.3 Main Earth

Each building shall typically be provided with PVC insulated copper earth conductor enclosed in conduit from the site main switchboard or building main switchboard or MEN to the earth electrode connection points and/or grading rings. At the earth connection point supply and install one or more copper clad steel core electrodes power driven to a sufficient depth. Where there is more than one electrode connection of all electrodes via a grading ring is required. Depth of electrodes to be either to local Supply Authority requirements or determined by calculation to relevant Australian standards.

Soil resistivity testing shall be conducted over the entire site.

The earth connection points shall be enclosed in an earth pit/box. The lid of the box shall be marked "Main Earth". The top face of the lid shall be level with the surface of the ground.

The position of each earth connection point shall be approved by the Supply Authority and shall be clearly described on a plastic covered drawing mounted in the main switchboard.

C.17.4 Substation Earthing

The design process for the high voltage earthing shall follow the process indicated in AS 2067, HB219, AS/NZS 3835, AS/NZS 4853 and AS/ACIF S009. The earthing systems shall in addition comply with all relevant standards.

Generally a combined/interconnected high voltage and low voltage earthing system is preferred however other arrangements such as separated systems may be permitted.

Each SMSB/transformer will typically have a separate MEN link and separate building main earth bar, grading ring/earth grid and earth electrodes. The earth electrodes, together with the connections to the building structure shall be connected to this bar.

The earth grid/earth grid shall be installed as part of the construction of the substation and shall consist of a series of copper bonded-steel earth electrodes, connected together by a grid of minimum 120 sqmm bare copper conductor buried to 600 mm depth.

Depth of electrodes to be either to local Supply Authority requirements or determined by calculation to relevant Australian standards.

All earth grid connections shall be by use of exothermic type connections. No bolted or clamped type connections shall be allowed.

Utilise a proprietary type ground enhancing material that exhibits resistance of less than 0.12 Ω . This should be placed as close as possible around the buried ground electrode in order to maximise its conductivity. 'Bentonite' slurry is not preferred to be used due to its hygroscopic nature and risk of cracking due to excessive drying out under drought conditions. Salts or sulphates are not to be used with the earth stakes due to the possibility of leaching to surrounding areas, which can result in serious environmental implications.

A minimum 40 x 6 mm earth bonding bar shall be installed on the substation walls as shown on the drawings. Earth bars shall be bonded to the earth bonding bars and to the substation main earth grid using minimum 120mm² copper cable with yellow/green PVC insulation.

Both ends of all HV switchboard earth bars and power transformer earth bars shall be bonded to the corresponding switch room earth bar using minimum 120mm² copper cable with yellow/green PVC insulation.

All other items of electrical equipment shall be bonded to the corresponding switch room earth bar using copper cable with yellow/green PVC insulation. Sizing of these minor earth bonding conductors shall be in accordance with AS/NZS 3000, with a minimum conductor cross sectional area of 16 mm².

- An earth bar made of copper shall be provided through the full length of the switchgear. Manufacturer's standard arrangement is acceptable;
- Each end of the earth bar shall be connected to an earthing terminal;
- All metalwork (other than current carrying parts) shall be bonded to the earth bar;
- An earthing transformer shall be provided on each of the bus-bar sections of any generator switchboards. A dedicated circuit breaker shall control these circuits as indicated on the drawings.

Transformers shall be bonded to the main substation earth grid and to their respective earth bars using minimum 120mm² copper cable with yellow/green PVC insulation.

C.17.5 Structural and Fencing Earthing

All structural steel work shall be bonded to the earth grid by minimum two 120 mm² copper cable connections with yellow/green PVC insulation connected to separate parts of the earth grid.

The transformer bay security fence shall be bonded to the earth grid at every post using minimum 70 mm² copper cable with yellow/green PVC insulation, with a lug on the cable bolted to a tag welded to each post above the concrete plinth.

Minimum of two flexible earth connections shall be provided between the hinge fence posts and access gates and connected to the substation main earth grid using 70 mm² copper cable with yellow/green PVC insulation.

C.17.6 Protective and Function Earthing

Provide all protective and functional earthing as required by Australian standards.

C.17.7 Earthing and Equipotential Bonding

Provide all earthing and bonding as required by Australian Standards.

The earth pin of all socket outlets and the metalwork associated with all light fittings shall be directly earthed. Bare earth wire in close proximity to all live metal, i.e. behind accessories and switchboard etc. shall be covered with green plastic sleeving.

Metallic piping of a water/gas/sewer supply system, any portion of which is underground installed within a building containing an electrical installation, shall be bonded to the main earthing conductor.

All metal structures, reinforcing metal work (inclusive of slab reinforcing), lightning protection systems, metallic trays, ladders, conduits, ducts, skirting ducts and equipment enclosures shall be earthed.

Where there are multiple slabs for a single building structure each individual slabs shall be interconnected via exothermic bonded earthing conductors.

C.17.8 Shop Drawings

Required as per section C3 of This Specification.

In addition:

- Provide shop drawings of the earthing system topology and design intent including particulars of products used, cable sizes and types, electrode and bar locations etc.
- Provide a final design of the substation earthing system, which shall be customised to suit the final, approved substation layout. The design work shall include confirmation by measurement of soil resistivity at the location of the substation.

C.17.9 Samples

Required as per section C.4 of This Specification.

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Earth bar
- Electrodes
- Cables
- Lugs
- Bonding information
- Ground enhancement material

C.17.10 Maintenance

C.17.10.1 General

Required - Refer to Section C.6 of This Specification for the general maintenance requirements.

C.17.10.2 One Monthly Services (12 off)

Nil

C.17.10.3 Six Month Service

Nil

C.17.10.4 Twelve Month Service

Carry out mandatory testing in accordance with AS/NZS 3000 and AS/NZS 3017.

C.17.11 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

C.17.12 Testing and Commissioning

Required as per section C.12 of This Specification.

Provide all material, labour and test equipment and carry out earth resistance tests on the installation. Record all tests and include the results in the operation manual.

Carry out earth resistance tests at each earth stake and of the entire interconnected substation earthing system.

Continuity tests shall be carried out to prove continuity of earthing conductors. Continuity tests shall be carried out with earthing conductors disconnected from equipment and structures.

Test and record the resistance for each earth electrode and shall also test and record the resistance of the whole earthing system using the three electrode method with dedicated earth resistance test instruments.

Any earth resistance which is significantly different from the mean of the other resistances shall be re-made and re-tested.

The system earth resistance test shall be carried out at a point in the system specified by the Engineer and the measured earth resistance of the whole system shall not exceed one ohm.

C.17.13 Certification

Required as per section C.13 of This Specification.

The earthing system shall be inspected and certified by the installer to have complied with This Specification, AS/NZS 3000 and other relevant standards.

C.18 SWITCHBOARDS

C.18.1 General

Standard equipment shall be supplied for the duty in accordance with the specification, with any departure from the specification to be clearly brought to the attention of the superintendent, referring clause by clause to all such departures.

Where "switchboards" are referenced within the contract documentation they refer to switchboards, distribution boards, load centres and all other nomenclature relating to an electrical enclosure designed for the purpose of housing electrical switchgear.

C.18.2 Australian Standards and Regulatory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS 2184 Low voltage switch gear and control gear
- AS/NZS 3000 Wirings Rules
- AS/NZS 3008 Electrical installations – Selection of cables
- AS 3439 Low Voltage Switchgear and Control gear Assemblies
- AS 3731.1 Stationary Batteries – Nickel Cadmium – Vented Type
- AS/NZS 3947 Low-voltage switchgear and control gear.
- AS 4044 Battery Chargers for Stationary Batteries
- AS 60044.1 Instrument Transformers – Part 1: Current Transformers
- AS 60044.6 Instrument Transformers - Part 6: Requirements for Protective Current Transformers for Transient Performance
- IEC 60255 Electrical Relays
- AS 60529 Degrees of Protection Provided by Enclosures (IP Code)
- AS 60890 Temperature rise assessment
- AS 60898.1 Circuit Breakers for Over current Protection for Household and Similar Installations
- AS/NZS 60947 Low-Voltage Switchgear and Control gear
- AS 61008.1 Residual Current Operated Circuit Breakers without Integral Over current Protection for Household and Similar Uses (RCCBs)
- AS 61009.1 Residual Current Operated Circuit Breakers with Integral Over current Protection for Household and Similar Uses (RCBOs)
- AS 61439 Low voltage switch gear and control gear assembly Series Part 0 to Part 6
- BS 159 High Voltage Busbars and Busbar Connections

In addition, all items of equipment and cabling used in the installation shall comply with the following:

- AS 61000 Electromagnetic Compatibility (EMC) standards to ensure acceptable immunity to Electromagnetic Interference (EMI).
- EN 60255-26 Measuring relays and protection equipment – Part 26: Electromagnetic requirements

The Switchboard Manufacturer shall be a member of the National Electrical Switchboard Manufacturer's Association (NESMA).

C.18.3 Coordination

Locations shall be coordinated with the Superintendent prior to commencing wiring installation works. The locations as shown on the services documentation are approximate only.

The switchboard shall have adequate space for the actual size of the incoming and outgoing cabling. Advise the switchboard manufacturer of the size of sub-mains being run to each board and whether top or bottom entry in order that adequate space and provision for terminations is made.

C.18.4 Discrimination and Cascading

The switchboard manufacturer shall carry out the design of switchgear in the distribution boards in such a manner so as to ensure discrimination between upstream and downstream switchgear. Should the schematic drawings be inconsistent with this requirement, the switchgear and the respective board design may be changed as required, provided the intent of the schematic is maintained.

Cascading techniques shall be utilised wherever possible to ensure the let through fault levels at each distribution board are limited, ensuring enhanced discrimination at all times.

Coordinate with the mechanical, hydraulics, and fire trades to ensure discrimination and cascading is appropriately coordinated across all disciplines.

The protection system performance shall reflect good zone selectivity; relay stability, speed with proper discrimination and reasonable sensitivity without any loss of reliability and maintainability. Cascading techniques shall be utilised wherever possible to ensure that the let through fault levels at each distribution boards are limited and at the same time, ensuring that full discrimination between protective devices is effective under all circumstances.

Carry out all necessary short-circuit calculations, check the adequacy of all equipment short-circuit ratings, provide the best protective device and coordinate all protective devices in the system.

All switchgear shall afford discrimination with the upstream switchgear in accordance with AS 3947-2.

Cascading shall also be utilised when selecting the downstream switchgear to achieve the lowest fault current (kA) rating possible.

Details shall be provided to the Engineer for approval. These details shall include, but not limited to, time current curves between the upstream and downstream circuit breakers and comparing the let through energy.

C.18.5 External Switchboards

All external switchboards shall:

- Be provided with anti-condensation heaters, unless explicitly documented or agreed by the Superintendent in writing that it is not required.
- Have ventilation be covered by mesh shields.
- Be fabricated from 3mm aluminium sheet Comalco H34-5005 or marine grade SAE 316 stainless steel.

Where external switchboards are main switchboards, provide an armour glass meter viewing window in accordance with Supply Authority requirements.

C.18.6 Internal Switchboards

- All internal switchboards shall:

- Be provided with a continuous rubber mat in front of all electrical apparatus where located within switchrooms and plantrooms.
- Be fixed to the wall / floor by Rawlbolts, or other approved fixings, suitable for the type of structure.

C.18.7 Installation

C.18.7.1 General

No building alteration shall be permitted when moving the switchboard into position. The switchboard shall be supplied in sections, where required, to facilitate installation into position.

Protective covering shall be applied to the switchboard during delivery and installation to preserve the manufacturers' paint finish.

C.18.7.2 Wall and Floor Mounting

Where boards are wall mounted they shall be firmly bolted to the wall or structure by means of rag-bolts and nuts of sufficient length and gauge to withstand the weights of the boards and cables connected to the boards. Suitable provision shall also be provided for mounting onto steel stud framed walls.

Where the boards are installed on steel columns or framework, purpose made mild steel clamps of robust construction shall be used for holding the boards in position. Drilling of holes in steel columns or steel structures work for the installation of switchboards shall not be permitted, except with the prior approval of the superintendent.

C.18.7.3 Boards with multiple construction sections

Where boards are supplied in multiple construction sections, each section of board is to be installed level with other sections of the board no gaps are permitted between sections of the boards and top, bottom, front and back edges are to be equal around each section, before any internal connections are made.

Internal connections shall be made by bolted connections for busbars, the use of packers to aligned busbars will not be accepted. All internal cabling and control cabling shall be neatly loomed and connected with screw held cable connections. Connectors shall be located in a common location immediately adjacent the section join unless otherwise approved by the Consulting Engineer.

C.18.8 Construction

C.18.8.1 General

All switchboards shall comply with the following:

- Be dead front.
- Be suitable for the maximum temperature permitted by AS 3439.1.
- Have consistent make and manufacturer of switchgear and components. Mixing and matching components from different manufacturers is not acceptable.
- Minimum chassis rating shall be 250A.

C.18.8.2 Material and Fabrication

Switchboards shall be fabricated from sheet steel of thickness not less than 1.2mm thick and shall as far as possible, utilize similar frame dimensions in depth, length and height and the front shall present a flush, clear appearance. The

enclosure shall be of all welded construction with sheets machine folded/bent where possible so as to minimize the number of welded joints. The four sides of the enclosure shall be returned at the front to facilitate fixing of front cover plates. All edges shall be rounded.

Sheetmetal cubicles, frames, brackets, doors and escutcheons, shall be of machine folded and welded construction, from first class quality furniture steel mounted upon a fully welded channel iron base with "toes" turned outwards.

Doors, escutcheons and panels shall be of not less than 1.6mm and shall have double turned edges for rigidity. Cubicles and brackets etc. shall be of not less than 2mm.

All hinged panels and removable sections shall close onto resilient full hollow perimeter rubber seals to exclude dust - such seals being fixed within deep channel frames around the perimeter of all openings - and arranged so as to be reasonably compressed at all points when the panel is secured.

Meshed louver or ventilation vent with filter shall be provided at both sides for ventilation. Unless stated otherwise, the degree of protection for the enclosures as per AS 60529 shall at least be IP42. When the doors are opened, the degree of protection to all live parts shall be at least IP 20.

Have holes of sufficient diameter (where conduit wiring is utilized) to suit the sizes of conduits concerned shall be drilled. Terminations of conduits within switchboards shall be by means of conduit lock nuts and female brass bushes, or conduit sockets and male brass bushes, whichever is preferred to suit the particular situation. Insulated type bushes of bakelite, PVC, or other similar material shall not be utilised for the termination of conduits within switchboards.

All metal work shall be rigid, symmetrical and neat in appearance with all visible joints filled and ground smooth.

Where lift-off access panels are provided they shall incorporate two lifting handles and a centrally located (on vertical centre line of panel) dowels and receptacles to assist in locating the panel on the main frame of the cubicle. Each panel shall have at least two lockable automobile type catches in addition to cadmium plated hexagon head fixing screws.

Escutcheons shall be fitted with square key turn buckles or screwdriver slot turn key buckles with two "D" type handles located centrally top and bottom of large escutcheon.

Cable, ducting and covers shall be fabricated and finished as for, and to match switchboard cubicles. All hardware shall be chrome plated externally and chrome or cadmium plated internally.

C.18.8.3 Finish

The basic materials shall be properly pre-treated before the final coats of resistant finishing paint are applied. All materials, used in the construction and for primary insulation shall be non-hygroscopic and have fire retardant properties and halogen free as practical.

After fabrication, all metal parts of the distribution board shall be thoroughly cleaned of rust, scale, oil, etc. and degreased before primer etched, undercoated and electrostatically sprayed with polyester/epoxy dry powder paint. They shall then be oven baked to the appropriate temperature recommended by the paint manufacturer.

The exterior shall be finished with a 2 tone semi gloss colour to the superintendent's approval. The frame colour shall be darker than the panel colour. The interior shall be furnished in white high gloss paint similar to exterior colour.

Non painted steel parts shall be electrolytically zinc plated.

The final finish shall be free from blemishes, orange peel effect, weld and metal finishing marks. Take all necessary precautions to ensure that paintwork is not damaged due to transportation to the project site. Any scratches or damage to the paintwork shall be properly rubbed down and repainted to a finish and appearance as good as the original before Practical Completion

Where no external colour is nominated the colour shall be advised (by the Consulting Engineer) upon request (from the Contractor).

The final finish shall be free from blemishes, orange peel effect, weld and metal finishing marks.

C.18.8.4 Doors

Full access shall be provided to maintain and connect switchgears inside the switchboard by means of suitable hinged doors with a door lock which can be opened by a lock knob. Unless otherwise stated, all distribution boards shall be provided with suitable doors for front access. The doors shall be provided with door latches and arranged to seal onto resilient full hollow perimeter rubber seals on the switchboard frame and be arranged such that they are reasonably compressed at all points when the doors are secured to exclude dust. The seal shall be fixed within deep channel frames around the perimeter of all openings and shall be made of a non-perishable dust proof such as synthetic rubber. Foam shall not be used. Doors shall be effectively earthed to the fixed enclosure by braided straps. Cover bolts or nuts shall be retained in place when undone.

Unless otherwise stated, all external doors on the distribution boards shall be mounted on hinges capable of 135 degrees outward swing. Hinges shall be of chrome plated brass construction with steel pivot pins and plastic bearing washers. Hinged access doors shall be free of switchgear and metering equipment but where this is deemed necessary, quick connect type plug/socket connections which utilize flexible wirings shall be provided.

C.18.8.5 Layout and Dimensions

Unless otherwise specified, all switchboards shall not exceed 2100mm in height when fixed into position on site. If the maximum dimension specified is not able to be achieved the Contractor is to advise at the time of Tender.

Equipment requiring access by operators not authorised to open escutcheons (such as circuit breakers, switches, fuses, meters etc.) shall be mounted on brackets (insulated where necessary) and shall protrude through neatly formed individual openings in escutcheons these shall solidly engage with the escutcheon.

All operating devices shall be mounted for operation at the front of the switchboard.

Switchgear and control gear shall be designed to minimise any risk of short circuit and to ensure personnel and operational safety during all operating conditions, inspections and maintenance. Even under extreme conditions of major short circuits or mal-operations there shall be no danger to persons in the vicinity of the assembly.

Where the switchboard has been designated "Front and Rear Access" in the Drawings, it shall mean that it is possible to access the cable installation in the switchboard from the rear (no front cable ways). Where cable entry is from the top, there shall be sufficient depth to provide adequate clearance between the bus bars system and the cables.

Provide adequate ventilation to ensure cross flow of air

Ventilation outlets and arc chutes shall be located to allow emissions to vent without damage to adjacent compartments. Emissions shall be directed upwards and away from the operator.

In all cases, covered, escutcheon cut-outs and drilled mounting brackets shall be provided for an extra 30% of future additional equipment.

Proprietary snap-in pole fillers shall be used throughout.

Meters, phase selection switches, indicating lights etc. shall preferably be mounted on fixed panels only. Circuit breaker "ON-OFF" operating handles shall be accessible through the front of the panel.

Hinged access doors should be free from switchgear and metering equipment but where this is impracticable quick connect type plug/socket connections and flexible wiring shall be provided.

Contactors and motor starters shall be mounted within a separate compartment within each switchboard. Allow 30% spare space in the compartment. This compartment shall have a separate hinged door to which shall be fixed alarm lights and overload reset buttons.

C.18.8.6 Performance and Fault Capacity

The LV switchgear equipment specified herein shall be suitable for operation on a 3 phase, 4 wire 50Hz system of nominal voltage 415V. All switchgear and their associated components shall be capable of withstanding the thermal and dynamic stresses resulting from the prospective short-circuit current as specified, without the possibility of injury to personnel.

The LV switchgear shall be designed to withstand any external fault and shall not be damaged in any way. In the event of an internal arcing fault on a functional unit, the damage should be locally confined to that functional unit and its associated busbar conductors connecting between the main busbars and that functional unit. All other sections of the main busbars and all other functional units shall remain fit for further service.

The LV switchgear shall be capable of withstanding the rated short circuit current for a period of 1 second. Unless otherwise stated, the value of the rated peak withstand current shall in no case be less than 2.2 times the rated RMS value of the rated short circuit current with a power factor not higher than 0.2.

The switchboard shall be capable of withstanding without damage, any sag, deformation or warping under any electrical, mechanical and thermal stresses produced under short circuit conditions for 50kA for one second (unless otherwise prescribed in the contract documents).

All switchboards and auxiliary panels shall comply with AS 3439 Switchgear and Control Gear Assemblies and AS 1939 Classification of degrees of protection.

The design and construction of switchboards and auxiliary panels, associated components and connections shall give satisfactory performance under all variations of load conditions as may be met within the service including short time overloads and short circuits.

C.18.8.7 Form Rating

Minimum rating of Form 2B for boards rated at less than 800A

Minimum rating of Form 3B for boards rated at 800A or greater.

Insulation barrier shall be mounted to screen each section of the distribution board from its neighbouring section and the bus bars system to prevent inadvertent contact with live parts. All metallic screen used shall be properly earthed. Serrated star washers shall be fitted to ensure satisfactory earthing of the front cover. All control wiring openings shall be lined with rubber/PVC grommets.

C.18.8.8 Switchboards with Multiple Sections

Where switchboards are documented with multiple sections:

- The escutcheon panels shall be colour coded to differentiate between Essential, Non-essential, UPS and ELV services sections.
- All sections shall be fully segregated from each other.

C.18.8.9 Switchboards with Bus-Ties

Within each switchboard containing a bus-tie:

- The essential and non-essential sections of each switchboard shall each be provided with a neutral bus-bar. The essential and non-essential section neutrals shall only be coupled (electrically connected) upon closure of the bus-tie.
- Each section of the switchboard, shall be capable of being isolated completely with respect to both the active and neutral conductors. In the instance of a Main Switchboard where a Multiple Earth Neutral (MEN) shall be installed within the switchboard, the neutral bar will not be discontinuous between sections and as such, a common Neutral will exist despite the position of the bus-tie.
- All main switches, whether they consist of circuit breakers or isolators, shall enable 4-pole switching. All bus-ties within Distribution Switchboards shall enable 4 pole switching.
- All main switches and bus-ties within a Main Switchboard (where an MEN is installed) shall be 3-pole unless otherwise specified.

Where three pole breakers are used in conjunction with switchboards with MEN points installed and have earth fault detection on the incomers the Modified Differential Residual Sensing Method shall be utilised with the appropriate external CTs installed.

C.18.8.10 Type Testing

Where type tested construction is specified, design and construction shall conform to the manufacturer's type test certificate.

Fully compliant with the requirements of Partially Type-Tested Assemblies (PTTA) as per AS 3439.1.

C.18.8.11 Neutral and Earth Bars

Switchboards shall have neutral bars and earth bars that are brass and of rectangular cross section.

Adequate number of terminals cable lugs and bolts shall be provided at each bar. All control and other wirings shall be carried out and fixed in a neat and systematic manner. Terminals at low voltage and extra low voltage shall be segregated and clearly labelled.

Have all switchboard frame earthing bars be in direct contact with the bare sheet metal of the switchboard, without the influence of epoxy coatings which act as an insulation. The same applies to all earthing bolts and nuts.

The earth bar shall run the full length of the switchboard and preferably located adjacent to the active and neutral busbars and shall also be easily accessible.

Sufficient connection points with adequate terminating facilities shall be provided for terminating the cable earth leads to the main earthing system using appropriate size earthing bolts and nuts with spring washers.

C.18.8.12 Equipment

The phase and neutral cable sizes between all outgoing MCBs, MCCBs, fuses, disconnectors, load break switches, fuse switches, switch fuses, etc. and the main busbars shall be of the same size as the outgoing cables, i.e. if the outgoing phase and neutral cable size for a 60A/100A MCCB are both 25mm², the phase and neutral cable connection between this MCCB and main busbar shall also be of minimum 25mm², irrespective of any cable correction factors.

Unless otherwise specified or shown on drawings, final power sub circuits shall be protected with 16 amp miniature automatic circuit breakers and final lighting sub circuits with 10 amp miniature circuit breakers.

All equipment shall be neatly and logically arranged in groups, rows, etc. Equipment shall be mounted to a maximum height of 2000mm above the surrounding floor level of any switchboard location.

Where equipment is identified within the documentation for future installation then all internal wiring shall be pre-installed and terminated to the proprietary preinstalled equipment base or if that is not possible to a set of clearly marked terminals fitted within the equipment enclosure to allow safe installation and commissioning of the new equipment without shutting down any section of the switchboard.

Contactors, relays and motor starters shall be Schneider, Sprecher and Schuh or Lovato, open type, unless otherwise specified.

Motor starters shall be fitted with correct size overload (reset buttons to protrude through escutcheons). Motor nameplate ratings shall be checked on site and overloads set accordingly.

Air Circuit Breakers (ACBs), Miniature Circuit Breakers (MCBs), Moulded Case Circuit Breakers (MCCBs) and RCBOs shall be Schneider, ABB or NHP or approved equivalent as specified above.

Where circuit schedules are provided, the pole spaces nominated are based on the following:

- Single phase MCB 1 pole space
- Three phase MCB 3 pole spaces
- Single phase RCD 1 pole space
- Three phase RCD 4 pole spaces

Where the switchboard manufacturer proposes circuit breakers with different pole configurations, the chassis size of each switchboard and distribution board shall be increased accordingly to maintain a minimum spare capacity of 30% based on the proposed circuit breakers.

HRC fuses shall be GEC Red Spot Series.

Generally switches shall be Schneider or Kraus and Naimer C16 (or larger as required) rotary type.

Generally the number of circuit breakers, fuses, etc. for each switchboard shall be as required by drawings and subsequent sections of the Specification.

Bolted busbar connections shall have minimum clearance holes only drilled to accommodate bolts to maintain maximum cross section of copper at the connection. Each steel bolt shall be equipped with flat machined washers under heads and nuts in addition to locking washers.

C.18.8.13 Wiring and Busbar

The line side connections to all protection equipment shall be made with high conductivity, hard drawn copper busbar.

Each busbar shall have sufficient capacity to carry the current shown on the drawing or where no current rating is shown the full connected load plus 50% without exceeding a temperature rise of 60 degrees Centigrade, after allowing for derating due to the degree of enclosure in accordance with Appendix C of AS 3000.

Busbars and the supports shall be designed and constructed to withstand all short circuit faults.

Permali shall not be used for busbar supports.

All busbar work shall comply with BS 159.

Circuit wiring through switchboards shall be contained in slotted side PVC duct.

Elsewhere PVC cables shall be neatly laid up, laced and fixed where necessary.

Cables terminating on bolts or studs shall be fitted with compression type cable lugs.

Adequate provision shall be made on all switchboards for the neat termination of all incoming and outgoing cables, conduits and troughing.

Crimp type solderless lugs shall be used for all main, sub-main and neutral cable terminations.

All main and sub main connections made electrically within the switchboards shall incorporate anti-vibration "Belleville" washers or approved equal to prevent bolted connections and termination from working loose.

C.18.9 Busbars

C.18.9.1 General

Busbars shall be:

- Plain hard-drawn, high conductivity electrolytic copper bars in accordance with IEC 60439 and AS 60890 and of adequate and uniform rectangular cross-section to carry continuously the specified current without overheating and without exceeding the maximum temperature rises stated in AS 3439.
- Air insulated and rigidly mounted on non-hygroscopic insulators, fully braced and supported so as to withstand any mechanical force to which they may be subjected under maximum fault condition. Busbar rating shall not be less than the rating of the incoming switchgear. The neutral busbar shall be of the same size as that of the phases, and if specified, they shall be of double size as required. All joints in the busbars shall be bolted or clamped, with contact surfaces suitably prepared and tinned to prevent oxidation while in service. There shall be no drilling of holes along the whole busbar length.
- Coloured red, white, blue and black at appropriate points to distinguish the phases and neutral. No tapes shall be used. The switchboard design shall be such that the main busbars are arranged in a horizontal plane (usually at the top compartment or middle section of the switchboard), and in the order of red, white, blue and black from back to front. On each panel, connections shall be red, white, blue and black from left to right when viewed from the front of panel.
- Provided with full sized neutral and earth bars.

The busbar system shall be accessible for future maintenance duties. In the event of a busbar short circuit, it shall be possible to clean or to replace the busbars and the associated support system without stripping the entire switchboard assembly. Each phase busbar shall be able to withstand at least an applied AC test voltage of 2kV for a period of 60 seconds.

The busbar arrangement of the switchboard shall be fabricated from hard drawn high conductivity rectangular electronically tinned copper busbars and shall be supported by non-tracking fibreglass polyester and self-extinguishing support which offers high dielectric and mechanical stress withstand and non-magnetic assembling parts characteristics.

The neutral bar shall be fully insulated at all other compartments with the same insulation level as the phase busbars. All neutral busbars shall be provided with terminals, lugs and bolts with nuts and washers to suit requirements.

Busbar connections shall be provided from main busbars to the individual switchgear via dropper busbars and connector busbars. Connection shall be so arranged that they do not impede access to cable entries and also subsequent maintenance of the switchboard. The droppers shall have full segregation by insulated materials. The insulation of the busbar jointing and branching points shall be of equal quality to that of the main bars and shall be removable and easily replaceable for inspection. All connection shall be effected by copper busbars. However, for lower rated circuits of 200A or below, PVC/PVC and/or XLPE/PVC single core cables of sufficient ratings in lieu of copper

busbars may be used from the dropper busbars to the individual switchgears. All cables shall be identified with PVC sleeving of the appropriate colour. The cable termination busbars sizes shall be adequately sized to receive the cable lugs.

C.18.9.2 Extensible BusBars

Where indicated busbars shall be designed and manufactured to allow expansion at a future date. Future connections on to the bus shall allow for extension of same sized bus without obstruction and derating of the busbars.

C.18.10 **EMF Mitigation Measures**

The primary and secondary busbars (three active and the neutral) should be in close proximity to each other with no greater than 150 mm separation distance between the adjacent buses.

The neutral bus should be insulated from the metal frame of the switchboard.

The main earth bar should be installed in close proximity to the four other busbars with not more than 300 mm distance from the neutral busbar.

The neutrals of the sub-main circuits rated 200A or greater should closely follow the associated actives even when the actives are passing through a circuit breaker.

EMF levels to be less than 10mG measured within the nearest spaces with regular building occupants.

C.18.11 **Labelling**

Nameplates and their fixing materials shall be made of a corrosion-resistant material such as laminated a corrosion-resistant material such as Gravoply or Rowmark with bevelled edges and shall be durable under the service conditions specified for the switchboard. Nameplates shall be fixed to the switchboard and its components by means of proven durable self-threading screws or rivets in a prominent position. Adhesive labels are not acceptable. Circuit label shall not be fitted on detachable doors or covers. Holes for fixing shall not influence in any way the protection degree of the enclosure.

Each and every component shall be clearly marked with its device function number and with terminal numbers to ensure quick identification of components and correlation with wiring diagrams.

Switchboards shall be labelled as follows:

All outgoing submain cables from each switchboard or distribution boards shall be labelled with the corresponding destination or origin of the supply.

Switchboards shall be externally labelled as per the labelling section of this specification and at a minimum as follows:

- Distribution Board Reference
- Incoming Cable Size and Type
- Incoming Cable Fed from
- Fault Rating: kA
- Main Switch Rating: A
- Manufacturer

All separate groups of switchgear (i.e. lighting, power, contactor controlled groups etc.) shall be identified by means of labelling and 6mm white painted dividing lines on the escutcheon.

Unless otherwise specified protection devices serving final sub-circuits shall be marked with IPA coloured and numbered markers.

Each distribution board shall be provided with a typewritten (not hand written) circuit schedule stating details of each circuit. The details shall include fuse/MCB/MCCB/isolator/load break switch ratings, phase number, cable sizes, number and type of loads, etc. The description of each circuit printed thereon shall include the corresponding circuit number in the As-Constructed schematic diagram. The schedule shall be fitted in a clear plastic fronted metal frame fixed on or near each switchboard.

An "as installed" single line diagram for the main switchboard shall be fitted in a clear plastic fronted metal frame on or near the main switchboard.

Rotary switch escutcheons shall be engraved to approval.

All remaining equipment, including KWh meters switches, reset buttons and contactors shall be identified with appropriately engraved labels on a corrosion-resistant material such as Gravoply or Rowmark fixed to panels using screws.

Labelling external and internal shall be standard lettering on black background using laminated a corrosion-resistant material such as Gravoply or Rowmark with bevelled edges. The labels shall be fixed to the sheetmetal panels using screws. Adhesive labels are not acceptable.

Any equipment, fitting or accessory on a particular board which is energised or controlled by equipment on another board shall be permanently labelled to that effect in an approved manner.

All incoming and outgoing circuit wirings and submain cables shall be properly labelled and identified WITHOUT EXCEPTION. All cables, including the neutral and earth conductors, shall be labelled using durable clip-on plastic labelling, indicating size and type of cables as well as cable origin (e.g. 4 x 1c 10mm² XLPEs from DB-1E). All identification tags shall be in accordance with the final approved "as installed" wiring diagrams and/or drawings.

Unless otherwise instructed by the superintendent, the colour of labels shall be as follows:

- Indicating labels shall be white
- Instruction plates shall be yellow
- Warning or caution plates shall be red
- Inscriptions shall be black with the exception of the warning or caution plates whose inscriptions shall be white.

C.18.12 Power Quality

Harmonic levels shall be in accordance with AS/NZ 2279.2. Electromagnetic compatibility of electrical and electronic equipment installed shall be in accordance with AS 61000.4.

C.18.13 Switchgear

C.18.13.1 Installation

All switchgear shall be mounted so as to give adequate clearance for cable and busbar connections. Allow 20% spare space in the compartment to accommodate future equipment. Switchgear shall be mounted on insulation runners where connected to busbars and on steel support or back panel of the enclosure whichever is more appropriate.

Withdrawable type of switchgear shall be mounted on framework assembly, including the runner rails and fixed rear isolation contacts, which shall be supplied as a part of the switchgear assembly. Each withdrawable switchgear shall be housed in its compartment with rear connected busbars.

When a withdrawable unit has been removed from the assembly, the live parts inside the fixed compartment shall be protected against touch, with a degree of protection of at least IP 20. When shutters are fitted to comply with above requirement, they shall be mechanically operated by the movement of the withdrawable unit and not dependent on gravity. Each set of shutters shall be capable of being individually operated and pad-lockable in the closed position. Shutters covering busbars or droppers shall be marked 'BUSBAR' and shutters covering the incoming supply, 'INCOMING SUPPLY'.

Exposed parts within the assemblies, which have to be accessible during normal operation, maintenance or equipping of spare compartments, shall either not be live in the opened position or shall be protected to a degree of protection of at least IP 20. The terminals of the incoming and sectionaliser switching devices can be alive when the device is in the off position. These terminals shall always be protected to a degree of at least IP 30.

HRC fuses and associated fuse carriers shall only be accessible when they are fully isolated or when they offer a degree of protection to live parts of at least IP 20 when the fuses are inserted, withdrawn or during withdrawal. Terminals of equipment installed on a compartment door and which can be alive when the door is opened, shall be shrouded to a degree of protection of at least IP 30.

All practicable measures shall be taken to prevent danger to personnel working on a disconnected functional unit with adjacent units still in operation. Parts likely to be removed for maintenance shall have retainable fastening means.

MCCBs, MCBs, isolators, fuse switches, fuses, etc., shall be mounted on insulated brackets and shall protrude through neatly formed individual openings in escutcheons. All separate groups of MCCBs, MCBs, isolators, fuse switches, fuses, etc. (such as lighting chassis, power chassis, etc.) shall be identified by means of labelling and 6mm white painted dividing lines on the escutcheon. All escutcheon cut-outs and drilled mounting brackets shall be provided to accommodate an extra 30% of future equipment. Proprietary snap-in pole fillers shall be used throughout.

C.18.13.2 Isolators

Unless otherwise noted, all switchboards shall be provided with three pole load break switch as the main isolator of the switchboard.

All high current isolators (greater than 600A) shall be Schneider ABB or NHP type.

Lower current (600A or less) isolators shall be quick make, quick break type fully compliant with AS 60947-1 and AS 60947-3. They shall be capable of breaking currents under normal conditions and shall be able to operate continuously at full current rating without any requirements to be de-rated.

The enclosure of isolators shall be constructed from heavy gauge steel plates and shall be rust protected accordingly.

Unless otherwise stated, all isolators shall be supplied with rotary handle and shall be pad-lockable.

Suitable interlocks shall be provided such that access to all live parts can only be made after the switch is in off position.

C.18.13.3 Air Circuit Breakers

Air Circuit breakers (ACBs) shall be fully compliant with AS 60947-2 and shall have a rated short-circuit breaking capacity as per specified in the Drawings. The service rating capacity (Ics) of the ACBs shall be equal to 100% of the ultimate breaking capacity (Icu). Unless otherwise stated, the minimum Ics rating for all ACBs shall be 50kA at 3 phase 415V for a period of 1 second. All ACBs shall be of the air-break type suitable for indoor use and shall be so constructed so as to be fully capable of clearing any fault conditions which may occur on the electrical system without damage to the equipment or personnel. Arc chutes and inter-pole barriers shall be provided for each pole of the circuit breaker and

these shall be easily removed for inspection and maintenance. ACBs shall be easily accessible and operable from the front and provided with padlocking facilities.

Where ACBs are used as section couplers in a low voltage switchboard, they shall be fully withdrawable 3-poles type without thermal-magnetic elements. Unless otherwise stated, all ACBs for incoming and outgoing circuits shall be fully withdrawable, 3-poles type with thermal-magnetic elements on all 3 poles of the circuit breaker. All withdrawable ACBs shall be complete with horizontal draw-out facilities and integrated with all necessary instruments, transformers, closing and tripping devices and protective instruments. If specified, ACBs shall also be supplied completed with fully motorized mechanism.

The operating mechanism and carriage of an ACB shall have the following positions:

- Service position The main and control contacts are engaged.
- Test position The main contacts are isolated but the control contacts are still engaged. It shall be possible to check the correct operation of the control circuits without energizing the main circuit
- Isolated position Both main and control contacts are isolated.

A direct coupled 'ON' and 'OFF' indicator shall be fitted to give clear indication of ACB position when in service. Locking facilities shall be provided on the circuit breaker and control switch so that, in any position, the circuit breaker can be prevented from being directly and manually operated. Mechanical and electrical lockouts shall be provided to prevent closing of the breaker after an over-current trip.

In addition, 'CLOSED', 'OPEN' and 'TRIPPED' indication lamps shall be provided. The operating mechanism of the hand or motor charged spring type shall be arranged so that the release of the spring to close the circuit breaker can only be achieved by a deliberate action. It shall not be possible for any mechanical shocks to release the charged spring. Hand-charged or motor-charged spring mechanisms shall have mechanical indicators to show 'SPRING CHARGED' and 'SPRING DISCHARGED'.

The closing and trip control switches shall be of the pistol grip type and shall turn clockwise for closing and anti-clockwise for tripping and labelled 'OPEN-NEUTRAL-CLOSE' with spring return to neutral. The handle shall be capable of being locked in the neutral position.

Facilities for operational tests of the circuit breaker shall be provided when in the isolated or withdrawn position.

All circuit breakers shall be provided with interlocks to ensure that: -

- They cannot be connected or withdrawn whilst closed.
- They cannot be closed until they are fully plugged in (service position) or completely isolated.
- They cannot be closed while the carriage or hinged panel is in any position between "service position" and "fully isolated" position and vice versa.
- The spring-charged mechanisms cannot be discharged until they are fully charged.

Key interlocks (Castell or similar) shall be provided in cases where multiple incoming supplies are not to be paralleled. Tripping of a closed circuit breaker shall not occur if an attempt is made to remove the trapped key or when it is in the withdrawn positions.

Auxiliary contacts (minimum 4 No. - 2 NO, 2 NC) for remote monitoring of all incoming and sectionalising breakers shall be provided. ACBs used for distribution on switchboards supplied from the emergency power system shall have provision for remote motorized operation (OPEN and CLOSE) for load management purposes. Where indicated on the

drawings, the ACB shall be provided with a high level connection (such as MODBUS) for the interface/connection to the BMCS.

Where specified in the Drawings, ACBs shall be supplied complete with integral microprocessor based electronic trip units with Built-in over-current protection having fully adjustable time-current characteristics (such as ampere setting, long time delay, short time pickup, short time delay, etc.). The electronic trip unit shall have a digital display that indicates the current time-current adjustment values and identify the reasons of tripping (e.g. Overload, short circuit, earth fault, etc.) following an automatic trip operation. All electronic trip units shall be provided with test jacks for in-service functional testing using a small hand-held test kit. If specified, the electronic trip unit shall also incorporate integral earth fault protection with adjustable time-current characteristics (such as earth fault pickup, earth fault delay, etc.).

The ratings of all breakers shown on the schematics are the installed breaker ratings operating within the switchboard and not the free air rating, (unless otherwise stated).

C.18.13.4 Moulded Case Circuit Breakers

Moulded Case Circuit Breakers (MCCBs) shall comply with AS 60947-2. They shall be constructed of moulded insulating material of good mechanical strength and shall be fully tropicalised to be used up in an ambient temperature up to 40°C without being required to be de-rated. All MCCB's shall be either Schneider, ABB or NHP type.

Unless otherwise stated in the drawings, all MCCBs shall have their service rating capacity (Ics) equal to 100% of the ultimate breaking capacity (Icu) for all circuit breakers installed inside LV main distribution boards. Unless otherwise stated in the drawings, MCCBs installed inside sub-switchboards, distribution boards and tenancy consumer units shall have their service rating capacity (Ics) equal to 50% of the ultimate breaking capacity (Icu).

All MCCBs shall be fitted with adjustable electronic trip units with inverse time-current characteristic. The tripping units shall be one of the following types:

- Solid state trip unit with adjustable overload protection and adjustable short circuit protection. Earth fault relay, if required, shall be either instantaneous or time delay type as specified.

MCCBs shall be of the quick-make, quick-break type incorporating a manually operable rotary type handle. Permanent position indicators (ON, OFF or TRIP) shall be provided to show the current status of the breaker. Means shall be provided to padlock the MCCBs and in the 'OFF' position.

When tripping occurs, the handle shall be in the 'trip' position midway between the 'OFF' and 'ON' position so as to provide positive indication of automatic interruption. The operating mechanism shall be calibrated in compliance with AS 60947-2 and shall be non-temperable and hermetically sealed at the factory.

The construction and operation of the MCCB shall be such that if a fault occurs, all the poles of the breaker shall operate simultaneously to isolate and clear the fault efficiently and safely without any possible risk to the operator or to the installation. The breakers shall have trip-free mechanism to prevent the breaker from being closed against fault conditions. On tripped condition, MCCBs shall not be possible to be energized again until they have been reset by first switching to the OFF position.

Where 3-pole MCCBs are used in a 3-phase 4 wires application, bolt-in type solid neutral links shall be provided for the neutral cable connection and these shall be fitted in the same compartment together with the MCCBs. Where MCCBs are used in a load shedding application, they shall be fitted with suitable facilities for remote operation (OPEN and CLOSE) and auxiliary contacts for remote indication. If specified, the MCCBs shall also have facilities for shunt trip, under-voltage/no voltage trip, external connected earth fault protection, external connected over current protection, etc.

The ratings of all breakers shown on the schematics are the installed breaker ratings operating within the switchboard and not the free air rating, (unless otherwise stated).

C.18.13.5 Miniature Circuit Breakers

Where used in main distribution boards, building distribution boards (other than distribution boards), all Miniature Circuit Breakers (MCBs) shall comply with AS 60947-2. Where used in distribution boards, all MCBs shall comply with AS 60898. All MCB's shall be the NHP type standard.

They shall be constructed of insulating material of good mechanical strength and shall be of IP20 construction and fully tropicalised to be used in an ambient temperature up to 30°C without being required to be de-rated.

MCBs used as incomer/main switch in a single phase application shall be of double pole type with thermal magnetic elements on all live and neutral poles. Unless otherwise stated, the minimum kA rating of MCBs in a main switchboard, sub-switchboard and distribution board shall be 10kA complying with AS 60947-2; Minimum kA rating for MCBs shall be 10kA complying with AS 60898. All MCBs shall have trip-free mechanism to prevent the breaker from being closed against fault conditions.

They shall be quick-make, quick break and trip-free type complete with de-ion arc interrupters. The tripping elements shall be of thermal magnetic type with inverse time delay over current and instantaneous short circuit characteristics (type C characteristics). The response to overload shall be independent of variations in ambient temperature.

They shall be manually operated by means of toggle type handles having visual indication of whether the breaker shall be provided with common-trip mechanism for instantaneous operation of all the poles.

The ratings of all breakers shown on the schematics are the installed breaker ratings operating within the switchboard and not the free air rating, (unless otherwise stated).

C.18.13.6 Residual Current Circuit Breaker

Residual Current Circuit Breakers (RCCBs) shall be two pole and the core balance type complying with AS 61008-1. RCCBs shall be highly resistant to nuisance tripping as a result of surge voltages (due to switching transients or induced by LED lightning) causing loading currents to flow in the installation without the occurrence of flashover. If specified, RCCBs of Type S category shall be installed to give sufficient resistance against unwanted tripping if the surge voltages cause a flashover which further resulted in a follow-on current occurring in the system.

Generally, RCCBs shall also be capable of interrupting residual currents with a maximum breaking time as follows:

- 0.3 sec when the residual current is equal to the value of $I_{\Delta n}$
- 0.15 sec when the residual current is equal to 2 times the value of $I_{\Delta n}$
- 0.04 sec when the residual current is equal to 5 times the value of $I_{\Delta n}$

The residual current detection and the residual current release shall be located between the incoming and outgoing terminals of the RCCBs. The moving contacts of all poles of multi-pole RCCBs shall be so mechanically coupled that all poles except the switched neutral, if any, make and break substantially together, whether operated manually or automatically. A switched neutral pole shall open after and close before the other poles.

All RCCBs shall have a Built-in trip-free mechanism and it shall be possible to switch the RCCBs on and off by manual hand operation. RCCBs shall be so constructed that the moving contacts can come to rest only in the closed position or in the open position, even when the operating means is released in an intermediate position. RCCBs shall be provided with suitable means to indicate their open and closed positions and this shall be easily discernible from the front of the RCCBs when fitted with its covers or cover plates. In general, RCCBs shall have a positive contact indicator which appears on the front face of the RCCBs. This indicator shall be linked to the contacts which show the positive opening of all poles. The indicator shall be red in colour when the contacts are in the closed position, and green in colour when the contacts are in the open position. RCCBs shall also be provided with a test device for periodic testing of the tripping function by simulating the detection of residual currents passing through the protective device.

The ratings of all breakers shown on the schematics are the installed breaker ratings operating within the switchboard and not the free air rating, (unless otherwise stated).

C.18.13.7 Residual Current Circuit Breaker with integral Overload Protection

Unless otherwise specified or as shown on Drawings, all lighting circuits and power circuits rated up to 20A shall be fully protected by two pole Residual Current Circuit Breakers with Integral Overload Protection (RCBOs) in accordance with AS 3000:2007. Unless otherwise stated, all final power sub-circuits shall be protected with 20A RCBOs and all final lighting sub-circuits with 16A RCBOs accordingly.

RCBOs shall have the same construction and operational characteristics as RCCBs. In addition, all RCBOs shall be fitted with thermal-magnetic tripping elements and unless otherwise stated, all RCBOs shall be of Type C thermal-magnetic tripping characteristics. All RCBOs shall be capable to operate in an ambient temperature up to 40°C without being derated and without affecting the over current tripping characteristics of the RCBOs.

C.18.14 **Surge Protection**

C.18.14.1 Surge Diverters

Provide transient surge suppression on the supply to each switchboard with the following specification:

- Operating Voltage - Nominal system Voltage of (Vrms) 240/415V, 50 Hz.
- Protection - Maximum Discharge Current, I_{max}, as defined in IEC 61643-1 shall be 50kA, 8/20μs per phase.
- Nominal Discharge Current, I_n, as defined in IEC 61643-1 shall be 25kA, 8/20μs per phase.
- Voltage Protection Level, U_p, as defined in IEC 61643-1 shall be less than 800V at 3kA 8/20us and 6kV 1.2/50μs.
- Maximum Continuous Operating Voltage, U_c, shall be 340 Volts.
- Alarms and Indicators - The surge diverter shall have mechanical flag status indication and a set of voltage free contacts for remote signalling to indicate that maintenance is due. These contacts shall be wired to the BMS interface terminal strip.
- Test Standards:
 - IEC 61643-12 Class I and II
 - AS 1768-2007 (Int)
 - ANSI/IEEE C62.41.2 Cat A, Cat B, Cat C

Surge diverters shall be ERICO, Critec TDS 350 TNC 277, or approved equivalent.

The installation of the unit shall be strictly in accordance with the manufacturer's recommendations.

C.18.14.2 Surge Filters

Provide surge reduction filters with the following specification:

- Operating Voltage - Nominal system Voltage of (Vrms) 240/415V, 50Hz.
- Max Line Current - I_L shall be 20Amps, based on IEC 61643-1.

- Protection - The total tested single shot surge rating shall be $I_{max} = 20kA$ between phase-neutral and phase-earth and $10kA$ between neutral - earth based of the $8/20\mu s$ IEC 61643-1 waveform. The Voltage Protection Level, Up , as defined in IEC 61643-1 shall be less than $700V$ at $3kA$ $8/20\mu s$.
- Voltage Protection Level, Up , as defined in IEC 61643-1 shall be less than $600V$ at $500A$ $8/20\mu s$.
- Maximum Continuous Operating Voltage, Uc , shall be greater than 320 Volts.
- The filter shall provide EMI filtering as well as lightning surge filtering.
- Attenuation at $100kHz$ shall be greater than $-50dB$.
- Attenuation between 5 to $50kHz$ shall be greater than $-15dB$.
- Alarms / Indicators - The surge reduction filter shall have visual alarms. In addition it shall be possible, as an optional extra, to have the filters fitted with voltage free contacts to indicate failures. These contacts shall be wired to the BMS interface terminal strip.
- Test Standards:
- Designed to Meet UL1449 Edition 2, AS 60950.1.
 - Surge Rated to Meet ANSI/IEEE C62.41-1991 Cat C, or IEC 61643-12 Class II and III.

Single phase surge filters shall be ERICO, Critec TDF 20 A 240, or approved equivalent.

Three-phase surge filters shall be Erico Critec SRF 363 DR series, or approved equivalent.

The installation of the unit shall be strictly in accordance with the manufacturer's recommendations.

C.18.15 Measuring Instruments

C.18.15.1 General

Where specified, measuring instruments such as ammeters, voltmeters, frequency meters, hour-run meters and the like shall be provided as per indicated in the Drawings. Measuring instruments such as ammeters and voltmeters shall generally be of digital type.

Measuring instruments shall generally be flush mounted, square fronted and of square dimension $96mm \times 96mm$ with square escutcheon plate. They shall be industrial grade type adequately shielded against stray magnetic fields and properly calibrated for accurate readings. The measuring instruments shall generally have an IP51 rating in accordance with AS 60529.

C.18.15.2 Current Transformers

Measurement and protection current transformers shall comply with AS 60044.1, be of the moulded resin encapsulated type and have a rated short circuit rating of not less than that of the associated LV switchgear. They shall be capable of withstanding, without damage, an open circuit secondary with full primary current. The rated short duration (one minute) power frequency withstand voltage shall not be less than $3kV$ when tested in accordance with AS 60044.1.

The ratios of current transformers shall be as stated in the Drawings. Unless otherwise specified, the output and class accuracy of current transformers shall meet the requirements of the relays provided. Current transformers used for kWh metering billing purposes shall be rated minimum $15VA$ and of class 0.2 unless otherwise stated. Unless otherwise specified, current transformers used for protection purposes shall be of class $5P10$ accuracy class.

Current transformers for protective gear shall have over current and saturation factors not less than those corresponding to the design short circuit level of the system. The output of each current transformer shall not be less than that specified and ensure that the capacity of the current transformers provided is adequate for the operation of the associated protective devices and instruments. Unless otherwise stated, the secondary of all current transformers for LV application shall be rated for 5A.

Manufacturer's magnetisation curves and ratio test results shall be provided for each type and rating of current transformer. Changes in current transformer ratios differing from those specified shall be approved by the superintendent for each specific instance.

The current transformers shall be installed on the circuit side of the circuit isolation devices in the cable compartment remote from the busbars except on busbar and sectionalising equipment. Current transformers shall be installed inside the switchboard in such a way that they are easily accessible for maintenance purposes and also to ensure that the details on the identification labels can be read easily with the respective panel doors opened.

The secondary terminals of current transformers shall be wired up to a terminal block with short-circuiting links and located at an accessible place. One side of the secondary winding shall be connected at this terminal to the earth bar.

Each current transformer shall be individually labelled and serial plates shall be provided for fitting to the outside of current transformer. The terminal markings shall identify:

- The primary and secondary windings
- The winding sections, if any
- The relative polarities of windings and winding sections
- The intermediate tapings, if any

The rating plate markings shall at least identify the followings:

- The manufacturer's name or other marks by which they may be readily identified
- A serial number or a type designation, preferably both
- The rated primary and secondary current
- The rated frequency
- The rated output and the corresponding accuracy class
- The highest voltage for equipment
- The rated insulation level and class of insulation
- The rated short time thermal current and the rated dynamic current
- The rated continuous thermal current

C.18.15.3 Metering

Unless noted otherwise all metering shall be:

- Be Class 1 (Class 0.5 for the CT's and Class 0.5 for the meters) unless noted otherwise.

- Be provided with a high level communications interface
- Provide readings in Amps, Volts, KVAR, KWH and KW, THD and maximum demand with energy management readings compliant with the IEC 62053-21 and IEC 62053-23.

The meters and communications cards shall meet the any interface requirements defined in the BMS Specification.

C.18.15.4 Power Meters for Main distribution boards

All multifunction meters shall be Schneider ABB or NHP type with communication module to suit serial bus plus interface to BACnet or Modbus Unless otherwise stated, Power Meters shall be provided to all incoming feeders at all LV main distribution boards. The power meters shall be flush mounted on the door panel and housed in a metal enclosed dust-proof IP52 housing. They shall be of industrial grade construction and adequately shielded against stray magnetic fields and properly calibrated for accurate readings. Power meters shall be suitable for operation under extreme temperature up to 45°C without premature failure and shall be highly insensitive to the influence of harmonics.

All power meters for main distribution boards shall be microprocessor based and shall offer a range of high accuracy instantaneous RMS, power, demand and energy measurements. Power meters shall be suitable for real-time monitoring, energy management and sub-billing purposes.

As a minimum requirement, the power meter shall have an integrated, anti-glare, backlit, 6-line LCD digital display that is capable of simultaneously presenting up to 4 concurrent values, including power and energy values, I/O conditions and alarm status. The Power meter shall be able to indicate the following information:

- Current demand : present, peak, predicted
- Voltage (L-L, L-N) : per phase, min/max, unbalance
- Power : real (kW), reactive (kVAr), apparent (kVA), per phase, total
- Power demand : present, peak, predicted
- Energy : real (kWH), reactive (kVArH), apparent (kVAH)
- Power factor : true and displacement, per phase, total, min/max
- Frequency: present, min/max
- Basic THD : voltage and current, per phase, min/max
- Individual THD : Voltage and current up to 31st harmonic order.

The Power meter shall be capable of performing detail power quality analysis and shall be able to capture the harmonic distortion waveform of each individual harmonic order either manually or by alarm status.

The power meter shall continuously log critical network information as follows and shall be able to eliminate data gaps that generally occur during network outages:

- Minimum and maximum log for all instantaneous readings
- Billing and energy log for kWH, kVArH, kVAH, power factor and kVAR demand.

The power meter shall have a minimum 6 digital input relays and 2 digital output relays. Digital output relays shall be capable of responding to internal alarms, external digital input status changes or commands over communications. The digital input relays shall be able to trigger alarms and data logging. The power meter shall have Built-in capabilities to

define up to 50 customize alarm conditions with 1 second response time so that critical events can be logged automatically.

The power meter shall be capable of simultaneously managing multiple communication ports and data streams to allow the meters to be used as part of a power energy management system and interface with other building automation system. As a minimum, power meters shall be supplied complete with RS-485 communication port(s) capable of sending and receiving MODBUS/LonWorks protocol and 10/100 UTP network port(s) fully supporting MODBUS protocols that operate on the TCP/IP platform. All power meters shall be fully compatible for high level integration.

C.18.15.5 Power Meters for Distribution Boards

The power meters shall be Schneider ABB or NHP type with communication module to suit serial bus flush mounted on the door panel and housed in a metal enclosed dust-proof IP52 housing. They shall be of industrial grade construction and adequately shielded against stray magnetic fields and properly calibrated for accurate readings. Power meters shall be suitable for operation under extreme temperature up to 45°C without premature failure and shall be highly insensitive to the influence of harmonics.

All power meters for distribution boards shall be microprocessor based and shall offer a range of high accuracy instantaneous RMS, power and energy measurements. Power meters shall be suitable for real-time monitoring, energy management and sub-billing purposes.

As a minimum requirement, the power meter shall have an integrated, anti-glare, backlit, LCD digital display that is capable of simultaneously presenting up to 3 concurrent values, including power and energy values, I/O conditions and alarm status. The Power meter shall be able to communicate the following information:

- Current demand (3 phases and neutral)
- Voltage (Phase to phase, phase to neutral)
- Frequency
- Active and reactive power (total and per phase)
- Apparent power (total)
- Power factor (total)
- Active energy
- Reactive energy
- Power demand (active, reactive, apparent power, present and max values)
- Hour counter

As a minimum, these power meters shall be supplied complete with RS-485 communication port(s) capable of sending and receiving MODBUS/LonWorks protocol. All power meters shall be fully compatible for high level integration.

C.18.16 Other Equipment

C.18.16.1 Selector Switches

Where specified, selector switches shall comply with IEC 60337 and be of positive-action rotary-cam switches incorporating double contacts. They shall be of modular construction and suitable for an extension of twelve cells. It shall also be possible to arrange the switches for four, six or eight positions and operations shall be in either direction.

Selector switch contacts shall be of double-break type and of hard silver alloy construction. They shall have a minimum continuous current rating of 10 amps and be of a high breaking capacity. Connections shall be by large terminals with clamp screws of 5mm minimum size.

Operating knobs shall be of the type that positively indicates the position of the switch. The switch position shall be clearly marked on an engraved legend plate which shall be made from black/white/black corrosion-resistant material such as Gravoply or Rowmark and the minimum character size shall be 5mm.

C.18.16.2 Indicating Lights

All indicating lights/lamps shall be of the LED type. The rated voltage shall be 10 volts in excess of the auxiliary supply voltage, whether AC or DC. LED indicating lights shall be supplied in standard colours, such as red, green, blue, white and amber to the Consultant Engineer's approval.

Lamp test facilities shall be provided so that all lamps on the panel can be tested simultaneously by operation of a common key. Where alarm fascias are specified, all alarm and monitoring indications (apart from circuit breaker isolator position indications) shall be incorporated in the fascia.

C.18.16.3 Contactors

Contactors shall be fully compliant with AS 3947.3 and may be of the latch type or the holding coil type. Contactor coils shall be suitable for high ambient temperature (50°C) operation and wound for continuous operation with minimum Class E insulation.

Where contactors are used for the switching of capacitors, lighting, etc., a suitable current rating and utilization category shall be selected by the switchboard manufacturer but shall in no way be less than utilization category AC-6B in accordance with AS 3947.3. Contactors for capacitor switching application shall be rated to at least 1.5 times the rated current of the capacitor.

C.18.17 Earthing

The earthing system shall comply with the Multiple Earthed Neutral (MEN) system which is deemed a subset of the TN-C-S earthing topology. The earthing configuration shall be in full compliance with AS 3000

All metal parts including doors, relays, instruments, etc., mounted on the switchgear shall be earthed through branch connections to the equipment earth bar. Frames of the draw-out circuit breakers shall be connected to the earth bar through a substantial plug type contact.

C.18.18 Internal ELV Control Wiring

Wherever possible, all internal control wirings shall be housed in a perforated PVC trunking with removable clip-on covers within the extra low voltage compartment of the electrical switchboard.

Wiring to instruments mounted on door panels where subject to movement shall be housed in flexible PVC conduit. Secondary wiring shall never be mounted direct to metal. The filling factor for PVC trunking and/or flexible PVC conduit shall not exceed 70%.

The internal control wiring for various instruments, etc. shall generally be of PVC insulating type and of minimum size 1.5 mm² for voltage circuits. For current transformer circuits, a minimum size of 2.5 mm² shall be used. Wirings between two terminals shall be continuous. Joints or interconnections shall not be permitted. These cables shall be neatly arranged with bends set at 90 degree and securely held in position with suitable clips.

Colour coding of secondary wiring shall generally be as follows:

- Power wiring similar & corresponding phase colour

- Neutral black
- Earth green/yellow-green
- LV control brown wiring active
- ELV control grey wiring active

Wiring shall be carried out in such a manner as to make circuits and connections easily traceable. Both ends of each conductor shall be provided with identification ferrules. The ferrules shall be of insulating material which shall be unaffected by oil, humidity and moisture. Characters shall be suitably marked in black. The ferrules shall be of the continuous ring type, not of the slip-on type. Markings shall be in accordance with the related manufacturer's drawings.

Terminals shall be designated in an approved manner. Terminals shall generally be rail mounted using high grade melamine. Partitions shall be fitted between terminals for different voltages. All current transformer terminals shall be provided with shorting links. Other terminals shall be provided with disconnecting links. Test terminals and plugs shall be provided at the front of the protective relay and instrument panel.

External wiring shall be terminated on approved type terminal blocks within the switchboard before any internal wiring is carried out. For internal panel wiring, no more than 2 wires shall be connected under one terminal connection. Wiring ends of stranded conductors shall be provided with compression-type pre-insulated wire pins with insulation support.

C.18.19 Design Verification

Undertake all verifications as required by AS/NZS 3439.

C.18.20 Shop Drawings

Required as per section C3 of This Specification.

In addition, for all switchboards provide full detailed shop drawings prior to manufacture, including the following:

- General arrangement showing both internal layout and front elevation
- Wiring diagram complying with single line diagram
- Form and construction details, including grade of metal used
- Equipment within switchboard including part numbers
- Description of all interface operation including generators, load shedding and lighting control
- Labelling, clearly shown

For all switchboards greater than 630A, provide the following extra information:

- Accurate, dimensioned elevations and sections of the switchboard
- Bus bar layout and temperature rise calculations in accordance with AS 3439
- Heat output figures for all equipment within switchboard and confirmation the cumulative heat output is within the design capacity
- Fault Calculations

For all switchboards with controls, provide the following extra information:

- Wiring diagrams of all control items
- PLC, DDC and all controller details and connection diagrams

Before completing drawings check the available space and required method of mounting of each switchboard from inspection on site.

When requested, submit type test certificates and/or design calculations to prove that each switchboard can withstand the nominated fault conditions.

C.18.21 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Nil

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Switchgear
- Indication equipment
- Control gear including PLC's
- Metering
- kWh meters
- Time Clocks

C.18.22 Maintenance

C.18.22.1 Six Month Service (1 off)

Check operation of all earth leakage circuit breakers.

C.18.22.2 Twelve Month Service (1 off)

Check operation of all earth leakage circuit breakers.

Thermographic survey of all electrical services switchboards (to be conducted during a period of high demand and not outside of the facilities normal operating hours).

C.18.23 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition:

- The Electrical Trade is to ensure all switchboard drawings are revised to 'As-Constructed' including any changes made on site to reflect the final installation of the switchboard and included with the Operation and Maintenance Manuals.
- Provide a copy of all switchboard circuit schedules.
- Provide a copy of the final discrimination and cascading study.
- Copies of certified test reports for surge protection devices.
- Copies all required verifications to AS/NZS 3439.

C.18.24 Testing and Commissioning

C.18.24.1 General

Required as per section C.12 of This Specification.

The Switchboard Manufacturer is responsible for manufacture, assembly, testing and commissioning of all switchboards.

Coordinate with the Superintendent a review of the switchboard in the following stages of manufacture, as required:

- Busbar installation complete
- First equipment installation
- Final shop floor review prior to dispatch to site.

The Switchboard superintendent shall carry out factory routine tests in accordance with AS 3439.1 before the switchboards leave the manufacturing facility. The following tests and inspections are deemed essential:

Inspection of the assemblies, wirings and electrical operational tests including capacitor bank functional step simulation in accordance with AS 3439.1 clause 8.3.1

Dielectric test/pressure test. All switchboards shall be tested at 2500V for 1 minute. All instruments which are designed for low operating voltage shall be disconnected to avoid damage. All dielectric/pressure test shall be carried out in accordance with AS 3439.1 clause 8.3.2

Checking of protective measures and the electrical continuity of protective circuits in accordance with AS 3439.1 clause 8.3.3. A secondary current injection test to the relay terminals shall be performed to the satisfaction of the superintendent.

Verification of insulation resistance in accordance with AS 3439.1 clause 8.3.4, insulation measurement using an insulation measuring device at a voltage of at least 500V shall be carried out. The test shall be deemed satisfactory if the insulation resistance between circuits and exposed conductive parts is at least 1000 ohm/V per circuit referred to the nominal voltage to earth of these circuits.

Phases shall be balanced on all boards to be within of 10% of each other.

All testing and measuring equipment shall be provided. All testing instruments shall be calibrated before the expiry of the calibration due date as specified on the equipment list. All calibrations shall be made against a certified standard or instrument of a higher accuracy and the methods shall be traceable to national/international known standards.

Surge protection devices shall be tested in accordance with IEC 61643-11.

C.18.24.2 Switchboard Alterations

Test and verify any switchboard alterations as a partially type tested assembly (PTTA) in accordance with AS 3439.1 on completion of the works.

C.18.25 Certification

C.18.25.1 General

Required as per section C.13 of This Specification.

Submit certification that all verifications have been conducted and comply with the requirements of AS/NZS 3439.

All electrical equipment shall be provided with certificate proving the required EMR level being lower than that allowed under AS/NZ 4252.1 levels or shall be fitted with individual harmonic filters to reduce the level of harmonics to below the required level.

Provide switchgear manufacturer certification that the discrimination and cascading fully complies with the Australian Standards.

Surge protection devices shall be certified in accordance with IEC 61643-11. Copies of Certified test reports shall be provided.

Copy of the switchboard manufacturers type test certificate(s).

C.18.25.2 Switchboard Alterations

For any switchboard alterations affecting the original construction of a board, provide certification from the switchboard manufacturer carrying out the modifications that the modifications have been done in accordance with AS 3439.1 to meet or exceed the performance of the switchboard prior to the works.

C.19 CABLE ENCLOSURES AND MATERIALS

C.19.1 General

Provide cable enclosure and materials as specified in the contract documentation.

C.19.2 Australian Standards and Regulatory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 2053 Conduits and Fittings for Electrical Installations
- AS/NZS 2067 Substations and High Voltage Installations exceeding 1kV ac
- AS/NZS 3000 Wirings Rules
- AS/NZS 3013 Electrical installations - Classification of fire and mechanical performance of wiring system elements

C.19.3 Conduiting

Generally galvanised screwed steel conduit shall be used. The minimum size conduit shall be 20mm. Except where conduit size is specified, conduits shall have capacity for one additional circuit.

Conduit sizes shown on drawings are for rigid conduit. If corrugated conduit being used select size to give equivalent internal diameter.

Exposed conduits where approved in writing shall be run square and plumb with building lines and as directed by the Consulting Engineer. All conduit ends and boxes shall be plugged in an approved manner until permanent fittings are installed. The electrical trades shall be present at all times when concrete containing conduit is being poured.

Conduit in concrete shall be installed in accordance with AS 3600 Section 14. Generally this requires conduits in slabs to be installed between the top and bottom layers of reinforcing steel. In columns and beams conduits shall be inside the ligatures with clearance from longitudinal steel reinforcement no less than the concrete cover to the steel reinforcement.

A gap of at least 40mm shall be provided between parallel conduits.

Unless otherwise specified, no conduit fittings other than deep conduit boxes, couplings and unions shall be installed in concrete.

To change direction conduits shall be set.

Flexible joints shall be made at right angles across concrete expansion joints. The ends of the conduit shall be kept 19mm apart (across the joints) and belled to form a firm sliding fit inside a larger size conduit sleeve (200mm long minimum). The sleeve shall be taped to conduits with "Scotchrap" to prevent ingress of slurry to the expansion joint. PVC accessories shall be used wherever possible.

Unless otherwise specified all joints in PVC conduit shall be welded.

One make of conduit, fittings and welding solution shall be used throughout.

Couplings on conduits shall be lock nutted. Conduit ends shall be bushed throughout.

Conduit boxes shall be proprietary units with conduit access facilities.

All joints in galvanised conduits and water pipe installations shall be made waterproof by use of "thread Seal Tape" or similar.

The ends of conduits shall be internally reamed clear of sharp edges and projections.

All spare conduits shall be provided with a suitable, durable draw-wire.

C.19.4 Cable Trays in riser

Minimum width of cable trays shall be 600mm (unless noted otherwise) and, **irrespective of any tray sizes shown on the documentation, all trays shall have spare room to accommodate a minimum 30% extra cables.**

Particular attention shall be paid to the construction of the under-slab soffits and the ceiling space prior to installation of fixings and brackets to support cable trays. Liaise with and seek approval from the Superintendent to ensure an approved method not detrimental to the construction is utilised.

In general cable trays shall be fabricated from perforated zinc-anneal sheet steel not less than 1.25mm thick and with a minimum of 30% perforated hole area to classify as a perforated tray in accordance with AS 3008 GKN Unitrax or equivalent is recommended.

Provide metal brackets and or fixings at intervals such that deflection does not exceed 6mm at any point. Brackets shall be hot dipped galvanised.

size the supports and fixings based on actual weight of final selection of cables in conjunction with the supplier to ensure the correct selection for the required duty is achieved.

Changes of direction shall be of radius not less than the minimum bending radius of the largest service installed on the tray and shall be complete with transition pieces, plates etc. If the size is not specified, then trays shall have spare room to accommodate 30% extra cables along the entire cable tray route.

Where cable trays are required within ceiling spaces and are solely for structured communications cabling purposes then Cable Mesh systems (such as EzyStrut Cable Mesh) are acceptable subject to review and approval by the Superintendent.

Cable trays installed in areas which are not totally enclosed on all sides and exposed to some ambient weather conditions shall be fit for purpose and location (typically hot dipped galvanised as a minimum).

Take all necessary precautions with the supply and installation of equipment specified to prevent corrosion.

The sizes of cable trays are, unless otherwise noted, to be determined by the Electrical Services Trades to ensure a minimum of 30% spare space after installation of cables. Submit details of cable trays to be installed to the Superintendent at time of Tender.

Fixing of cables to the underside of trays is not acceptable.

For ease of recognition of services, cable trays in the ceilings or under soffits shall be painted as follows:

- Electrical Services Cable Trays - A 500mm long orange stripe, on the underside of the tray, shall be painted every linear 10mm of tray.
- Communications Services Cable Trays - A 500mm long blue stripe, on the underside of the tray, shall be painted every linear 10m of tray.

Final location of all cable trays in ceilings shall be determined on site with the Superintendent, after liaison with all other trades has taken place.

C.19.5 Cable Ducts

Shall be fabricated from not less than 1mm thick zinc-seal sheet machine folded with returned edges for rigidity.

Fixings shall be by means of metal thread screws through the bottom of the duct to that wall surface or to metal brackets. Brackets shall be hot dipped galvanised.

The ducts shall be complete with removable clip on lids fixed at each end with metal thread screws.

Changes of direction shall be of radius not less than the minimum bending radius of the largest cable installed in the duct and shall be complete with transition pieces, plates etc.

If the size is not specified then ducts shall be sized to give spare space for 30% additional cables without exceeding the requirements of AS 3000.

C.19.6 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Indelible labels that are to be affixed to the building and used to indicate the positions where cables enter building(s).

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Cable trays and ducts.

C.19.7 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition:

- The exact location of all pits shall be identified on as-constructed drawings via exact GPS coordinates.
- The exact location of all underground conduit entry into buildings shall be identified on as-constructed drawings via exact GPS coordinates.

C.19.8 Testing and Commissioning

Not applicable

C.19.9 Certification

Not applicable

C.20 LOW VOLTAGE (LV) INSTALLATION

C.20.1 General

Supply, install and commission the low voltage installation as specified within the contract documentation. Refer to the Project Specific Section of This Specification for the information specific to this project.

C.20.2 Australian Standards and Regulatory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 3000 Wirings Rules
- AS/NZS 3008 Electrical installations – Selection of cables
- AS/NZS 3013 Electrical installations - Classification of fire and mechanical performance of wiring system elements
- AS/NZS 3100 Approval and test specification - General requirements for electrical equipment
- AS 1429.1 Electric cables - Polymeric insulated - For working voltages 1.9 / 3.3 (3.6) kV up to and including 19 / 33 (36) kV
- AS 1939 Degrees of protection provided by enclosures for electrical equipment (IPCODE)
- AS/NZS 3000 Approval and Test Specification – General Requirements for Electrical Equipment
- AS/NZS 60079 Electrical apparatus for explosive gas atmospheres - Classification of hazardous areas

In addition, all items of equipment and cabling used in the installation shall comply with the following:

- AS 61000 Electromagnetic Compatibility (EMC) standards to ensure acceptable immunity to Electromagnetic Interference (EMI).

All requirements of the Australian Standards shall take precedence over the requirements of This Specification.

C.20.3 Socket Outlets, Switches and Accessories

The locations of all accessories or outlets shown on the drawings are indicative only. The symbols shown the drawings are not to scale. Allow to move any fitting by up to 3m from the positions indicated on the drawings.

Accessories shown grouped together on the drawings shall be installed side by side with a 10mm separation between outlets. Ensure that segregation between services is maintained in all instances.

Accessories and socket outlets mounted on concrete and masonry (or any other "solid") walls shall be mounted over recessed wall boxes chased into the wall.

Socket outlets fixed on stud walls shall be mounted over the appropriate mounting "C" clip fixed to the stud frame.

The installation of accessories and socket outlets on surface mounted wall boxes is not acceptable unless prior approval is obtained in writing from the Consulting Engineer or Superintendent.

Flush plates shall be plumb and fit hard against wall surfaces. Heights were documented shall be from finished floor level to the centre of the accessory.

The exact position of all accessories and socket outlets shall be decided on site by the Architect. Request the Architect for these positions not less than ten (10) days before positions are required. Regardless of positions shown, accessories on wall tiling shall be located centrally over the nearest tile course intersection.

Socket outlets mounted in wet areas containing movable shower heads shall comply with the requirements of the AS/NZS 3000 without exception. Socket outlets mounted in areas prone to damage or exposed to the elements shall be from the industrial range.

Socket outlets shall be 10 or 15 amp switch socket combinations with standard size horizontal flush plates as noted on the drawings.

Externally mounted socket outlets with continuous exposure to the elements shall be IP66 rated. Externally mounted socket outlets in semi-covered areas shall be a minimum of IP53 rated.

Each accessory and socket outlet shall be fitted with circuit designation labels identifying the circuit number and phase corresponding to the respective circuit breaker installed. The circuit designation labels shall be typed and permanently fixed to each accessory or socket outlet. Unless otherwise noted, all circuit designation labels shall be fixed behind the outlet cover plate.

All accessories and socket outlets shall be provided with residual current device (RCD) protection in accordance with the requirements of AS/NZS 3000.

RCD protection shall be provided via single pole combined MACB/RCD units installed at the switchboard with a separate MACB/RCD unit for each socket outlet circuit.

C.20.4 Cabling and Wiring

C.20.4.1 General

All cable shall be unconditionally guaranteed and such guarantee shall cover replacement of faulty cable and full reimbursement of all costs involved.

Unless otherwise specified all cable shall have copper conductors and V75 grade PVC insulation, and sheathed where required as set out below.

TPS cables shall be used in the following situations:

- In accessible ceiling spaces.
- In wall cavities, stud walls and door mullions.
- In cable duct systems.
- Where required by the Supply Authority.

In ceiling spaces, TPS cables shall be clipped to the roof structure or slab at a maximum distance of 900 between clips. Elsewhere, unless otherwise specified, TPS or PVC insulated cable shall be installed in conduit.

In all cases every cable shall be installed in a manner such that it is replaceable at any time without damage to the building.

All wiring shall be carried out under the loop in system and no joints or connectors shall be allowed.

Unless otherwise specified power and light wiring shall be carried out with 4 square millimetres and 2.5 square millimetres cable respectively in accordance with AS/NZS 3000 and AS/NZS 3008.

Derating of sub circuit cabling in accordance with AS/NZS 3000 and AS/NZS 3008.1.1 shall be the electrical trades responsibility and all cables shall be appropriately sized and derated to suit the method of installation.

Generally, all wiring shall be concealed. Where unavoidably exposed, conduit shall only be installed as directed by the Consulting Engineer and approval provided in writing.

At all times refer to drawings and requirements of other trades and services in particular plumbing and mechanical services and install all cables, cable ducts, conduits and electrical equipment clear of same.

C.20.4.2 Main and Sub-Main Cables

Where submains are required to be terminated to switchboards or equipment provided by other trades, liaise carefully with them for the exact point of connection required. Unless otherwise specified an adequate earthwire shall be run with each set of cables.

C.20.4.3 MIMS/Fire Rated Cables

MIMS cables shall be 1000V/1000V class except for 250 volt final sub-circuits which shall be 600V/600V class. All MIMS cable fittings shall be supplied and installed in accordance with the manufacturer's recommendations.

Accessories, tools and junction boxes shall be as recommended by the manufacturer and shall be similar to "Pyrotenax" manufacture.

PVC covered type MIMS cables and fittings shall be used where exposed to the weather, dampness or corrosion or where installed in contact with dissimilar metals.

Cables shall not be cut and left unsealed during installation. Immediately after cable is cut to length the end shall be sealed, if necessary temporarily.

All cables shall be fixed by means of brass or copper clips or saddles secured by brass pins or screws, which will not cause electrolytic corrosion with the cable or the support to which it is fixed. Bushes shall be provided where cables pass through dissimilar metallic materials.

Clips or saddles shall be spaced not more than 150mm on either side of a fitting, accessory or right angle bend and not more than 600mm apart elsewhere.

MIMS cables shall be properly dressed into neat and symmetrical forms.

MIMS cables may be run in the same duct or on the same tray as PVC/PVC cables. In such cases allowance shall be made for derating the PVC cables and an air gap of at least 25mm shall be maintained between MIMS and PVC cables.

C.20.4.4 Bus-Duct Systems

As shown on the drawings bus-duct systems with a 30 year service life must be utilized as the consumer mains from the LV terminals of the transformer to the LV Main Switchboard. The busbar system must be fully enclosed within a duct constructed from high quality electro-galvanised sheet steel of minimum 2.0mm thick, or a fire rated compact resin type and must be supplied and installed by the switchboard builder. The steel duct must be provided with removable covers the full length of the duct. The removable covers must be bolted closed.

Busbars must be of plain hard-drawn, high conductivity electrolytic copper bars in accordance with AS 3439.2 and of adequate and uniform rectangular cross-section to carry continuously the specified current without overheating and without exceeding the maximum temperature rises stated in AS 3439.

Busbars must be PVC insulated, or resin in the case of the compact resin type and be rigidly mounted on non-hygroscopic insulators, fully braced and supported utilising a proprietary support system with support brackets spaced at 1.5 metre intervals so as to withstand any mechanical force to which they may be subjected under maximum fault condition. Busbar rating must not be less than the maximum current rating of the respective transformer under fan-forced operation. The neutral busbar must be of the same size as that of the phases, and if specified, they must be of double size as required. All joints in the busbars must be bolted or clamped, with contact surfaces suitably prepared and tinned to prevent oxidation while in service. There must be no drilling of holes along the whole busbar length.

Busbars must be coloured red, white, blue and black at appropriate points to distinguish the phases and neutral. No tapes must be used.

The busbar system must be accessible for future maintenance duties. In the event of a busbar short circuit, it must be possible to clean or to replace the busbars and the associated support system without removal of the steel duct assembly, only the removable covers. Each phase busbar must be able to withstand at least an applied AC test voltage of 2kV for a period of 60 seconds.

Where connections are made to transformers, flexible connections must be utilised to make the joint between duct and transformer terminals.

Where the busbar system is not 2 hour fire rated then proprietary fire rated wall flanges must be used.

C.20.4.5 Supplies For Electronic Equipment

All supplies serving Electronic Equipment (for example lifts, escalators, inverters, variable speed drives, split system air conditioners, UPS systems or other fixed equipment supplies whereby the equipment selection is unknown to the contractor) shall be in accordance with AS/NZS 3000 and AS62103. These supplies shall be provided with a protective conductor of at least a cross sectional area of 10mm² Cu. The following alternatives are also acceptable:

- Laying of a secondary protective conductor through separate terminals and electrically parallel to the protective conductor in accordance with IEC60364-5-54.

- Monitoring of the protective conductor by means of a device which automatically disconnects the electronic equipment in the case of a fault and does not introduce nuisance tripping.
- The provision of testing certification of the Electronic Equipment to be installed, in accordance with the procedures set out in AS62103, stating a leakage current of less than 3.5mA A.C or 10mA D.C.

C.20.5 Shop Drawings

Required as per section C3 of This Specification.

Specifically:

- Bus-duct layout and construction details

C.20.6 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Sample of bus-duct
- Sample of tee-off box

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Bus duct
- Tee off box system
- Power socket outlets and other accessories.

C.20.7 Maintenance

C.20.7.1 Six Month Service (1 off)

Check operation of all earth leakage circuit breakers.

C.20.7.2 Twelve Month Service (1 off)

Use RCD tester to test all outlets connected to earth leakage protected circuits

C.20.8 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

C.20.9 Testing and Commissioning

Required as per section C.12 of This Specification.

Provide a copy of the test certificates and details of test results of the items required in AS 3000 Section 8. Including but not limited to:

- Polarity

- Insulation resistance
- Continuity of earthing system
- Correct circuit connections
- Verification of earth fault loop impedance
- Operation of RCDs

C.20.10 Certification

Required as per section C.13 of This Specification.

In addition:

- Provide a copy of the electricians ticket to the Electrical Supply Authority.

C.21 LIGHTING INSTALLATION

C.21.1 General

Allow within the tender sum the complete process of ordering, procurement, storage, assembly, fixing, testing, aiming, commissioning and protecting the luminaires from damage until Practical Completion.

The light fittings shall be installed complete with poles, luminaires, lamps, diffusers, reflectors, lenses, optics, control gear, circuit protection (including residual current protection as required), terminals and all wiring, generally as detailed herein and on the drawings. All final fixing items, such as screws, battens, roses, sockets, spigots or brackets, necessary for a proper installation shall be provided whether specifically included within the documentation or not.

C.21.2 Australian Standards and Statutory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 1158 Lighting for roads and public spaces
- AS 1680 Interior Lighting
- AS/NZS 3000 Wirings Rules
- AS/NZS 3008 Electrical installations – Selection of cables
- AS 4034.2 Incandescent Lamps in General Service Lighting, Part 2: Minimum Energy Performance Standard (MEPS).
- AS 4674: Design, Construction and Fit-out of Food Premises
- AS/NZS 60079 Electrical apparatus for explosive gas atmospheres - Classification of hazardous areas
- AS 60598 Luminaires
- AS 61000.1.1 Electromagnetic Compatibility General Requirements
- EN 62471 Photobiological safety of lamps and lamp systems.

- AS CISPR15 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

C.21.3 Alternative Luminaire Package

Alternative luminaire packages shall only be submitted when a fully complying tender is submitted with the specified luminaires as noted on the light fitting schedule. Alternative luminaire packages submitted without a fully complying tender shall be deemed as not approved in which case, the specified luminaires shall be installed at no additional cost to the Superintendent.

The Consultant and/or the Superintendent is under no obligation to review or accept any or all of the alternative luminaires submitted.

Any alternative luminaires submitted requires the following information to be included at the time of tender as part of the alternative submission:

- Illumination calculation in DIALux or AGI for all areas affected by the alternative luminaire
- Full data sheets (including lumen output and power consumption) of each of the specified luminaire and alternative luminaire including any laboratory test data (minimum of LM-79 and LM-80 tests for LED luminaires).
- Sample of each of the specified luminaire and alternative luminaire.
- Unit price for each of the specified luminaire and the alternative luminaire.
- Total cost adjustment to the Contract Price.
- Warranty offered.

Alternative luminaire packages submitted without the above information will not be assessed. Once the above information has been provided, request a meeting with the Superintendent, Architect, Principal, Consulting Engineer and any other interested parties to review the sample submission. The alternative luminaires shall be assessed individually and in relation to other luminaires on the project in relation to the photometric, thermal and energy performance, aesthetic and construction quality and benefit to the project through financial, ease of installation and maintenance or time saving.

Following the submission of the alternative package allow two week review time by the Superintendent to assess the package.

Alternative luminaire packages will not be accepted due to project time constraints not imposed by the Superintendent. Where the Contractor has failed to order the specified luminaires to meet the project programme, air freight the specified luminaires, or install temporary luminaires until the specified luminaires are delivered to site at no additional cost to the Principal.

C.21.4 Installation

All luminaires shall be installed square to building and field lines with true vertical drops. Adequate clearance shall be maintained in accordance with AS/NZS 3000 between flammable building materials and high temperature parts of the luminaire.

Installation of the luminaires shall be coordinated on site prior to installation with all other services. Unless shown explicitly on the electrical drawings, the set out of luminaires shall be as per the co-ordinated architectural reflected ceiling plans, elevations, sections, floor plans and details. Follow all instructions for the installation of luminaires as instructed by the luminaire supplier.

Inspect each fitting as it is removed from its package. Damaged fittings shall be replaced or rectified to approval of the Superintendent.

The installation shall not weaken any structural member through an excess of weight or through installation practices related to the method of attachment. The depth of any ceiling cut-out required for recessed luminaires shall be verified prior to the hole being cut. All luminaire shall be installed to allow the manufacturer's required clearance around the luminaire for heat dissipation. Any discrepancy shall be reported to the Superintendent.

Any additional supports or fixing shall be provided by the Contractor and included as part of the tender submission.

Where a project has a base building lighting installation which is to be retained, the Contractor has the responsibility to ensure all lighting (including base building lights) are handled with due care. At a minimum, there should be a record of the notice provided to the builder and other contractors on the site of the lighting installation that is to be retained. All damage to the existing lighting to be retained shall be corrected at the Contractor's expense.

C.21.5 Luminaire Construction

Luminaires shall be manufactured in accordance with AS 60598. All luminaires shall be provided with a Regulatory Compliance Mark (RCM) to ensure electromagnetic compatibility (EMC) and manufactured in accordance with AS CISPR15:2006.

Ceiling recessed troffer luminaires shall be constructed of sheet-metal not less than 1mm furniture grade zinc-anneal, machine folded and welded construction, rigid, symmetrical and neat in appearance with all visible joints filled and ground smooth. Heavy gauge metal sections and/or adequate bracing shall be provided where necessary for rigidity.

Ceiling recessed troffer luminaires metalwork shall be painted gloss white, unless noted otherwise in the documentation. Before application of finishing coats metal shall be thoroughly prepared for good paint adhesion and treated to prevent rust, cracking or deterioration of surface finish.

All luminaire paintwork shall be of a first class finish appropriate to the application. Luminaires with inferior or damaged paint shall be rejected. There shall be no visual appearance of rivets or any other fixings from viewing the installed luminaires at the finished floor level closest to the luminaire.

C.21.6 LED Luminaires

All LED luminaires shall:

- Be provided complete for 240V operation. Any remote drivers must be housed and/or fixed in a secure and mechanically protected location suitable for the manufacturer's recommendation. Drivers shall not be left resting on ceiling surface. Drivers shall be installed in a location where access is available for replacement. All LED control gear shall be designed and manufacture red in accordance with IEC 61347.1 and IEC 61347-2-13.
- Be installed in an arrangement which adequately dissipates heat created by the LED, driver or control gear.
- Be supplied with information package providing the following:
 - Luminaire lumen output
 - Driver current rating and luminaire operating current
 - LED chip/package/engine arrangement, manufacturer and model
 - LM-79 test report
 - LM-80 test report

- Achieve a light output minimum colour rendering index (CRI) of 80 for illumination lighting. LEDs for illumination must be RGB mixed or phosphor converted light output. Each LED luminaire must be within a minimum of 3-step MacAdam ellipse for LED colour matching, unless otherwise noted.

The approved method test procedures (LM-79 and LM-80) shall be carried out at an IES certified lighting laboratory.

If a LED colour temperature has not been provided it is assumed to be 4000K for areas illuminated above 40 lux average and 3000K for areas illuminated below 40 lux average. Unless otherwise noted, all external LED sources shall be a colour temperature of 3000K.

Ensure that the control gear, the lamp and the light fitting are all tested and compatible, whether control gear is remote or integral with the light fitting. The maximum distance that the control gear must be from the light fitting must be 2000mm or as approved by the control gear and lamp manufacturer.

C.21.7 Residual Current Device

All lighting circuits shall be protected by a residual current device. Generally unless shown within the documentation otherwise, for cable lengths less than 100 meters the circuit protection shall be through a residual current breaker with overload protection (RCBO). Generally unless shown within the documentation otherwise, for cable lengths greater than 100 meters provide a 30mA RCD within each of the light pole adjacent to the fuse to comply with AS/NZS 3000 requirements. Confirm with the Superintendent prior to installation for residual current protection.

C.21.8 Night testing

Allow to carry out night testing of the light fittings locations prior to final fixing of fittings. This shall be carried out on site, after normal working hours, in conjunction with the Superintendent. Provide all necessary power supplies and access to pole tops for operation, testing and adjustment of the light fittings.

Allow for a site walk around with the Superintendent and for the illumination levels to be sampled at various locations for general comparison with the lighting calculation.

C.21.9 Shop Drawings

Required as per section C3 of This Specification.

The successful tenderer shall produce detailed shop drawings along with full photometric data and illumination plots of the specified (and any proposed alternative) fittings.

C.21.10 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- One sample of all types of light fittings, clearly labelled with the letter designation from the light fitting schedule.
- One sample of each type of lighting switch.
- One sample of each type of motion sensor.

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Nil

C.21.11 Maintenance

C.21.11.1 One Monthly Services (12 off)

Not Applicable

C.21.11.2 Six Month Service (1 off)

Not Applicable

C.21.11.3 Twelve Month Service (1 off)

The following maintenance shall be completed annually:

- Obtain regular illumination measurements throughout the installation to confirm the depreciation curve of the luminaire light source. Any luminaire below the manufacturer's depreciation curve shall be replaced.
- Calibrate motion sensors to Client's requirements.
- Each luminaire luminous face shall be cleaned in accordance with the manufacturer's requirements.

C.21.12 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition,

- As Installed luminaire schedule complete with images of each luminaire, name and details of luminaire suppliers and lamp details (including lamp colour temperature) and locations where installed.
- As Installed layout drawings showing the lighting installation.
- Repair and maintenance instruction for each luminaire.
- Clear and precise instruction for aiming and directing adjustable luminaires including diagrams where necessary.

C.21.13 Testing and Commissioning

Required as per section C.12 of This Specification.

Each luminaire shall be tested to ensure its operation is as per the manufacturer's requirements.

Each dimmable luminaire shall be testing to confirm the dimming curve is as per the manufacturer's requirements.

Prior to final handover, request the presence of the Consulting Engineer/Lighting Designer to coordinate the process of the final aiming session of any adjustable luminaires to the Principal's requirement. Following the final aiming session or immediately prior to final handover each luminaire shall be thoroughly cleaned.

C.21.14 Certification

Required as per section C.13 of This Specification.

C.22 LIGHTING CONTROLS

C.22.1 Australian Standards and Statutory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 3000 Wirings Rules
- AS/NZS 3008 Electrical installations – Selection of cables
- AS/NZS 60079 Electrical apparatus for explosive gas atmospheres - Classification of hazardous areas
- AS CISPR15 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

C.22.2 Low Voltage Controls

C.22.2.1 General

All accessories such as faceplates shall match throughout the site (e.g. lighting faceplates shall match power outlet and communications faceplates).

C.22.2.2 Light Switches

Light switches shall be:

- Clipsal/Legrand series manufacture unless otherwise specified within the documentation.
- 15A(min) miniature rocker style or pushbutton mechanisms with LED power on indicator in miniature flush plates to partitions and vertical standard size flush plates elsewhere. Mechanisms shall be "X" rated for use with fluorescent fittings. Provide neon switch indicators to light switches switching luminaires located remotely from the switch position, e.g., switching luminaires in a storeroom or in an adjacent room. Refer to the lighting legend for rocker or pushbutton type.
- Wired for the switch indicator light to be a 'power availability indicator' which is ON when the lighting is off and switched OFF when the lighting is on, unless the room function is required to have complete darkness and the indicator light would be a distraction.
- Mounted at 1100 AFFL unless noted otherwise. In areas of public use with a single exit from the room (such as a public amenity room), the light switch shall not be located in an easily accessible position for nuisance switching. Confirm location of light switch prior to installation.

C.22.2.3 Light Switch Panels

Light switch panels shall be one gang, two gang, four gang or six gang in a standard Clipsal/Legrand face plate.

Where light switch panels are greater than six gang, a stainless steel metal plate switch assembly shall be provided.

Light switch panels greater than 4 gang shall have switching areas labelled indelibly either with recessed plastic strip with protective film, engraved faceplate or engraved mechanism.

C.22.2.4 Dimmers

Where noted on the drawings the light switch is 'push dim', the lighting switch shall be one touch on-off, push and hold to ramp lighting level up and down, Clipsal 31E2PUDM, Legrand 400A2P series O.A.E.

All dimmable light switches must be coordinated with the luminaires within the circuit to ensure correct compatibility of the luminaire control gear and the dimmer.

C.22.2.5 Occupancy Sensors

Generally the following occupancy sensors shall be used unless specified elsewhere within the contract documentation:

- General indoor locations – Clipsal 5753L, Legrand 630R02 or IAutomation BEG series, 360° view, set to 10 minutes timeout
- Exterior locations – Clipsal 5750WPL or Legrand 488TRI3W series set to 15 minutes timeout
- Underground Carparks – MySmart MWS3A-PRM set to 5 minutes timeout.
- Long time out (i.e. public amenities) – MySmart MWS5 set to 30 minutes timeout.

Motion sensors shall be installed a minimum of two meters away from any luminaire.

External occupancy sensors shall not be installed in a vandal prone location.

C.22.2.6 External Lighting Controls (Time Switches and PE Cells)

External lighting shall be controlled over the hours of darkness by an astronomical time switch (Rex 2000 or similar) installed within the distribution board or operated by a photo-electric cell relay similar to National which shall be located in an approved position at high level. Prior to installation of the photo-electric cell confirm position with the Superintendent.

Time switched lighting shall be turned on by separate contactors operated by the photo-electric relay but shall be turned off by a time switch. The time switch shall have 9 hour on delay.

Each distribution board with external lighting shall have external lighting control equipment. A manual override switch for the contactor shall be provided on the Principal accessible face of the distribution board unless otherwise specified.

C.22.3 **Intelligent Lighting Control Systems**

C.22.3.1 General

Provide a lighting control system as specified within Part B of this specification.

It shall be possible to upgrade the firmware in any of the Load Controllers or Panels over the lighting control network from a remote location. This is to ensure that at commissioning, the latest software shall be installed in every device.

Installation of enclosures, panels, controllers and wiring and termination of the load controllers shall be in accordance with the Specialist Trade's requirements. The Specialist Trade shall have a proven recent track record in similar sized projects and employ its own staff to program and commission the system. No "third party" commissioning agents or contractors shall be accepted.

C.22.4 **Installation**

An experienced specialist subcontractor shall carry out the supply, programming, testing and commissioning of the system. Installation of enclosures, panels, controllers and wiring and termination of the load controllers shall be in accordance with the Specialist Sub-contractor's requirements. The Specialist Sub-contractor shall have a proven recent track record in similar sized projects and employ its own staff to program and commission the system. No "third party" commissioning agents or contractors shall be accepted.

C.22.5 **Shop Drawings**

Required as per section C3 of This Specification.

Provide a shop drawing showing the final wiring and connection installation.

C.22.6 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Lighting control equipment.

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Nil

C.22.7 Licences

For lighting control systems only, provide all appropriate system / equipment licences including 3rd party licences. Pay all initial and annual charges for such licences as required up to 10 years after the date of Practical Completion.

C.22.8 Maintenance

C.22.8.1 One Monthly Services (12 off)

Not applicable.

C.22.8.2 Six Month Service (1 off)

Not applicable.

C.22.8.3 Twelve Month Service (1 off)

Calibrate the lighting control system to suit the Principal's requirements.

Calibrate each motion sensor to the Principal's requirements. Allow for a site walkthrough every space with a motion sensor and verify the time out setting is appropriate.

C.22.9 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

Within the project Operating and Maintenance Manual there shall be a section on Lighting Control and the following information shall be provided:

- As Installed equipment list schedule complete with details of each light switch, occupancy sensor, PE cell and control equipment.
- As Installed layout drawings showing the lighting control installation including control zoning diagrams and locations of switches and equipment.
- Details of lighting control maintenance contractor.

The lighting control section may be combined with the lighting section of the Operating and Maintenance Manual if there is no automatic lighting control system.

C.22.10 Testing and Commissioning

Required as per section C.12 of This Specification.

Specialist intelligent lighting control system trades shall complete the commissioning (using factory trained commissioning engineers) with liaison with the audio visual and electrical trades.

Commissioning schedules, operational flow charts, functional prerequisites shall be supplied for approval prior to commissioning.

- Time Switches: Adjust the setting as instructed. Prove that the time switch controls the correct circuits as specified and show that the manual override switch is operative.
- Photocells: Check the operation by shading and check that the correct circuits are controlled. Check that manual override switches operate correctly.
- Motion Sensor: Calibrate to the Principal's requirements. Allow for a site walkthrough every space with a motion sensor and verify the time out setting is appropriate.

Allow for one 90 minute long commissioning meeting with the Principal prior to or immediately following Practical Completion (within a week) to demonstrate the switching arrangement with the rooms. Receive feedback, make any changes to the system as requested and notify the Superintendent of the changes completion. Allow for a further 60 minute site visit six months after Practical Completion to confirm with the Principal the operation of the system is to their requirements.

C.22.11 Certification

Required as per section C.13 of This Specification.

C.23 EMERGENCY AND EXIT LIGHTING

C.23.1 General

Supply and install self-contained, non-maintained automatic in operation emergency light fitting as a "single point system".

Examine all architectural and services drawings to ensure that fittings are located to comply with the requirements of the relevant Authorities, and be responsible for the coordination and installation of fittings with regard to type, suitability based upon the installed location (to suit ceilings, walls, openings, ducts, pipes, cable trays and other services). Liaise with the building trades to determine the exact location for the fittings and coordinate their installation.

Batteries, charger, inverter shall be concealed within the fitting or ceiling space.

Batteries for shall be lithium ion providing a two (2) hour emergency operation after a full charging cycle, maintenance free period of 10 years.

Where such fittings are switched, supply an active feed from the line side of the switch to each emergency fitting for supply failure sensing.

Lamps shall be rated for 120% of normal supply.

Provide test facilities for the emergency lighting in each distribution board.

C.23.2 Australian Standards and Statutory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS/NZS 3000 Wirings Rules
- AS/NZS 3008 Electrical installations – Selection of cables
- AS/NZS 2293.1 Emergency escape lighting and exit signs for buildings – Part 1: System design, installation and operation;
- AS/NZS2293.2 Emergency escape lighting and exit signs for buildings – Part 2: Inspection and Maintenance.

In addition, all items of equipment and cabling used in the installation shall comply with the following:

- AS 61000 Electromagnetic Compatibility (EMC) standards to ensure acceptable immunity to Electromagnetic Interference (EMI).
- AS CISPR15 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

C.23.3 Exit Signs

Exit signs shall be maintained "single point systems", fully self-contained, automatic in operation.

Exit signs shall be the pictogram type in accordance with the latest standard and the latest NCC (BCA).

C.23.4 Shop Drawings

Required as per section C3 of This Specification.

C.23.5 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Nil

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Each type of emergency luminaire
- Each type of exit sign
- Test controls

C.23.6 Maintenance

Provide maintenance log books/records in accordance with AS/NZS 2293.2

One Monthly Services (12 off)

Not applicable

Six Month Service (1 off)

Six monthly inspection and maintenance procedures in accordance with AS 2293.2.

Twelve Month Service (1 off)

Yearly monthly inspection and maintenance procedures in accordance with AS 2293.2.

C.23.7 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

In addition:

- Include manufacturers' product data sheets for each type of emergency luminaires and exit sign.
- Provide manufacturers' literature and/or single line diagrams for all test controls.

C.23.8 Testing and Commissioning

Required as per section C.12 of This Specification.

- Check that each emergency light operates correctly when the appropriate normal power circuit voltage fails.
- For fittings with maintained operation, check that the manual switches energise the appropriate fittings.
- Check the power available light and the test switch on single point fittings are operative.
- Conduct commissioning tests in accordance with AS 2293.

C.23.9 Certification

Required as per section C.13 of This Specification.

C.23.10 Shop Drawings

Not applicable

C.23.11 Samples

Required as per section C.4 of This Specification.

Samples of the items listed below shall be submitted for approval prior to purchase:

- Nil

Manufacturers' literature giving detailed specification, literature on software / user interface, physical appearance and size for the following equipment shall be submitted for approval prior to purchase:

- Nil

C.23.12 Maintenance

C.23.12.1 Twelve Month Service (1 off)

C.23.13 Operating and Maintenance Manuals

Required as per section C.7 of This Specification.

C.23.14 Testing and Commissioning

Required as per section C.12 of This Specification.

C.23.15 Certification

Required as per section C.13 of This Specification.

C.23.16 Certification

Required as per section C.13 of This Specification.

C.24 TELEPHONE BACKBONE CABLING

C.24.1 General

Supply and install the telephone installation including the following main items:

- Distribution frames, boxes and blocks
- Backbone cabling
- Telecommunication reference conductor system

All miscellaneous items such as insulating crossings and cable and covers, cable trays, conduits, ducts, battens and sundries such as clips, screws, masonry anchors fasteners, etc. as required for a complete concealed re-wireable installation.

Supply and install 5 pair telephone cable (MIMS or fire rated equivalent) to each lift shaft or lift motor room (terminated on telephone frame), to each FIP / EWIS panel.

All telephone cabling shall be carried out by an Australian Communications Authority (ACA) approved Contractor.

C.24.2 Australian Standards and Statutory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code, ACMA and the following Australian Standards:

- AS 1367 Multiple outlet distribution systems
- AS/NZS 3000 Wirings Rules
- AS 3080 Integrated Communications Cabling Systems for Commercial Premises
- AS 3085.1 Administration of Communications cabling systems – Basic Requirements
- AS / ACIF S008 Requirements for Authorised Cabling Products
- AS / ACIF S009 Installation Requirements for Customer Cabling
- EN 50174 Information technology. Cabling installation. Installation specification and quality assurance
- EN 50346 Information technology. Cabling installation. Testing of installed cabling
- Australian Communications Media Authority (ACMA)
- HB29-2007 Communications Cabling Manual

All work shall be carried out in accordance with the current issue of "Communications Cabling Manual" issued by Standards Australia and in accordance with all other requirements of Telstra and the ACMA.

In addition, all items of equipment and cabling used in the installation shall comply with the following:

- AS 61000 Electromagnetic Compatibility (EMC) standards to ensure acceptable immunity to Electromagnetic Interference (EMI).

C.24.3 Abbreviations

The following abbreviations have been used within this section of the specification.

- CD Campus Distributor
- BD Building Distributor
- FD Floor Distributor

C.24.4 Cable

Telephone cabling located internal to buildings shall be internal PVC insulated and PVC sheathed.

Telephone cabling located externally shall be external jelly filled cabling and shall be installed within conduiting.

Velcro cable ties shall be used to secure the cable(s) to the surfaces to which it is mounted/installed on (with the exception of where fully enclosed within conduits). Plastic cable ties are not acceptable.

Provide lightning surge protection to both ends of all external telephone cables to protect the equipment against induced lightning and other surges. The surge arrestors shall be Erico, or equivalent approved.

Telephone cable shall be in fire rated wiring to each lift, security alarm panel and FIP / EWIS. Liaise for exact location and termination details with the relevant services trade(s).

Provide cable record book at each CD, BD and FD location.

Liaise with the Superintendent for provision of telephone number for monitoring of the FIP / EWIS and lifts services prior to Practical Completion. Provide all patching, cross connect, labelling, etc. as required.

C.24.5 Cabling Access and Termination

Underground conduits shall be white PVC pressure pipe, other conduits shall be grey or white in colour. All conduits shall be complete stranded, insulated draw wires.

Termination blocks shall be equal to Krone and IDC type, able to utilise standard Krone termination tool.

C.24.6 Surge Arrestor

Supply and install approved line protector units (surge arrestor) to all telephone incoming lines at the Campus Distributor and Building Distributors. The surge arrestors shall be "Erico" type or equivalent approved complying with ACA and TS009.

C.24.7 Cable Records

At each distribution frame provide a durable cable record book showing the frame number and details of all pairs terminated, including sufficient description to identify location of each outlet.

The record book shall be located in a suitable housing fixed adjacent to the rack or on the back of the cabinet enclosure door.

The record book shall include the following minimum details:-

- Source of origin of incoming cable, with sketch for CD and BD
- Outgoing BD and FD served with sketch.

C.25 ACCESS CONTROL SYSTEM

C.25.1 General

Provide an Access Control System (ACS). The system includes but is not limited to the following:

- Card Readers and Proximity Cards or Fobs or Air Keys
- Card Readers and Proximity Cards
- Door Release Buttons
- Emergency Door release Buttons
- Magnetic Reed Switches
- Magnetic Locks
- Electric Strikes
- Include all necessary accessories as required
- Provided with interfaces to other systems as required

C.25.2 Australian Standards and Statutory Requirements

The whole of the installation shall be carried out in accordance with the requirements of the National Construction Code and the following Australian Standards:

- AS 2201.1 Intruder alarm systems - Client's premises - Design, installation, commissioning and maintenance
- AS 2201.3 Intruder alarm systems - Detection devices for internal use
- AS 5007 Powered doors for pedestrian access and egress
- AS/NZS 3000:2007 Electrical Installations.
- AS/NZS 3008 Electrical installations – Selection of cables
- Australian Communications Media Authority (ACMA).
- AS 3080 Integrated Communications Cabling Systems for Commercial Premises.
- AS 3084 Telecommunications pathways and spaces for commercial buildings.
- AS 3085.1 Administration of Communications cabling systems – Basic Requirements.
- AS / NZS 4117 Surge Protection Devices for Telecommunications Applications.
- AS / NZS IEC 61935.1 Testing of balanced cabling in accordance with ISO / IEC 11801 – Part 1.
- ISO 11801 Ed 2 Information Technology – Generic cabling for customer premises.
- Australia Communications Authority (ACA)

- AS / ACIF S008 Requirements for Authorised Cabling Products.
- AS / ACIF S009 Installation Requirements for Customer Cabling.
- ANSI TIA / EIA 862:2002 Building Automation Systems Cabling Standard for Commercial Buildings.
- HB29-2007 Communications Cabling Manual

In addition, all items of equipment and cabling used in the installation shall comply with the following:

- Electromagnetic Compatibility (EMC) standards to ensure acceptable immunity to Electromagnetic Interference (EMI).
- IEC 801-2, (IEC 1000-4-2) Electrostatic Discharge (ESD).
- IEC 801-3, (IEC 1000-4-3) Electric Field Susceptibility.
- IEC 801-4, (IEC 1000-4-4) Electrical Fast Transients (Burst).

C.25.3 Equipment

C.25.3.1 Access cards

Proximity cards shall provide both a facility identification and individual identification in the encoded information.

The card shall be manufactured by embedding the electronic card and a personnel identification card within a durable, hard wearing casing.

C.25.3.2 Card Readers

Proximity type readers shall be suitable for mounting behind glass or other non-magnetic materials and capable of reading proximity cards at a distance of at least 50mm. The card readers shall be vandal resistant and weather-proof.

Card readers shall be recess mounted and provided with a neat, cover panel.

Card readers detailed within lift cars are required to provide full function access control on a per lift per car per floor basis for all floors served by the lift car. The programming access group matrixes associated with lift control shall be incorporated. Provide to the lift trade the required specifications for cables required to be installed in the trailing cable harness of each lift car. Advise the lift trade of the required location and mounting details for the card readers in each lift car.

C.25.3.3 Access FOBS

Proximity fobs shall provide both a facility identification and individual identification in the encoded information.

The fob shall be manufactured within a durable, hard wearing casing.

C.25.3.4 Access airkey

Air keys shall provide both a facility identification and individual identification in the encoded information.

The fob shall be manufactured within a durable, hard wearing casing.

The air key shall provide suitable wireless signal minimum 20m from the controlled device.

C.25.3.5 Magnetic Reed Switches

Supply and install a Sentrol 1078C series (or approved equivalent) magnetic reed switch in each door frame where detailed on the drawings.

Supply and install heavy-duty Sentrol 2200 series magnetic reed switches (or approved equivalent) to the locations indicated on the drawings and generally to roller shutter doors.

Terminate cabling at both ends and install end of line resistors at the magnetic reed switch.

C.25.3.6 Door Lock Control and Monitoring Devices

The electric locking devices shall be of the manufacture or of an approved equivalent listed in architectural document.

The electromagnetic locks shall be complete with:

- Door status indicator
- Power on to lock configuration
- Bond Sense monitoring

Free egress type operations shall be provided with egress handle operations shunting the door reed switch for a pre-programmed time.

Valid access by card reader or egress by push button shall shunt the door reed switch for a predetermined time.

All installed devices shall be tested and fully operational following installation and connection to the ACS.

C.25.3.7 Request to Exit Push Button

Request to Exit push buttons shall be installed on a standard size flush plate to suit the lighting fixtures used, and be engraved "PRESS TO EXIT" in red lettering.

Provide the Rex button for automatic opening of fire doors for disabled access on all floors from bay 4 to bay 5

C.25.3.8 Emergency Door Release Unit (EDRU)

Emergency door release units shall be installed at doors located as shown in the drawings.

The EDRU unit shall be:

- Dual separate contact monitoring type, providing independent contacts for lock/door deactivation and alarm reporting
- Plastic insert key test type
- Hinged cover engraved with "Emergency Use Only" over the collapsible face to stop accidental use, (unless device is to meet D2.21 of the NCC). Lettering shall be in red and minimum of 6mm
- Key resettable
- Localised sounder shall be fitted to each EDRU. EDRU alarm signal shall connect to the paging system (site wide) and alert the security on the status if activated

The cabling to the associated electric locking device shall be via the EDRU unit such that operation of the EDRU unit shall unlock the electric locking device regardless of system status.

All EDRU activations shall be monitored through the second contact set within the EDRU by the ACS.

C.25.3.9 Door open too long

Required door open too long audible alarms shall be installed on a standard size flush plate adjacent to controlled door or integrated into door access control hardware.

C.25.4 Power Supply

Supply, install and commission all necessary power supplies as required.

PART D. TENDER RETURN

D.1 APPENDIX C - TENDER SUMMARY

Tenderers shall submit a breakdown of the total tender price including administration cost and profit for each section of the works as follows:

The amounts included in the Total Tender sum including overhead costs and profit margins are as follows:

(a) Main Switchboard works	\$ _____
(b) New Distribution boards	\$ _____
(c) Sub-mains cabling	\$ _____
(d) Cable trays, ducts and conduits	\$ _____
(e) Sub-circuit cabling	\$ _____
(f) Accessories and Outlets	\$ _____
(g) Luminaires and Lighting Control	\$ _____
(h) Emergency Evacuation Lighting	\$ _____
(i) Access Control System	\$ _____
(j) Telephone Installation	\$ _____
(k) Testing and Commissioning	\$ _____
(Minimum of 2% of Total Tender Sum)	
(l) Maintenance	\$ _____
(m) Miscellaneous	\$ _____
TOTAL TENDER AMOUNT (EXCLUDING GST)	\$ _____
GOODS & SERVICES TAX (10%)	\$ _____

TOTAL TENDER AMOUNT (INCLUDING GST)	\$ _____

NAME OF TENDERER: _____

CONTRACT: _____

D.2 APPENDIX D - SCHEDULE OF CONTRACT RATES

Tenderers shall submit the following Schedule to allow assessment of variations:

Composite Rates:

The following rates shall include for the supply and delivery of all materials, transport, erection and labour to complete the installation of the following elements in the works: surveillance

Description	Unit	Cost/Unit	GST	Total/Unit

Hourly Labour Rates (including GST):

Period	Labour 1	Labour 2	Labour 3	Labour 4	Labour 5	Labour 6
Ordinary Time						
Time and a Half						
Double time						

NAME OF TENDERER: _____

CONTRACT: _____

D.3 APPENDIX 3 - SCHEDULE OF CONTRACT RATES

Tenderers shall submit the following Schedule to allow assessment of variations:

D.3.1 Material

Mark-up to be applied on cost to purchase materials _____%

D.3.2 Unit Rates (including GST)

The unit rates below shall be used to assess variations which may be required as part of the project. Include administration cost, overhead costs and profit within each item of the unit rates listed below.

Unit Rate Items	Materials Supply Only	Material Supplied and Installed	Item Deleted before Installation
(a) Error! Reference source not found. - 16A single phase MACB - 20A single phase MACB - 20A three phase MACB - 25A three phase MACB - 32A three phase MACB - 16A single phase 30mA combined RCD - 20A single phase 30mA combined RCD - 20A three phase 30mA combined RCD - 50A three phase MCCB - 63A three phase MCCB - 80A three phase MCCB - 100A three phase MCCB - 125A three phase MCCB - 160A three phase MCCB - 250A three phase MCCB - 400A three phase MCCB			
(b) LOW VOLTAGE (LV) INSTALLATION <u>MAIN AND SUB-MAIN CABLES</u> <u>Multicore</u> (per metre)			

- 1x4C 10mm² +E Cu XPLE/PVC - 1x4C 16mm² +E Cu XPLE/PVC - 1x4C 25mm² +E Cu XPLE/PVC - 1x4C 35mm² +E Cu XPLE/PVC - 1x4C 50mm² +E Cu XPLE/PVC <u>Single core (each set per metre)</u> - 4x1C 70mm² Cu XPLE/PVC + E - 4x1C 95mm² Cu XPLE/PVC + E - 4x1C 120mm² Cu XPLE/PVC + E - 4x1C 150mm² Cu XPLE/PVC + E - 4x1C 185mm² Cu XPLE/PVC + E - 4x1C 240mm² Cu XPLE/PVC + E - 4x1C 300mm² Cu XPLE/PVC + E - 4x1C 400mm² Cu XPLE/PVC + E - 4x1C 500mm² Cu XPLE/PVC + E <u>Fire Rated Cable (per metre)</u> - 1x2C 4mm² +E Cu XPLE/PVC - 1x2C 6mm² +E Cu XPLE/PVC - 1x2C 10mm² +E Cu XPLE/PVC - 1x2C 16mm² +E Cu XPLE/PVC - 1x4C 16mm² +E Cu XPLE/PVC - 1x4C 25mm² +E Cu XPLE/PVC - 1x4C 35mm² +E Cu XPLE/PVC - 1x4C 50mm² +E Cu XPLE/PVC - 1x4C 70mm² +E Cu XPLE/PVC			
(c) Error! Reference source not found. <u>Cable Trays (per metre)</u> - 300mm wide - 450mm wide			

- 600mm wide - 900mm wide <u>Cable Ladders (per metre)</u> - 300mm wide - 450mm wide - 600mm wide - 900mm wide <u>Galvanised Conduits (per metre)</u> - 25mm - 32mm - 40mm			
(d) Error! Reference source not found. SUB-CIRCUIT CABLING (PER METRE) - 2.5mm² single phase TPS - 4mm² single phase TPS - 6mm² single phase TPS - 2.5mm² three phase TPS - 4mm² three phase TPS - 6mm² three phase TPS			
(e) Error! Reference source not found. ACCESSORIES, OUTLETS AND APPLIANCES <u>Socket Outlets</u> - 10A, single switched GPO including 10m of sub-circuit cabling - 10A, double switched GPO including 10m of sub-circuit cabling - 15A, single switched GPO including 10m of sub-circuit cabling - 20A, single switched GPO including 10m of sub-circuit cabling - 10A, single switched IP54 weatherproof GPO including 10m of sub-circuit cabling - 10A, double switched IP54 weatherproof GPO			

including 10m of sub-circuit cabling - Skirting duct mounting kit <u>56 Series Socket Outlets</u> - 10A, single phase switched socket outlet including 10m of sub-circuit cabling - 15A, single phase switched socket outlet including 10m of sub-circuit cabling - 10A, three phase switched socket outlet including 10m of sub-circuit cabling - 20A, three phase switched socket outlet including 10m of sub-circuit cabling - 32A, three phase switched socket outlet including 10m of sub-circuit cabling <u>56 Series Isolators</u> - 10A, single phase isolator including 10m of sub-circuit cabling - 15A, single phase isolator including 10m of sub-circuit cabling - 20A, single phase isolator including 10m of sub-circuit cabling - 32A, single phase isolator including 10m of sub-circuit cabling - 10A, three phase isolator including 10m of sub-circuit cabling - 15A, three phase isolator including 10m of sub-circuit cabling - 20A, three phase isolator including 10m of sub-circuit cabling - 32A, three phase isolator including 10m of sub-circuit cabling			
(f) Error! Reference source not found. - One gang light switch and 10m of switch wire - One gang two way light switch and 10m of switch wire - Ceiling mounted 360° dual technology occupant detector including 30m of cabling - Each type of luminaire including 10m of sub-circuit			

cabling			
(g) Error! Reference source not found. - Single sided exit sign including 10m of sub-circuit cabling - Double sided exit sign including 10m of sub-circuit cabling - Weatherproof exit sign including 10m of sub-circuit cabling - Recessed emergency luminaire including 10m of sub-circuit cabling - Recessed emergency luminaire including 10m of sub-circuit cabling and surface mounted box - Single sided exit sign including 10m of sub-circuit cabling - Double sided exit sign including 10m of sub-circuit cabling - Weatherproof exit sign including 10m of sub-circuit cabling - Recessed emergency luminaire including 10m of sub-circuit cabling - Recessed emergency luminaire including 10m of sub-circuit cabling and surface mounted box			
(h) Error! Reference source not found. - MATV outlet including 30m of cabling - 4 way drop taps including 30m of cabling - 4 way splitters including 30m of cabling			
(i) Error! Reference source not found. - Remote arming keypad including 30m of cabling - Proximity card reader including 30m of cabling - "Press to Exit" pushbutton - Electric strike including 30m of cabling - Electric mortice lock including 30m of cabling - Magnetic lock including 30m of cabling - Security break glass unit including 30m of cabling			

- Reed switch including 30m of cabling			
- 2 door controller including 50m of cabling			
- 4 door controller including 50m of cabling			
- Data gathering panel including 50m of cabling			

ASN Co Bay 5 Commercial Use

Hydraulic Specification

Prepared by:

David Turnbull
Project No.33307

P:\33307\PROJECT DOCUMENTATION\HYDRAULIC\DESIGN\SPECIFICATION\H_SP_001.DOCX

Date:
21 December 2017

Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
T: (02) 8484 7000 E: sydney@wge.com.au W: www.wge.com.au

REVISION

Revision	Date	Comment	Prepared By	Approved By
P1	13.12.17	Preliminary Issue	D Turnbull	-
P1	21.12.17	Preliminary Issue-2	D Turnbull	
A	12.02.18	Tender Issue	D Turnbull	

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: David Turnbull



SIGNATURE:

CONTENTS

PART A.	PRELIMINARIES.....	2
PART B.	PROJECT SPECIFIC INFORMATION	3
B.1	HYDRAULIC SERVICES.....	3
B.2	PROJECT OVERVIEW.....	3
B.3	PROJECT OBJECTIVES	3
B.4	DESIGN STANDARDS AND CRITERIA.....	4
B.5	DETAILED SCOPE OF WORK.....	4
B.6	WORK BY OTHER TRADES	7
PART C.	TECHNICAL.....	8
C.1	GENERAL	8
C.2	COMMISSIONING	17
C.3	DRAWINGS	18
C.4	DOCUMENTATION AT PRACTICAL COMPLETION	19
C.5	MATERIALS AND WORKMANSHIP	21
C.6	SANITARY PLUMBING AND DRAINAGE	39
C.7	COLD WATER SERVICE.....	42
C.8	HOT WATER SERVICE	44
C.9	FIRE HOSE REEL SERVICE	47
C.10	APPENDIX A- TENDER SUMMARY	50
C.11	APPENDIX B - SCHEDULE OF CONTRACT RATES	51
C.12	APPENDIX C - CLAIMS FORM.....	52
C.13	APPENDIX D - PROJECT SPECIFIC QUALITY ASSURANCE ITEMS	53

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

PART B. PROJECT SPECIFIC INFORMATION

B.1 HYDRAULIC SERVICES

The work included in this section of the specification is for the supply of all labour and materials for the execution of the hydraulic services work indicated on the drawings and/or specified as follows:

- Sanitary fixtures and fittings.
- Sanitary waste and drainage/plumbing.
- Domestic cold water service.
- Domestic hot water service.
- Fire hose reel service.
- Authority fees and charges.
- Maintenance manuals and as-constructed drawings.

B.2 PROJECT OVERVIEW

The project covers the removal of the existing facilities and pipework and the installation of the new facilities on Ground Floor, Levels 1, 2, 3 and 4 and mechanical provisions for water and drainage to the Roof Level.

The existing building envelope is to remain intact and is heritage protected. All existing authority services are in place and there is no work required outside the building envelope.

- Staff toilet and change areas.
- Cleaner's facilities.
- Staff kitchen/tea preparation areas.
- Plant areas

B.3 PROJECT OBJECTIVES

- To provide Hydraulic Services that minimises initial capital cost (to suit budget constraints) without excessively compromising quality or ongoing maintenance costs.
- To provide Hydraulic Services necessary for each area that fulfils designated function.
- To provide Hydraulic Services of commercial quality with a minimum engineered design life of 20 - 25 years.
- To provide adequate sized Hydraulic Services that allows an acceptable level of flexibility for future development.

B.4 DESIGN STANDARDS AND CRITERIA

B.4.1 Design Standards

- Hydraulic Services to comply with the Building Code of Australia **2017**
- Hydraulic Services to comply with all current statutory requirements and guidelines including Council Water Authority, Fire and Emergency Services Authority, Health Department and Department of Environmental Protection.
- Hydraulic Services to comply with current Australian Standards where applicable and particularly the following:
 - AS 3500 : National Plumbing and Drainage Code incorporating:
 - Part 1 - 2010 Water Supply.
 - Part 2 - 2011 Sanitary Plumbing and Drainage.
 - Part 4 - 2010 Heated Water Services.
 - AS 2441 : 2009 Fire Hose Reel Installations.

B.4.2 Design Criteria

- Hot Water : Storage Temperature (domestic use) minimum 60°C
 - : Supply Temperature (domestic use) maximum 50°C
 - : Supply Temperature to disabled facilities maximum 42°C

B.5 DETAILED SCOPE OF WORK

B.5.1 Sanitary Fixtures and Fittings

- Provision for first grade commercial quality sanitary fixtures, fittings and tapware to the following areas:
 - Staff male/female toilet areas.
 - Cleaner's facility.
 - Staff kitchen and tea preparation areas.
- Provision of fixtures and tapware conforming to the WELS (Water Efficiency Labelling Standards) which identifies the following maximum flow rates.
 - Showers @ 9-12 ltrs/minute
 - Hand Basins @ 6 ltrs/minute
 - Sinks @ 6 ltrs/minute
 - Toilets @ Dual Flush 6/3 litres (4 1/2 litre available)

B.5.2 Sanitary Waste and Drainage

- Provision for the collection of all domestic waste discharges from fixtures and fittings via PVC fixture and branch wastes and including:
 - Toilets.
 - Hand basins.
 - Urinals.
 - Dishwashers.
 - Kitchen sinks.
 - Cleaner's sink.

Note: Exposed fixture wastes within the toilet areas shall be chrome plated copper.

- Provision for all required floor wastes and tundish wastes, maintenance access and inspection openings.
- Provision for all required fire stop collars to services passing through structural slabs, fire walls and floors.
- Provision for all required sanitary waste and drainage ventilation services terminating to atmosphere at roof level.
- Provision for below ground PVC sanitary drainage services collecting waste discharges from waste stacks, fixture wastes etc. with gravity connection to the sites sanitary drainage services infrastructure and incorporating all required maintenance and inspection openings.
- Removal of the existing reflux valve pits and valves on the Ground floor and installation of new PVC reflux valves with clear our risers to floor level.
- Removal of existing sanitary fixtures and associated pipework, overflow gully and external vent at ground floor.

B.5.3 Cold Water Services

- Provision for reticulated cold water supplies to all sanitary fixtures, fittings and tapware as required incorporating all required maintenance isolation valves.
- Removal of existing cold water pipework to redundant fixtures pipework
- Provision for all required internal hose connection taps to assist general cleaning, wash down complete with vacuum breakers and all necessary backflow prevention devices.
- Provision for all required backflow prevention devices to mechanical equipment, hot water units, hose taps, laboratory tapware etc.
- Provision for fluid aprons to all tap breaches in walls and ducts.
- Water hammer and its effects are to be eliminated by addressing the following issues:
 - Appropriate design of water service pipework to maintain water velocities to a maximum of 1.2 metres/second.

- Appropriate use and spacing of pipe supports and fixings.
- Minimising the specification of quick closing tapware such as ceramic disc, quarter and half turn tapware.
- Utilising appropriate hammer arrester devices to items such as dishwashers, glasswashers and washing machines.

B.5.4 Hot Water Services

- Provision for hot water heaters comprising 25litre mains pressure units with copper tray, installed in the cleaner's space on all floors and serving the following areas:
 - Staff Kitchenette and Tea Preparation Areas, staff male/female toilet amenities.
- Provision for reticulated hot water services with connections to all fixtures and tapware and incorporating all required maintenance isolating valves and temperature control devices.
- Provision for insulation to all reticulated hot water services as required.
- Temperature control devices are to be utilised to restrict hot water temperatures to the following areas:
 - Disabled Facilities - max 45°C
 - Public Toilet Amenities - max 50°C
 - Staff toilet amenities - max 50°C

Provision for all required backflow prevention devices and temperature relief valves.

Removal of existing hot water pipework to redundant fixtures pipework

B.5.5 Fire Hose Reel Services

- Provision for all required fire hose reels providing first aid Fire Fighting Protection to all areas and located within 4m of a fire exit and allowing full coverage from a 4m hose stream issuing from a 36m fire hose and nozzle.
- Provision for reticulated fire hose reel services complete with identification to all internal fire hose reel locations.

Note: Our commission for the project allows for the design of wet fire services nominated in accordance with the "Deemed to Satisfy" requirements of the BCA. Any move away from the "Deemed to Satisfy" provisions will require the input from a certified Fire Engineer under an "Alternate Solution" commission.

B.5.6 Mechanical Plant Waste and Water

- Provision for the collection and disposal of all mechanical air conditioning plant condensate waste via all required floor drains, and tundish wastes as required.
- Provision for all required valved cold water spur connections for mechanical air conditioning plant make up as required.
- Wood & Grieve Engineers will liaise with mechanical consultant to determine and co-ordinate all mechanical waste points and water points.

B.5.7 Work Not Included

- Nomination of sanitary ancillaries (by the Architect).

B.6 WORK BY OTHER TRADES

Excluded from the hydraulic services part of the work are:

B.6.1 Building Work

- Provide all hydraulic ducts and form large hydraulic penetrations as shown on structural and architectural drawings. All other penetrations by Hydraulic Contractor.
- Access panels to all ducts and ceilings, inspection openings and fire hose reel housings (where agreed with architect).
- Cut all holes in finished surfaces, timber, cupboards, false ceilings, vanity units, shelves, etc., as required by the Hydraulic Contractor and shown on Hydraulic Contractors penetration drawings.
- Supply and installation of waterproof membranes in all wet areas.
- Set out of building grids to allow set out of core holes.
- Fire hose reel cupboards and necessary signs.
- Making good and fire rating of all penetrations.
- Boxing out to conceal exposed pipe risers.
- Making good and fire rating of all penetrations where fire collars are not appropriate.

B.6.2 Electrical Work

Electrical supply and a connection to all equipment requiring power and mentioned within this specification to the control panels where required and direct to equipment where required, including the following:

- Electrical supply to individual Hot Water Units located in each cleaners area
- Electric supply to boiling water units and dishwashers.
- Electrical supply to transformer at all urinal water saving devices for urinal cisterns.

B.6.3 Mechanical Work

- Extension of condensate wastes from A/C unit to floor wastes or tundishes provided by the Hydraulics Contractor.
- Extension of cold water service to A/C plant from control valves provided by hydraulic contractor.

B.6.4 Fire Services Work

- Complete supply and installation of all fire hydrant and fire sprinkler services to the building

B.6.5 Sanitary Fixtures and Tapware

Sanitary fixtures and tapware shall be in accordance with the Schedule of Sanitaryware and Tapware in the Architectural Specification.

Allow to supply and install all items as specified with all brackets and fixings in accordance with the manufacturer's details.

PART C. TECHNICAL

C.1 GENERAL

Attention is directed to the Head Contract, all conditions of which form an integral part, of this section are equally binding and applicable to all sections of this specification and accompanying drawings as listed.

C.1.1 Contract

The Contractor shall tender to cover the supply, installation and commissioning of the Hydraulic Services as described in section A.2 with the price broken down as set out in the Tender Breakdown located in section A.4.

C.1.2 Unforeseen Site Conditions

The Services drawings indicate services being installed in this contract. Deviations of services other than that indicated are to be brought to the attention of the Superintendent prior to the commencement of any installation relating to such deviation.

C.1.3 Site Inspections

The Contractor is advised to visit and inspect the site, the existing and/or adjacent structures and services prior to tendering to acquaint himself with its nature, means of access and working space. Take note of levels and local conditions and include and allow for in this tender all necessary items which are implied but which may not be stated or shown on the drawings. The Contractor acknowledges that before tendering that he has inspected the site, and has become conversant with all visible existing conditions of access to the site for building purposes and with existing services as shown on the hydraulic contract documents.

No claims arising from the neglect of the foregoing on the grounds of ignorance of the amount and kind of work involved and the conditions under which the works will be executed will be allowed.

C.1.4 Tender Submission

Tenders are to conform strictly as per the specification and drawings. This will be deemed a conforming tender.

C.1.5 Construction Staging

The construction phase of this contract may be staged as detailed in the Head Contract. The contractor is to make himself familiar with the staging program and ensure that all temporary services that may be required are allowed for.

All services are to remain in operation during construction works and any interruptions are to be kept to a minimum and carried out at time to suit the Superintendent.

C.1.6 Making Good

All disturbed surfaces are to be made good (particularly paving, footpaths, gardens and roadways) to the satisfaction of the Superintendent.

Take all reasonable care to prevent any damage to existing water, communication, irrigation, electrical or underground/overhead services. Any damage to services due to the activity of the Contractor or otherwise shall be made good to the satisfaction of the Superintendent at the Contractor's expense.

Prior to commencement of any work, the Contractor shall liaise with all relevant authorities and or management of the site to ascertain the exact location of such services and whether any alterations will be required to them.

C.1.7 Clean Up

Periodically, but not less than three times per week, clean up and remove from site all excess materials and debris resulting from undertaking the works.

C.1.8 Compliance with Australian Standards

The Contractor without in any way restricting his obligations under the Contract shall comply with the requirements of all Statutory Authorities. Work not covered by Statutory Authorities shall comply with the appropriate publication of the Standards Association of Australia.

The Contractor shall carry out all tests necessary for the satisfactory, compliant completion of the works. Reasonable notice shall be given prior to commissioning tests so that the Superintendent may be present. A record of such tests as applicable shall be kept and submitted as a test report.

The intent of this Specification and drawing/s is to procure the execution of the Works in accordance with the Standards described herein.

Where an item is usual or necessary or is reasonably or properly to be inferred in the type of work generalised in this Specification but not specifically mentioned, it shall be deemed to be included in the Specification.

C.1.9 Dimensions

The Contractor shall be fully responsible for all dimensions including site dimension, required for the production of drawings or included on the drawings and shall be responsible for their accuracy.

Any errors or inaccuracies and the consequences of such errors or inaccuracies shall be rectified at the Contractor's expense.

C.1.10 Regulations

The whole of the Hydraulic Services installation shall be carried out by and/or under the direct supervision of a fully licensed Plumber in strict accordance with the latest licensing authority requirements. Notwithstanding the foregoing, the whole of the Hydraulic Services installation shall be to the entire satisfaction of the Superintendent.

C.1.11 Authority Requirements

The Contractor shall submit evidence that:

- Requirements of authorities relating to the work under the contract have been ascertained prior to the commencement of the hydraulic services installation.
- Fees to authorities, if any, have been paid and all types of approvals obtained.
- Certificates of compliance with regard to the extent of the installation. Such certificates have to be obtained on completion of the installation.
- All fittings, pipes, accessories and the like used in the works shall bear approval marks where and as required by

the regulatory authorities.

- Test certificates for all essential service fittings to be provided prior to completion.

Standards

The quality and performance of the hydraulic services works specified herein shall comply with the requirements nominated in the current edition of the Australian Standards, BCA, By-Laws, Rules, Regulations and any other Authority having jurisdiction over the project.

A complete and up to date copy of AS/NZS 3500 is to be kept on site during the construction phase.

Materials, manufactured articles and workmanship shall conform to the latest edition of the relative Standards Association of Australia Specification and Codes (including the latest amendments) except where the provision thereof conflict with the specification or the requirements of the statutory authorities. Where relevant Standards Association of Australia publications do not exist, the latest edition of the relevant British Standards specification shall apply.

Compliance with these requirements shall not result in a variation.

C.1.12 Certificates

On completion of work, the Contractor shall provide certificates of compliance for the installation of the hydraulic services, as required by the Building Code of Australia (BCA), and any other governing authority. All certificates and test results to be included in the operating and maintenance manual.

C.1.13 Foreman

A competent Foreman Plumber with documented accreditation of previous experience as a Plumbing Foreman on projects of a similar size and nature, empowered to receive and carry out instructions from the Superintendent, must be employed on the site **at all times**.

An essential requirement of this specification is that, the appointed foreman shall be **fully conversant** with **all** regulations governing **all** aspects of the design and installation of the Hydraulic Services, has a **working** knowledge of building construction methods and an **appreciation** of the requirements of all other trades involved in this project.

C.1.14 Coordination and Liaison

It should be noted that the layout, sizing, arrangement and routing of services have generally been coordinated with mechanical and electrical services layout and must not be varied without consultation. Notwithstanding this requirement, the Contractor shall make such variation as may be necessary and dictated by site conditions and the most up to date Architectural/Structural and other services layouts to obtain clearances from obstructions and other services. Do not scale the tender drawings. Verify all dimensions from the architectural drawings and by site measurements.

Note: The mechanical services shop drawings may differ to the mechanical consultant's contract drawings. The contractor is to obtain and maintain a copy of all shop drawings for the purposes of co-ordination.

Maintain continuous liaison with all other trades to ensure that possible problems arising from the conflict with structural elements or other services are minimised, and can be resolved before any of the work is committed or installed.

Liaison includes lodging notice of interest including a standing request to all trades to be included as recipient for all issues of all shop drawings, checking and commenting in reply.

C.1.15 Existing Services

Existing services indicated on the contract drawings are shown in approximate locations only. The Contractor shall remain responsible for obtaining the location of all existing utility services including sewer, water, gas, telecommunications and

power both within the site boundary and external to the site. Prior to commencement of any site works the contractor shall liaise with all utility services provided to ascertain extent of contractors scope of work and restriction or excavations in close proximity, in order to eliminate the risk of accidental damage to main services.

The contractor shall allow for all required investigations up to 2.0m radius and to a depth of 1.0m from the location indicated on the drawings.

Where it is necessary to shut down existing services to make connections, liaise with the Superintendent, relevant trades and authorities to determine a suitable program, outlining the agreed times and dates to ensure that such works cause the least disruption to the activities/operation of the complex.

During the currency of the Contract, protect all existing sewers and appurtenances, telecommunication cables, water, electricity and gas or other services from damage, which may result from the work.

In the event of any damage being done to any of the abovementioned services during the execution of the work, the Contractor shall bear the cost of restoration. This work may be carried out either by the Contractor or by another appropriate agency as directed by the Superintendent.

C.1.16 Setting Out

Physically check and confirm all details pertaining to main service connections before commencing any committing work.

Notwithstanding approved documents, establish an early on-site liaison with the particular relevant Authority Area Inspectors for the purpose of identifying any aspect of the works, which, in the opinion of the Inspector, conflicts with the relevant regulations.

The drawings show the general layout and are generally diagrammatic only. Reference shall be made to architectural details for positions of fixtures, plant, equipment, etc.

All invert levels shown on plumbing and drainage design drawings are recommended only and must be checked on site before excavation or fabrication and installation of pipework to ensure correct cover and fall.

The Contractor shall be responsible for checking all dimensions and levels indicated against site restrictions and ensure that the proposed layout is practical before commencing work.

Before setting out each of the various stages of building, set up on-site models of the various Hydraulic Services installations appropriate to that stage of the construction, and obtain approval from the Superintendent for the purpose of providing all setting out dimensions. Models shall be complete with all necessary piping and fittings for accurate assessment of dimensions.

C.1.16.1 Core Holes & Penetrations

The Hydraulic Contractor shall set out all core holes and openings as required and necessary for the passage of pipes and/or conduits throughout the structure.

All penetrations through suspended floor slabs shall be individually sleeved and fire stopped. Foam blocks are not structurally permitted.

Sleeves exposed in rooms without ceilings and the like shall give a neat appearance and be fully sealed and grouted from the underside.

Should any penetration sleeve be inadvertently omitted all holes required shall be diamond saw core hole drilled. Take all necessary precautions to retain water adjacent to hole being drilled and prevent damage elsewhere.

All penetrations shall be 10mm oversized and made good to maintain fire rating requirements and where appropriate,

watertightness.

Do not cut any holes, openings, chases or otherwise interfere with the work of other trades without the specific approval of the Superintendent. Any damage done to other trades shall be made good at the contractor's expense.

C.1.16.2 Accessibility

The set-out of piping, valves and equipment shall be arranged in conjunction with other trades so as to be readily accessible for operating, servicing, maintaining and repairing same.

In no circumstances shall any pipes, valves, etc. be concealed before inspection and approval by the Authorities and/or the Superintendent.

Piping, valves, etc. which are installed in unsuitable locations shall be removed and relocated as directed by the Superintendent. All expenses caused by this action shall be made good without extra charge.

If the Specification and Drawings does not make mention of minor parts, which in the opinion of the Superintendent are reasonably and obviously necessary for the satisfactory completion of the Works, then such parts are to be provided without extra charge.

C.1.17 **Obvious Work**

The nature and spirit of the Specification and Drawings is to provide for the work herein enumerated and shown on the tender documents to be fully understood that the Contractor, on accepting the contract, agreed to furnish everything necessary for such construction notwithstanding any omission in the Specification and Drawings.

C.1.18 **Trade Name References**

Any reference in this Specification to trade names or to a particular manufactured product should not be interpreted to mean that the particular article or product is the only one to be supplied or used.

The reference is given as an indication of the quality, class, type and finish of the items to be used and as information to Contractors on the amount to be allowed for the items concerned.

Articles or products of equal type and quality produced by the other manufacturers may be submitted by the Contractor to the Superintendent for approval at tender. The reference "equal to" shall be taken in all cases to be the same as the reference "equal in all respects to".

Any alternative product that is put forward for consideration and use must be proved to be "approved equal" to that specified, at the discretion of the Superintendent.

C.1.19 **Samples**

Samples are required to demonstrate workmanship, techniques, designs and materials of key components within the installation. The following samples at least will be supplied in adequate dimensions and detail to demonstrate the above:

- submission of all equipment/accessories whose appearance will be visible and any other items as requested.
- approved prior to installation.
- be held on site after approval and used as a standard for acceptance or rejection of subsequent production units. Samples will be returned on completion of the project.
- be labelled to identify their intended use.

C.1.20 Measurements

Before beginning any work or taking delivery of materials check all levels and dimensions at the site and call attention to any discrepancies.

C.1.21 CONSTRUCTION PROGRAM

The Contractor shall ensure that all work is manufactured, installed, commissioned and tested as required by the construction program.

C.1.22 Protection

The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his Sub-Contractors in connection with this work, and special care shall be taken to protect all parts thereof in such a manner as may be necessary or as directed. This protection shall include covers, crating, sheds, stores, or other means to protect the apparatus, equipment and materials from the weather and to prevent dirt, grit, plaster or other foreign substances from entering the working parts of machinery or equipment.

Sanitary fixtures are to be adequately protected against damage and any item not considered in first class condition on completion of the work shall be removed and replaced upon receipt of notice from the Superintendent at no variation to the contract.

Pipe ends and openings into pipes shall be provided with adequate temporary end closures maintained during the full term of construction.

All drainage inlets and similar fittings cast flush with floor level are to be sealed by the fixing of a suitable sized 1mm thick P.G.I cover plate laid over the fitting and secured at two corners with appropriate C.S.H screws into masonry anchors.

The Contractor shall protect all parts of the building and the work of other Sub-Contractors from damage which may be caused by the Contractor's workmen or Sub-Contractors. The Contractor shall be responsible for making good any such damage.

Suitable fire extinguishers shall be readily available at the position where such work is proceeding.

C.1.23 Identification of Services

Provide permanent identification of all Hydraulic Services in accordance with Australian Standard 1345. Identification may be of applied durable proprietary adhesive labels.

All valves shall be identified by a machine engraved tone on tone tag not less than 40mm x 20mm secured to the valve spindle with a heavy gauge brass wire split ring. Engraving shall identify purpose and extent of control and shall correspond with 'As Constructed' drawing information.

All items of mechanical equipment, boilers, hot water units, gauges, controls and alarms shall be adequately identified by applied sign writing or tags as appropriate to identify function, extent of control or purpose.

In ground water, fire, sewer and gas main extensions from boundary and up to the building shall be identified with a plastic service indicator tape with the appropriate service name facing upwards.

Indicator wrapping shall be a minimum of 80mm wide and buried 300mm above the service and be of aluminium type.

C.1.24 Testing and Commissioning

The complete installation shall be tested in the presence of the Superintendent and approved by all governing authorities having jurisdiction therein. Prior to handing over the completed works, the Contractor shall deliver to the

Superintendent two (2) copies of all approval and test certificates issued by Authorities. The Superintendent shall be given seven (7) days written notice of commencement of tests.

Provide all fees, labour, materials and instruments required for the purpose of carrying out tests.

On completion, the whole of the equipment and installation is to be inspected by the appropriate authorities in the presence of the Superintendent. Where certificates are to be obtained from the Local Authorities concerned, to the effect that equipment and installations comply with their requirements, they shall be forwarded to the Superintendent as a prerequisite of practical completion.

C.1.25 Fire Stopping of Services Penetrations

Fire separation and integrity of the building elements shall be maintained at all times. Pipes passing through fire and/or smoke rated walls, floors, bulkheads etc., shall be suitably sealed utilising BCA approved materials, whether shown on the Drawings or not and maintain the required FRL of the building.

Install fire stopping products around all service pipe penetrations through masonry floors, walls, ceilings, ducts and other fire rated elements. Product used shall be of approved manufacture, compatible with materials being used in the installation.

Pipe work installed through a fire boundary to be set out with metal pipework situated at a minimum of 100mm from any combustible material 2m either side of the penetration. Alternatives to this shall be submitted for consideration by certifier prior to installation.

Fire stopping shall generally conform to:

- National Construction Code of Australia, particularly but not limited to Volume two Part C3.15.
- Local Relevant Authorities.

PVC and polyethylene pipes - fire stop collars and fire wrap applicable to the type and circumstance.

Insulated pipes - sleeved through fire barrier and wrapped or fire stopped with a system tested to AS 1530: Part 4

Metallic pipes - sleeved through fire barrier and then grouted around with fire retardant product with non-combustible fire wrap or similar approved system.

FRL Required	Pipe Type	Product	Description
-/60/60	PVC/DWV/P-EX	Promat Fire Collar	Intumescent fire collar
-/60/60	Copper	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of the penetration.
-/60/60	Copper Lagged	PROMASEAL® FlexiWrap	Intumescent wrap installed over the lagged pipe, and extending through the penetration by 50mm on each side.
-/60/60	Steel	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of the penetration.
-/90/90	PVC/DWV/P-EX	Promat Fire Collar	Intumescent fire collar
-/90/90	Copper	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of

			the penetration.
-/90/90	Copper Lagged	PROMASEAL® Flexi Wrap	Intumescent wrap installed over the lagged pipe, and extending through the penetration by 50mm on each side.
-/90/90	Steel	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of the penetration.
-/120/120	PVC/DWV/P-EX	Promat Fire Collar	Intumescent fire collar
-/120/120	Copper	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of the penetration.
-/120/120	Copper Lagged	PROMASEAL® FlexiWrap	Intumescent wrap installed over the lagged pipe, and extending through the penetration by 50mm on each side.
-/120/120	Steel	PROMASEAL® Wrap	Ablative wrap to be wrapped on each side of the penetration.
-/180/180	PVC/DWV/P-EX	Promat Fire Collar	Intumescent fire collar
-/180/180	Copper	Promat Board System	Please consult Promat WA for details- 08 9445 8300
-/180/120*	Copper Lagged	PROMASEAL® FlexiWrap	Intumescent wrap installed over the lagged pipe, and extending through the penetration by 50mm on each side.
-/180/180	Steel	Promat Board System	Please consult Promat WA for details- 08 9445 8300
-/240/240	PVC/DWV/P-EX	Promat Fire Collar	Intumescent fire collar- Consult Promat WA for correct collar 08 9445 8300
-/240/240	Copper	Promat Board System	Please consult Promat WA for details- 08 9445 8300
-/240/120*	Copper Lagged	PROMASEAL® FlexiWrap	Intumescent wrap installed over the lagged pipe, and extending through the penetration by 50mm on each side.
-/240/240	Steel	Promat Board System	Please consult Promat WA for details- 08 9445 8300

*FRL changed to reflect tested system. No 3 + 4 hour insulation criteria available for FlexiWrap

Contractor to submit specific fire penetration product to be used and certifier/certification prior to installation of pipework through fire boundaries

C.1.26 Fire Rating Certification

Provide fire rating certification for all installed hydraulic services, such as fire stop collars, sealants, materials and the like, to maintain the integrity of the fire compartments. Certification shall be provided by an independent party.

C.1.27 Testing & Sterilisation of Systems

Carry out progressive testing of the services shown on the drawings and/or nominated in the Section and required by the respective Authorities.

The following types of tests shall be applied to the pipe services:

C.1.27.1 Sewer Drainage & Stormwater Drainage

Water tests by gravity to the flood point of each sewer and stormwater pipe being tested.

C.1.27.2 Sanitary Plumbing

Water test by gravity to the flood point of each pipe section being tested.

Alternatively an air test may be applied @ 30kPa for a minimum of 30 minutes.

C.1.27.3 Cold Water Services, Hot Water Services & Fire Hose Reel Service

Fill pipework with water, remove all air from the pipework and then water pressure test the pipework.

C.1.27.4 Water Test Pressures

Before applying water pressure tests check with the manufacturers of each different piping material installed, considering the material of which the pipes and fittings are manufactured, the class of pipe (ie. suitable for certain pressures) and the pipe wall thickness to determine which maximum pressure should apply to the water test to be applied to each particular pipe material and pipe diameter. As a minimum, water test pressures shall be 1.5 times the working pressure of the system.

PROHIBITED: Air testing of any water pipe during the progress of the works or completion of the works.

Testing may be required at any time during the progress of the works, for the examination of any materials used and inspect the workmanship employed. Any materials and workmanship that are not in accordance with the specification and drawings may be rejected.

Supply all labour, plugs, pressure gauges, measuring gauges, plumbing equipment and necessary materials and equipment etc. required for testing.

Precaution shall be taken during testing of pipe services to pressurise to the limits recommended by the manufacturer of the piping material. Seal off items of equipment not designed to withstand the test pressure.

Pipework, fittings, valves and ancillaries damaged, such as annealed copper tube yielding and distorting at joints and other pipework either breaking, cracking, fittings leaking or blown off or apart from pipework, caused by excessive test pressures and procedures shall be replaced at no variation to the contract.

C.1.27.5 uPVC Pipework

Ensure solvent cement joints have been cured for at least 24 hours before testing.

Underground or enclosed works shall not be covered or concealed from view until it has been inspected, tested and approved by the Authorities concerned.

On completion, the works shall be tested under normal working conditions and as directed and passed by all Authorities having jurisdiction over the works. All defects shall be remedied immediately and the tests re-applied to the satisfaction of the Authorities. Make good at no cost any defects disclosed during tests.

C.1.27.6 Sanitary Fixtures

Shall be tested by subjecting them to normal use and visually checked for leaks.

C.1.27.7 Electrical Connections

All plant and equipment having electrical connections shall be tested for insulation and earth resistance and approved by the Supply Authority. Give seven (7) days written notice of commencement of final tests.

C.1.27.8 Sterilisation of Completed Cold Water, Domestic Hot Water Pipework Systems

Disinfect pipework installations before practical completion to comply with AS/NZS 3500.

All pipelines shall be flushed clean then charged with disinfectant using 50 mg of chlorine per litre of water. The system should remain charged for a period of at least three days, checked and adjusted for free residual chlorine and flushed out thoroughly with clean water before being used. Repeat procedure where necessary.

C.1.28 **Contract Maintenance**

In addition to the requirements of maintenance during the defects liability period, provide all necessary operating and preventive maintenance required for the period of the defects liability period to service items of mechanical equipment, boilers, hot water units etc, supplied and installed in the execution of the Hydraulic Services work.

C.1.29 **Warranties**

Warranties for items of equipment supplied in the Hydraulic Services installations shall date from the date of Practical Completion and this fact shall be stated in all orders placed for equipment. In the event of any warranty claim the Practical Completion date reckoning will be applied at no variation to the contract.

C.2 **COMMISSIONING**

C.2.1 **General**

The Contractor shall be responsible for commissioning the various installations carried out under this Contract in accordance with the programme and to the approval of the Superintendent and Local Authorities.

Subject all systems to a commissioning and testing procedure before they are put into service.

Provide all test instruments and other testing facilities required to verify system and equipment performance and to complete all inspection test plan records.

Any work which does not comply with the specification shall be made good.

Allow in the Tender Price to pay the Authorities for any necessary and chargeable testing work.

Give at least two (2) weeks notice of the commissioning of any particular system, and submit a programme of testing and commissioning procedures for that system. Modify the programme as required.

C.2.2 Inspection Test Plan

Prepare a detailed and comprehensive Inspection Test Plan (ITP) prior to commissioning and testing. Gather information required for this check list, submit three months prior to the start of commissioning the proposed ITP for approval.

The purpose of the check list is to:

- Ensure that all items that should be checked are checked.
- Produce a permanent record of the commissioning checks carried out.

Accordingly the check list must be built up from information contained in this specification, from suppliers, manufacturers' installation and commissioning data and from experience in commissioning similar equipment and systems.

C.2.3 Electrical Work

All equipment supplied and work carried out under the contract shall comply with the requirements of the latest appropriate Australian Code of Practice.

The electrical installation shall be carried out in accordance with the requirements of the Local Supply Authority.

All items of equipment shall be of first grade with regard to design and manufacture and shall be completely satisfactory for operation, control, safety and maintenance under all conditions of service.

Uniformity of type and manufacture of switch gear, control gear, fittings and accessories shall be preserved throughout the whole of the installation, refer to the Electrical and Mechanical Specification for the type of fittings, wiring, conduits, control gear, etc.

C.2.4 On Completion and Cleaning Up

On completion of the work all pipe lines and drains shall be flushed until clear, taps and valves are to be inspected and re-washed if necessary, filters and strainers shall be cleaned, ducts, manholes and pits shall be cleared of debris, all fixings shall be tightened, pipework shall be cleaned, taps, outlets and the like and sanitary fixtures shall be cleaned and polished, tap buttons shall be tightened, cistern flushes adjusted and pan seats tightened and outlet strainers removed, cleaned and reinstalled..

Mechanical equipment shall be tested and commissioned, services performance balancing shall be completed and the whole of the work shall be left in perfect condition to the satisfaction of the relevant Authorities and the Superintendent.

C.3 DRAWINGS

C.3.1 Contract Drawings

The design drawings as scheduled are issued to indicate the installation intent as coordinated by the Head Consultant's design team. The drawings and specification are intended to be mutually explanatory and complete, but all work called for by one, even if not by the other, shall be fully executed. Should the documents be in conflict, the Hydraulic Contractor will be deemed to have included in his tender price for the larger quantity and the more expensive components, as applicable.

Final set outs shall be determined from the latest architectural layouts. Do not scale the tender drawings. Verify all dimensions by site measurement.

This specification shall be read in conjunction with the following Hydraulic Services drawings and amendments during the construction of the project.

Drawing No.	Drawing Title
HY-000	Hydraulic Services Cover Sheet
HY-001	Hydraulic Services Legend Sheet
HY-200	Hydraulic Services Ground Floor & Level 1 Layout
HY-201	Hydraulic Services Level 2 & 3 Layout
HY-202	Hydraulic Services Level 4 & Roof Layout
HY-900	Hydraulic Services Diagrammatic Services Layout

These drawings must not be used for architectural or structural work but are to be read in conjunction with architectural, structural and all other relevant drawings including preliminary and final shop drawings prepared by other trades which form part of the contract documents or as issued **from time to time** in clarification of contract documents.

Ensure all reference drawings utilised are of current issue.

Take Note: The details of hydraulic services shown on the contract drawings indicate the principles of design and design coordinated routes of piping. Notwithstanding the information shown on drawings or specified herein, coordinate the installation of all hydraulic services without conflict with structural elements or the services of other trades and in complete accordance with the requirements of all relevant Authorities.

Any discrepancies between the relevant drawings which may effect the Hydraulic Services installation shall be reported to the Superintendent before the work proceeds.

C.4 DOCUMENTATION AT PRACTICAL COMPLETION

C.4.1 As Constructed Drawings

One (1) week prior to practical completion submit for approval Operating and Maintenance Manuals. The Contractor shall allow to develop the workshop drawings or design drawings for the purpose of recording all variations to installed work. A set of Drawings shall be kept on site and progressively marked up as the work proceeds to record the locations, inverts and details of all the installed services, equipment and valves.

At the completion of construction, update the original dimensioned construction Drawings to provide as-constructed record Drawings without individual revision notations. Produce additional drawings as required to form a complete record of the installation.

The as-constructed Drawings shall show precise details of all services exactly as installed and shall record any variations or modifications made during installation, testing and commissioning. As constructed drawings shall be produced to the same quality as tender drawings provided, using AutoCAD version 2008 (or later) by a qualified computer drafts person.

Supply two (2) copies of all approved installation drawings together with an electronic copy suitably burnt onto CD ROM which have been correctly brought up to date to reflect all field changes and are a true and accurate representation of the actual installations. These Drawings shall also include the following:

- The as-installed location of all equipment and fittings.
- The arrangement of all pipework including the position of all pits and cleaning eyes, including inverts, grades of pipework and size.
- 'As Installed' locations of all pipework systems to be dimensioned off building elements and grids.
- Survey all inground pipework system and provide exact invert levels.
- The location of all isolating valves.
- The location of all meters and control panels.

The above Drawings shall be reduced to A3 size and incorporated in the maintenance manuals.

C.4.2 Operating and Maintenance Manual

On completion of satisfactory performance tests and subject to approval of the superintendent, supply (3) copies of Operating and Maintenance Manuals. The manual shall include a full description of the installation and functioning of the systems involved and instructions for the efficient operation and maintenance of the installations.

The manuals shall include all relevant information necessary for the maintenance, testing, procurement of parts and removal of the service or items of equipment.

Contents to Include the Following Information:

- Dates of Practical Completion.
- Dates for end of defects liability period.
- Index of Contents.
- Drawing List.
- Definition of Terms.
- Outline Description of Systems and Design reference.
- Commissioning Information and Test Data.
- Manufacturer's Installation and Service Manuals.
- Manufacturer's Spare Parts List including recommended Prices and contacts for supply.
- Manufacturer's Spare Ordering instructions.
- Manufacturer's Warranties/Guarantees.
- Operational Routines, inspection and test plans.

- A fully detailed preventative maintenance and procedure schedule including recommended maintenance procedures and equipment maintenance intervals.
- Maintenance duties in general, daily and other periodic maintenance and lubrication chart.
- Annual testing of essential services.
- Details of emergency measures including a fault finding guide to assist in the rectification of minor operation breakdowns.
- A schedule of suppliers with postal addresses and telephone numbers.
- Name of firm, postal address and telephone number of specialist service contractors.
- Equipment schedule.
- Completed quality assurance certificates.
- One copy of all 'As Installed' drawings, diagrams, schedules and arrangements for each manual.
- Test Certificates for equipment and associated service reticulation installed.
- Any other information and instructions necessary for operation and maintenance of the equipment.
- Electronic copy of the produced fire block plan in Auto CAD format.
- Certification of independent Fire Certifier to state that all hydraulic penetrations through fire walls have been sealed in accordance with relevant Australian Standards.

Format to Include:

- "A4" size ring binder with substantial hard cover.
- Title and volume number printed on spine and face of manual.
- All contents to have reinforced binding holes.
- All 'punched' contents able to be read without removing from binder.
- Where this is not possible, contents to be contained in high quality plastic pockets for easy removal.
- Suitable 'dividers' provided.
- Contents numbered or in other defined order.

C.5 MATERIALS AND WORKMANSHIP

C.5.1 General

All equipment, materials and accessories used in this contract shall be new, shall conform to the appropriate current Australian Standard specification and shall comply with Local Authority requirements.

The whole of the work shall be carried out by skilled, qualified tradesmen, supervised by the Contractor, and/or his authorised representative. Workmanship shall be of the **highest** standard and each section of the work shall be properly and neatly executed to the best current trade practice.

Untidy work whether **exposed** or **concealed** will not be accepted.

If required, samples of any materials or item of workmanship shall be submitted for the approval of the Main Contractor before being installed.

C.5.2 Excavation

Tenderers must form their own opinion, and take what tests on site they consider necessary to ascertain what is the nature of the ground, sub-surface strata and ground water levels.

Excavations of all trenches shall be true to line and level, performed in strict observance of sound engineering principles with consideration for the preservation of adjacent structures and services and where necessary adequate sheet piling shall be provided to maintain such structures or services. Trench widths shall be kept to a minimum consistent with the bed width requirements and the requirements of adequate working space and shoring.

Where required by regulation, all excavations shall be surrounded by adequate barricades for protection of the public and/or site workers and clearly defined at night by illuminated lanterns.

Excavations shall be performed, serviced and backfilled in the shortest possible period and none shall be left open unnecessarily. Where over excavation occurs, below the required level of excavation, the over excavation shall be replaced with well compacted granular material as approved by the Main Contractor. Prepare the base of excavations with clean sharp sand. Allow for sand to be imported if necessary, free of stones and not less than 100mm depth, true to line and grade and of density equal to that required by relevant regulation where appropriate, but in no case less than that of the natural un-excavated material.

Excavations shall be kept free from water, debris and falling earth.

Where it is found necessary to excavate adjacent to or below the level of adjacent footings, obtain approval from the Superintendent as to the method of excavation and protection of footings and method of backfill to be used prior to starting such excavations. Excavation by mechanical means shall not continue to a depth greater than 100mm above the invert level of the pipe at any point.

The Superintendent shall at any time during the Contract stop any works he considers necessary if, in his opinion, any part of the work is in an unsafe condition. The Contractor shall immediately rectify the unsafe condition as directed by the Superintendent. The Contractor shall be responsible for safety at all times.

C.5.3 Excavation in Rock

The removal of all rock and/or stone required to perform adequate excavation and trenching for the installation of Hydraulic Services shall be by Mechanical means. Removal by the use of explosives will not be permitted.

No additional charges will be considered for excavation in rock.

C.5.4 Dewatering

The Contractor shall allow within this Tender the cost of all dewatering and any additional construction costs due to wet ground conditions.

Dewatering for any reason arising shall be in continuous operation implemented to preserve prepared excavations and installed services from the consequences of flooding.

Dewatering discharge shall be controlled, directed clear of the site for disposal in a manner not causing interference with adjacent property or the public and to the entire satisfaction of the relevant Authorities.

Excavations, which have been flooded, shall not be utilised until completely dried out and the base re-consolidated. Where the consequential delay of drying out cannot be tolerated or where drying out is not possible the matter shall be referred for instruction before proceeding further.

C.5.5 Timber and Shoring

During excavation the contractor shall advance work in a careful, secure and safe manner and take all precautions against accidents. Where necessary erect approved shoring/timbering to prevent earth or other materials from slipping, falling or being shaken from the faces and sides of the excavation. All costs associated with the supply, erection, withdrawing or abandoning of shoring/timbering shall be included in the tender price.

C.5.6 Public Utilities & Existing Services

Where underground public utility lines and surface drainage works and underground pipes, conduits or cables exist in the vicinity of the works, take care to protect such services. Any damage to such services must immediately be reported to the responsible Authority and to the Superintendent.

C.5.7 Excavation in Existing Pavement & Roadways

When excavating through existing pavement, saw the pavement and/or road to a depth of at least 100mm and then remove the material with pneumatic tools. If required by the Superintendent, trenches across the existing roads shall be excavated and the pipeline constructed therein so that half the roadway is always maintained open to traffic.

Allow to place 25mm thickness steel plates to Council approval over open drainage trenches during and after each days work so as vehicular and pedestrian traffic flow is maintained.

C.5.8 Making Good

Make good any damage that may be caused to the building and surfaces generally and any other works that may be distributed or injured by cartage, work generally or other operations. The reinstatement shall be at least as good a state of repair as before commencement.

C.5.9 Existing Service Connections

Seal off all existing service connections to Authorities mains to their satisfaction.

C.5.10 Gradients

Lay drains to gradients complying with the relevant authority's requirements, to the levels, if any shown on the Drawings, and in any case not less than the following:

Pipe diameter (mm)	Sewer drains
65-80	1 in 40
100	1 in 60
150	1 in 100
225	1 in 150

C.5.11 Bedding of Pipes

All pipes shall be laid in trenches free of any large objects such as tree roots, rocks or other large protruding objects. To enable proper bedding under the barrels of the pipes for the whole length of the pipeline approved compressible supports shall be placed under the pipes at intervals of not more than 1.5m and cement mortar of four to one placed there under. Where the excavation is in sand or loam and free of rock or other hard objects, the pipes may be laid direct onto the base of the trench, provided such base is suitably graded and pipes are supported along their entire length. Pipes shall be free from loading of any objects.

Where the base of a trench is unstable or water charged ground, drains shall be supported on steel reinforced concrete beams and piers designed for that purpose. Submit details of all beams and supports for approval before commencing installation.

Inspection openings shall be installed at intervals of not less than 30m continuous run of drains, downstream of change in direction or grade or elsewhere where required by the Local Authority, or where specified or indicated on drawings.

Lay a detectable strap or plastic tape in the trench after pipe laying, testing and initial backfilling for all services.

Provide a marker plate at ground level at each change of direction of underground gas services, engraved to show the direction of the line and the name of the service. Inset the marker in a 150 x 150 x 150 mm concrete block, with top set flush with the finished ground or surface level.

C.5.12 Backfill

Backfill surrounding the installed service shall be of clean, sharp sand, imported if necessary, free of stones to depth of 300mm over the service pipe barrel, placed by hand and consolidated as specified hereafter. Backfill above this level may be original material granulated, free of stones and machine placed in layers not exceeding 150mm depth before compaction.

Where the excavated material, in the opinion of the Main Contractor is not suitable for trench backfilling, the material shall be disposed of as directed by the Main Contractor. Unless the excavated material is of a granular nature the material will not be considered as being suitable for backfilling.

C.5.13 Consolidation

Backfill to excavations in areas where consolidated fill is specified shall be consolidated to the requirements of the structural specification, and to adhere to minimum requirements as outlined in AS/NZS 3500 and as mentioned below.

Fill to not less than 150mm above the top of the pipes. Compact in layers of not more than 150mm loose thickness without damage to the pipework. Compact to AS 1289. Backfill service trenches as soon as possible after approval of laid and bedded service, generally as specified. Compact as specified to the compaction density which applies to the location of the service trench. However, do not place backfill against concrete until the concrete has been in place for fourteen days, unless otherwise approved.

Compact each layer of general filling to the specified dry density of 90% modified mean dry density.

Backfill for services under roads, pavements and concrete slabs shall be gravel sub-base class 2 compacted to 95% modified mean dry density placed as nominated for general filling.

Protect the works during compaction from damage by compaction operations. Compact by hand if necessary to prevent damage or disturbance to services, pipe joints and the like.

Vibrating rollers shall not be used for consolidation of backfill over services for the first 600mm minimum above pipe barrel. Consolidation to this depth shall be done with a mechanical hand tamper of approved type.

Compaction by vibration will not be accepted and the Plumber shall be responsible for marking the locations of any underground piping to ensure no vehicular traffic passes over such after installation.

C.5.14 Anchorages

Install anchorages in the form of lateral or longitudinal anchor blocks, of not less than 15 MPa concrete, to restrain lateral movement in pipelines at bends and changes of direction on pipework of 100mm diameter and above. Bear anchor blocks against the body of the fitting only, clear of joints, and against firm undisturbed ground or compacted filling.

Where the gradient is greater than 1 in 20 (5%) concrete stops shall be provided 150mm thick and built around the pipe extending from the bottom of the trench up to a height of 300mm above pipe and recessed 75mm into each side of the trench.

C.5.15 Bedding Fittings

Provide short lengths (not more than 600mm) of flexibly jointed pipe on each side of concreted fittings, pits, manholes, and the like, in principle as illustrated in AS/NZS 3500 Part 2.

C.5.16 Concrete Encasing

Unless otherwise permitted by the relevant Authority, concrete encase the following:

- Vitrified clay sewer pipelines beneath buildings.
- Pipelines which cannot be provided with the required minimum cover.

Encase with 20 MPa concrete, not less than 150mm above and below the pipe and 150mm each side or the width of the trench, whichever is the greater.

C.5.17 Drains Beneath Building

Where sewer drains pass beneath footings, encase pipes with not less than 150mm of 20 MPa concrete measured clear of the line of collars.

With the exception of cast iron penetrations build into structural concrete, where drains of any kind pass through foundation walls make neat opening, minimum 6mm clear of pipe all round.

Provide suitable arch wall construction so that no superimposed loading is imparted to pipe. Seal pipe in approved manner. At outer walls make suitable approved provisions to prevent ingress of rodents and other vermin.

C.5.18 Minimum Cover over Pipe

Unless overridden by regulatory authority requirement or otherwise specified, the following table shall apply:

Pipes not subject to vehicular loading:	300mm
Pipes subject to vehicular loading:	
Not in roadways:	500mm
Under sealed roadways:	500mm
Under unsealed roadways:	500mm

Pipes in embankments or subject to Construction equipment loading: 750mm

C.5.19 Installation

Install pipework in straight lines and uniform grades without sags. Provide bends and sets as required, and sufficient unions, flanges, isolating valves and the like for satisfactory removal of piping and fittings for maintenance. Arrange and support pipework as necessary where suspended, so that it remains free from vibration whilst permitting necessary movements such as thermal expansion and contraction. Keep the number of joints to a minimum.

Do not install copper in contact with steel, zinc or other materials likely to generate electrolytic, galvanic or corrosive action. Make junctions between dissimilar metals with special fittings manufactured in suitable compatible material.

For changes of direction use bends where practicable in preference to elbows. Use elbows where pipes are led up or along walls and then through to fixtures.

Arrange valves together in operational grouping, in convenient and readily accessible positions.

Concealed pipework, located in false ceilings, roof spaces, under suspended ground floors, plant rooms, and the like shall be arranged adjacent to and horizontally parallel with each other and with walls, beams and the like. Keep at least 150mm above ground surface if under suspended ground floors. Provide adequate spacing of at least 25mm between pipes or pipe insulation, 50mm between pipes or pipe insulation and electrical cables. Take off branches at right angles.

C.5.20 Concealment

Wherever possible, pipework is to be concealed in ducts, ceiling spaces, cavities or by chasing into walls, where walls are not load bearing as defined by the Superintendent or designated as face brickwork on the Superintendent's drawings.

Pipes concealed in wall chases shall be recessed to a depth providing not less than 10mm cover to pipe barrel from rough face of wall.

Pipes concealed in wall chases shall be spiral wrapped in approved insulation not less than 6mm thick and fully mortar grouted. Copper services shall be pre-lagged 'Kemlag' type.

Water supply pipes **shall not under any circumstances** be directly cast into or under concrete floor slabs unless installed in adequately sized sleeves or where conduits are provided as part of a specific manufacturers product such as 'Rehau'.

C.5.21 Accessibility

Locate fittings and valving in accessible positions, with adequate clearance to allow, pipe fittings requiring maintenance or servicing, including inspection openings, cleaning points, joints designed to enable removal of pipes, control valves and the like.

As far as practicable, install plumbing work inside buildings so that it is removable without damage to the building structure or finishes.

Where practicable, conceal pipework so that it is accessible within ducts or non-habitable enclosed spaces and does not appear on external walls. Obtain prior approval for the location of exposed pipework.

If pipework is proposed to be enclosed so as to be not accessible after completion, obtain prior approval for the location of pipe runs and pipe fittings, and record the actual locations on work as constructed drawings.

C.5.22 Core Holes and Sleeves

The Contractor shall be responsible for setting out work and shall ensure that provision is made for core holes by fitting sleeves or other devices to formwork for floors, walls, beams, columns, etc., in conjunction with the fixing of formwork and/or placing of concrete.

To prevent weakening of the building structure, the size and location of all core holes shall be approved by the Main Contractor and project structural engineer prior to coring.

The Contractor shall make good all holes and chases through walls, floors, etc., including fitting flush after the installation of pipework.

Provide fire stop collars for uPVC pipework, check for damage prior to installation of pipework. All penetrations shall be waterproof sealed to prevent penetration of water to lower floors.

C.5.23 Wall & Floor Penetrations

Pipes passing through walls below ground level shall be provided with a water stop puddle flange.

Metal pipes penetrating fire rated walls, ceilings or floors shall incorporate galvanised mild steel sleeves, overall diameter not less than 40mm larger than the penetrating pipe. Seal with a fire stop material/fire prevention, to comply with AS 1530 Part 4.

Provide approved fire collars to uPVC piping wherever a fire rated wall, ceiling or floor is penetrated. The rating of the fire collar is to be the same fire rating of the wall, ceiling or floor penetrated, to comply to AS 1530 Part 4.

C.5.24 Pipe Supports and Fixings

All pipework shall be fixed clear of walls and each other with appropriate clips securely fixed to structural elements. Where the method of support is not detailed or specified the method proposed shall be submitted to the main contractor for approval before installation commences.

C.5.24.1 Requirements for Supports

Piping shall be adequately supported and secured in an approved manner.

All pipes shall be adequately supported and secured to adjacent walls or slab. Pipework, except in chases, must not come into contact with any other service pipes or part of the building structure unless insulated with 25mm minimum thick section mineral wool lagging.

Pipes chased or built into walls shall be installed with one (1) layer of 4mm "DENSO" tape or be pre-lagged "Kemlag" type. All pipework shall be free to move without causing stresses in the pipework.

Elsewhere pipework must be free to move without causing stresses in the pipework or in pipe joints.

Where provision has been made for movement in mains, the branch lines shall be unrestrained and in the case of copper tube, annealed for a minimum of 2m from the main. Where this is not feasible some other approved provision for movement shall be made.

Pipework supports shall be galvanised mild steel complete with purpose made galvanised spring nuts, framing fittings, pipe clamps, and insulator.

Pipework supports shall be in accordance with the manufacturer's instructions.

Mild Steel brackets shall be hot dipped galvanised after fabrication. Vertical frames where used to support suspended horizontal runs shall allow for complete adjustment of clamps supports to suit pipe gradients as required.

Secure all supports and necessary sanitary fixtures with "RAWLOCK" or equal approved metal anchors.

Where pipework is insulated, provide supports formed to fit around the insulation. Remove the insulation in the way of the supports and replace with wood spacer blocks formed to fit the pipe, and with outside diameter equal to that of the insulation. Butt the insulation up to the blocks and seal with silicone compound. Pipes of nominal size less than 25mm may be supported without wooden blocks.

uPVC pipework shall be supported to AS 2032, Clause 6.8, at maximum spacings to Table 6.3.

Pipe hangers shall be installed at every change of direction. No pipe hanger shall be fixed to a pipe clamp already supported from other pipework, or other services.

NOTE: Explosive fixings, wooden plugs or screw-ins shall not be used.

Provisions for movement in pipework are to be made in accordance with AS 2032 and AS 2033.

C.5.24.2 Support Intervals

Fixings shall be provided and spaced as scheduled herein; or unless otherwise required at closer centres by controlling Authority or Code requirements. Notwithstanding, all fixings shall be spaced at centres required to adequately support the particular pipe, including content, and hydraulic performance without deflection.

Pipework Material	Pipe Size mm (dia)	Maximum Spacing of Brackets, Supports and Clips-Meters		
		Horizontal	Graded	Vertical
Cast Iron	100 and 200	3.0	3.0	3.0
Copper/Copper Alloy	15 and 20	1.5	-	3.0
	25	2.0	-	3.0
	32 and 40	2.5	2	3.0
	50 and 65	3.0	2	3.0
	80 to 150	3.0	2.5	3.0
uPVC	40-50	1.0	.9	1.8
	65	1.2	1.2	2.5
	80	1.4	1.4	2.7
	100	1.5	1.5	3.0
	150	2.0	2.0	3.0
Polybutylene	10	.5	.5	1.0
	18	.6	.6	1.2
	22	.7	.7	1.4
	25	.75	.75	1.5

In the case of spigot and socketed pipes such as cast iron, etc., there shall be at least one fixing behind each collar of pipe or fitting.

All pipework shall be supported against sagging or distortion and must be held to line and grade by means of approved clips, saddles or other fixings.

Plan hot water pipe routes on site to ensure that sufficient offsetting is achieved to compensate for length increases due to expansion of the pipe. Pipe brackets on hot water pipework systems are to be guide type only and are not to restrain the pipe from longitudinal movement.

Hanger rods shall be sized in accordance with the Manufacturer's recommendations and generally as scheduled herein.

Pipe Diameter	Hanger Thread Size
mm	mm
15-80	10
100 - 150	16

Where hangers exceed 250mm in length side bracket bracing shall be provided to prevent sway.

C.5.25 Dissimilar Materials

The Contractor shall be responsible for separating dissimilar metals from direct contact with each other. All necessary gaskets, dielectric couplings, etc., required shall be supplied and installed by the Contractor. All metal screws, clamps, etc shall be of the same metal and finish as the materials supported.

Where clips, brackets and pipe supports are of dissimilar metal to the actual piping used, completely insulate the piping at all fixing points with at least 10mm thick Aeroflex insulation or 8mm thick Vibration Resistant Rubber wrapped around the pipe prior to fixing in position.

C.5.26 Corrosion Protection

"Denso 600 tape" shall be used to protect all underground copper piping, nuts and bolts on all fittings, valves, hydrants, mechanical joints, tapping bands and as directed.

All pipework in stud wall cavities shall be insulated with 8mm thick Aeroflex installed to manufacturer's specification.

All copper service lines chased into masonry constructions shall be spirally wrapped with 6mm thick x 65mm wide foam insulation, with all joints tape sealed. The chase shall be fully grouted and packed firm.

Any service lines cast in concrete shall be spirally wrapped with foam insulation as specified in clause above and cover wrapped with Denso 600 tape.

All steelwork shall be hot dipped galvanised after fabrication.

All nuts, bolts, washers, clips etc., used in connection with any of the services shall be of non-corrosive material, compatible with materials in contact.

Surface rust, scale, build-up, etc., on any component in the installation shall be removed during the progress of the works and the affected area de-scaled, brushed and treated with a compound recommended by the manufacturer of the product.

On completion of joint, all residual flux must be removed. This is to be done by quenching in water.

C.5.27 Capping Off

During construction, temporarily seal open ends of pipes flush with the surrounding slab to prevent a trip hazard or the ingress of foreign matter into pipework. Seal pipes with "Templugs" as supplied by Civil and General or approved equivalent.

C.5.28 Chases and Encasing

Cut chases with a power saw unless otherwise approved. Do not chase reinforced concrete work without approval.

Pipes chased into masonry or encased in concrete shall not cross any movement joint and shall be insulated so that expansion and contraction can take place without damage to the pipe or to the material or surface finish of the surrounding element.

Provide a minimum cover of 25mm and lay in continuous lengths without fittings unless the fittings are permanently accessible.

C.5.29 Clean Outs

Install cleanouts in positions as indicated on the drawings, and as required by Local Authorities. Allow to extend from drain lines to finished surface level using a 60° junction and 30° bend.

Provide 100mm diameter, brass cleanouts at finished floor level. Clean out cover plates shall be of antislip design and shall have a rubber seal insert to achieve a airtight seal.

C.5.30 Chrome Plating

All pipes, valves, cover plates, unions and fittings exposed to view with exception to plant room and under floor areas shall be chrome plated.

Surfaces to be bright chrome plated to AS 1192.

C.5.31 Cover Plates

Where water services emerge from wall, floor or ceiling surfaces, provide cover plates or non-ferrous metal, finished to match the pipe, or of stainless steel as follows:

Sizes:

Pipe diameter:	Cover plate diameter (nominal):
up to 20mm	65mm
up to 50mm	100mm
larger than 50mm	50mm larger than pipe

C.5.32 Protection of Finished Surfaces

Protect stainless steel and chromium plated exposed surfaces during construction by an application of a strippable polyethylene coating. Apply the coating as soon as practicable and do not remove until completion of the job. On removal, clean the surface with methylated spirits and polish with a soft dry cloth.

C.5.33 Pipe Identification

Satisfactory label all pipework to conform with the requirements of AS 1345 - Identification of Piping, Conduits and Ducts.

Pipe Markers shall be of the vinyl, pressure sensitive, self adhesive type consisting of combined flow direction arrow and name of service.

Markers shall be provided on all hydraulic pipe lines at not greater than 3 metre centres. Additional markers shall be provided for:

- Both sides of a wall or partition through which a pipe passes;
- A marker adjacent to valves;
- Both legs of a bend;
- Both sides of a pipe, which can be approached from two directions.

Markers shall be 'SAFETYMAN' or approved equal to comply with AS 1345 (NAZ2257):

Prior to the application of self-adhesive type pipe markers clean pipe surfaces with steel wool to remove oxide films and dirt. Pipe markers that peel off or crack shall be replaced with new pipe markers without additional cost.

C.5.34 Copper and Brass Pipes and Fittings

Copper pipes shall conform to AS 1432 Tables as below:

Domestic Water Service	-	Type B in protected position above ground.
Domestic Water Services	-	Type B buried or inaccessible positions wrapped with 4mm thick "Denso" tape.
Gas Service pipes	-	Type B.

Brass Pipes shall be 60/40 alloy not less than 1.6mm wall thickness when used as part of the sanitary plumbing system.

Fittings for copper and brass pipes shall be properly formed manufactured units of approved type as specified.

C.5.35 Cross Linked Polyethylene Pipe & Fittings (pe-x)

Cross linked polyethylene pipe and fittings (PE-X) for hot and cold water system, shall be of first quality and in accordance with AS 2492.

Water services pipes shall be not less than Class 16 to comply with AS/NZS 3500.

Fittings shall be Brass Dezincification Resistant as to AS 3688 with jointing as per manufacturer instructions.

Tubes which are to be installed within concrete slabs are to be run in retractable sleeves and shall comply with the requirements of the appropriate building authority (AS/NZS 3500).

Retractable sleeves Cross Linked Polyethylene will not be used in areas as specified in AS/NZS 3500.

C.5.36 PVC Pipes and Fittings

Unplasticised polyvinyl chloride pipes and fittings shall be manufactured in accordance with Australian Standard AS 1415 for soil, waste and vent applications, AS 1260 for sewer drains and AS 1464 Type 2, Class 100 for gas installations.

C.5.37 uPVC Pressure Pipes and Fittings

uPVC pressure pipes and fittings for water services and pumped discharges shall be of first quality and be in accordance with AS 1477 Parts 1-6 and AS 2032.

Solvent-cement or rubber ring joints: To AS 2032.

C.5.37.1 Pipe Classes

Class PN 16 - For a maximum working pressure of 1.6 MPa (160m head approximately) at 20°C material temperature.

Class PN 20 - For a maximum working pressure of 2.0 MPa (200m head approximately) at 20°C material temperature.

C.5.38 uPVC Pressure Pipe for Fire Hydrant Services

uPVC pipe and fittings for fire hydrant services shall be first quality and in accordance with AS 1477 Parts 1 to 6. Equal to Blue Brute Class 18 as manufactured by Hardie Iplex or class 16 as manufactured by Acutech.

C.5.39 Polybutylene

Polybutylene pipes and fittings shall be manufactured in accordance with Australian Standard Specification AS 2642 Parts 1, 2 and 3 and installed in accordance with Australian Standard Specification AS/NZS 3500 Part 1 and Part 4 or any subsequent revision thereof and of class as required by the local governing authority except the minimum acceptable polybutylene pipe used shall be Class 16.

C.5.40 Polyethylene

Polyethylene pipes and fittings shall be manufactured in accordance with Australian Standard specification AS 1159 - 1079 and installed in accordance with Australian Standard specification AS 2033 - 1977.

C.5.41 Galvanised Mild Steel Pipe for Hydrant Services

Pipes and fittings shall be first quality hot dipped galvanised mild steel to AS 1074.

Pipes and fittings shall be joined, threaded and screwed or assembled using a roll grooved jointing system similar to Victaulic 77 fittings and couplings.

C.5.42 Cast Iron Non-Pressure Pipes and Fittings

Cast iron non-pressure pipes and fittings shall be manufactured in accordance with Australian Standard AS 1631/1974 and shall be installed in accordance with local authority manufacturers requirements.

C.5.43 Materials for Subsoil Drainage

Pipework shall be either:

- uPVC pipe with longitudinal slots.

Sub-soil drainage shall be laid on blue metal 20mm single size round or crushed aggregate conforming to AS 2758.1.

Permeable Fabric shall be of Geo-textile fabric of mass not less than 150 grams per square metre.

C.5.44 Vitrified Clay Pipes and Fittings

Vitrified clay pipes and fittings for sewer systems shall be first quality and in accordance with AS 1741, Class Y. Pipes and fittings shall be jointed with black sewer standard type rubber rings, complying with AS 1693.

C.5.45 Ductile Iron Pipes and Fittings

Ductile iron pipes and fittings for water services shall be first quality and in accordance with AS 2280, AS/NZS 2544.

Pipe Class: Below ground class 9.

Above ground class 10.

Ductile iron pipes and fittings shall be jointed in accordance with manufacturer's instructions:

- rubber ring for below ground installations.
- flanges for above ground installations.

C.5.46 Glass Pipes and Fittings

Glass pipes and fittings for laboratory drainage systems shall be first quality, made from high grade, low thermal expansion, borosilicate glass and in accordance with BS 2598 Part 4.

Glass pipes and fittings to be jointed with compression type couplings to manufacturer's instructions. Pipe and fittings shall be equal to KIMAX.

C.5.47 Piping Jointing

C.5.47.1 Copper and Brass Pipe Joints

Copper and brass pipe and pipe fittings shall be jointed with a lap. Brazed using not less than 2% silver solder.

For lapped joints the copper tube shall be annealed and expanded one end to form a socket. The procedure shall be to clean the inside of the socket and the outside of the mating tube with steel wool to remove all traces of discolouration.

Joints made with proprietary brand capillary fittings shall be cleaned with steel wool, fluxed and heated in accordance with the manufacturer's instructions.

Upon completion of the joints all traces of flux shall be removed from the joints.

C.5.47.2 Flanged Joints

Where flanged joints are necessary or shown on the drawings, or needed to match valves, AS B52 Table F flange shall be used.

C.5.47.3 Silicone Sealant

Silicone sealant shall be self-polishing with anti-fungicide additive equal to Ciba-Geigy manufacture and used as recommended by the manufacturer. White shall be used around vitreous china sanitary ware and clear for sealing under fixture taps and stainless steel.

C.5.47.4 Solvent-Welding Joint

Polyvinyl Chloride (PVC or uPVC) pipes shall be jointed by solvent-welding of the type recommended by the manufacturer. Clean joint with approved solvent cleaning fluid. Apply liberally an even layer of the approved solvent cement to both surfaces of the joint and allow to stand to become touch dry. Apply a second coat to both surfaces of the joint and push together. Remove surplus solvent with a clean, dry cloth complying with AS/NZS 3879.

C.5.48 Cement

Cement shall be 'Portland' cement of approved local manufacture conforming to Australian Standard 1315/1973.

The cement shall be supplied and delivered to the site in the Manufacturers branded and sealed bags. Arrange for adequate protective cover and storage to prevent deterioration.

Cement which does not comply with the required standards or has been adversely affected in storage shall be removed from the site.

C.5.49 Sand

Sand shall be clean sharp pit sand, screened if necessary free from all foreign or organic matter and conforming in cleanliness with the requirements of Australia Standard No A1465/1974.

C.5.50 Coarse Aggregate

Shall be nominal 20mm graded sharp bluestone or other approved screenings of hard durable uncoated particles free from all foreign or organic matter and conforming in cleanliness with the requirements of the Australian Standard No A1465/1974.

C.5.51 Concrete

Properties for all concrete in this Contract shall be:

- 20 MPa - full curing characteristic compressive strength at 28 days.
- 75mm – slump.
- 20mm - maximum aggregate size.
- Cement - approved white cement.
- Aggregate - salt free river gravel.
- Cement Render - 1 part cement; 2 parts graded blue metal screenings (max. size 5) and 1 part sand: slump zero.

C.5.52 Wall Boxes

Provide wall boxes to accommodate above ground valves, regulators and the like, constructed of 1.2mm galvanised steel plate continuous welded box construction with leading edge twice folded at 90° to form 25 x 25mm frontal surround. Fix to masonry backing with four 10mm galvanised masonry bolts.

C.5.53 Fittings Generally

Provide the necessary fittings for the proper functioning of the hydraulic service, including taps, valves, pressure and temperature control devices, strainers, gauges, automatic controls, alarms and the like to the following standards unless otherwise specified:

Safety valves generally (including relief valves): To AS 1271.

Pressure and temperature relief valves for storage water heaters: To AS 1357.

Pressure-reducing, pressure-limiting and pressure-ratio valves for storage water heaters: To AS 1357.

Non-return devices for water storage heaters: To AS 1357.

Vacuum relief valves for storage water heaters: To AS 1357.

Air release valves: To AS 1271.

Water hammer devices to be 15mm stainless steel. Install on all cold water supplies to each apartment, retail outlet, etc.

Thermostats and energy regulators generally: To AS/NZS 3161.

Thermostats and over-temperature energy cut-outs for electric water heaters: To AS 1308, adjustable or fixed settings as required.

Water gauges: To AS 1271.

C.5.54 Taps

To AS 1718, dezincification-resistant, pressure tested to 2.0 MPa.

C.5.55 Valves

Valves shall be provided wherever specified or shown on drawings and whenever necessary for isolating sections of the system.

Valves shall be of "JOHNS" manufacture or equivalent approved for the particular application and shall bear the Testing Authority's stamp where applicable.

Valves shall be placed in approved accessible positions for maintenance.

All valves up to 80mm shall be bronze, gunmetal or of other non-ferrous metal construction. Valves in excess of 80mm shall be cast iron with bronze or other non-ferrous metal internal trim.

All brass used in manufacture of valves shall have copper content in excess of 75% and preferably containing 0.05 to 0.6% arsenic to inhibit dezincification. Bodies of brass valves shall be of LG2-C (85% copper, 5% lead, 5% zinc, 0.5% arsenic).

C.5.55.1 Isolation Valves Generally

Shut off valves up to and including 50mm diameter shall be fitted by screwing to a tube bush brazed to pipe on inlet side and to a flare boiler union on the outlet side.

All shut off valves of 65mm diameter and larger shall be flanged unless otherwise indicated.

Unless otherwise shown on the drawings isolating valves for use with cold water shall be high pressure brass stop cocks and screwed ends. Gate valves shall be flanged bronze gate valves.

Isolating valves for use with hot water shall be bronze body ball valves with stainless steel ball resilient seating for hot water application to withstand 90°C minimum.

Check valves shall be bronze spring loaded type with screwed ends. Check valves for use on hot and cold water piping 65mm diameter and over shall be bronze swing check valves with flanged ends.

C.5.55.2 Hose Taps

All hose taps shall be fitted with integral hose connection vacuum breakers. Chrome plated hose taps and fittings exposed inside building and polished brass elsewhere.

C.5.56 **Gate Valves and Control Valves**

C.5.56.1 15mm to 50mm

Gate Valves shall be "JOHNS", or equivalent approved pattern of gunmetal with screwed ends and with seats cast integral with the body. The spindle shall be gunmetal of the non-rising type and must not project into the bore of the valve when valve is in the 'Full Open' position. The bore shall be clear and unobstructed in this position. The valve shall be a wedge shaped single piece casting and valve faces and seats shall be accurately machined.

C.5.57 **Non-Return Valves**

C.5.57.1 15mm to 40mm

Check valves 15mm to 40mm shall be of the horizontal pattern with gunmetal body, and gunmetal swing check with a limit stop to prevent it from remaining open.

The body shall be globe shaped and shall provide a clear passage equal in area to that of the pipe to which it is connected.

The face angle of the swing check in the 'Closed' position shall be as near as practicable to the vertical.

Check valves of over 50mm shall be tilting disc horizontal pattern with disc pivoted off centre and inclined at an angle to provide non-slam characteristics. Valves shall be lined with approved material.

Valves shall be flanged to AS B52 Table F.

C.5.58 **Double Check Valves - RPZ Valves**

Double Check Valve - RPZ valve assemblies shall be Watts/RMC type or similar approved of applicable sizes as indicated on drawings, installed to manufacturer's recommendations. Install lockable isolating valves on inlet and outlet.

C.5.59 **Sluice Valves**

To be installed on all incoming water, fire hydrant and sprinkler services. Provide and locate flanged valves in underground valve box to comply with AS 2638.

C.5.60 **Gas Valves**

Install valves to control and cut off gas flow in gas lines to AG 601, Clause 2.6.2 and to approval list AG 201 of AGA and ALPGA 'Approved Appliances and Components'.

C.5.61 **Pressure Reduction Valves**

Install reduction Valves, pressure limiting valves, or ratio valves, to produce the specified reduction in pressure. Prior to installation, obtain a guarantee from the manufacturer stating the reduction in pressure and flow rates obtained under test conditions.

C.5.62 Globe Valves

Install valves on hot water reticulation systems to AS 1357.2 and as indicated on drawings. Fit with unions on each side of valve for easy maintenance and removal.

C.5.63 Balancing Valves

Install on all hot water return lines as indicated on drawings to comply with AS 1357.2. Valves to be installed with unions for easy maintenance and removal. Valves shall be suitable for water temperatures not exceeding 99°C and pressures not exceeding 1600 kPa.

C.5.64 Ratio Valves

Shall be 2:1 ratio valves, to be installed in fire hydrant service as indicated. Valves to be equal to PHILMAC Ratio Pressure Reducing Valves. Size: 150mm flanged. Installation as per manufacturers requirements.

C.5.65 Diaphragm Valves

Shall be hand wheel operation, cast iron rubber lined diaphragm valves installed to the discharge side of the sub-soil stormwater and sewage drainage pumps.

C.5.66 Y' Strainer

Strainers shall be installed after the water meter and on each branch line with a flow control valve, solenoid or thermostatic mixing valve. Strainers are to be capable of arresting particles larger than 1.2mm, having a mesh surface area of not less than four (4) times that of the pipe.

Install check valve and control valve before each strainer. Fit each strainer with valve and drain line to facilitate ease of maintenance.

C.5.67 Flow Control Valves

Supply and install to all tapware and fittings water conservation flow control vdevices similar or equal to those manufactured by Jemflow.

Install to manufacturer's requirements; provide all necessary valving, unions and fittings required.

Water conservation valves shall be selected to provide a water conservation rating in accordance with WELS (Water Efficiency Labelling Standards).

C.5.68 Water Conservation - Urinals

Supply and install passive infrared urinal flush control valve similar and/or equal to Zip Pearl Urinal Flush Controller No.41091. The urinal flush sensor shall be complete with adjustable fill and delay times, Janitorial flush each 12 hours of non-use, single battery input and low battery detection and identification lamp.

C.5.69 Backflow Prevention

Provide backflow prevention devices as required by the local Regulatory Authority or in accordance with the provisions of AS/NZS 3500 Part 1 Section 4 and Section 8 where applicable.

Wash down Hose Points Hose vacuum breaker

Hose Taps Generally Non-testable air vacuum breaker at outlet equal to R.M.C. "Aqua Gard"

Fire hose reels	Double Check Valves
Irrigation Service	RPZ valve
Non-potable Water service	RPZ Valve
Garbage Room	RPZ Valve
Rainwater & Fire Tank Automatic Infill	Dual Check Valve

C.5.70 Unions

Unions shall be three (3) piece brass, bull-nose taper type unions. Brass and nylon olive type connections shall not be used under any circumstances. Unions shall be located on the outlet side of all valves.

C.5.71 Gauges/Thermometers

C.5.71.1 Gauges

Pressure gauges shall be installed on the suction and discharge sides of all pump sets, and equal to those manufactured by Shearer Wright, be a minimum of 100mm diameter and be graduated in metres head and kilo Pascals, be of bronze construction mid pointing and activated by a double spring. Each gauge shall be complete with an approved gunmetal stop cock under the gauge and connected to the pipework, in accordance with CB 9 Code for pump tests.

C.5.71.2 Dial Thermometers

Provide adjacent to the hot water flow and return lines vapour pressure type thermometers with a range of 10°C to 120°C. Fix each thermometer head to a 150 x 25mm pre-painted timber panel in a position adjacent to the equipment served and easily visible for the balancing of the system.

Provide on the upstream side of each balancing valve a thermometer well having an internal bore of not less than 16mm and inserted in a section of pipe having a free flow area of not less than the line being served.

C.6 SANITARY PLUMBING AND DRAINAGE

C.6.1 Extent of Work

The work in this section of the Specification shall include the supply, installation testing and commissioning of the sanitary plumbing and drainage services as shown on the drawings and specified herein in accordance with all relevant Australian Standards and Codes of Practice. All work shall conform to the requirements of the Local Authority having jurisdiction.

The work includes the supply and installation of all pipework and fittings, hangers, brackets, and all miscellaneous equipment, gaskets, jointing materials, hardware and fixings including the use of all necessary tools and work aids as may be necessary for the proper and satisfactory completion of the Contract works.

Generally lines shall be run as shown on the drawings to correct grade, true to bore and alignment and connected to the sewer drainage where shown on the drawing

Allow to undertake a CCTV examination of the existing sewer drainage system from the proposed connection to the existing the existing boundary trap to determine that the system is in appropriate condition for the connection of the new works.

Provide a copy of the CCTV details and a written report to the superintendent, with recommendations on maintaining or replacement of this section of drainage.

Within the Tender Summary in Appendix A, allow a separate monetary sum for works involved in replacement of the above section of existing drainage, if after review, it is found to be beyond repair.

Within the monetary sum allow to excavate the existing slab, provide the new drainage run and backfill the excavation to the soffit of the replacement slab.

Dimensions must be checked before work is put in hand or prefabricated.

Verify the invert levels and surface levels indicated on the drawings before excavation or installation of pipework to ensure gravity connection to supply service with correct cover and fall.

Allow for all necessary diversions and minor adjustments of pipework and equipment as may be necessary to complete the works.

C.6.2 Pipes and Fittings

All pipes and fittings shall be of the diameters as shown on the drawings and shall comply with the relevant standards indicated for each material and to the current regulations of the Local Authority.

C.6.2.1 Inground Drainage

Shall be uPVC pipes and fittings conforming to AS 1260 and AS 2032.

C.6.2.2 Elevated Pipework

Elevated pipework 100 diameter and over to be uPVC SWV grade and fixed as previously specified. Drainage under 100 diameter to be uPVC DWV grade. All pipework to be installed to the requirements of the Local Authority.

Provide expansion joints as required in accordance with AS/NZS 3500, AS 2032 and AS 2033 of a type approved by the Local Authority.

C.6.2.3 Testing

As specified under 'Testing and Commissioning' in this Specification.

C.6.3 Inspection Openings

Install inspection openings where indicated on the drawings and where required by the Local Authority. Extend inspection openings to the surface where indicated on the drawings and as detailed. Internal inspection caps shall be chrome plated brass.

Internal inspection openings to have a rubber seal installed to achieve an air and gastight seal.

Install inspection openings in pipes so that each section of pipework is accessible in at least one direction. Inspection openings shall be placed in accessible positions and to the approval of the Local Authority.

C.6.4 Reflux Valves

Provide reflux valves for sanitary drainage, manufactured and tested to AS 3718 and AS 3578.

Install with access riser and finish with inspection opening at finished floor level

C.6.5 Fixture/Wastes

Chrome plated copper where exposed and uPVC / poly in cupboards.

C.6.6 Expansion Joints

Are to be installed and shall be of a type, material and manufacture approved by the Local Authority. Install expansion joints between fixed points and where pipework crosses building structural expansion joints.

C.6.7 Floor Wastes

Shall be 80mm x 50mm, or 65mm as shown on the drawings and shall consist of a self-cleansing 'P' trap with 80mm riser and screwed chrome plated brass grate set at level to ensure adequate drainage of all floor areas. The maximum length of the riser shall be 600mm.

C.6.8 Condensate Drains

All condensate drains installed above ground to be fully insulated with 'Thermotec' insulation to the first point of connection to the drainage system.

C.6.9 Traps

Traps to fixture outlets and floor fittings shall be as scheduled hereafter. All traps shall be 'Universal' pattern type except where otherwise noted. Like traps shall be of the same brand and style throughout. Chrome plating shall be of even thickness, dense and without defect and all unions and inspection openings shall be brass with chrome plate finish where appropriate.

FIXTURE TRAP	TRAP EXPOSED	TRAP CONCEALED	FINISH	UNION
Basin (Vanity)	B	-	C	D
Basin (Handicapped)	B	-	C	D
Basin (Wall)	B	-	C	D
Sink & Trough	-	P	PL	D
Sink & Trough	B	-	C	D
Floor Waste Gully	B	P	PL/C	-

B= Brass, C=Chrome Plated, D=Double, N=Nil, P=Plastic, PL=Plain, Cu=Copper, CI=Cast Iron

C.6.10 Mechanical Plant Room Drains

In positions indicated in mechanical plant rooms and elsewhere as shown on drawings provide and install floor wastes of dimension and trap seal depth nominated and generally as previously specified, connect with wastes of diameters noted and extend to and connect to floor waste stack and stormwater drains.

Note that position of all plant room drains shown on hydraulic services drawings for mechanical services equipment are indicative only. Actual installation positions are to be determined from mechanical services shop drawings in conjunction and liaison with Mechanical Services Sub-Contractor.

C.6.11 Branches - Sanitary

When a branch line enters a vertical pipe, the branch fitting shall be wholly outside the vertical pipe so that the internal bore is maintained. Form a 25mm radius at the throat of the bend in branches up to 80mm diameter and 50mm radius

in branches above 80mm diameter.

C.6.12 Offsets

Where stacks, waste pipes and vents are required to be offset, sweep bends shall be used and the maximum fall shall be given to the pipe work within the space available.

C.6.13 Vent Pipes

Provide and install all duct, group vents and relief vents of sizes shown on drawings and complete with all bends, junctions and reducers. Terminate all vents through roof with a uPVC cowl. Confirm locations of vent penetrations with Main Contractor prior to installation.

C.6.14 Flashing - Tile Roof

Provide sheet lead flashings to all vent pipes. Flashings shall be dressed up around vent pipe and dressed down and weathered to roof tiles.

Provide cover flashing, cone shaped and solvent welded to vent pipe and fitted down over sheet lead flashing upstand.

C.6.15 Flashing Metal Roof

Use 'Dektite' rubber flashing consisting of an upstand to tightly fit around the vent pipe and an aluminium reinforced rubber skirt to provide an easily moulded firm base for sealing and fixing to the roof.

The rubber shall be an EPDM rubber compound with carbon black to give maximum resistance to weathering and sunlight.

Flashing shall be shaped to the roofing profile, continuously sealed under all edges with silicone sealer and self tap screwed or riveted along the top and bottom edges. Roof surface shall be cleaned and de-greased prior to sealing.

Vent pipes shall be free to move through the weatherproof flashing.

C.6.16 Air Admittance Valves

Shall comply with AS/NZS 4936, and be similar and or equal to that manufactured by Studor. Selection of valve shall be sized to comply with AS/NZS 3500.2 Table 6.6 and table 6.7.

C.7 COLD WATER SERVICE

C.7.1 Generally

The work under this part comprises the complete supply and installation of the cold water service from the existing water service as shown on the drawings, to the various connection points either mentioned in this specification or shown on the drawings, or as necessary to complete the whole of the installation.

Allow for the supply and fixing of all piping, valves, unions, fittings and sundry equipment to the satisfaction of the Main Contractor. All pipework shall be copper tube Type B to AS 1432.

C.7.2 Pipework

C.7.2.1 Copper Pipes

Copper pipes shall be jointed by brazing copper and brass to copper with low-temperature silver brazing alloy containing not less than 5% silver. Use oxyacetylene heating for all low-temperature brazing.

When copper-to-copper joints are made the pipe shall be softened and expanded with a proper expanding tool to form a slip joint to the following table:

Pipe Size O.D. Length of Slip Joint	
13mm to 20mm	10mm
25mm to 32mm	13mm
40mm to 65mm	16mm
80mm to 100mm	20mm

No valves shall be brazed or soldered direct to pipes.

Connections shall be made with brass union type adaptor silver-soldered to pipe, and fittings screwed or flanged.

Under no circumstances will a compression fitting or back nut and rubber ring or brass or copper cone type fitting be permitted to be used on the installation, except at service pipe connections to fixtures.

All fittings shall be brass or copper and shall be MP52 compliant and bear the stamp of approval of the testing authority.

In addition to general provisions for installation of copper pipe, pipes shall be fixed in continuous lengths wherever practicable and bent at changes of direction in preference to using brass fittings.

All pipework shall be of the sizes shown on the drawings or as specified. Wherever possible, pipes shall be run parallel with walls, slabs, etc., and with each other and all other branches taken off at right angles.

Where pipes are let up along walls and then through to fixtures, the pipes shall not be bent but are to be fitted with elbows to allow for correct fitting of cover plates.

Short pipe extension pieces from walls connecting fixtures shall be fitted with union connections to allow for removal of fixtures. Pipes shall be separated from the building structure with unistrut type brackets.

Provide 4mm thick PVC insulation between pipe and bracket.

C.7.3 Testing

On completion, all pipework shall be subject to a pressure test of 1800 kPa for 8 hours. Any defects found in the system shall be remedied and test re-applied. Disconnect pipes from mechanical and hydraulic equipment prior to testing and re-connect on completion. All testing shall be conducted prior to backfilling of trenches to enable ease of trouble shooting in the event of leakage.

C.7.4 Flow Control Valves

Supply and install to all tapware and fittings water conservation devices similar or equal to those manufactured by Jemflow.

Install to manufacturer's requirements; provide necessary valving, unions and fittings required.

Water conservation devices shall be selected to provide conformance ratings with WELS (Water Efficiency Labelling Standards).

C.7.5 Protection of Potable Water Supplies

All water supply systems shall be installed and maintained so as to prevent contaminants being introduced into the potable water supply.

No device or system that may permit the introduction of any foreign substance into the water service, shall be connected directly or indirectly to any part of the water supply service, including fire service, garden water and irrigation systems or to any temporary attachment to the water service without a method of cross-connection control and backflow prevention authorised by the regulatory authority.

C.7.6 Backflow Prevention Devices

In all cases backflow prevention devices shall comply and be installed to all the requirements of AS/NZS 3500/1, as and where directed by the relevant Authority.

Where specific backflow prevention devices are nominated on the contract drawings that include reduced zone pressure devices, double check valve assemblies or registered air gap and break tank installations, the contractor shall complete the relevant test recording sheets (within this specification) for inclusion into the operating and maintenance manual. A copy of all relevant test recording sheets shall additionally be submitted to the local governing authority.

Note: All backflow prevention device installations and completion of test recording sheets shall be carried out by a registered backflow prevention installer. **Backflow prevention valve test sheets contained in the appendix to this specification** require to be duly completed and included in the operating and maintenance manuals.

C.7.7 Water Hammer

Water hammer shall be eliminated by suitable approved devices inserted in the water supply pipework, should it prove impossible to eliminate the problem by water supply pipework modification, and at the Contractor's expense. Any pipework subject to water hammer shall be fitted with adequate anchors, and bends in the pipework and shall be arranged clear of brackets to avoid stress points. Where pipework is installed within buildings the maximum water velocity shall be 1.6m/sec.

C.8 HOT WATER SERVICE

C.8.1 Generally

The work under this section comprises the complete supply and installation of the hot water storage and reticulation system and associated valves and pipework to the various fittings and connection points mentioned in this specification or shown on the drawings.

The system consists of the installation of Rheem or equal, 25litre, 3.6kW electric, mains pressure, storage water heaters.

Heaters shall be installed on a 450mm square copper safe tray, separated by a plastic mat and mounted on a wall bracket within the cleaners sink recess.

Extend the tray drain and temperature/pressure relief pipe to discharge over the mechanical services tundish drain adjacent to the cleaners sink.

Supply and fit a 50° tempering valve on the hot water outlet from the heater as detailed

The supply and fixing of all hot water plant piping, valves, unions, fittings and all sundry equipment to the satisfaction of the Main Contractor and the Local Authority. Pipework installation shall conform strictly with the manufacturer's recommendations and to the approval of the Superintendent.

C.8.2 Temperature Settings

Temperature settings shall be as follows:

- Individual hot water outlets 50 degrees C (to AS/NZS 3500)

C.8.3 Pipework

C.8.4 Pipe Supports and Fixings

As specified in 'Pipe Supports and Fixings'.

C.8.5 Testing

As specified in 'Testing and Commissioning'.

C.8.6 Expansion and Contraction

Make adequate provision for expansion and contraction so that under all working conditions no strain is imposed on pipework or fittings. Pipes located in walls and floors shall be provided with sufficient insulation so that expansion and contraction does not impose a strain on the pipework or finished surfaces. No joints will be allowed within or under concrete slabs. Expansion joints to be provided at a maximum of 18 metre centres and either side of building construction joints at every level. Expansion joints to be similar to Bestobell bellows type.

C.8.7 Backflow Prevention Devices

Backflow prevention devices shall be installed in hot water supply systems in the same manner as for cold water supply systems and must be suitable for hot water application.

C.8.8 Thermostatic Mixing Valves

Each thermostatic mixing valve shall be installed in accordance with the manufacturer's instructions and the requirements of AS/NZS 3500.4 and any relevant authority.

Each thermostatic mixing valve shall have a isolating valve, line strainer and non-return valve fitted to the hot and cold water supply lines.

Thermostatic mixing valves are to be adequately supported independent of all pipework and shall be readily accessible.

The thermostatic mixing valves shall be supplied with the manufacturers/agent's full directions for the commissioning, operation and maintenance of the valve/s.

Supply and install thermostatic mixing valve similar or equal to 'Enware Aqua blend 2000' where indicated on the hydraulic drawings to comply with AS/NZS 4032.

C.8.9 Tempering Valves

Each tempering valve shall be installed in accordance with the manufacturer's instruction and the requirement of AS/NZS 3500.4 and any relevant authority.

Each tempering valve shall have an isolating valve, line strainer and non return valve fitted to both the hot and cold water supply lines.

Each tempering valve is to be adequately supported independent of all pipework and shall be readily accessible.

All tempering valves shall be supplied with the manufacturer/supplier full directions for the commissioning, operation and maintenance of the valve(s).

C.8.10 Hot Water Heaters

Supply and fix the hot water heaters in the locations indicated on the drawings and as scheduled.

Each hot water heater shall be constructed with a double coating of high temperature corrosive resistant vitreous enamel lined steel cylinder, insulated with a high density insulation or approved equal and totally enclosed in a heavy gauge zincanneal outer jacket.

The jacket shall be finished in baked enamel to an approved colour.

Provide heaters with the following:-

An automatic surface mounted temperature control thermostat with adjustable ranges on automatic over-temperature cut out to shut down the fuel or power supply should the thermostat malfunction.

A temperature and pressure relief valve to conform with the requirements of AS/NZS 1357 and terminate over a tundish or F.W. as noted on drawings.

Electric hot water heaters shall be in accordance with AS/NZS 1056 and be tested and approved by the electrical supply authority.

A copper safe tray shall be supplied and installed under the hot water heater and shall be constructed of 1.8mm sheet copper. Joints shall have soldered edges, be reinforced and turned up 50mm. a 32mm outlet shall be fitted and sealed to the tray and discharge in the position noted on the drawings.

Hot water heaters shall be mounted on the safe trays and supported on 40mm x 25mm hardwood batons or a plastic mat designed for the purpose.

C.8.11 Pipe Insulation Generally

Hot water pipelines wherever they are installed throughout the buildings shall be insulated with 20mm thick Thermotec 4-Zero, insulation, in one (1) metre lengths.

“Thermotec 4-Zero” insulation shall be covered with reinforced aluminium foil incorporating an overlap. Provide and fix to longitudinal joints and circumferential butt joints 75mm wide, self adhesive reinforced aluminium tape.

Hot water and cold water copper pipework within stud wall framing, chased in masonry or concrete walls shall be hard drawn pre-lagged type similar to “KEMLAG”.

C.8.12 Boiling Water Units

Supply and install boiling water units finished in white enamelled casing, equal to “Zip”. Each unit shall have a storage capacity and single phase element as scheduled, and shall be thermostatically controlled.

Each unit shall operate automatically and be complete with inlet and outlet connection, drain plug, steam condensing, cowl and spring loaded non-drip fixed outlet tap.

C.9 FIRE HOSE REEL SERVICE

C.9.1 Generally

The work under this section comprises the complete supply and installation of the hose reel system from the existing water service to all hose reels as shown on the drawings.

Allow for the supply and installation of all piping, hose reels, valves, brackets and bolts, necessary to complete the installation to the approval of the Local Fire Brigade, Local Authority and the Superintendent.

Testing of the system shall be carried out by an independent testing authority at the Contractor's expense.

The Contractor is required to commission the fire service at the earliest possible stage of the contract. All fire service connections into the site are to be applied for and completed as a priority with the contractor providing all necessary flow and pressure data available on the connection to the Hydraulic Services consultant. Provide and maintain the service including all fire hose reels in operative condition in accordance with the Building Code of Australia.

C.9.2 Pipework Generally

Above ground pipework shall be steel in accordance with AS1596. And as specified for 'Cold Water'

All pipework shall be of the sizes shown on the drawing or as specified. Wherever possible, pipes shall be run parallel with the building slabs, walls etc. and all branch take-offs shall be at right angles.

C.9.3 Valves

Refer to 'Valves' section of this specification.

All valves used shall be 'Johns' or equal approved by the Main Contractor and shall be the best of their type, quality and grade. All external valves shall be installed as detailed on the drawings.

C.9.4 Testing

As specified in 'Testing and Commissioning'.

C.9.5 Hose Reels

Fire hose reels shall comprise 19mm diameter, 36 metres long PVC hose, galvanised steel mounting plates, reel roller guides, 19mm diameter nozzle, 25mm diameter brass 'Johns' gate valve fitted with a swinging arm.

The hose reels shall be approved by the Local Council and be equal to the fire hose reels as manufactured by 'Galvin' swing out type or equal approved. Positions of hose reels to be where indicated on the drawings.

Hose reels, unless otherwise stated, shall be installed with the centre of the hub 1.5m above the floor level and all to comply with the latest amended code AS1221, AS 1851.2.

Secure reel hub to masonry walls or steel bollards by means of 10mm diameter 'Dynabolt' type fixing and to plasterboard walls by means of fixing approved by the Superintendent. Provide 'Galvin' sheet metal hydrant hose reel cabinets where nominated on drawings. Fix to walls with masonry anchors and bolt or build into formed openings in walls. Cabinets shall be pre-painted and sign written.

Additional operating instruction sheets shall be procured and secured in a position adjacent to the reel in a permanently upright position.

C.9.6 Noise Generated by the Hydraulic System

Noise from the hydraulics system should be minimised by:

- Limiting pipe velocities in water systems to not more than 1.2m/s.
- Laying out pipes to minimise the number of changes in direction and installing pipes so that the effective cross-sectional area of the pipe is maintained at pipe bends and junctions.
- Selecting valves and fittings that minimise the generation of noise.
- Installing pressure reducing stations as required to eliminate excessive pressure at the terminal valves.
- Controlling structure-borne noise (ie. plant and pipe vibration transmitted into the building).

C.9.7 Structure Borne Noise and Vibration

The Sub-Contractor shall minimise the transmission of vibration to the building structure to ensure the noise and vibration criteria are achieved by:

- Statically and dynamically balancing rotating plant and equipment. Out of balance should not exceed 0.03mm kg/kg of rotating element after installation. Where specified, provide balancing test certificates.
- Providing isolation mounts or hangers for vibrating plant and equipment.
- Providing inertia blocks where required to limit the vibration amplitude.
- Isolating piping, electrical conduit, etc. subject to vibration from the building structure.
- Providing flexible connections where piping is connected to vibrating plant and machinery.

Submit a schedule of isolation mounts indicating make, model, rated load and static deflection, actual load and static deflection, unloaded height, fully loaded height.

C.9.8 Pipe Vibration Isolation

Where required install neoprene pipe sleeves between the pipe and pipe clamps to isolate pipe vibration from the clamps. The neoprene should compress 10-20% under the weight of the filled pipe. Do not compress sleeve more than 30% when clamp is tightened. Use 10mm thick neoprene rubber for pipe O.D. 65mm to 150mm; 4mm thick rubber for pipe O.D. up to 65mm.

Where required install pipe vibration hangers or supports of the type indicated in the table below in Section 5.4.

Flexible connections should be fitted to all pump piping connections. These should be twin sphere reinforced-rubber elements, be capable of withstanding internal pressure and other forces and be compatible with the fluid in the pipe.

C.9.9 Equipment Bases

Mount equipment on rigid bases. The bases shall be sufficiently rigid not to deform under the weight of the machinery or during operation and reduce the effectiveness of the isolation mounts.

Where required, concrete inertia bases shall be installed, the mass of the base shall be at least 1.5 times the mass of the equipment being supported including pipe fittings, etc. Bases shall minimise the height of the centre of gravity of the machine/base.

C.9.10 Installation of Vibration Isolation Mounts

The mounts shall be levelled once the equipment is fully loaded in its operating condition with a minimum clearance between the machine and the structure of 20mm, and adjusted to ensure that the isolators are loaded correctly. Ensure that the isolators are not bridged by mounting bolts or contact between any part of the machine or an unisolated part of the isolation mounts and the structure.

The number and spacing of the mountings shall be selected to minimise machine rocking. Static and dynamic forces during operation and start-up shall be considered when selecting the mounts.

During construction, pump isolation mounts shall be bridged with a timber block to prevent the possibility of overloading of the mounts during the installation of the piping.

Piping hangers and mounts shall be adjusted so that there is minimum strain on piping with the system operating in its normal condition.

Where there is a possibility of significant lateral loads occurring use hold down bolts, lateral restraints, or housed mounts to locate equipment.

C.9.11 Pipe Penetrations

Seal pipes penetrating slabs or walls according to the project noise criteria in the adjacent spaces, as follows:

PROJECT NOISE CRITERION	SEAL TYPE
IN ADJACENT SPACES	
Greater than 40 dB (A)	Type PA or PB seal.
Less than or equal to 40 dB (A)	Type PB seal.

C.9.12 Waste Pipes over Habitable Rooms

Waste pipes over habitable rooms and where exposed over toilet areas, shall be lagged with a layer of 8kg/m² loaded vinyl having an outer aluminium foil backing, separated from the pipe with a layer of 25mm thick open cell foam. Overlap all joints in the loaded vinyl by minimum of 50mm and tape airtight with aluminium tape.

C.10 APPENDIX A- TENDER SUMMARY

Tenderers shall submit a breakdown of the total tender price including administration cost and profit for each section of the works as follows:

The amounts included in the Total Tender sum including overhead costs and profit margins are as follows:

(a)	Provision for supply of all sanitary fixtures, fittings and tapware	\$ _____
(b)	Soil, waste and ventilation services including fixture installation and CCTV review of existing sanitary drainage.	\$ _____
(c)	Hot and cold water services including all necessary temperature control equipment and hot water units and tapware installation	\$ _____
(d)	Fire hose reel services	\$ _____
(e)	Authority Fees and Charges	\$ _____
(f)	Testing and Commissioning	\$ _____
(g)	Maintenance (during defects liability period)	\$ _____
(h)	Operating and Maintenance Manuals including As-Constructed Drawings	\$ _____
(i)	Provisional Sums	\$ _____
(j)	Provide separate price for replacement of existing sewer line to boundary trap including cutting slab, excavation & backfill to soffit of slab.	\$ _____
	TOTAL TENDER AMOUNT (EXCLUDING GST)	\$ _____
	GOODS & SERVICES TAX (10%)	\$ _____
	TOTAL TENDER AMOUNT (INCLUDING GST)	\$ _____

NAME OF TENDERER: _____

CONTRACT: _____

C.11 APPENDIX B - SCHEDULE OF CONTRACT RATES

Tenderers shall submit the following Schedule to allow assessment of variations:

Composite Rates:

The following rates shall include for the supply and delivery of all materials, transport, erection and labour to complete the installation of the following elements in the works:

Description	Unit	Cost/Unit	GST	Total/Unit
Stand-down of Works	Day			

Hourly Labour Rates (including GST):

Period	Labour 1	Labour 2	Labour 3	Labour 4	Labour 5	Labour 6
Ordinary Time						
Time and a Half						
Double time						

NAME OF TENDERER: _____

CONTRACT: _____

C.12 APPENDIX C - CLAIMS FORM

Item	Tender Amount	% Complete	Amount Claimed
(a) Preliminaries and Mobilisation	\$	%	\$
(b) Demolition and Removal	\$	%	\$
(c)	\$	%	\$
(d)	\$	%	\$
(e)	\$	%	\$
(f)	\$	%	\$
(g)	\$	%	\$
(h) Commissioning	\$	%	\$
(i) Insurance, Transport and On-Costs	\$	%	\$
(j) Shop Drawings	\$	%	\$
(k) Provisional Sums	\$	%	\$
(l) Variations Approved			
- Variation Order No. 1	\$	%	\$
- Variation Order No. 2	\$	%	\$
TOTAL VALUE OF WORK CLAIMED (EXCLUDING GST)	\$		
GOODS & SERVICES TAX (10%)	\$		
TOTAL PRICE OF WORK CLAIMED (INCLUDING GST)	\$		
LESS PREVIOUS CLAIM	- \$		
CURRENT CLAIM	\$		

C.13

APPENDIX D - PROJECT SPECIFIC QUALITY ASSURANCE ITEMS

HYDRAULIC SERVICES

QUALITY ASSURANCE CERTIFICATE

SAMPLE OR EQUIPMENT DETAIL

Project: _____ * *ENTER DETAILS* *

WGE Project No: _____ * *ENTER DETAILS* *

Contractor: _____

Description of Sample or Equipment Detail:

Manufacturer/Supplier: _____

Model No/Catalogue No: _____

Does sample or equipment proposed meet the requirements of the specification and drawings? **YES/NO**

If no, provide details and reasons for deviations.

Contractors Signature: _____

Date: _____

HYDRAULIC SERVICES

QUALITY ASSURANCE CERTIFICATE

PROGRESS CLAIM

Project: _____ * **ENTER DETAILS** **

WGE Project No: _____ * **ENTER DETAILS** **

Contractor: _____

Original Contract Sum \$ _____

Adjusted Contract Amount at this date \$ _____
(Includes approved variations only)

We certify that we have completed work on this Contract to the value of \$ _____

Amount previously claimed \$ _____

Amount claimed in this certificate \$ _____

Breakdown of progress claim attached in accordance with specification **YES/NO**

Details showing calculation of adjusted contract amount attached **YES/NO**

We certify that the work completed and materials used comply with the specification, drawings, instructions and variations. **YES/NO**

If no attach details of any alterations.

Contractors Signature: _____

Date: _____

HYDRAULIC SERVICES

QUALITY ASSURANCE CERTIFICATE

PRACTICAL COMPLETION

Project: _____ * **ENTER DETAILS** *

WGE Project No: _____ * **ENTER DETAILS** *

Contractor: _____

We confirm that:

The Hydraulic Services installation is complete and ready for operation
If no, attach details of any work that is incomplete. **YES/NO**

The Hydraulic Services installation complies with the specification,
drawings, instructions and variations.
If no, attach details of any deviations **YES/NO**

Hydraulic Services commissioning and testing has been completed and results recorded. **YES/NO**

Hydraulic Services As Constructed Drawings and Operating and Maintenance Manuals
have been provided **YES/NO**

Contractors Signature: _____

Date: _____

HYDRAULIC SERVICES

QUALITY ASSURANCE CERTIFICATE

FINAL COMPLETION

Project: _____ * **ENTER DETAILS** *

WGE Project No: _____ * **ENTER DETAILS** *

Contractor: _____

Date of Practical Completion: _____

Date of Final Completion: _____

We confirm that:

All Hydraulic Services defects brought to our attention have been rectified **YES/NO**
If no, attach details of any defects that have not been rectified.

We have recently inspected the Hydraulic services installation and it is in efficient working order. **YES/NO**

Date of inspection:

Hydraulic Services maintenance has been carried out in accordance with the specification
and we have retained copies of records of all preventative and corrective maintenance work. **YES/NO**

Contractors Signature: _____

Date: _____

ASN Co Bays 1-4

Fire Services Upgrade

Fire Specification

Prepared by:

Grant Backhouse
Project No. 33307-1

\\WGE-SYD-FS-01\PROJECTS\33307-1\PROJECT DOCUMENTATION\FIRE PROTECTION\DESIGN\SPECIFICATION\F5-SP-001.DOCX

REVISION

Revision	Date	Comment	Prepared By	Approved By
001	23 February 2018	Preliminary for Review	GRB	GRB

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: Grant Backhouse

SIGNATURE:



CONTENTS

PART A.	PRELIMINARIES	1
PART B.	PROJECT SPECIFIC INFORMATION	2
B.1	PROJECT OUTLINE	2
B.2	FIRE SERVICES GENERAL.....	3
B.3	HERITAGE BUILDING.....	3
B.4	PROJECT STATUS	3
B.5	APPROVED / PREFERRED FIRE SERVICES CONTRACTOR.....	3
B.6	FIRE SERVICES CERTIFICATION	3
B.7	SCOPE OF WORK	4
B.8	FIRE SERVICES EQUIPMENT SCHEDULES	12
B.9	SPRINKLER TYPES.....	13
B.10	SYSTEMS INTERFACE AND CONTROLS.....	13
PART C.	TECHNICAL	15
C.1	GENERAL TECHNICAL REQUIREMENTS.....	15
C.2	SAMPLES AND DETAILS	15
C.3	SHOP DRAWINGS	16
C.4	MATERIALS AND WORKMANSHIP	16
C.5	INCOMING WATER SUPPLY	17
C.6	COMBINED HYDRANT SPRINKLER FIRE BRIGADE BOOSTER	17
C.7	FIRE SPRINKLER SYSTEM.....	17
C.8	FIRE HYDRANT SYSTEM	19
C.9	FIRE HOSE REEL SYSTEM.....	20
C.10	PORTABLE FIRE EXTINGUISHERS	20
C.11	PIPEWORK AND FITTINGS	20
C.12	CENTRIFUGAL PUMPS	30
C.13	PORTABLE FIRE EXTINGUISHERS	36
C.14	FIRE DETECTION AND ALARMS.....	36
C.15	EMERGENCY WARNING AND INTERCOMMUNICATION SYSTEM	36
C.16	SOUND SYSTEM AND INTERCOM SYSTEM FOR EMERGENCY PURPOSES (SSISEP).....	42
C.17	WIRING	43
C.18	FIRE SYSTEMS COMMISSIONING.....	45
C.19	BUILDING MANAGEMENT CONTROL SYSTEM (BMS) FIRE SERVICE INTERFACE INTERCONNECTION	55
C.20	TESTING AND MAINTENANCE	55
PART D.	APPENDICES	58
D.1	APPENDIX A - TENDER SUMMARY.....	58

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

PART B. PROJECT SPECIFIC INFORMATION

B.1 PROJECT OUTLINE

B.1.1 General

The ASN Co Bays 1-4 project comprises the refurbishment and upgrade of the existing Fire Services Systems and the Emergency Light and Exit Light Systems within Bays 1-4 inclusive at the existing Heritage listed building at 1-5 Hickson Road, Sydney. Note that the Fire Services and Emergency Light and Exit Sign System required with Bay 5 of this building are the subject of a separate contract however these services will be extended from the existing services infrastructure that is being upgraded under the scope of the works described herein.

This specification outlines the scope of the Fire Services installation and identifies the associated Technical Requirements. This specification shall be read in conjunction with the nominated Reference Documents and Drawings.

B.1.2 Reference Documents

The following reference documents form part of this specification:

- Services Drawings
- BCA Compliance Report

The Fire Services work shall be in accordance with this specification and drawings and in accordance with the Environet Consultancy Pty Ltd BCA Compliance Report PR-425/2016-cl94 dated 29 November 2017, the whole of which shall be deemed to constitute one document. A copy of the Environet BCA Compliance Report is appended to this document.

No additional costs shall be allowed for works specified in the reference documents.

B.1.3 Drawings

The following drawings shall form part of this Specification and shall be read in conjunction herewith.

WGE Project No.	Drawing No.	Drawing Name
33307-1-FP	000	Cover Sheet
33307-1-FP	001	Notes, Legend & Site Plan
33307-1-FP	100	Ground Floor Plan
33307-1-FP	101	Level 1
33307-1-FP	102	Level 2
33307-1-FP	103	Level 3
33307-1-FP	104	Level 4
33307-1-FP	800	Details
33307-1-FP	801	Fire Pump Room Details

33307-1-FP 900 Schematics

The above drawing(s) and this Specification shall be considered as co-operative and any work omitted from one but inferred or present in the other shall form part of this Contract.

B.2 FIRE SERVICES GENERAL

Tenderers shall complete the attached Tender Form and shall provide a Schedule of Rates for the works specified (Refer Appendix A and B).

The Fire Services Contractor shall make full allowance for working with the design team to complete the fire services engineering design and preparation of fire services drawings "For Construction". "For Construction" drawings shall be submitted for approval.

The Contractor shall perform the work of this Contract in such a manner as to conform with the general building programme and shall provide for working in with other trades and Sub-Contractors under the general direction of the Builder in accordance with the clauses of the Conditions of Contract.

B.3 HERITAGE BUILDING

The proposed works will be located within a state significant heritage building. All areas of the building, adjacent to heritage fabric and surfaces are to be protected during works in accordance with a heritage construction management plan. The works are not to include any chasing into heritage walls or floor structures. the cutting of heritage walls for new fire doors is as documented.

A heritage construction management plan is to be submitted for approval prior to commencement of the works.

The proposed fire services system should maintain the reversibility of the existing system such that it is able to be removed without damage to any heritage fabric. the drawings and or specification should include information regarding the reversibility of the design.

B.4 PROJECT STATUS

This specification and associated drawings were produced under a design and construct contract and therefore should be read in this context. These documents are intended to represent of design development and are not fully complete, nor fully comprehensive.

The contractor shall allow to complete the design and for any additional costs that may arise as a result of the design being incomplete, and for the risk associated with this. These documents represent the design intent and the contractor shall be responsible for confirming details, co-ordinating with other disciplines and installing the systems so that their intended function is achieved in accordance with this design intent.

B.5 APPROVED / PREFERRED FIRE SERVICES CONTRACTOR

All Fire Services Contractors are to have accreditation of AQF-Cert III in sprinkler fitting.

B.6 FIRE SERVICES CERTIFICATION

The Fire Services Contractor shall engage the services of an independent Competent Fire Safety Practitioner to inspect and certify the essential safety systems under this contract and shall pay all associated costs. The Fire Services Contractor shall arrange and liaise with the Competent Fire Safety Practitioner to ensure the inspections occur in a timely manner and at such times to ensure the construction programme is not adversely affected.

A copy of each and every Certificate of Compliance prepared by the Competent Fire Safety Practitioners' is to be submitted to upon completion of the testing and commissioning phase of the works.

B.7 SCOPE OF WORK

B.7.1 Scope of Work

The scope of works comprises the supply, installation, testing, commissioning, maintenance and defects liability, materials labour and equipment for the complete Fire Protection Services installation for ASN Co Bays 1-4 at 1-5 Hickson Road, Sydney.

The work shall include all necessary minor and incidental work required to implement the intent and meaning of this specification and associated drawings.

Whether or not the words "supply and install" appear in this Specification or on the drawings, unless clearly excluded, all items of equipment for the complete installation are required and shall be supplied and installed.

The scope of works is summarised below and set out in more detail in the Specification and on the Tender Drawings.

B7.1.1 General

- Fire sprinkler protection upgrade.
- Fire hydrant protection upgrade.
- Upgrade of the fire detection system for smoke hazard management initiation, status indication and override control
- Provision of an Occupant Warning System to Bays 1-4 of the ASN Co Bays 1-4 building
- Provision of an Emergency Warning and Intercommunication System to Bays 1-4 of the ASN Co Bays 1-4 building
- Upgrade of the existing Fire Brigade monitoring equipment.
- Maintain, modify and upgrade as necessary all existing interfaces with other services and the building structure.
- Attendance at site and coordination with the main building program.
- Supply, installation and packing of sleeves through the fire rated penetrations with approved mineral fibre, to maintain the fire rating. Packing of sleeves through sound rated partitions, to maintain sound rating.
- Cable trays for the conveyance of new fire system cables.
- Supply and install replacement signage and new signage as required by the Code and Authorities having jurisdiction to meet current requirements
- Detailed ("shop") drawings and schedules of equipment, fully depicting the entire installation, for approval prior to purchase or manufacture.
- All plant and scaffolding necessary for the execution of the Contract.
- Design and Construction Programme for the Fire Services for review, discussion and approval by the Project Manager, submitted for approval prior to preparation of shop drawings.

- Testing and commissioning plan.
- Manufacturers certified drawings, upon request.
- Samples, where specified, prior to placing orders.
- Operations and Maintenance manuals, including As-Constructed documentation.
- Submission of all necessary details to Authorities before, during and after construction, to ensure that the system complies with their requirements. Obtain all necessary certificates and payment of all fees.
- Arrange inspections by the FRNSW and obtain their approval of the installation.
- Testing and commissioning including payment of fees to Witnessing Authorities, the Consulting Engineer, the Principal and the Competent Fire Safety Practitioner, including provision of materials such as smoke generators, etc.
- Attendance and participation in functional testing of smoke hazard management systems.
- Preventative testing and maintenance during the twelve (12) months period following practical completion.
- Comprehensive maintenance and warranty of all new and upgrade plant during the construction period and for the defects liability period in accordance with AS 1851.
- Miscellaneous and associated works as further specified.
- Wall, slab, partition and baffle penetrations and making good as required.
- Build in all sleeves for penetrations and subsequent making good. The Contractor to supply all sleeves and provide adequate detailed drawings.
- Concrete plinths under equipment, including pumps, 150mm high.
- Removal of tiles and ceiling suspension, as required for removal or installation of sprinklers, detectors and EWIS speakers.
- Excavation, backfilling and making good for all inground pipework.
- Removable panels and access hatches in plaster ceilings for access to equipment.
- Enclosure for Fire Brigade booster connections.
- Hob surrounding floor drain in sprinkler valve room.
- Security storage and site shed accommodation.
- Temporary lights.
- The following signs:
 - Location Plate Sign shall be located on an external wall as near as possible to the sprinkler stop valve

The sign shall read "SPRINKLER STOP VALVE INSIDE" shall be in raised letter or other approved type. The words "Sprinkler Stop Valve" should be in letters minimum size 35mm high and the word inside should be in letters minimum 25mm high.

It is recommended that the words be painted white on a black background.

- Fire Brigade Booster connection signs should be located on the booster connection enclosure door. The signs shall read "HYDRANT AND SPRINKLER BOOSTER CONNECTION" in letters minimum 50mm high in contrasting colour to that of the enclosure door.
- Where the fire indicator panel is obscured by a door, that door shall be marked with the words "FIRE INDICATOR PANEL" in letters not less than 50mm high. No other lettering shall be on the door.
- Penetrations for pipework through glass panels, walls and make weatherproof where necessary.
- Supply a master key to the fire brigade for emergency access to all fire protection equipment.

The work shall include all necessary minor and incidental work required to implement the intent and meaning of this specification and associated drawings.

Whether or not the words "supply and install" appear in this Specification or on the drawings, unless clearly excluded, all items of equipment for the complete installation are required and shall be supplied and installed.

The scope of works is summarised below and set out in more detail in the Specification and on the Tender Drawings.

B.7.2 Incoming Water Supply

The existing incoming water supply service supplying the Sprinkler system shall be retained and reconfigured as indicated on the drawings.

The existing incoming water supply service supplying the hydrant service shall be capped above ground at the existing brigade booster location. The isolation sluice valve on the town main connection point shall be closed shut.

B.7.3 Common Fire System Infrastructure

The sprinkler and hydrant service shall be served by a common water supply infrastructure. The extent of works associated with the Common Fire System Infrastructure includes the following:

- Alteration of pipe arrangements within the existing Pump and Valve Room to direct the incoming water supply via the Brigade Booster Connection facility before returning to supply directly to separate sprinkler and hydrant branch take-offs. Works shall include but not be limited to the following:
 - Demolition and removal from site of all redundant piping, valves, pumps and ancillary equipment within the existing fire pump and valve room
 - Demolition and removal from site of the existing sprinkler and hydrant brigade booster inlet facilities including the capping off of the existing incoming town main connection pipework.
 - Provision of all new pipework, valves, and fittings within the existing fire pump room
 - Provision of new brigade booster arrangement in the location of the existing facility. The brigade booster connection is a combined service to provide Fire Brigade connection for both the main Sprinkler and

Hydrant services and shall consist of 1 x 4 valve main suction manifolds and 1 x 4 valve booster inlets with a hard suction connection.

-
- Provision of twoe-off Diesel Fire Pumps in Duty / Standby configuration to suit the combined hydrant and sprinklers system demand, complete with piping, valves, fuel storage, exhaust systems, batteries and controls.
- Final system demand to be based on requirement for Ordinary hazard 3 sprinklers based on 18 operating heads and two simultaneously operating hydrants in accordance with the design parameters nominated in this specification.
- Provision of one off automatic Fire Hose Reel pump complete with all piping, valves, pressure accumulator and controls. This pump shall serve a double purpose as the Hydrant system pressure maintenance pump.
- Provision of one off manual jacking pump complete with all piping, valves, and controls to serve the sprinkler installation
- Provision of Fire Pump Remote Start Switches at the Main FIP .located in Bay 4 Level 2
- Provision of fixed flow test installation to allow proving of system flow drained to the existing Pump and Valve Room floor sump In addition allow to construct a bund around this existing sump to control the discharge of water during test and drain operations.
- Piping, pipe fittings, valves, pressure gauges, pipe hangers and support for the entire installation.
- Provision of Valves, Booster outlets etc. as shown on the drawings.
- Provision of all new permanent signs, specifically
 - Block Plans to the FIP, Pump Room and each Booster Cabinet.
- Provision for Master Fire Service Block Plan to brigade booster cabinet.
- Complete systems of electrical power and controls for installation.
- Commissioning and testing of all equipment and systems.
- Co-ordination with all other components and trades.

B.7.4 Automatic Fire Sprinkler System

- Installation of a new 100NB set of Installation Control Valves complete with all pipe, valves and controls within the existing Pump and Valve Room.
- Upgrade of the existing sprinkler system throughout the building
- Sprinkler system design to be in accordance with AS2118.1:2017 based on the following design criteria:
 - Below Ceiling/Exposed Sprinkler spacing 12 m² maximum
 - Max No. of operating sprinklers 18
 - Minimum discharge per sprinkler 60 litres per minute

- Additional sprinkler pipe work throughout the building with sprinkler heads as required for compliance with AS 2118.1 and as generally shown on the preliminary drawings, including concealed roof, ceiling and floor space sprinkler protection.
- Replacement of existing flow switches and test solenoid arrangements including connection to existing drains.
- Installation of test valve manually operated at the sprinkler control valve assembly connected to common drain pipe to be discharged to the sump pit in the pump room.
- Re-connection of the existing remote monitoring system to the sprinkler control valve assembly and interfaced back to the Fire Indicator panel.
- Interfaces with the fire detection and alarm system.
- Fully hydraulically calculated pipework to be submitted for approval and work sheets as necessary for the production of all pre-fabricated components and for information required by other trades and authorities.
- Submission of all necessary details to Authorities, before, during and after construction as required to ensure that the system complies with requirements and the obtaining of all necessary certificates, payment of all fees.
- Draining and refilling the sprinkler system where necessary.
- Provision of all new permanent signs, specifically
 - Location plate.
 - Emergency instructions at the main control valve.
 - Engraved traffolyte Block Plan
- Provision of a new water motor alarm and gong.
- Provide a notice detailing the Fire Brigade's testing procedure.
- Third Party Certification.

B.7.5 Fire Hydrant System

- Provide additional fire hydrant protection throughout the each building at the ASN Co Bays 1-4 development as indicated on the drawings
- Disconnection and removal from site of all existing hydrant valves.
- Extension of pipe from existing hydrant riser pipes to supply new Hydrant valves with fire protected egress pathways including all pipe and valves.
- Provision of engraved traffolyte Block Plan, notice of test and working pressures and system details adjacent the new brigade booster facility.

B.7.6 Fire Hose Reel System

- Disconnection and removal from site of all existing fire hose reels
- Provide of new 36m fire hose reel system throughout the premises.

B.7.7 Portable Fire Extinguishers

- Provide portable fire extinguishers to satisfy the requirements of the Building Code of Australia, FRNSW and the local authorities as indicated on the drawings
- Mounting of existing fire extinguishers in accordance with Australian Standard requirements and provision of all required identification signage

B.7.8 Fire Detection and Alarm Systems

- Expansion and re-programming as required of the existing Main Fire Indicator Panel located In Bay 4 Level 2 as shown on the drawings. All existing Fire Fan Controls, remote flow switch test solenoid switches and interconnection for Fire Brigade monitoring connection shall be maintained.
- Expansion and re-programming as required of the existing Fire Indicator Panel located in the existing Pump and Valve Room as shown on the drawings. This panel shall be arranged on a pier to pier basis with the Main Fire Indicator Panel
- Re-connection of fire detection system directly to the local Fire Brigade.
- Interfaces between fire detection and system and emergency warning system to provide automatic alarm notification.
- Re-connection of existing interfaces with smoke hazard management services and all other items of equipment which must operate under fire emergency conditions, as required by AS 1668.1
- interfaces with EWIS and all other items of equipment which must operate under fire emergency conditions, as required by AS 1668.1
- Supply, installation and wiring of additional detectors as shown on drawings.
- Supply, installation and wiring of a Fire Alarm Bell and Strobe to be positioned near the FIP where approved both by the Architect and the FRNSW.
- Supply, installation and wiring of flow and pressure switches to the sprinkler system.
- Supply, installation and wiring to valves and pumps for supervised monitoring of the same.
- Supply and installation of engraved traffolyte building block plans adjacent to the showing the zoning and coding as required by the FRNSW.

B.7.9 Emergency Warning and Intercommunication System for Emergency Purposes (EWIS)

- Provide an EWIS throughout the premises in accordance with AS1670.4.
- Master emergency control panel to be co-located within the main Fire Indicator Panel cabinet.
- Secondary emergency control panel co-located with the FIP in the existing Pump and Valve Room..
- Speakers throughout all areas of the building.
- Flashing emergency beacons in disabled and accessible toilets as shown on the Drawings.
- Warden intercom phones on all levels as shown on the Drawings.

- Break alarm points located adjacent all Warden phones.

B.7.10 Demolition

Demolition isolation, disconnection, amendment services shall be carried out to suit the phasing of the works.

B.7.11 Shop Drawings

Provide shop drawings for all fire protection services, for approval prior to construction.

B.7.12 Painting

Paint and rust proof all exposed pipework and equipment.

B.7.13 Testing and Commissioning

Testing and commissioning of all works in accordance with the relevant Australian Standard and the Regulatory Authorities requirements.

B.7.14 Operating and Maintenance Manuals

- Provide Operating and Maintenance Manuals.

B.7.15 Maintenance

Provide preventative inspection and maintenance during the Defects Liability Period.

B.7.16 Authority Approvals and Certification

Provide all certificates required by the Building Code of Australia and the Australian Standards for all services specified under this contract.

All necessary details shall be submitted to the Authorities, before, during and after construction as required to ensure that the system complies with requirements and the obtaining of all necessary certificates, payment of all fees.

Provide certification of the system at completion. Certification shall be provided by a person recognised as a "Competent Fire Safety Practitioner" as defined by the NSW Government Dept. of Fair Trading.

Arrange inspections by the FRNSW and obtain their approval of the installation.

Provide a notice detailing the Fire Brigade's testing procedure.

B.7.17 Other items

- Co-ordination of the fire protection services with all other building services.
- All plant and scaffolding necessary for the execution of the Contract .
- Loading/unloading materials and handling to final position.
- Demonstration of the fire protection system operation for the Regulatory Authority and the Engineer's satisfaction.

B.7.18 Provision for Alterations

The Fire Services Contractor shall include the cost of the following future alterations.

- Relocation and/or addition of sprinkler heads as indicated on the drawings.
- Relocation and/or addition of smoke detectors as indicated on the drawings..
- Relocation and/or addition of Speakers as indicated on the drawings..
- All necessary associated works, such as system drain down, modification of FIP's, re-inspection and testing etc, related to the above work.
- Should any costs associated with the above not be expended during the contract period such sums shall be deleted from the total contract sum.

B.7.19 Work Excluded

The following works are specifically excluded:

- Fire services work to Bay 5.

B.7.20 Work by Other Trades

The following works and/or materials will be provided by other trades free of charge to the Fire Services Contractor.

Details of these associated works, however, shall be provided to the respective trades by the Contractor in the form of dimensioned drawings, sketches and memorandums.

B7.20.1 Work Provided by Mechanical Services Contractor

- Mechanical ventilation to fire pump and valve room.
- Liaise and cooperate with Fire Contractor for commissioning of fire systems

B7.20.2 Work Provided by the Lift Services Contractor

- Cut out and installation of a WIP phone unit within the lift car.
- The WIP is to be provided by the Fire Services Contractor and free issued to the Lift Services Sub-Contractor.
- Cut out and installation of an EWIS speaker within the lift car.
- The speaker is to be provided by the Fire Services Contractor and free issued to the Lift Services Sub-Contractor.
- Screened trailing cable between the WIP phone and EWIS speaker and a termination box outside the lift machine room.
- Termination only of interconnecting cabling between the MECP and the lift machine room provided by the Fire Services Sub-Contractor.
- Access to the head of each lift shaft for the installation of smoke detectors only.

B.7.21 Assistance from the Principal

The following services will be provided by the Principal free of charge to the Fire Services Contractor.

Details of the requirements associated with these works shall be provided to the Principal in the form of dimensioned drawings, sketches and memorandums.

- Temporary 240 Volts and 415 Volt power supply.
- Toilets and temporary water.
- Preparation of Contract documents.

B.8 FIRE SERVICES EQUIPMENT SCHEDULES

B.8.1 Fire Pump Schedule

B8.1.1

Designation	FP1	FP2	SJ1
Service	Hydrant & Sprinkler	Hydrant & Sprinkler	Sprinkler Jacking
Drive	Diesel	Diesel	Electric
Purpose	Duty	Standby	Jacking
No. of	1	1	1
Location	Ground Floor Sprinkler Pump and Valve Room		
Flow Rate	27 L/s		0.5 L/s
Estimated System Duty	650 kPa		800 kPa
Electric Motor Duty (kW)	-	-	2.2 kW
Electric Motor Type/Speed	Drip proof, 48 r/s	-	Vertical multi-stage 24 r/s
Diesel Engine Cooling	Water cooled-	Water-cooled	-
Diesel Engine Capacity (kW)	-	55 kW	-

Note:

- Allowances shall be made to the above pump duties to cater for flow of water to the diesel engine cooling circuit as specified by the engine manufacturer.
- Engines shall have ample capacity to carry the loads imposed without overloading with maximum impeller fitted at the specified speed and minimum head.
- Where two pumps of the same duty are required they shall be identical irrespective of prime mover.

B.9 SPRINKLER TYPES

The following types of sprinkler heads shall be used:

Type	Location	Description
(a)	Ceiling (Tiled/Plasterboard)	15mm 68°C (last/standard response) semi-recessed type with white body and white 2 piece escutcheon plate – Ordinary Hazard areas
	Ceiling (Tiled/Plasterboard)	10mm 65°C (last/standard response) semi-recessed type with white body and white 2 piece escutcheon plate – Light Hazard areas
(b)	Ceiling (Foyer, lobbies and external undercroft areas)	15mm 68°C flush pattern type with coverplate soldered to head holders. Coverplate to be white, satin chrome finished or other colour approved by Architect.
(c)	Ceiling (High)	15mm 68°C fast/standard response semi recessed type with removable satin chrome (or coloured) finished escutcheon plate.
(d)	Plantrooms	15mm 68°C brass conventional pattern upright or pendant.
(e)	Concealed Spaces	Exposed 10mm 68°C upright or pendant brass sprinklers.
(f)	Walls	15mm 68°C horizontal sidewall pattern.
(g)	Kitchen Exhaust Hood	15mm 182°C standard response, pendant position
(h)	Above Fat Fryer	15mm 141°C Stainless Steel finished sprinkler and stainless Steel fittings.
(i)	Kitchen Exhaust Duct	15mm 182°C standard response.
(j)	Roof or Ceiling	20mm 93°C Conventional pattern upright or pendant position. (High Hazard)
(k)	In-rack	15 mm upright intermediate in-rack sprinkler with guard and water shield

B.10 SYSTEMS INTERFACE AND CONTROLS

B.10.1 General

The following systems and interfaces are existing and/or existing and shall be maintained within the building, complete with manual, automatic and alarm controls as identified.

B10.1.1 Automatic Fire Sprinkler System

- Sprinkler alarm valve (new)
- High pressure switch controls for direct brigade alarm (new)
- Remote solenoid test valve controls. (existing)
- Flow switch identification alarm. (existing)
- Stop valve security alarms.(existing)
- Electric operated sprinkler jacking pumps.(new)
- Fire pump sets (diesel and jacking) and associated control panels.(new)

B10.1.2 Hydrant and Hose Reel System

- Fire pump sets (diesel and jacking) and associated control panels.(new)

B10.1.3 Automatic Fire Detection and Alarm System

- Smoke detection circuits for plant control as required.(existing)
- Smoke detection circuits for specific risk areas as required.(existing)
- FIP and associated battery/battery charging plant.(existing)

B10.1.4 Building Fire Mode System

- Emergency warning evacuation alarm activation (existing)
- Fire mode/shutdown control circuits.(existing)
- Building fire mode logic and plant control.(existing)
- Fire alarm status indication to Mechanical Services installation.(existing)
- Smoke hazard management plant override control key switches.(existing)

PART C. TECHNICAL

C.1 GENERAL TECHNICAL REQUIREMENTS

Fire services installation to comply with the current edition of Building Code of Australia (BCA).

- The entire fire services installation shall comply with local Water Authority and FRNSW requirements.
- The entire fire services installation shall comply with current Australian Standards where applicable and particularly the following:

AS 1851 - 2012	Routine Service Maintenance of Fire Protection Systems and Equipment
AS 1668.1 – 2015	The use of ventilation and airconditioning in buildings – Part 1: Fire and smoke control in multi-compartment buildings
AS 1670.1 - 2015	Fire Detection, Warning, Control and Intercom Systems design, installation and commissioning – Part 1: Fire
AS 1670.4 - 2015	Fire Detection, Warning, Control and Intercom Systems design, installation and commissioning – Part 4: Sound systems and intercom systems for emergency purposes
AS 2118.1 - 2017	Automatic Fire Sprinkler Systems – General Requirements
AS 2419.1 - 2005	Fire Hydrant Installation – System Design, Installation and Commissioning
AS 2441 - 2005	Installation of Fire Hose Reels
AS 2444 - 2001	Portable Fire Extinguishers and Fire Blankets
AS 2941 - 2013	Fixed Fire Protection Installations - Pumpset Systems
AS/NZS 3000 - 2007	Wiring Rules
AS 3500.1 – 2003	Plumbing and drainage – Part 1: Water Services

C.2 SAMPLES AND DETAILS

Samples of the items listed below shall be submitted for approval at least 2 weeks before approval is required. Samples shall be clearly marked with the manufacturers name and catalogue number.

After approval, samples will be available for incorporation in the works

- Smoke detector.
- Breakglass device.
- Sounder alarm and flashing light.
- Sprinkler head (each type proposed and its intended location).

Manufacturers literature giving detailed specification, physical appearance and size for the following equipment shall be submitted for approval prior to purchase. Information shall be submitted at least 2 weeks before approval is required.

- Break Glass units / Manual Call Points.
- Alarm Valves.
- Fire Pumps.

C.3 SHOP DRAWINGS

Refer to the Preliminaries for shop drawing requirements. Allow for the following additional requirements.

- Drawings shall be prepared using AS 1102 drafting standard symbols.
- Drawings shall be provided with a legend of symbols, where applicable.
- Shop drawings shall all be on the same size drawing sheets and shall be to the scale of not less than 1:100 and larger where necessary.
- Shop drawings shall be of the same size as the project drawings.
- Shop drawings shall cover the following parts of the work:
 - Fire indicator panel, sub panel and mimic panel.
 - Sprinkler system details and layouts
 - Fire detection and alarm systems
 - Fire pump and Valve room
 - Fire brigade booster assembly
 - Fire services supports and fixing details

Shop drawings shall be submitted in .pdf format. Allow 2 weeks for return of shop drawings with approval and/or comments. When requested amend shop drawings and resubmit.

Note that shop drawings are reviewed for general principle of design only and approval of shop drawings by the Principal in no way relieves the Fire Service Contractor of his responsibility to comply with the requirements of this specification and associated drawings.

C.4 MATERIALS AND WORKMANSHIP

All materials, labour and plant shall be provided by the Fire Service Contractor unless otherwise specified. All materials shall be the best of their respective kinds and free from all defects.

Workmanship in each trade shall be carried out in a first class manner and in accordance with the true intent and meaning of this Specification and accompanying Drawings, General Conditions of Contract and to the entire satisfaction of the Architect.

So far as it is reasonably and economically practicable and where it is not prejudicial to the Proprietor to do so, the Fire Service Contractor shall in the performance of the Contract use labour, materials, plant, equipment, supplies and services available within the State of Western Australia.

All materials, equipment and work shall comply with the appropriate Australian Standard Specification or Code, or if such have not been prepared with the appropriate British Standard.

All materials, equipment and work shall also comply with the relevant rules and regulations laid down by any Statutory Authority having jurisdiction over such work, and shall conform with the requirements of Insurance Underwriter's Codes.

Any workmanship, materials or installation, which on inspection by such authorities, is found to require modification to be acceptable to the authority concerned shall be replaced, changed, modified, or otherwise put in a form to pass the relevant regulations. Such modifications shall be at the expense of the Fire Service Contractor and at no cost to the Proprietor.

The Fire Service Contractor shall take all necessary precautions with the supply and installation of equipment specified to prevent corrosion.

If, in the opinion of the Fire Services Contractor, equipment specified cannot be adequately protected against corrosion he shall request an instruction regarding same from the Principal.

Any component or accessory showing signs of rust or corrosion during the maintenance period shall be renewed or otherwise made good in an approved manner.

C.5 INCOMING WATER SUPPLY

C.5.1 General

The incoming water supply is existing. The contractor is required to reuse the incoming water supply that serves the existing sprinkler system for the Sprinkler and Hydrant installations as indicated on the drawings.

The Fire Services Contractor is required to arrange for and pay associated fees to the Water Supply Authority for the disconnection of the existing incoming water supply that serves the hydrant system.

The rearranged water supply connection pipework shall be provided with Double Check Valve Detector Assemblies in accordance with Water supply Authority requirements.

Interconnect the Fire Pump and Valve Room with the Brigade Booster facility through the existing 100NB inground pipe connection.

C.6 COMBINED HYDRANT SPRINKLER FIRE BRIGADE BOOSTER

Demolish and remove from site the existing hydrant and sprinkler Brigade booster facilities

Provide and install a new combined Hydrant and sprinkler Brigade Booster facility in the current Booster location. The booster connection shall have 65mm connections to fit FRNSW appliances complete with compatible valves, a 100mm diameter pressure gauge complete with shut off valve and chained blank caps. Interconnect with the Fire Pump and Valve Room through the existing 100NB inground pipe connection.

Provide a permanent sign indicating the maximum allowable inlet pressure.

C.7 FIRE SPRINKLER SYSTEM

C.7.1 General Technical

Provide and maintain complete fully operational fire sprinkler system to the building in accordance with AS 2118.

C.7.2 Areas to Be Protected

All areas of the Building shall be protected in accordance with the requirements of the relevant Codes and Statutory Authorities and in accordance with the BCA compliance reports.

C.7.3 Water Supply

Water supply to the sprinkler system shall be to the requirements of AS 2118.1 and as identified in the Project Specific section of this Specification.

C.7.4 Sprinkler Head Locations

Sprinkler head locations in all areas shall be as shown on the drawings.

The Fire Services Contractor shall be responsible for ensuring that the locations of all heads comply with the requirements of all Codes and Statutory Authorities referenced herein.

Discrepancies between this specification and the Codes and Statutory Authorities' requirements shall be referred to the Principal for resolution prior to any fabrication or installation. Variations due to abortive work resulting from failure to comply with this requirement will not be accepted.

C.7.5 Ancillary Work

The Fire Services Contractor shall supply and install all ancillary pipework, wiring and equipment, other than that indicated necessary to form a complete installation.

C.7.6 Equipment

All equipment supplied shall comply with AS 2118 and AS 4118 and shall meet the following requirements.

C7.6.1 Alarm Valves

Each alarm valve assembly shall incorporate the following:

- A main isolating gate valve, complete with position indicator and a padlock locking mechanism (in the 'open' position).
- An alarm valve of approved type and size for the installation connected, incorporating a water motor alarm to drive the local alarm gong on loss of downstream pressure.
- A direct Brigade alarm device of an approved type to transmit the fire alarm signal to the local Fire Brigade.
- Two freestanding 100mm dial type pressure gauges to measure the water pressure directly above the alarm valve and directly below the alarm and isolating valves.
- Gauges shall be mounted adjacent to the alarm valve and shall be fitted with shut-off ball valves in the gauge lines.
- A drain valve to drain the installation side of the alarm valve assembly, with a 50mm minimum diameter drain line to the floor drain in the Sprinkler Valve Room.
- A fixed flow test assembly "Annubar" incorporating an approved measuring device and drain connection.

C7.6.2 Sprinkler Heads

Sprinkler heads shall be of the glass bulb type in accordance with the requirements of AS 2118 .

Sprinkler heads shall be of Viking or Tyco/Grinnell manufacture, or approved equivalent.

All sprinkler heads shall be of one manufacture and the number of models or types used shall be kept to the practicable minimum.

Sprinkler heads shall be selected to compliment existing sprinklers where located within the same space. Style, finish and RTI shall be consistent irrespective of the whether sprinklers heads within a common area are existing or new.

The Contractor shall supply to the Principal spare sprinkler heads of each type, in quantities in accordance with the recommendations included in AS 2118.

In addition, the Contractor shall supply to the Principal a complete set of spanners or special tools required for removal and replacement of sprinkler heads.

C.7.7 **Stock of Spare Sprinklers**

A stock of spare sprinklers shall be provided within the valve room complete with the necessary spanners required for replacement.

The sprinklers shall be stored with the spanners in a suitably sized sheetmetal cabinet painted to AS 2700 "Signal Red" No. 537 and labelled in white 25mm high letters with the words "SPARE SPRINKLERS".

Spare sprinklers shall be stocked for all types and/or temperature ratings installed within the protection systems but in any case shall not be less than the requirements of AS 2118.1.

C.7.8 **Local Alarm Gong**

The local alarm gong shall consist of a turbine driven gong incorporating a revolving striking hammer, rotator nozzle, screen gong and gong cover. The gong shall drain to waste.

The gong shall be mounted on the external face of the valve room

C.8 **FIRE HYDRANT SYSTEM**

C.8.1 **Generally**

Provide and maintain complete fully operational fire hydrant system to the building in accordance with AS 2419.1. Existing hydrant landing Valves located in positions external to fire protected egress paths shall be disconnected and removed from site.

New hydrant landing Valves shall be installed within fire protected stairs and on external fire egress stair as indicated on the drawings.

C.8.2 **Design Criteria**

The fire hydrant and hose reel system shall be capable of the minimum flow and pressure at the most disadvantaged point in the system, in compliance with the requirements of the Building Code of Australia and the relevant Australian Standards.

C8.2.1 Hydrants

The hydrant system flow rate and residual pressure shall satisfy the requirements of AS 2419.1 Table 2.1 to 2.3 and Table E2 respectively.

C8.2.2 Pipework

The hydrant and hose reel pipework installation shall include all equipment sized to achieve the flows and pressure specified.

C.8.3 **Fire Hydrants**

Provide Fire Brigade approved 65 mm BIC pattern hydrant valves located at each level within the isolated staircase and as shown on the drawings. Install valves with spindle uppermost and hose connection orifice axis at 90° to ring main fire riser. Set valves with hose connection centre 1,000 mm above floor. Provide clip immediately under each hydrant valve and brace back to rigid structure.

C.8.4 **Testing**

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

Subject the adjusted system to performance tests as required by the Fire Brigade. Wait on and liaise with the Fire Brigade testing officers including fire pump manufacturer attendance at all Fire Brigade acceptance tests.

Subject the entire fire service to visual sighting and hydrostatic tests as required by the Water Corporation.

C.9 **FIRE HOSE REEL SYSTEM**

Provision for fire hose reels as shown on the drawings.

Allow to disconnect and remove from site the existing 30m fire hose reels.

C.9.1 **Fire Hose Reels**

Provide and install new 36m fixed type fire hose reels where indicated on the drawings. The final installation shall provide adequate coverage to all floor areas from a hose stream issuing from a 36m hose and nozzle. Install in strict accordance with manufacturer instructions supplied

C.10 **PORTABLE FIRE EXTINGUISHERS**

Fire extinguishers are existing. Allow to hang these existing extinguishers in accordance with code requirements. Fixings are subject to approval.

C.11 **PIPEWORK AND FITTINGS**

C.11.1 **General**

Acceptable materials and jointing procedures are defined below. Alternative materials and/or jointing procedures may be employed in accordance with AS 4118.

1. Pipework of 50mm nominal diameter or less:
Medium weight black steel to AS 1074, screwed and socketed.
2. Pipework above 50 mm nominal diameter:

- Medium weight black steel to AS 1074 flanged and welded.
- 3. Drain pipework of 25 mm nominal diameter or less:
Annealed copper tube to AS 1432 Type B with flanged or screwed union connections.
- 4. Drain pipework above 50 mm nominal diameter:
medium weight galvanised steel to AS 1074 screwed and socketed.

This section of the Specification covers the supply and installation of all piping systems including valves and associated fittings.

The drawings indicate the size of pipes and the manner in which the various systems are to be run. They do not, however, purport to show all minor pipework offsets, hangers, method of fixing and clearances, all of which must be co-ordinated and measured on site. Such co-ordination will include allowance for light fittings, ductwork structure, plumbing and other services. All piping arrangements shall be shown in detail on shop drawings and approved in general detail prior to commencement of installation.

All piping systems shall be complete with all valves, supports, vents, anchors, drains and fittings necessary for the full operation of the system and shall be connected to such items as pumps and ancillary equipment to the recommendation of the equipment manufacturers and in accordance with the requirements of the Regulatory Authorities, good engineering practice and to approval.

Irrespective of the need or otherwise for flexible connections, connection to pumps and similar equipment shall be arranged in such a manner as to eliminate undue strains and vibration in piping and equipment.

Prior to installation, all pipework shall be thoroughly cleaned and during installation, all open ends shall be kept covered in an approved manner to prevent the ingress of dust and general building debris. Responsibility shall be accepted for all damage to equipment due to dust and debris left in the pipework during installation.

All work shall be installed in an approved manner to meet structural and architectural conditions. Special care shall be taken to achieve a neat and workmanlike appearance and arrangement with all necessary provision for concrete shrinkage, thermal movement, grading, alignment and access for maintenance, to approval. All pipework shall be laid out and constructed such that it will be adequately free for contraction and expansion and shall be located with at least 50mm clearance between external surfaces of pipes, adjacent services or building structures. Provisions shall be made for replacement of each piped service without disturbing other services and that support hangers and brackets are independent.

C.11.2 Schedule of Piping and Materials

C11.2.1 General

The piping systems to be provided under this specification shall conform with the following requirements.

Service	Material	Grade Code	Fittings Jointing	Design Pressure	Working Pressure
Fire Sprinkler	Galvanised Mild Steel coupling or Black Mild Steel	AS1074 "medium" or Rollgrove	Flanged, Welded	1700 kPa	1200kPa
Fire Hydrant	Galvanised Mild Steel coupling	AS1074 "medium" or Rollgrove	Flanged, Welded	1700 kPa	1200kPa

Service	Material	Grade Code	Fittings Jointing	Design Pressure	Working Pressure
Fire Hose Reel	Galvanised Mild Steel or copper	AS 1074 "Medium" AS 1432 Type B	Screwed Capillary brazed	1300 kPa	1300 kPa
Diesel Exhaust	Black Mild Steel	AS 1074 "Mild"	Welded	N/A	
Pump/bleeds oil supply, air vents, drains	Copper	AS1432 Type B	Capillary brazed	N/A	

All piping shall be of the best available quality and shall be supplied clean in full standard straight lengths, free from any defects such as mill scale, rust, burns, dents, kinks and with all ends sealed against the ingress of foreign matter and protected against mechanical damage. All piping shall be kept in a clean condition at all times during storage, fabrication, installation and testing.

Where electro fusion welding is proposed qualified tradesmen are to have current competence certification from the manufacturer.

C11.2.2 Steel Piping

All steel tubing shall be of the ERW, continuous weld, butt weld or hot finished seamless carbon steel type complying with the requirements of AS 1074, AS 1835 and AS 1836, ATSM 53 Grade 'B', ASTM 106 or APL 15L Grade 'B' as appropriate.

All steel piping shall have wall thicknesses as suitable for the design working pressure specified. Steel tubes shall be of Australian origin where possible

Where galvanised pipework is used it shall be hot-dip galvanised. It shall be cold formed and electric resistance welded mild steel pipe made from hot-rolled steel strip and then Hot-dip galvanising after forming, welding and cutting to length shall protect the pipe internally and externally.

The wall thickness of pipes shall exceed those specified in Table 3.1.2 of AS 4118.2.1 - 1995, giving them a suitable pressure rating for use in AS 2118-conforming sprinkler systems.

The steel used to manufacture shall conform to the relevant requirements of ASTM A 135-01, providing improved resistance to impact at 0°C.

The hot-dip galvanised coating of pipes shall conform to the requirements of AS/NZS 4792. Coating Class HDG300, the minimum coating mass being 300 grams/m².

The pressure rating shall be suitable for use in sprinkler systems in accordance with AS 2118.1 and fire hydrant installations in accordance with AS 2419.1

Pipes shall be suitable for use with rolled-groove type couplings and fittings of suitable diameter and groove profile, also suitable for joining by shouldered-end couplings, or by butt-welding.

Hot-dip galvanised fire sprinkler and hydrant pipe shall comply with the requirements of;

1. SSL Active Fire Listing Scheme.
2. AS 4118.2.1-1995, Australian Standard, Fire Sprinkler Systems, Part 2.1: Piping-General.

3. Underwriters Laboratories Test Procedures and Follow-up Service.

C.11.3 Pipe Supports

Pipework shall be independently supported and not utilise supports, hangers or brackets provided for other services, such as ductwork, electrical cabling and ceiling suspension grids.

All pipes shall be adequately and substantially supported and appropriately restrained both horizontally and vertically by use of hangers, brackets, pedestals, clips and anchors designed to suit the requirements of each piping system.

All piping exposed to view shall be supported from common supports and shall be run in neat groups.

Where pipe supports and associated fittings are exposed to moisture or the external elements, they shall be hot dip galvanised after fabrication to AS 1650 and shall be isolated by non-conductive materials between dissimilar metals to approval.

Contact between dissimilar metals shall be prevented by non-conductive isolating materials between contact surfaces to approval.

C11.3.1 Support Loadings and Spacings

All piping shall be supported with hangers or pedestals designed to withstand the combined weight of pipe, pipe fittings, valves, fluid in the pipes and service and erection stresses and loads and shall be capable of keeping the pipe in proper alignment and shall not exceed the following recommended spacing.

Detail of all pipe supports shall be submitted for approval.

Where rolled grooved coupling joints of approved type are installed, pipework supports shall be provided at both sides of each coupling joint.

Spacings may be adjusted on approval, to other than specified where allowed by relevant standard codes or where recommended by the piping materials manufacturer.

All pipework shall be laterally restrained in a similar manner to maintain alignment under all conditions (at not greater than 6000 centres).

In addition to the above, consideration shall be given to providing supports at no further than 1m from any change of direction and at other specific locations as follows:

Pipework Function	Location of Support
Range of range run.	Not more than 2m from distribution or riser pipework connection and 1m from end
Distribution run.	Not more than 2m from main pipework connection and 1m from end of distribution
Mains	Not more than 1m from end of run.
Riser of riser.	May utilise supports from horizontal distribution pipework if support within 300mm
Joints	Refer to specific requirements for Rolled Grooved couplings.

C11.3.2 Pipe Clamps and Saddles

All clamps shall be rated for full load of pipe plus its fluid contents, flanges, valves and fittings. Where necessary, particularly in respect of pipe sizes of 200mm and larger, the spacings of the supports shall be reduced as necessary to be compatible with the rated carrying capacities of any selected clamps or saddles to the manufacturers specification.

All individual hanging pipes shall utilise 'U' clamps, pipe bands, shallow/deep clips, girder or beam clamp and saddle bracket in accordance with AS 2118 and manufacturers specifications.

Hook bolt type supports shall not be used for any pipe sizes. Similarly, slip lock pipe hangers shall only be restricted to supporting pipework ranges up to 50mm.

Allowance for movement due to thermal expansion and contraction shall be in the method of support, e.g. hanger rods or rollers and not between the pipe and the saddle or clamp. Vibration shall be absorbed by the use of anti-vibration hangers.

C11.3.3 Hanger Rods

All hanger rods and associated fittings shall be fabricated from hot dip galvanised or zinc plated mild steel bar.

C11.3.4 Fixed Supports

Where no allowance need be made for expansion, contraction or vibration, hanger rods may be fixed direct to floor slabs, structural members or to support brackets fixed to floor slabs, walls or structural members. Alternatively, the pipes may be clamped directly on to support brackets fixed to floor slabs, walls or structural members.

Where two or more pipes are to be run in parallel and adjacent to each other, they may be supported from common channel section rigid brackets or trapeze type supports fixed to floor slabs, structural members or walls as appropriate for pipe sizes up to and including 100mm. For pipe sizes larger than 100mm the supports shall be of standard rolled steel channel sections.

All proprietary type channel sections shall be installed and used strictly in accordance with the manufacturer's recommendations particularly in respect of maximum allowable loadings and within permissible stress limitations of AS 1250.

All supports shall comply with all appropriate Codes and Statutory requirements and all loadings on buildings floor slabs, structural members and walls shall be to the approval of the appropriate authority in this matter and no fixings to the building floor slabs, structural members or walls shall be made until such approval has been obtained.

All supports, brackets, pedestals and other ferrous fixings shall be fully detailed on shop drawings for approval prior to manufacture.

Pedestals for supporting pipes on the underside in the plantrooms and on roof areas shall be fabricated from mild steel, hot dip galvanised after fabrication and fixed firmly to floor slabs, structural members or wall brackets as appropriate and all to approval.

C.11.4 Jointing

C11.4.1 General

Joints may be made by any one of the following methods. Where a particular type of joint is shown on the drawings, this type shall be employed. Joints shall not be made within the thickness of walls of slabs.

C11.4.2 Black Steel Pipe

- Screwed and socketed up to 50mm size.
- Electric arc or gas welding, 65mm diameter or over.
- Welded-on flanges, 65mm diameter or over.
- Mechanical grooved coupling, 65mm diameter or over.

C11.4.3 Galvanised Steel Pipe

- Screwed and socketed, up to 50mm size.
- Screwed flanges, 65mm diameter or over.
- Underground pipe, 65mm diameter or over, to be welded and hot dip galvanised after fabrication.
- Mechanical grooved coupling, 65mm diameter or over.

C11.4.4 Copper Pipe

C11.4.4.1 Capillary Brazed Joints

Approved trade-line capillary fittings shall be used or alternatively, the end of the tube shall be expanded, by heating and using approved forming tools. Length of socket shall be adequate to develop full pipe strength.

Diametrical clearance shall be .12mm to .25mm. Clean all mating surfaces and braze with silver/copper/phosphorus rod. Tube ends shall be formed parallel, not belled. Capillary fittings shall be copper or bronze.

C11.4.4.2 Flanged Joints

Brass flanges, brazed as for capillary joints and fitted with brass nuts and bolts. Flanges to comply with AS B52.

C11.4.4.3 Flare Compression Joints

These may be used up to 20mm size except where vibration occurs. Flare fittings shall be copper or copper alloy.

C11.4.5 Screwed Joints

Screwed joints shall comply with AS 1722 and AS 1572. Threads shall be accurately cut to match the profile length and taper of the joining valve or fitting.

Screwed joints shall be made with fine hemp and an approved compound.

C11.4.6 Welding

All welding and welding procedures shall conform to the following codes and requirements:

- AS 1554 Metallic Arc Welding for mild steel construction.
- AS 1674 Fire Precautions in Cutting, Heating and Welding Operations.
- AS 1796 Certification of Welders and Welding Supervisors.

Welding shall be done only by qualified welders.

Any welder may be asked by the Principal to carry out a test weld. Should the test weld not meet the required standard the welder shall be removed from the project.

Welding or branch piping shall not protrude into the main pipe, which may cause flow restriction.

C11.4.7 Mechanical Grooved Coupling

Mechanical grooved couplings shall be approved by the Water Authority and the relevant Fire Authority.

Roll grooved couplings shall not be mechanically cut.

Gaskets shall be approved synthetic rubber, inserted in the groove using lubricant approved by the manufacturer. The roll Grooved coupling shall be capable of withstanding the pressure requirements of AS 2118 or other Codes relevant to that particular pipe material and pressures involved in the system.

C11.4.8 Flanges

Flanges shall comply with AS 2129 Flanges for Pipes, Valves and Fittings Code. Minimum pressure/temperature rating in accordance with Table 'E'.

Welded-on flanges shall be done with the pipe demounted. Screw threads of screwed flanges shall finish just inside the back of the flange boss.

Flanges and bolts shall be galvanised when joining galvanised piping.

C.11.5 **Drains and Vents**

All piping shall be installed so that the system can be drained. All drains and vents shall be valved, clearly labelled and installed in easily accessible locations.

Adequate drains and vents shall be provided in all pipes to permit complete emptying of pipes for service and the proper operation and testing of the installation. Drains shall be provided where the pipework is below the installation drain valves and also shall be provided at the lowest point of in-rack sprinkler piping.

C11.5.1 Drains

Drainpipes shall be run to the nearest waste point. All drip trays, pump gland wells, flow switches and parts of equipment in which water needs to be disposed of during normal operation shall be drained to waste with galvanised steel or copper pipe of at least 25mm nominal size.

Drain outlets over floor wastes shall be visible and run into a tundish if required, so that leakage may be observed.

All drainpipes shall be arranged to permit cleaning either by dismantling or rodding through. Union connections shall be provided where necessary to facilitate dismantling.

C11.5.2 Vents

Manual air vents shall be 10mm diameter.

All high points of pipework systems shall be vented.

C.11.6 Flexible Connections

Where installed flexible expansion joints shall be of the stainless steel bellows flanged or screwed end type, meeting the system pressure, temperature and vibration requirements and be installed in complete accordance with the recommendations of the manufacturer.

C.11.7 Valve Identification & Locks

All valves shall be marked for identification purposes. Each valve provided with operating handwheel shall have a circular aluminium or brass disc fixed under the valve handwheel retaining nut. The valve identification mark shall be stamped on the disc in symbols 10mm high.

Valves which have no operating handwheels shall be marked by aluminium or brass straps attached by wire to the bodies of the valves. The straps shall be 20mm wide by 90mm long, stamped in the same manner as the valve identification discs.

Details of all proposed identification marking numbers shall be submitted for approval at the appropriate time.

Where valves are required to be locked to comply with the relevant code, leather straps and padlocks shall be provided to approval. All locking facilities shall meet the requirements of the relevant Local Authority.

C.11.8 Gauge and Instrument Fittings

Pressure gauge tappings, pressure gauges and flow measurement fittings as shown on drawings, or where necessary, shall be installed for the successful operation, commissioning and recording of each system in accordance with all relevant Codes.

Approved pockets shall be installed in pipework for all gauges and instruments in positions where no adverse effects occur to flow conditions and of such material that electrolytic action is avoided (mild steel, bronze, stainless steel or brass as appropriate).

Bosses for pressure gauge tappings and similar purposes shall be of the standard inside fitted type, welded at right angles to the pipes and tapped as required for each application. The lengths and outside diameter of pipe bosses shall be kept to a minimum consistent with pipe sizes.

C11.8.1 Gauge Panels

All gauges on pump assemblies and similar equipment shall be neatly installed on to a pressed galvanised sheetmetal gauge panel painted to approval, located clear of vibrating equipment and where required, incorporate pulse snubbers or siphon connecting tubes.

Pet cocks or gate valves shall be used for isolation of pressure gauge connections and incorporate handles suitable for padlocking in "open" position to the requirement of the relevant Codes.

C11.8.2 Pressure Gauges

Pressure gauges shall be selected with scales suitable for the system pressure range, with normal standing or operating pressures located within the mid-point zone of the scale range and identified with red adjustable point.

C.11.9 Flow Measuring Devices

Connections for flow measuring devices shall be installed as required. These devices shall be of common manufacture and model throughout the project and shall be of the low-pressure loss type. Pitot tube type such as "Annubar" or approved equal shall be used. Unless otherwise specified, orifice plate types will not be accepted.

Flow measuring devices shall be installed in accordance with the instructions of the manufacturer and in locations providing adequate lengths of straight pipe on either side of the device in accordance with such recommendations.

A brass plate stamped to indicate all relevant piping data, gauge ranges and flow or temperature co-efficient shall be fixed to the pipe adjacent to the device.

One set of gauges designed for use with the flow measuring devices shall be supplied prior to completion of the project. The gauges shall be complete with suitable padded wooden or steel box to protect the gauges from movement and damage when being carried. The gauge scale range shall be suitable for use throughout the expected range of flow with the design flow at approximately mid scale.

C.11.10 Valves and Fittings

C11.10.1 General

All valves and fittings shall be the standard products of approved valve manufacturers as scheduled. A list of the proposed valves shall be submitted for approval prior to installation and in some cases, sample valves may be required to be inspected for approval.

Valves shall be entirely suitable and correctly sized for each application and unless otherwise shown shall be of pipeline size.

All valves and fittings shall be suitable for the system design pressure and in any case, not less than 1000 kPa design pressure.

All valves and accessories shall be installed in positions easily accessible for operation and maintenance. Pressure gauges and similar instruments shall be readily visible after installation. Valve packings shall be suitable for the duty and, upon completion of piping system and before placing it in service, such packings shall be examined and where necessary replaced.

The connection between each valve and adjacent lines shall be made with either flange or union to permit removal of the valve without dismantling piping. Flanges shall be suitable for the system design pressure and in any case, not less than Table 'E' of AS 2129.

All valves for services under the jurisdiction of a Regulatory Authority, shall be stamped with the approval of that Authority.

C11.10.2 Isolating Valves

- 50mm diameter or less:
 - Wedge type gate valves with cast gunmetal body, brass stem and gunmetal wedge of approved manufacture.
 - Full flow ductile iron butterfly valve.
- Above 50mm diameter:
 - Wedge type gate valves with cast iron body, brass stem, cast iron wedge with bronze disc ring seats and bronze seat of approved manufacture.
 - Full flow ductile iron butterfly valve.
 - Micro switch shall be provided to indicate the "On/Off" status of each isolation valve.

- The electrically monitored valves shall be equipped with micro switch mounting bracket for detection of hand wheel movement.
- Each stop valve shall be secured with "Open/Close" by a strap and padlock under the master key system and suitably labelled to identify the area of protection they control.

C11.10.3 Alarm Valves

Alarm valves shall be flanged and shall be of cast iron construction with bronze trim.

Alarm valves shall be of the vertically mounted type of approved manufacture.

Alarm valves shall be incorporated into an alarm valve assembly AS specified.

Alarm Valve to incorporate a facility to activate an alarm to the Fire brigade through the use of either a Flow Switch or Pressure switch however if it is the a pressure switch, it must be a potter manufacture with a retard setting Model WSFR-F

C11.10.4 Check Valves

Check valves shall be of the full swing type check type with bronze body and stainless steel disc and seat of approved manufacture. Check valves shall be of Tyco Manufacture Model CV-F1 or approved equal.

Check valves of 50mm nominal diameter or larger may be of the spring loaded, double-disc type subject to approval by the Architect.

C11.10.5 Pressure Switches

Pressure switches shall be double-acting, of the diaphragm, bellows or Bourdon tube type of approved manufacture.

Pressure switch for the control of fire pump shall be of proprietary made constructed of heavy gauge, dust proof steel casing with enamel finish suitable for mounting on pipe lead for hydraulic operation

The pressure switch shall be properly selected for the range and working pressure and shall have a sensitivity of better than 30 kPa.

The pressure switch shall be operated by mercury switch and shall have an external adjustable device

C11.10.6 Pressure Gauges

Pressure gauges shall be of the Bourdon tube type complying with the requirements of AS 1349.

Maximum scale reading and graduation intervals shall be in accordance with AS 2118.

C.11.11

C.11.11 **Painting and Corrosion Protection**

All pipework and equipment covered by this Specification shall be cleaned, primed and painted to the Principals' approval.

Cleaning shall be carried out using approved solvents and surface wire brush treatment as required to provide a satisfactory base for painting.

Primes shall be approved, anti-corrosive, metal primers. Galvanised pipework shall be primed with an approved acid-etch metal primer.

After priming, surfaces shall be painted with an approved undercoat, compatible with the subsequent finish coats.

Surfaces shall be finally painted with two finish coats of oil and petrol resistant Fire Brigade Signal Red enamel paint of approved manufacture. All exposed pipework will be painted including pumproom equipment as per AS 2941. Pipework identification shall be in accordance with AS 1345.

Any painting or finishing of pipework or equipment which is deemed by the Principal to be defective or to have experienced excessive deterioration during the Maintenance Period, shall be made good to the Principals' satisfaction at the Fire Services Contractor's cost.

C.12 CENTRIFUGAL PUMPS

C.12.1 General

Centrifugal pumps shall be of approved manufacture selected to comply with the requirements of this Specification.

Tenderers shall include provision for inspection of pumps and associated equipment by the manufacturer or his licensed representative, at least twice during the course of the installation.

Contractor to ensure adequate deterioration factor applied to pump care.

All pumps shall deliver the specified water quantities against the respective system resistances without objectionable noise and vibration. The scheduled duties are for estimating purposes only and may be altered to approval.

Responsibility shall be accepted for assessment of the actual resistance for each piping system and equipment installed.

All pressure drops through equipment offered shall, be allowed to suit the piping arrangements prepared as part of the shop drawings. The pump duties as scheduled herein shall not be used for technical purposes when ordering equipment.

Provide suitable start/stop push button together with pump running indicator lights and alarm buzzers adjacent to Fire Brigade Booster cabinet to enable fire personnel to exercise control of the Fire Hydrant Pumps.

Pumps shall be of ample design and construction to withstand the hydraulic and other forces encountered under normal operating conditions. Where pumps are required for direct connection to town mains, selection shall be made to ensure that each pump is capable of performing to maximum flow rate conditions as related to the most favourable building fire zone area for the particular Hazard Classification all as defined in AS 2118, AS 2941 and AS 2419 as applicable.

Prior to manufacture of such pump sets, performance curves relating to maximum and minimum duties combined with town mains input; characteristic duty at sprinkler valve set and/or hydrant outlet and square law curve for the most hydraulically favourable area of the particular installation, shall be submitted for approval.

In addition, pump suction sizes shall be provided at least one size larger than the discharge. Pipeline connection sizes shall be such that the suction pipe velocity does not exceed 4.0m/s at maximum flow rate conditions of the pump.

Valves with pump suction and discharge pipework shall be pipeline size and not pump suction or discharge sizes.

Pumps shall be of the centrifugal, back pullout, non-overloading, volute type operating at not more than 48 r/s and selected such that their impeller diameters do not exceed 90% of the maximum size impeller which can be fitted into the pump casing.

Pump construction shall be as follows:

Casings:	Good quality, close grained cast iron at ASTM A126 or A48 25 designed for 1400 kPa working pressure or 1½ times the actual discharge pressure whichever is the greater. Fitted with air vents, drains and inlet and outlet pressure gauge tapping.
Impellers:	Bronze to BS 1400 grade LG2 fully enclosed and dynamically balanced. Stainless steel shaft to AISI 416.
Casings	Wear
Rings and Shaft	Wear
Sleeves:	Bronze to BS 1400 grade LG2.
Bearings:	Ball or roller type effectively sealed to prevent loss of oil and entrance of dirt or water and selected for 100,000 hours operation.
Drives:	Direct-coupled with flexible spacer type coupling of the type that does not impose restriction of normal endplay or expansion. Key and lock coupling to shaft in a manner that pump or motor can be removed without disturbing the other.
Base:	Cast iron or fabricated steel of ample size to hold pump and motor in correct alignment.
Seals:	Seals shall be of the packed gland type with glands of gunmetal to AS 1565 alloy 83B or approved equivalent with graphited asbestos packing. Provide gland drain, 20mm dia. minimum, to waste point.

Each pump shall be fitted with an effective coupling, guard, complying with all Local Authority requirements and sufficient rigid to be free of vibration.

Each pump shall be accurately aligned with its respective motor and the pump manufacturers written approval shall be obtained to start each pump following the final alignment.

Fire service pumps shall be provided as identified in the Fire Pump Schedule Section of this Specification

C.12.2 Diesel Pump Engines

C12.2.1 General

Diesel engines shall be a naturally aspirated or supercharged direct coupled four stroke, solid injection, water cooled, high -speed diesel unit complying with AS 2941.

Governing of the unit shall be to AS 2789. Governors shall be capable of adjustment to set speed within +/- 4% of duty speed.

C12.2.2 Cooling System

The engine cooling system shall be of the arrangement detailed below:

Water cooled radiator/jacket system served by sprinkler/hydrant systems as applicable, during operation. System capacity shall not be affected by loss of water to the engine cooling circuit by arranging pump capacity to be increased to compensate if necessary.

The engine manufacturers acceptance of the cooling system proposed for installation shall be obtained and submitted.

The ambient temperature within the pump room for diesel engine operation shall be considered. The cooling system shall be sized for this application based on a maximum 10°C temperature rise when measured by water, radiator or air discharge outlet temperature.

The cooling water discharge shall be run to the nearest drain. Water discharge shall be visible and cooling water shall only circulate when the engine is operating.

C12.2.3 Fuel System

The diesel engine shall be suitable for operation using Class "A" fuel oil to BS 1864 or equivalent.

A fuel storage tank shall be provided with minimum capacity to operate the engine for a period of 4 hours at maximum performance condition.

Copper fuel piping shall be run from the fuel storage tank to the engine fuel inlet.

Connection to the engine shall be with adequate bends and fixings to avoid deterioration due to vibration. The oil pipework system shall be bled of air by means of screwed plug cocks. A gate valve shall be installed in the fuel line adjacent to the fuel tank and provided with a means of locking in the open position. A fuel filter of an approved type with readily replaceable elements shall be included adjacent to the engine in a easily accessible location.

C12.2.4 Starting and Control System

The diesel engine controller shall serve the diesel driven fire pump and the controller shall conform to the requirements of AS 2118, AS 2941 and AS 3000.

- The controller shall incorporate all circuits and associated with the following:
 - Automatic Starting (cyclic cranking))
 - Manual Starting
 - Speed Sensing
 - Alarm and Status indicating
 - Automatic Resetting to stand-by start position on shutdowns
 - Control circuit operation
 - Battery Low voltage indication (aural and visual)
 - Indicator lights and aural alarm test facility.
- The Indicator lights shall be of the filament (two individual type), neon or LED type. The voltage applied shall not exceed 80% of the rated voltage of the lights. All lights shall be accessible for accessibility and shall be colour coded as follows:
- Power Supply to fire pump controller – Green
- Phase Failure - Red

- Failure of engine to start automatically - Red
- Automatic Start Circuit disconnected - Red
- Pump Running – Red
- Battery Charger supply failure - Red
- Battery Low Voltage – Red
- Fuel Low Level - Red
- Aural Alarms silenced – Red
- The controller shall incorporate but shall not be limited to having the following features:
 - Duty Selector Switch (On/Off/Manual)
 - Voltmeter and Ammeter
 - Manual start pushbutton (6 starting attempts)
 - Pilot lamps for:
 - Controller not set to "ON"
 - Low oil pressure
 - High engine jacket temperature
 - Engine overspeed
 - Audible alarms at the pump station for conditions such as fail to start, power failure, low oil pressure, high engine jacket temperature etc.
 - Outlet contacts, voltage free bar external alarms such as fail to start and power failure, low oil pressure, etc.

The diesel driven fire pump shall be actuated upon the sensing of a drop of system pressure within the trunk main. The pressure sensors shall be set to operate when the pressure in the trunk main has fallen to a value of not less than the highest design pressure requirement for the system. Duplicated pressure sensors shall be provided in accordance with AS 2118 Fig. 4.12.1.

On receiving the signal to start the controller circuits shall perform the following functions:

- Activate the fuel system
- Open cooling water solenoid valve
- Crank the engine
- Disconnect the starting motor upon engine start
- Allow the engine to run until manually shutdown

If the engine shall fail to start after 6 starting attempts or 1-1/2 minutes of cranking, the controller shall disconnect the starter motor and activate the visual and audible alarm to indicate overcrank/failure to start.

A time delay relay shall be provided which will on receiving a signal from the electronically driven pump controller delay automatic starting of the diesel engine for 10 seconds.

Batteries shall not be installed in the Fire Pump Controller or below the fuel tanks, as per AS 2941.

C12.2.5 Starting System

Provision shall be made for both automatic and manual starting of the engine pump set.

The engine shall be capable of cold starting in ambient conditions, which may vary 5°C - 40°C, without the use of any form of heating, i.e. glow plugs or similar.

The engine shall accept full load and provide full pumping capacity within the minimum possible time from receipt of start up signal and shall not exceed 15 seconds.

Automatic starting shall be initiated by a fall in pressure in the water supply pipe and provide for several starting attempts with the starter capable of cranking the engine for a minimum of three (3) continuous minutes.

Manual starting shall be by crank handle (if engine size permits) or electric starter motor. For electric starter motor manual starting shall be arranged as an emergency provision comprising pushbutton non-locking switch protected by a lead/wire-sealed spring closing hood. The switch shall be wired in parallel with control pressure switches and without means of isolation. The manual start shall be labelled "EMERGENCY MANUAL START".

C12.2.6 Lubrication System

The engine shall be provided with an adequate self-contained lubricating oil system with sump capacity sufficient for at least 12 hours continuous operation at full load, without replaceable elements.

To enable sump to be easily drained, piping shall be run from sump connection clear of base and terminated in a suitable plugged valve.

C12.2.7 Exhaust System

Provide diesel exhaust pipework complete with thermal and acoustic insulation and galvanised steel so that it can discharge directly to outside air at a height above the ground level to be approved by the Architect or Consulting Engineers prior to fabrication and site installation.

The complete exhaust system shall be installed to the engine manufacturer's approval and designed to match the permissible backpressure on the engine under all load conditions.

Flexible exhaust connections shall be provided within the engine exhaust system.

Silencers shall be installed adjacent to the engine exhaust outlet and adjacent to the discharge point to ensure noise levels do not exceed the criteria specified by the Regulatory Authorities and acoustic report where provided.

Exhaust piping and silencers shall be located at a minimum height of 2200mm above pump room floor level unless otherwise shown. Suitable traps or dead legs shall be provided in the exhaust pipe system to prevent condensate drain to engine. Condensate drains shall be run to suitable sump or similar.

All exhaust pipes shall be insulated/lagged with 25mm high temperature sectional insulation finished with a fire retardant bonded surface where pipe is located less than 2400mm above floor level.

C12.2.8 Spare Parts and Tools

A suitably sized sheetmetal cabinet shall be installed within the Pump Room, located to approval or as indicated on the drawing.

The cabinet shall be constructed from 1.2mm thick galvanised sheetsteel fitted with chromium plated lockable handle and suitable catch.

The cabinet shall be painted to colour AS 2700 Signal Red No. 537 and labelled in white lettering with the words "SPARE PARTS AND TOOL KIT".

The cabinet shall be sized to contain the following:

- Standard kit of tools for complete diesel engine and pump set.
- Two sets of fuel and air filter elements and Seals.
- Two sets of lubricating oil filters elements and Seals.
- Two sets of belts where applicable.
- One complete set of engine gaskets, joints, washers and hoses.
- Two complete injectors.
- Workshop manual and parts identification schedule.

C.12.3 **Jacking Pump**

C12.3.1 General

Jacking pumps shall be supplied complete with the specified pumps, drivers, controls and ancillary items.

The pumping equipment shall be installed as recommended in the applicable standard and acceptable to the Regulatory Authority.

C12.3.2 Pump

The pump shall be vertical multistage centrifugal pump suitable for fire service application.

The pump shall not transmit hydraulic thrust loads to the electric motor and will be supplied with its own integral thrust bearing.

The mechanical seal of the pump shall have two silicon carbide faces and be of a standardised design.

The lower bearing of the pump shall be a plain bearing of the silicon carbide and lubricated by the pumped liquid. The lower bearing will be sited above the first impeller (to ensure the bearing is not affected by sedimentation from the pumped liquid).

C12.3.3 Electric Motor

The pump driver shall be a vertical flange mounted ball bearing induction motor. The motor shall have a minimum enclosure protection rating to IP54 and shall be of GRUNDFOS manufacture

C12.3.4 Fittings

The pump manufacturer shall supply brass 32NB pipe fittings, non-return valve on the pump discharge, suction and discharge lockable valves.

- A lockable test outlet for flow measurement shall be supplied to comply to AS 2941.
- A pipe union downstream of the suction valve and a pipe union upstream of discharge valve shall be provided to facilitate service as required by AS 2941.

A 63mm glycerine filled pressure gauge suitable for the unit working pressure shall be installed to indicate discharge pressure.

A hydro pneumatic diaphragm type tank shall be supplied that is suitable for the working pressure of the system.

C12.3.5 Electrical Fittings

The unit shall be controlled by a pressure switch set to activate the pump when the pressure at the unit falls below the required pressure. The pressure switch will stop the pump set when the hose reel has been turned off and the pressure rises to the required pressure. The unit shall be fitted with a device to prevent short cycling of the pump set and consequential motor burn out.

C.13 PORTABLE FIRE EXTINGUISHERS

C.13.1 Generally

C13.1.1 Scope

Handheld fire extinguishers with signage and fire blankets shall be provided throughout the building in accordance with the BCA requirements, the outcomes of the Fire Engineering Report and AS 2444.

C13.1.2 Fire Extinguishers

Supply and install fire extinguishers as indicated on the drawings, including mounting brackets and approved signage. Final location shall be determined on site to approval.

Extinguishers shall comply with AS/NZS 1841 and AS 2444.

C.14 FIRE DETECTION AND ALARMS

C.14.1 General

The Fire Detection and Alarm system is existing. Allow to make the alterations indicated and expand and reprogramme the system as required.

The Fire alarm installer shall be registered members of the Fire Protection Association of Australia (FPAA).

C.14.2 Fire Indicator Panel

The existing Fire Indicator Panel (FIP) and Sub-Fire Indicator Panels (SIP) shall be reused.

C.15 EMERGENCY WARNING AND INTERCOMMUNICATION SYSTEM

An Emergency Warning and Intercommunication System (EWIS) shall be installed throughout the building in accordance with this specification.

The prime function of an EWIS is to transmit alert signals, evacuation signals and verbal address clearly and reliably via speakers in emergency zones.

The system shall be provided with a microphone to enable announcements via a PA facility, and shall allow manual override control.

C.15.1 Master Emergency Control Panel

The Master Emergency Control Panel (MECP) shall be located adjacent the main FIP cubicle, with separate labelling to indicate the area served. All equipment shall be serviceable via front access only, by using plug in modules, with the field terminations accessible by opening the swing frame.

The MECP shall contain the Auto/Manual/Isolate/Public Address facility, and the common System Status controls and indicators.

A set of emergency operating instructions shall be mounted on the left hand side of the master control panel.

The Cabinet shall be a wall mounting cubicle with an internal swing frame. All equipment shall be serviceable via front access only, by using plug in modules, with the field terminations accessible by opening the swing frame.

The control sections of the equipment shall be secured by a locked door keyed to 003. All controls and indicators shall remain visible with the door closed.

The battery section shall be segregated from the main equipment section.

The operator's manual shall be accommodated in the inner side of the locked door.

The colour finish shall be Arch White or as nominated by Consultant.

The Control Panel shall contain the Auto/Manual/Isolate facility, the All Call facility and the common System Status controls and indicators.

A set of emergency operating instructions shall be mounted on the left hand side of the master control panel.

C.15.2 Automatic/Manual/Isolate Key Switch

C15.2.1 Automatic Position

In the Automatic Position the EWIS shall enter the programmed evacuation sequence when an alarm signal is received.

The switch key shall be removable only in this position.

A green indicator shall illuminate when the switch is in the automatic position.

C15.2.2 Manual Position

The purpose of this position is to take manual control of the building evacuation, irrespective of the state of the alarm signals.

The automatic initiation of an evacuation sequence shall be inhibited.

The system shall be reset (when required) by first acknowledging the alarm input, via the buzzer mute switch and then pressing the master reset switch.

C15.2.3 Isolate Position

This position shall not isolate the alarm inputs.

This key-switch position is local to the control panel. A green indicator shall illuminate when the switch is in this position.

C.15.3 **System Status Controls and Indicators**

C15.3.1 Buzzer Mute

When the BUZZER MUTE button is pressed, all outstanding alarm and fault conditions shall be acknowledged. All flashing indicators shall go steady, and the buzzer silenced. For system wide faults (see below), pressing the BUZZER MUTE shall acknowledge the fault.

System wide faults are:

- amplifier / speaker line faults
- alarm system fault
- communications fault
- system on batteries - if all ECP's remotely powered
- battery fault - if all ECP's remotely powered
- charger fail - if all ECP's remotely powered
- tone generator fail / microphone pre-amp fail
- module fault
- system fault

C15.3.2 Lamp Test Facility

The LAMP TEST shall be invoked by momentarily pressing the LAMP TEST button.

C15.3.3 Zone Status (Fault Diagnostics)

To aid in diagnosing the type of fault on an evacuation zone, three buttons shall be included on the Control Panel. These buttons shall represent the three types of evacuation zone faults that can occur, i.e. alarm system, amplifier/speaker line and visual indicator. When one of these buttons is pressed, only the zones with a fault present as represented by the push button shall have their OWS fault origin indicators illuminated. This facility shall be non-latching and therefore the OWS fault origin indicators shall return to their former state when the button is released.

There are twelve system status indicators. These shall illuminate as detailed:

Power On	-	when the control panel is operating from mains supply
System on Batteries	-	when the control panel is operating from batteries
Charger Fault	-	when the battery charger fails

Battery Fault	-	when the battery voltage drops below the lower limit
Battery Isolated	-	when the batteries have been isolated from the battery charger
Tone Fault	-	when the signal/speech generator has failed
ECP In Control	-	see MANUAL POSITION for the key-switch
CPU Fault	-	whenever the microprocessor controlling the control panel is held in RESET
Comms Fault	-	whenever a fault is detected in the communications bus
System Fault	-	whenever a module in the system has a fault
Module Fault	-	when any module in the system has failed
Microphone Fault	-	when the microphone

C.15.4 Emergency Warning System

Each evacuation zone shall have amplifier(s) and a number of associated speakers.

The EWIS shall have two possible types of alarm signal inputs to indicate that an emergency condition is occurring in the building. These are:

- Emergency Alarm Initiating Devices (EAIDS)
- Fire Alarm

These inputs shall be grouped according to the building evacuation zones.

When an input initiates an alarm signal, the EWIS if in automatic mode, shall initiate a preset evacuation sequence. The evacuation sequence shall sound the alert and the Evac signals to the evacuation zones within the building (and activating the visual alarm devices if installed) according to the pre-programmed evacuation sequence. The manual override shall cease the pre-programmed evacuation sequence, and output alert and Evac signals to evacuation zones as dictated via the EWIS panel control switches.

The EWIS shall provide full system status and fault indication facilities.

C.15.5 Occupant Warning System Zone Control Switches and Indicators

The control switches shall allow any of the audio channels to be switched to any of the zones. The Control Switches shall be inhibited when the OWS is in the AUTOMATIC state.

Pressing any of the control switches for an evacuation zone shall automatically cancel the previous selection for that zone, i.e. only one audio channel shall be assigned to a zone at any one time.

For each evacuation zone there shall be a set of control switches and associated indicators:

- CANCEL - Control switch only
- PA - Control switch and indicator
- ALERT - Control switch and indicator

- EVAC - Control switch and indicator

C15.5.1 Occupant Warning System Zone Fault

OWS Zone Fault indicator shall flash when a fault is detected by the MAIN EQUIPMENT on any of the wiring or components associated with that zone, and go steady when the fault is, acknowledged by the buzzer mute switch.

C15.5.2 Alarm Origin

Alarm Origin indicator shall flash when an input, associated with that zone, has been activated and go steady when the alarm is, acknowledged by the buzzer mute switch.

Fault and Alarm indicators shall not be inhibited by any key-switch operation.

C15.5.2.1 Signal Generator

This shall generate the alert and Evac signals to comply with the Australian Standard AS1670 clause 8.7.

When the alert signal is first initiated to a zone, the signal bursts shall increase in amplitude, starting at 50db down and increasing at 10db increments to full output by the sixth step.

The Evac signal shall have four bursts of Evac signal.

C15.5.2.2 Microphone

The Microphone shall be used for the PA facility. The microphone shall have a press to talk (PTT) switch.

C15.5.2.3 Zone Volume Adjustment

Each Amplifier shall have a volume adjustment on the front edge of the module. This may be field adjusted to suit.

C15.5.2.4 Emergency Alarm Initiating Device

The EAID on the control panel shall be one of the Alarm inputs for the evacuation zone that corresponds to the section of the building where the control panel is located.

C15.5.2.5 Power Supply/Charger

Provide a power supply/battery charger of modular construction. Each module is to be used in parallel and rated at 7.5 amps. As well as being modular the power supply must comply with AS2220 part 1 and 2.

Mains supply shall be 240V AC (+6% ± 10%) at 50Hz and installed in accordance with AS3000 and AS1670 - 1986.

C15.5.2.6 Batteries

Supply and install sealed lead acid batteries that comply with AS1670.

C15.5.2.7 Field Devices

All field devices shall:

- Be designed and installed in locations with a view to minimise the detrimental effects of moisture, dust, insects and other foreign materials.
- Be installed in accordance with manufactures recommendations.

C15.5.2.8 Speakers

All ceiling speakers shall:

- Have an overall maximum diameter of 100mm
- Have a multi-tap transformer
- Be supplied with a matching grill
- All horn speakers shall:
 - Have a minimum power rating of 10 watts
 - Be reflex horn type with a multi-tap transformer

C15.5.2.9 Visual Alarms

All visual alarms shall:

- Have an overall diameter of 100mm
- Incorporate a xenon tube

C15.5.2.10 Emergency Alarm Initiating Devices

All break-glass EAID's used as EAID's shall:

- Be white in colour
- Be approved to AS2036

C15.5.2.11 Testing

The system shall be tested in accordance with AS2220 Part 2 Appendix E, F, G and H and the results submitted to this office as part of the as installed drawings.

C15.5.2.12 System Test

Each control panel shall be equipped with a SYSTEM TEST button, to be used for commissioning and testing.

If the OWS system is in automatic and if the system test button is depressed, and then the key-switch moved from auto -> manual -> auto, and the system test button is released, then the zone off switches shall become active for 20 seconds. Depressing a zone off switch within 20 seconds will cause the evacuation sequence for that zone to be commenced. The sequence shall be aborted if the key-switch is moved, or the OWS receives an alarm input.

Similarly, if the OWS system is in the automatic mode, and the system test button is depressed, then the key-switch is moved to the isolate position and the system test button released, the system test button shall be active in the isolate state. With the system test button active, if it is depressed and then released, then the evacuation sequence for any zone shall commence by depressing the corresponding zone off switch within 20 seconds of releasing the system test button for the second time. The evacuation sequence shall be indication only, i.e. zone speakers and visual display devices are inhibited, and all time-outs are reduced to 5 seconds. The sequence shall be aborted if the key-switch is moved, or the OWS receives an alarm input.

C15.5.2.13 Operators Manual

Provide an operators manual detailing full operation of the system.

C15.5.2.14 System Cabling

The system cabling shall comply with the Australian Standards listed under rules and regulations of this document and follow the appropriate guidelines listed below.

C15.5.2.15 Control Panel to Speakers

A two core cable from each amplifier shall be installed to the first speaker and then looped to the other speakers in that zone. An E.O.L. resistor shall be installed across the 100V line at the last speaker of each zone.

C15.5.2.16 Master Emergency Control Panel to Visual Alarms

A two core cable shall be installed to the first pair of visual alarms and then looped to the other VA's in that zone.

A building occupant warning system is to be installed utilising the PA system and speakers to provide the tones.

Supply and install to the fire indicator panel an output module to initiate a building occupant warning signal. Liaise with the PA system installer as to the signal requirements and confirm compatibility of signal output with the input to the PA system. From the fire indicator panel supply and install fire rated cabling to the evacuation module of the PA system. The PA system installer will terminate the cable into the evacuation module. Allow to test the cable for the instruction of the PA system installer in the termination of the cable. Assist the commissioning of the building occupant warning system. Provide the relevant documentation to the PA system installer to confirm compliance of the system.

Refer to the Electrical Services section of the main Building Specification for details of the EWS and PA System and Relevant interface.

C.16 SOUND SYSTEM AND INTERCOM SYSTEM FOR EMERGENCY PURPOSES (SSISEP)

C.16.1 Automatic System Operation

An input alarm signal from the FIP shall initiate delivery of Alert tone to the associated zones for Stage 1 Alarm and following a pre-alert time delay of 120 seconds (adjustable from 0 to 300 seconds). Expiry of the pre-alert timer shall also initiate an alert timer set for normally 120 seconds and capable of adjustment from 20-200 seconds.

Should the alarm signal not be acknowledged at the MECP and/or ECPs before time out of the alert timer, Alert tone shall be delivered to the zone and Evacuate tones shall be delivered to the adjacent zones.

Delivery of warning tones shall continue to progress through the building until reset from the MECP/ECPs, notwithstanding restoration of the initiating FIP alarm signal.

Further FIP alarm signals shall cause the sequence of events as described above for such FIP alarms regardless of the number of other FIP alarms concurrent.

Evacuation Tone shall take precedence over Alert Tone.

C.16.2 Manual System Operation

From an MECP/ECP it shall be possible to manually initiate or reset the delivery of Action tone, Alert tone or Public Address announcements to any combination of, or all zones. Such manual selections shall override any automatically initiated signals.

All functions shall be subject to the following hierarchy of precedence, which shall not be capable of being overridden:

- Emergency PA Announcement (from ECP)
- Action Tone
- Alert Tone
- Local Zone Level (volume) Controls (where provided)
- Local and General PA Announcement
- Background Music
- The MECP shall be able to override the ECP.

C.16.3 Intercommunication

From an ECP it shall be possible to call and communicate with all or selected WIPs.

C.17 WIRING

Fire services wiring will comply with AS 3000 and the following specific requirements.

C17.1.1 General

All cable shall be unconditionally guaranteed and such guarantee shall cover replacement of faulty cable and full reimbursement of all costs involved.

Unless otherwise specified all cable shall have copper conductors and V75 grade PVC insulation, and sheathed where required as set out below.

TPS cables shall be used unless specified or noted otherwise.

In ceiling spaces, TPS cables shall be clipped to the roof structure or slab at a maximum distance of 900 mm between clips. Elsewhere, unless otherwise specified, TPS or PVC insulated cable shall be installed in conduit.

In all cases every cable shall be installed in a manner such that it is replaceable at any time without damage to the building.

All wiring shall be carried out under the loop in system and no joints or connectors will be allowed.

Unless otherwise specified wiring shall be carried out with 2.5mm² (7/067) for power circuits or 1.5 mm² (7/0.50) cable for indication/control circuits.

Generally, all wiring shall be concealed. Where unavoidably exposed, conduit shall only be installed as directed by the Architect.

At all times refer to drawings and requirements of other trades and services in particular plumbing and mechanical services and install all cables, cable ducts, conduits and fire services equipment clear of same.

C17.1.2 MIMS Cables

MIMS cables shall be 600V/600V class. All MIMS cable fittings shall be supplied and installed in accordance with the manufacturer's recommendations.

Accessories, tools and junction boxes shall be as recommended by the manufacturer and shall be similar to "Pyrotenax" manufacture.

PVC covered type MIMS cables and fittings shall be used where exposed to the weather, dampness or corrosion or where installed in contact with dissimilar metals.

Cables shall not be cut and left unsealed during installation. Immediately after cable is cut to length the end shall be sealed, if necessary temporarily.

All cables shall be fixed by means of brass or copper clips or saddles secured by brass pins or screws, which will not cause electrolytic corrosion with the cable or the support to which it is fixed. Bushes shall be provided where cables pass through dissimilar metallic materials.

Clips or saddles shall be spaced not more than 150mm on either side of a fitting, accessory or right angle bend and not more than 600mm apart elsewhere.

MIMS cables shall be properly dressed into neat and symmetrical forms.

MIMS cables may be run in the same duct or on the same tray as PVC/PVC cables. In such cases allowance shall be made for derating the PVC cables and an air gap of at least 25mm shall be maintained between MIMS and PVC cables.

C.17.2 Cable Enclosures and Materials

CONDUITING: Generally class B rigid PVC conduit shall be used except where exposed to mechanical damage or sunlight where galvanised screwed steel conduit or G.W.P. shall be used.

Where necessary PVC sheathed flexible Kopex conduit shall be used to enclose final connections to fixed equipment.

The minimum size conduit shall be 20mm. Except where conduit size is specified, conduits shall have capacity for one additional circuit.

Conduit sizes shown on drawings are for rigid conduit. If corrugated conduit being used select size to give equivalent internal diameter.

Conduits, unavoidably exposed shall be run square and plumb with building lines and as directed by the Architect. All conduit ends and boxes shall be plugged in an approved manner until permanent fittings are installed. The Builder shall be present at all times when concrete containing conduit is being poured.

Conduit in concrete shall be installed in accordance with AS 3600 Section 14. Generally this requires conduits in slabs to be installed between the top and bottom layers of reinforcing steel. In columns and beams conduits shall be inside the ligatures with clearance from longitudinal steel reinforcement no less than the concrete cover to the steel reinforcement.

A gap of at least 40mm shall be provided between parallel conduits.

Unless otherwise specified, no conduit fittings other than deep conduit boxes, couplings and unions shall be installed in concrete.

To change direction conduits shall be set.

Flexible joints shall be made at right angles across concrete expansion joints. The ends of the conduit shall be kept 19mm apart (across the joints) and belled to form a firm sliding fit inside a larger size conduit sleeve (200mm long minimum). The sleeve shall be taped to conduits with "Scotchwrap" to prevent ingress of slurry to the expansion joint. PVC accessories shall be used wherever possible.

Unless otherwise specified all joints in PVC conduit shall be welded.

One make of conduit, fittings and welding solution shall be used throughout.

Couplings on conduits shall be locknuttet. Conduit ends shall be bushed throughout.

Conduit boxes shall be proprietary units with conduit access facilities.

All joints in galvanised conduits and water pipe installations shall be made waterproof by use of "thread Seal Tape" or similar.

The ends of conduits shall be internally reamed clear of sharp edges and projections.

All spare conduits shall be provided with a suitable, durable draw-wire.

C17.2.1 Cable Trays

Cable trays shall be fabricated from perforated zincanneal sheet steel not less than 1.25mm thick.

Provide metal brackets, fixings at intervals such that deflection does not exceed 6mm at any point. Brackets shall be hot dipped galvanised.

Changes of direction shall be of radius not less than the minimum bending radius of the largest cable installed on the tray and shall be complete with transition pieces, plates etc. If the size is not specified, then trays shall have spare room to accommodate 30% extra cables.

C17.2.2 Cable Ducts

Shall be fabricated from not less than 1mm thick zincseal sheet machine folded with returned edges for rigidity.

Fixings shall be by means of metal thread screws through the bottom of the duct to that wall surface or to metal brackets provided by the Sub-Contractor. Brackets shall be hot dipped galvanised.

The ducts shall be complete with removable clip on lids fixed at each end with metal thread screws.

Changes of direction shall be of radius not less than the minimum bending radius of the largest cable installed in the duct and shall be complete with transition pieces, plates etc.

If the size is not specified then ducts shall be sized to give spare space for 30% additional cables without exceeding the requirements of AS 3000.

C.18 FIRE SYSTEMS COMMISSIONING

C.18.1 General

All necessary competent personnel, equipment and materials shall be provided to carry out testing and commissioning of the installation covered by this Specification, at a time agreed with the head contractor/Principal.

All tests shall be carefully pre-planned and scheduled to ensure that they are co-ordinated with the work of other relevant trades involved and that they are carried out in a safe and efficient manner with the minimum of inconvenience to all concerned.

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

The Principal and/or management of the building shall be advised regarding the nature of the tests, which shall be co-ordinated with them to minimise any possible hazards or inconvenience that may arise. In addition, the Engineer shall be notified at least 7 days before commencement of commissioning so that a representative may attend as necessary. Allow to attend on the tests of other interfacing trades where such trades require the operation of equipment or systems installed under this Specification.

Complete commissioning tests shall be carried out including:

- Water Systems - Static, flow and pressure tests.
- Automatic Fire Detection Alarm System.
- Electrical Systems - Controls and power circuits.
- Pump Sets - Capacity tests and operation.
- Gauges and Instrumentation - Functions, identification and operation.
- Test required by the Regulatory Authorities.
- EWIS operation.

All other testing, checking and adjusting shall demonstrate that the capacity of the installed equipment and systems complies with the Specification, Drawings, applicable Codes, Statutory requirements and Regulations.

All such commissioning and testing shall be completed prior to the certification of Practical Completion. Each item of equipment individually and each system as a whole, shall be checked and adjusted to approval to verify compliance with the design duties and generally as follows:

C.18.2 Testing of Piping

Each pipework system shall be tested as a whole or in sections as the work proceeds in accordance with all appropriate Regulatory Authorities and Australian Standard Code requirements and as follows.

Test pressures shall be applied during the construction period and prior to the pipelines being painted with each section being blanked until further tests are made.

Where necessary, all equipment shall be "blanked off" to prevent excessive pressures to equipment, seals or other similar parts of the system.

Care shall be taken that the pressures used do not overstress any part of the system due to working pressure or static head. If such is likely to occur, permission shall be obtained to vary the test condition.

Leaking joints in welded and silver soldered pipes shall be remade in accordance with the appropriate Australian Standard for the system being tested. Leaking joints in screwed fittings shall be fully remade and shall not be caulked. All faulty joints shall be retested after rectification and tests repeated as necessary until the entire system is satisfactory.

C.18.3 Water Systems

Flush out and thoroughly clean all water systems and equipment prior to start up of all Plant.

All water piping and connections to equipment shall be pressure tested to the requirements stated on the relevant Australian Standards.

All pressure and flow actuated controls, relief devices, bleeds, vents and drains shall be checked and proved to approval.

All water flow rates shall be adjusted to within 5% of the specified flow rates and in a manner to the approval of the Regulatory Authority.

Manufacturer's test certificates shall be provided for all proprietary manufactured items (such as tanks, pumps, diesel sets, system pressure vessels) required to operate under pressure and such certificates shall comply with the appropriate Clauses of this Specification and all applicable Codes, Statutory Requirements and Regulations.

C.18.4 Hydrant System commissioning tests

Commissioning shall be completed in accordance with the requirements of AS 2419 "Section 7, Testing" with all tests witnessed to the satisfaction of the Regulatory Authorities.

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

C.18.5 Sprinkler System commissioning tests

Commissioning shall be completed in accordance with the requirements of AS 2118, "Appendix B Completion Certificate" with all tests witnessed to the satisfaction of the Regulatory Authorities.

C.18.6 Fire Pumps Testing Procedure

Testing procedures shall be carried out strictly in accordance with AS 2941 where the pump sets are to be tested via a direct discharge to drain.

The solenoid test per floor is not a correct procedure for pump testing; which may result in development of excessive pressures as a result of sprinkler/hydrant design.

Testing procedures shall be arranged as follows:

- Pump Test - start up from full in combined reticulation system pressure, only from opening discharge valve to drain. The pumps should then be isolated.
- Floor Test - multiple testing of all floors to confirm pressure switch alarm.
- One pressure switch shall be tested for direct brigade alarm in a sequential manner, per week with all other pressure switches verifying only a floor identification at the FIP. This test shall be, carried out by operating the manual 15mm test valve to the floor system. It is also a requirement that the valve set serving that floor system is physically inspected.
- All remaining pressure switches shall be tested via the remote test panel.

- Test solenoids to be reset to allow automatic jacking pump to revert system to selected standing pressure. The 25mm bypass valve around the 3mm orifice can be opened to increase the rate of rise in pressure. Pump sets to be placed back on auto after standing pressure is achieved, to avoid over pressurisation/automatic starting.

C.18.7 Gauges and Instrumentation

All controls shall be adjusted and activated by competent personnel provided by the manufacturer or his authorised agent. A complete log of the settings and readings of all controls, gauges and instruments shall be maintained at suitable intervals throughout the commissioning period. These must include readings from all permanently installed gauges, ammeters and similar instruments.

In addition, portable instruments as necessary shall be provided to check the log readings for which permanent gauges or instruments may not have been provided including: Ammeter readings for all motors; Megger tests of all electrical equipment; Voltage tests; Speeds of all rotating equipment; Water flows and pressures in each system; Gas flows and pressures in each system; System response time.

Insulation resistance tests in accordance with AS 3000 shall be recorded for all new and/or altered alarm circuits as required in Appendix D, AS 1670.

Using a voltmeter with an accuracy of better than 0.5% of reading test battery charger output voltage under the following conditions:

- Input voltage of nominal - 10% - full load
- Output voltage shall vary by no more than 2% during these tests.
- The output current of the battery charger under short circuit conditions shall be measured and shall be not more than 120% of rated full load current.
- With the battery charger voltage plus 3% test the fire indicator board for correct operation by operating every switch on the board to every position.
- With the mains supply switched off and a voltage equivalent of 2.1 volts per cell applied to the battery leads, test the fire indicator board for correct operation by operating every switch on the board to every position. Verify operation of the ancillary equipment controls as applicable.

C.18.8 Electrical Systems

All materials and equipment shall be tested in accordance with the relevant publications of the Standards Institution both at the manufacturer's works and on site as applicable. Certificated manufacturer's test certificates shall be provided in duplicate within two weeks after the equipment leaves the manufacturer's works.

The complete installation shall be progressively and finally tested to ensure that it complies with the specification, is mechanically and electrically safe and that it will operate correctly under normal, emergency and fault conditions.

All control, protection and operative devices shall be checked for correct adjustment and rating. All test equipment shall be provided as required.

Record of test results shall be kept and two copies shall be provided at the completion of the work. The format shall be to approval.

All faulty materials and equipment shall be rectified free of charge. Faulty manufactured items shall be rectified by the manufacturer, again free of charge.

C.18.9 Tests at Manufacturer's Works

In addition to the clause above the following tests shall be undertaken:

- All termination and gland provisions shall be checked to ensure that they are suitable for all cables to be installed on site;
- All clamps, fixings and terminations shall be mechanically checked;
- All switchgear, contactors and control gear shall be mechanically and electrically operated as applicable.

C.18.10 Tests on Site

The following tests shall be undertaken on site:

- All clamps, fixings and terminations shall be mechanically checked;
- All power and control equipment shall be put into operation and tested under normal, emergency and fault conditions (power fault conditions may be simulated);
- All defective equipment including all faulty lamps shall be replaced.
- All phase identifications shall be checked to ensure they match throughout the installation. In this regard correct phase sequence will not be deemed sufficient proof.
- Long runs of conduits shall be checked to ensure that there are no expansion problems.
- MIMS cables shall be tested for insulation resistance immediately after installation and again at Practical Completion with a 500 V Megger and where readings of less than infinity are obtained, the termination shall be remade until a satisfactory reading is obtained, or the cable replaced.
- The operation all motors, starters, electrical interlocks, indicating/recording instruments, associated equipment, status indicating lights, associated flashers, relays and the like shall be checked with operation proven under working conditions.
- Resistance measurements on all motors and starters, including all new and/or altered alarm circuits, shall be carried out in accordance with AS 3000 and recorded as required in Appendix D, AS 1670.

C.18.11 Pump Sets

The testing of the complete diesel engine pump sets shall be completed to the satisfaction of approving authorities and the Engineer, in accordance with AS 2941 "Fixed Fire Protection Installation - Pumpset Systems".

Pre-delivery shop testing and certification shall be carried out as detailed in AS 2941 - Section 10 with performance test data sheets issued as described within Appendix B.

Following installation, commissioning shall be in accordance with Appendix D with reports issued for each pumpset and its associated ancillary system jacking pump.

C.18.12 Automatic Fire Detection Alarm Systems

Fire conditions shall be simulated for all thermal, flame, combustion and smoke detectors installed. Operation of all alarms, electrical relays and detectors shall be verified with heat and smoke intensities with time delays suitably

recorded. Detectors that fail to operate normally after two consecutive tests shall be rejected and replaced with a new detector.

Commissioning shall be completed in accordance with the requirements of AS 1670, "Section 6, Commissioning and Maintenance" with the appropriate following reports, records or statements, referred to therein, completed prior to granting of Practical Completion.

Appendix B - Standard Form of Installer's Statement for Fire Alarm System (including Certificate).

Appendix C - Fire Alarm Symbols.

- As Installed Diagrams (Block Layout Plans).

Log Book - Establish and locate at FIP.

Appendix D - Commissioning Test Report

In addition, system batteries shall be tested in accordance with the requirements of AS 2220, Part 2. Section 6, "Commissioning" with records completed as detailed in Appendix D.

Testing shall be carried out during normal operation of air conditioning plant or similar equipment. In the event of non-activation of combustion and smoke detectors due to specific air movement or distribution patterns, allowance shall be made for relocation of detectors to ensure correct sensing, operation and protection of the area intended.

C.18.13 SSISEP (formally EWIS)

Testing shall include as a minimum, all tests required by AS 1670.4 including:

- Sound level tests including adjustment of speaker levels.
- Indicator and control function confirmation.
- Full load battery tests.
- Functional and performance test of all WIPS.
- Tests of all alarm initiating devices and visual warning signals.
- Test of interface to the FIP.
- Test of all paging functions.
- Attendance at Authority tests.

C.18.14 Test Records

Test log sheets proposed to be used during the performance tests shall be submitted for approval at least 4 weeks prior to the commencement of the tests.

C.18.15 Test and Installation Instruments

All instruments and appliances necessary to complete the performance tests specified shall be supplied for the duration of the tests.

Gauges and instruments provided as permanent parts of the installation may be used during performance testing.

Test instruments proposed for use during performance testing shall all be checked for accuracy by the manufacturer or an approved laboratory. Calibration certificates shall be provided for each of the instruments to be used prior to the commencement of tests.

All instruments provided as part of the installation shall be checked and calibrated as specified above and again after 6 months of normal operation. Any instrument, which will not hold calibration shall be replaced.

C.18.16 Commissioning and Performance Data

Copies of all data recorded during commissioning of the installation shall be provided together with all necessary inspection certificates from authorities having jurisdiction and appropriate manufacturer's pressure test certificates and performance curves or tables for the following items:

- All pumps (including Q-H, NPSH and BKW curves applicable to the diameters and speeds of the installed impellers together with details of the installed, minimum and maximum impeller diameters).
- Manufacturing guarantees in respect to motors, tanks and other items requiring performance.
- Data covering all other specific items of equipment installed.
- Noise level tests.

Practical Completion will not be granted until all data, certificates and performance curves referred to above have been received and approved.

C.18.17 Handing Over

The following procedure shall be adopted prior to handing over the installation:

- All preliminary testing, checking, adjusting and verification of interlocks of the installation shall be carried out before forwarding notification that the installation is considered to have reached Practical Completion.
- After inspection and when the Regulatory Authority is satisfied and agrees that the installation is ready for handing over, the plant shall be finally commissioned and Operating and Maintenance Manuals, together with "as installed" drawings shall be provided.
- All spare sprinklers, spanners, engine spares and test instruments shall be supplied and in position.

Practical Completion will be certified only after the plant has been inspected and approved and the above requirements fulfilled.

C.18.18 Installation Block Plan

A block plan diagram shall be provided in the form of a permanent diagram constructed to resist water and fading. The diagram shall include the following information:

- The layout of the protected buildings and adjacent streets.
- A diagram of water supplies including sizes and locations of Supply Authority mains and valves (dimensioned), storage tanks (capacity and locations) and pump duties.

- The location of control valves, subsidiary stop valves, tail-end air valves, antifreeze devices, drains, air release valves, orifice plates, external sprinklers and any unusual features of the installation.
- The location and telephone number of the fire station to which the system is connected.
- The location of the main switchboard, distribution boards and starters and ratings of electrical services associated with all pumps and details of auxiliary power supply, if applicable.
- The location of the stock of replacement sprinklers.
- The year of installation of the system and of any major extension thereto.
- The height in metres above the installation gauge of the highest sprinkler used for the purpose of sizing the distribution pipework for each installation and hazard class the pressure/flow requirements when carrying out proving tests and details of the flow measuring devices installed to test each installation or section of the works.
- Where a sprinkler system is an extension or addition to an existing building, the block plan diagram shall clearly indicate the fire-protected areas of the whole building.

C.18.19 "As Installed" Drawings

At Practical Completion three (3) complete copies of all "as installed" drawings shall be supplied, correctly brought up to date to present true and accurate representation of the actual installation and to a scale of not less than 1:50.

The following shall be included in these drawings:

- Complete layout drawings showing fire and smoke alarms' actual size and locations of all pipes, sprinklers, valves, outlets and gauges and the final measured pressures at all relevant locations.
- Complete plantroom and/or equipment layout drawings with full identification of each and every item of equipment.
- Complete piping layout drawings showing the actual size and locations of all water and other lines applicable to the system(s).
- Complete electrical wiring schematics clearly showing terminal numbering system. Include on the drawings settings (actual and scale) of all time delays and overloads.
- Complete schematic flow and control diagrams of all water and electrical systems incorporated in the installation. The drawings shall show all motorised, automatic and hand-operated controls such as valves, relief valves, cutouts, flow measuring devices, solenoid valves, bleeds, vents, drains, strainers, gauges, bypasses, sight glasses and all similar items pertinent to the functioning of the installation.
- Where applicable the drawings shall include the settings, throttling ranges and differential bands of all controls, cutouts and other variable or adjustable items. All items must be clearly identified as to type and function.
- Also included should be readings of all pressure gauges across each item of equipment, including strainers.

The above drawings shall be neatly prepared and bound in the Installation Operating and Maintenance Manual, with one additional copy supplied on CAD (.dwg) file to suit the computer system advised during the construction period by the Engineer.

Where the quantity of drawings involved is too great to conveniently bind in the Operating and Maintenance Manual, then a separate matching cover shall be supplied for each of the drawing sets. Application can be made for approval to use full size drawings in this arrangement.

C.18.20 Operating and Maintenance Manual

On completion of satisfactory performance tests supply, prior to Practical Completion, three (3) copies of Operating and Maintenance Manuals.

The Manual shall include a full description of the installation and function of the various systems involved and instructions to cover every action necessary for the efficient operation and maintenance of the installations. The Manual shall be neatly prepared and bound in a blue vinyl hard-back folder with stamped lettering on the front

In addition, the words "OPERATING AND MAINTENANCE MANUAL" and the project name and the year of installation shall be stamped in lettering along the spine of each folder.

The contents of the Manual shall be in the following general format:

C18.20.1 Section 1 Index

The Index shall subdivide each section including lists of drawings, equipment and similar for quick reference.

C18.20.2 Section 2 General Description and Capacities

This section shall be subdivided between mechanical system and electrical system components.

Full details of each water system, automatic fire detection and alarm system, emergency warning system, electrical system, special hazards fire protection systems and equipment designed criteria/capacities and similar information shall be included as applicable. Such information shall also include the operating and maintenance requirements specifically detailed within the appropriate Australian Standards applicable for design, installation maintenance of these systems.

Copies of all data relating to commissioning testing/records shall be included as a sub-subsection of the individual system sub-sections applicable.

In particular, the electrical system sub-section shall include specific details of FIP/SIP and MECP/ECP equipment as applicable and incorporate the hard copies of microprocessor programme data, floppy disk copy and other associated documentation.

C18.20.3 Section 3 "As Installed" Drawings

This section shall include all "as installed" post contract drawings (minimum 1 x A3 set and USB/CD with soft copy).

C18.20.4 Section 4 Equipment

This section shall be subdivided as for Section 2 and shall list all system items of equipment installed complete with manufacturer's name, model and/or type no., serial no., size design ratings (i.e. all relevant data necessary for re-ordering or replacing).

All major pump equipment shall be broken down to individually identifiable items such as motors, engines, drive belts, bearings, glands and similar components.

C18.20.5 Section 5 Installation Maintenance & Operating Instructions

This section shall be subdivided as for Section 2 and manufacturer's installation, maintenance and operating instructions shall be included for each item of equipment, such as motors and pumps. A comprehensive maintenance schedule to be followed throughout the Maintenance and Defects Liability Period shall also be included.

C18.20.6 Section 6 Routine Testing Procedure

This section shall be subdivided into sub-sections, one for each system or functional sub system. Each sub-section shall describe, in clear English understandable to a non-technical person, the extent and frequency of routine tests to be undertaken pursuant to the applicable codes and requirements of the Authorities having jurisdiction. The latter requirements shall specifically include all particular requirements for the building concerned as specified by the Fire and/or Building Authorities. Liaise with interfacing trades to ensure description is consistent for all services.

C18.20.7 Section 7 Plant Operating Instructions

This section shall be subdivided as for Section 2 and a complete description and correct sequence of all actions necessary to start-up, operate and shutdown all plant for emergency operation shall be included. These instructions shall include full information on such items as normal and abnormal gauge readings, instrument settings and control points, differential time delays, oil levels, water temperatures and all similar relevant variable and adjustable items, to permit checking and adjustments where practicable and identification of hazardous conditions or malfunction of the plant. In addition, the instructions shall include information on the immediate action to be taken in the event of hazardous conditions arising and conclude with the following sentence in large lettering.

C18.20.8 Section 8 Certification and Warranties

Provide copies of all self certification, third party certification and plant and equipment warranties.

"FOR SERVICE - CALL (TELEPHONE NO.)"

C.18.21 Instructions in Plantrooms

Additional copies of the Operating Instructions shall also be framed behind glass or transparent plastic and mounted in a prominent position in the appropriate plantrooms. In addition, control and wiring diagrams shall also be framed and mounted in a similar manner to the abovementioned operation instructions.

C.18.22 Proprietor Instruction

The services of the Fire Protection Services Commissioning Engineer shall be required for up to 5 full working days during the Test and Commissioning period, to instruct the Proprietor's nominated representative in all details of the plant operation.

C.18.23 Power, Fuel and Water for Testing

All power, fuel, water and other facilities consumed prior to Practical Completion, shall be included in the works covered by this Specification.

Power, fuel and water consumed after Practical Completion will be provided free of charge by others.

C.18.24 Certification Approvals

Supply, compile and co-ordinate all requirements associated with the certification of essential services as required by BCA. This shall include submission to the Approving Authority, together with payment of fees, correlation of installers certified forms.

Obtain approval certificates from the local Municipal Council, Fire Brigade and all Regulatory Authorities.

The certified requirements shall be submitted to the Approving Authority with due consideration of programme for practical completion and/or handover to the Proprietor in order to obtain a Certificate of Occupancy/Classification.

C.19 BUILDING MANAGEMENT CONTROL SYSTEM (BMS) FIRE SERVICE INTERFACE INTERCONNECTION

C.19.1 General

This section of the Fire Services specification describes the extent of BMS Monitoring Functions which shall be:

- The Fire Services Contractor shall provide dry contacts in a Terminal Box as shown on BMS Function Schedule for BMS connections
- The Mechanical Contractor shall connect and terminate into the terminals provided on the Fire Services systems and complete the BMS.

The Fire Services Systems shall provide terminal connections and strips for the Alarm and Monitoring system as specified herein for BMS connections. Terminal connections shall be identified on the wiring diagrams.

The contractors shall co-ordinate everything necessary for the Fire Services and BMS requirements and testing.

C.20 TESTING AND MAINTENANCE

C.20.1 General

Testing, commissioning and maintenance of the entire installation, including all specified and required procedures during the construction period and for the duration of the Maintenance Period.

C.20.2 Testing

The Contractor shall:

- Make all necessary adjustment such that the complete installation is left in a satisfactory and reliable operating condition.
- Record adjustment particulars in the log book.
- On completion, but prior to leaving the site, test each circuit and all detectors.
- Service the whole of the system at his own expense during the defects liability period and construction period.
- Perform all tests as required by AS 2118, AS 2419 and AS 1670.

C20.2.1 Testing of Electrical Equipment

Test the completed installation in compliance with SAA Wiring rules "Testing of Installation" and other relevant clauses. Such tests shall include:

- Insulation between conductors
- Insulation between conductors and earth
- Earth resistance of connection equipment

- The Contractor shall also test and show that all outlets and fittings are correctly circuited.

The Sub-Contractor shall demonstrate the correct functioning of any emergency power system or equipment by isolating the normal power supply. Allow to carry out this test outside normal working hours.

The Contractor shall carry out tests of the fire alarm installation after completion, in the presence of the Principal and as further required by the FRNSW.

These tests shall include:

- Heat tests on all thermal detectors
- Smoke tests on all smoke detectors
- Alarm tests for all groups
- Fail-safe tests for all groups
- Isolation tests for all groups
- Any other tests deemed necessary by the Principal.

The results of all tests shall be entered in a logbook provided by the Sub-Contractor.

The Sub-Contractor shall provide all necessary testing equipment and any costs involved shall be borne by the Sub-Contractor.

C20.2.2 Pipework Testing

All pipework and equipment comprised in the Fire Sprinkler system shall be subject to a hydrostatic pressure test in accordance with AS 2118 and AS 2419.

Pipework sections shall be tested during construction prior to building in and/or painting.

Upon completion, each installation shall be similarly hydrostatically tested.

C.20.3 Commissioning

Upon completion of the installation, the entire system specified herein shall be fully tested and commissioned to the satisfaction of the Architect's representative and the relevant Authorities.

The commissioning and testing procedures shall include but not be limited to the following:

- Hydrostatic testing of all pipework systems as specified in "Pipework Testing" above.
- Flow and pressure tests on all installations.
- Functional testing of all flow, smoke and thermal alarms.
- Functional testing of the Fire Indicator Panel, including all group alarms, alarm output signals and plant control functions.

C.20.4 Principal Instruction

Provide experienced personnel to instruct the Proprietor's nominated representatives in the operation of the fire service equipment and systems.

C.20.5 Maintenance

Provide corrective maintenance and repair to all fire equipment and systems which become defective, or is found to be defective, during the Defects Liability Period, including the making good of any resulting damage.

In addition, provide preventative maintenance of the fire services for the full duration of the Defects Liability Period, in accordance with this section.

Prepare and retain copies of all service reports, including details of all preventative and corrective maintenance work carried out and copies of log book entries. At the completion of the maintenance period or at any other time when requested submit a copy of all records to the Architect.

C20.5.1 Preventative Maintenance

Generally, the routine preventative maintenance shall include the inspections, testing and such other checking as may be considered necessary at the time.

Notify the Proprietor's representative on arrival and log details of all visits.

Preventative maintenance shall be in accordance with AS1851-2005 and shall include all weekly, monthly, six-monthly and annual maintenance activities.

PART D. APPENDICES

D.1 APPENDIX A - TENDER SUMMARY

TENDER SUMMARY

Tenderers shall submit a breakdown of the total tender price including administration cost and profit for each section of the works. The amounts included in the Total Tender sum including overhead costs and profit margins are as follows:

(a)	Alterations to the existing Incoming water service pipework and reticulation to Fire Brigade booster cabinets	\$ _____
(b)	Fire System Pumpsets	\$ _____
(c)	Fire hydrant system alterations	\$ _____
(d)	Fire Sprinkler system alterations	\$ _____
(e)	Fire Hose Reel System alterations	\$ _____
(f)	Fire Detection System alterations	\$ _____
(g)	EWIS.	\$ _____
(h)	Portable Fire Extinguishers	\$ _____
(i)	Testing and Commissioning	\$ _____
(j)	Miscellaneous including:	
	- As Constructed Drawings, Operating and Maintenance Manuals	
	- Spare Parts Provision	
	- Painting and labelling of all equipment & materials	
	- Comprehensive Maintenance	
	- Training of the operators for proper operation of the entire system	\$ _____
	TOTAL TENDER AMOUNT (EXCLUDING GST)	\$ _____
	GOODS & SERVICES TAX (10%)	\$ _____
	TOTAL TENDER AMOUNT (INCLUDING GST)	\$ _____

NAME OF TENDERER: _____

CONTRACT: _____

Schedule of Technical Data

Note: This Schedule of Technical Data will be used for assessing tender submissions and will not relieve the Tenderer from compliance with the requirements of the specification. Code numbers, trade names, model numbers, classification, etc shall be thoroughly checked for compliance with the specification by the Fire Services Contractor prior to ordering any equipment.

D.1.1 EWIS

Manufacturer _____

Model _____

D.1.2 Jacking Pumps

Manufacturer _____

Model _____

Type _____

Capacity – l/s _____

Total Pressure – k/W _____

Motor Power – k/W _____

Motor Speed – -k/W _____

D.1.3 Diesel Pumps

Type _____

Capacity – l/s _____

Total Pressure – k/Pa _____

Motor Power – k/W _____

Motor Speed – r/s _____

Construction Material:

Casing _____

Impeller _____

Shaft _____

Seals _____

Base _____

Sprinkler Alarm Valves:

Manufacturer _____
Model _____
Type _____

NOTE: This form must be submitted in duplicate.

Dated.....this day of.....20xx

Signature of Tenderer.....

Company.....

Address.....

.....Phone.....

ASN Co Bay 5 Commercial Use

Fire Specification

1-3 Hickson Road – The Rocks

Prepared by:

Grant Backhouse
Project No. 33307

P:\33307\PROJECT DOCUMENTATION\FIRE PROTECTION\DESIGN\SPECIFICATION\FP-SP-003_TENDER.DOCX

Date:
23 February 2018

Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
T: (02) 8484 7000 **E:** sydney@wge.com.au **W:** www.wge.com.au

REVISION

Revision	Date	Comment	Prepared By	Approved By
001	15/12/2017	Preliminary Issue	GRB	GRB
002	21/12/2017	Tender Issue	GRB	GRB
003	23/02/2018	Tender Issue	GRB	GRB

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: Grant Backhouse

SIGNATURE:



CONTENTS

PART A.	PROJECT SPECIFIC INFORMATION	2
A.1	PROJECT OUTLINE	2
A.2	PROJECT SPECIFIC QUALITY ASSURANCE ITEMS	ERROR! BOOKMARK NOT DEFINED.
A.3	FIRE SERVICES GENERAL	ERROR! BOOKMARK NOT DEFINED.
A.4	PROJECT STATUS	ERROR! BOOKMARK NOT DEFINED.
A.5	APPROVED / PREFERRED FIRE SERVICES CONTRACTOR.....	ERROR! BOOKMARK NOT DEFINED.
A.6	SCOPE OF WORK	ERROR! BOOKMARK NOT DEFINED.
A.7	GREEN STAR REQUIREMENTS	ERROR! BOOKMARK NOT DEFINED.
A.8	FIRE SERVICES EQUIPMENT SCHEDULES	ERROR! BOOKMARK NOT DEFINED.
A.9	SPRINKLER TYPES.....	ERROR! BOOKMARK NOT DEFINED.
A.10	SYSTEMS INTERFACE AND CONTROLS.....	ERROR! BOOKMARK NOT DEFINED.
PART B.	TECHNICAL	ERROR! BOOKMARK NOT DEFINED.
B.1	GENERAL TECHNICAL REQUIREMENTS.....	ERROR! BOOKMARK NOT DEFINED.
B.2	SAMPLES AND DETAILS	ERROR! BOOKMARK NOT DEFINED.
B.3	SHOP DRAWINGS	ERROR! BOOKMARK NOT DEFINED.
B.4	MATERIALS AND WORKMANSHIP	ERROR! BOOKMARK NOT DEFINED.
B.5	INCOMING WATER SUPPLY	ERROR! BOOKMARK NOT DEFINED.
B.6	FIRE SPRINKLER SYSTEM.....	ERROR! BOOKMARK NOT DEFINED.
B.7	FIRE HYDRANT SYSTEM	ERROR! BOOKMARK NOT DEFINED.
B.8	FIRE HOSE REEL SYSTEM.....	ERROR! BOOKMARK NOT DEFINED.
B.9	PORTABLE FIRE EXTINGUISHERS	ERROR! BOOKMARK NOT DEFINED.
B.10	PIPEWORK AND FITTINGS	ERROR! BOOKMARK NOT DEFINED.
B.11	CENTRIFUGAL PUMPS	ERROR! BOOKMARK NOT DEFINED.
B.12	WATER STORAGE TANKS	ERROR! BOOKMARK NOT DEFINED.
B.13	PORTABLE FIRE EXTINGUISHERS	ERROR! BOOKMARK NOT DEFINED.
B.14	FIRE DETECTION AND ALARMS.....	ERROR! BOOKMARK NOT DEFINED.
B.15	BUILDING OCCUPANT WARNING SYSTEM	ERROR! BOOKMARK NOT DEFINED.
B.16	SOUND SYSTEM AND INTERCOM SYSTEM FOR EMERGENCY PURPOSES (SSISEP).....	ERROR! BOOKMARK NOT DEFINED.
B.17	WIRING	ERROR! BOOKMARK NOT DEFINED.
B.18	FIRE SYSTEM INTERFACING AND CONTROLS.....	ERROR! BOOKMARK NOT DEFINED.
B.19	FIRE SYSTEMS COMMISSIONING	ERROR! BOOKMARK NOT DEFINED.
B.20	BUILDING MANAGEMENT CONTROL SYSTEM (BMS) FIRE SERVICE INTERFACE INTERCONNECTION	ERROR! BOOKMARK NOT DEFINED.
B.21	TESTING AND MAINTENANCE	ERROR! BOOKMARK NOT DEFINED.
B.22	TACTICAL FIRE PLANS	ERROR! BOOKMARK NOT DEFINED.
PART C.	APPENDICES	ERROR! BOOKMARK NOT DEFINED.
C.1	APPENDIX A - TENDER SUMMARY.....	ERROR! BOOKMARK NOT DEFINED.
C.2	APPENDIX B - SCHEDULE OF CONTRACT RATES	ERROR! BOOKMARK NOT DEFINED.
C.3	APPENDIX C - QUALITY ASSURANCE CERTIFICATES.....	ERROR! BOOKMARK NOT DEFINED.
C.4	APPENDIX D - ESD SUMMARY	ERROR! BOOKMARK NOT DEFINED.
C.5	APPENDIX E - FIRE BRIGADE MINUTES	ERROR! BOOKMARK NOT DEFINED.

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

PART B. PROJECT SPECIFIC INFORMATION

B.1 PROJECT OUTLINE

B.1.1 General

B.1.2 Reference Documents

The following reference documents form part of this specification:

- Architectural Drawings.
- Structural Drawings.
- Services Drawings
- Fire Engineering Report
- BCA Compliance Report

The Fire Services work shall be in accordance with this specification and drawings the whole of which shall be deemed to constitute one document. .

No additional costs shall be allowed for works specified or required by the reference documents. The reference documents are available in full for inspection at Wood & Grieve Engineers' office.

B.1.3 Drawings

The following drawings shall form part of this Specification and shall be read in conjunction herewith.

WGE Project No.	Drawing No.	Drawing Name
33307-SYD-FP	FP -000	Cover Sheet
33307	FP -001	Notes and Legend
33307	FP-101	Site Plan
33307	FP-201	Ground Floor Fire Services Layout
33307	FP-202	level 1 Fire Services Layout
33307	FP-203	Level 2 Fire Services Layout
33307	FP-204	Level 3 Fire Services Layout
33307	FP-205	level 4 Fire Services Layout

The above drawing(s) and this Specification shall be considered as co-operative and any work omitted from one but inferred or present in the other shall form part of this Contract.

B.2 FIRE SERVICES GENERAL

Tenderers shall complete the attached Tender Form and shall provide a Schedule of Rates for the works specified (Refer Appendix A and B).

The Fire Services Contractor shall make full allowance for working with the design team to complete the fire services engineering design and preparation of fire services drawings "For Construction". "For Construction" drawings shall be submitted for approval.

The Sub-Contractor shall perform the work of this Contract in such a manner as to conform with the general building programme and shall provide for working in with other trades and Sub-Contractors under the general direction of the Builder in accordance with the clauses of the Conditions of Contract.

B.3 HERITAGE BUILDING

The proposed works will be located within a state significant heritage building. All areas of the building, adjacent to heritage fabric and surfaces are to be protected during works in accordance with a heritage construction management plan. The works are not to include any chasing into heritage walls or floor structures. the cutting of heritage walls for new fire doors is as documented.

A heritage construction management plan is to be submitted for approval prior to commencement of the works.

The proposed fire services system should maintain the reversibility of the existing system such that it is able to be removed without damage to any heritage fabric. the drawings and or specification should include information regarding the reversibility of the design

B.4 SCOPE OF WORK.

B.4.1 Scope of Work

The scope of works comprises the supply, installation, testing, commissioning, maintenance and defects liability, materials labour and equipment for the complete Fire Protection Services installation for ASN Co Building Bay 5 at Hickson Road, The Rocks.

The work shall include all necessary minor and incidental work required to implement the intent and meaning of this specification and associated drawings.

Whether or not the words "supply and install" appear in this Specification or on the drawings, unless clearly excluded, all items of equipment for the complete installation are required and shall be supplied and installed.

The scope of works is summarised below and set out in more detail in the Specification and on the Tender Drawings.

B4.1.1 General

- Fire sprinkler protection to the ASN Co Building Bay 5 building. Sprinkler protection shall be extended from the existing fire services infrastructure that serves the remainder of the ASN Co Building which is occupied.
- Fire hydrant protection to the ASN Co Building Bay 5 building by way of hydrant coverage from the fire stairs located in Bay 4.
- Provision of fire detection for smoke hazard management initiation, status indication and override control throughout the building. Fire Detection shall be extended from the existing fire services infrastructure that serves the remainder of the ASN Co building.

- Provision of an Emergency Warning and Intercommunication System (EWIS). The EWIS shall be extended from the existing fire services infrastructure that serves the remainder of the ASN Co building.
- Fire Brigade monitoring of the fire detection and sprinkler systems via the existing monitoring equipment
- Interfaces and coordination with other services and the building structure.
- Attendance at site and coordination with the main building program.
- Pipe sleeves to the Builder for installation. Packing of sleeves through the fire rated penetrations with approved mineral fibre, to maintain the fire rating. Packing of sleeves through sound rated partitions, to maintain sound rating.
- Cable trays in the fire/security ducts and ceiling space.
- Signs required by the Code and Authorities having jurisdiction.
- Detailed ("shop") drawings and schedules of equipment, fully depicting the entire installation, for approval prior to purchase or manufacture.
- All plant and scaffolding necessary for the execution of the Sub-Contract other than where permission is granted to use the Builder's scaffolding in position.
- Schedule of Fire Services separated from but coordinated with total project schedule, submitted for approval prior to preparation of shop drawings.
- Testing and commissioning plan.
- Manufacturers certified drawings, upon request.
- Samples, where specified, prior to placing orders.
- Operations and Maintenance manuals, including As-Constructed documentation.
- Testing and commissioning including payment of fees to Witnessing Authorities, the Consulting Engineer, the Superintendent and Third Party Certifier, including provision of materials such as smoke generators, etc.
- Attendance and participation in functional testing of smoke hazard management systems.
- Preventative testing and maintenance during the twelve (12) months period following practical completion.
- Comprehensive maintenance and warranty of all new and upgrade plant during the construction period and for the defects liability period in accordance with AS 1851.
- Miscellaneous and associated works as further specified.

The work shall include all necessary minor and incidental work required to implement the intent and meaning of this specification and associated drawings.

Whether or not the words "supply and install" appear in this Specification or on the drawings, unless clearly excluded, all items of equipment for the complete installation are required and shall be supplied and installed.

The scope of works is summarised below and set out in more detail in the Specification and on the Tender Drawings.

B.4.2 Incoming Water Supply

The incoming water supply is existing.

B.4.3 Fire System Infrastructure

The Fire System Infrastructure is existing and includes the following:

- Water Supply Grade 3 to comply with the Building Code of Australia and the requirements of AS 2118.1.
- Fire system pumps complete with piping valves and controls.
- Piping, pipe fittings, valves, pressure gauges, pipe hangers and support for the entire installation.
- Fire Brigade booster valve connection

B.4.4 Automatic Fire Sprinkler System

An Automatic Fire Sprinkler system shall be installed comprising, but not limited to, the following features:

- Provision of Ordinary Hazard Group 3 sprinkler protection based on the following design criteria:
 - Sprinkler spacing 4.0m x 3.0m maximum (FAST RESPONSE)
 - Sprinklers in operation 18 No.
 - Minimum sprinkler discharge 60LPM
- Reticulate sprinkler pipe work throughout the building with sprinkler heads as required for compliance with AS 2118.1 and as generally shown on the preliminary drawings, including concealed roof, ceiling and floor space sprinkler protection.
- Provision of sprinkler protection below Mechanical Ductwork.
- Provision of test valves, flow switches, solenoids and drains to replace the existing equipment.
- Interfaces with the fire detection and alarm system.
- Fully hydraulically calculated pipework to be submitted for approval and work sheets as necessary for the production of all pre-fabricated components and for information required by other trades and authorities.
- Submission of all necessary details to Authorities, before, during and after construction as required to ensure that the system complies with requirements and the obtaining of all necessary certificates, payment of all fees.
- Draining and refilling the sprinkler system where necessary.
- Provision of all new permanent signs, specifically
 - Location plate.
 - Emergency instructions at the main control valve.
- Provide a notice detailing the Fire Brigade's testing procedure.
- Third Party Certification.

B.4.5 Fire Hydrant System

- Provide fire hydrant protection at the ASN Co Building Bay 5 development.
- Provision of Block Plan, notice of test and working pressures and system details in brigade booster cabinet.
- Provision of Master Fire Service Block Plan to brigade booster cabinet.

B.4.6 Portable Fire Extinguishers

- Provide portable fire extinguishers to satisfy the requirements of the Building Code of Australia, FRNSW and the local authorities.

B.4.7 Fire Detection and Alarm Systems

A Fire Detection and Alarm system shall be installed comprising, but not limited to, the following features:

- Provision of fire detection and alarm systems as required in accordance with AS 1670.1:2015 and where indicated on the drawings. The system shall be extended from the existing building infrastructure.
- Provision of smoke detectors in “special risk” areas such as electrical switch rooms and lift motor rooms.
- Provision for all necessary interface with smoke hazard management systems via the existing Fire Fan Control Panel.
- Interfaces between fire detection and system and emergency warning system to provide automatic alarm notification.
- Interfaces with air conditioning, ventilation, EWIS and all other items of equipment which must operate under fire emergency conditions, as required by AS 1668.1:2015
- Supply and installation of fire rated cabling from the FIP to mechanical switchboards for initiation of air-conditioning and ventilation system shutdown.
- Supply, installation and wiring of detectors as shown on drawings.
- Supply and installation of circuits from the FIP to the security panel and automatic sliding doors to automatically release electric door locks.
- Supply, installation and wiring of flow and pressure switches to the sprinkler systems.

B.4.8 Emergency Warning and Intercom System (EWIS)

An EWIS shall be installed comprising, but not limited to, the following features:

- Extend the existing system throughout Bay 5 in accordance with AS1670.4:2015.
- Interconnect with the existing Master emergency control panel
- Speakers throughout all areas of Bay 5.

B.4.9 Shop Drawings

Provide shop drawings for all fire protection services, for approval prior to construction.

B.4.10 Painting

Allow to repair surfaces that are damaged during transit or installation process with paint suitable for application to the substrate i.e. galvanised surfaces shall be touched up with cold gal paint where damage repair is required.

B.4.11 Testing and Commissioning

Testing and commissioning of all works in accordance with the relevant Australian Standard and the Regulatory Authorities requirements.

B.4.12 Operating and Maintenance Manuals

- Provide Operating and Maintenance Manuals.
- Provide Operator's training to selected personnel.

B.4.13 Maintenance

Provide preventative inspection and maintenance during the Defects Liability Period.

B.4.14 Authority Approvals and Certification

Provide all certificates required by the Building Code of Australia and the Australian Standards for all services specified under this contract.

All necessary details shall be submitted to the Authorities, before, during and after construction as required to ensure that the system complies with requirements and the obtaining of all necessary certificates, payment of all fees.

Provide certification of the system at completion. Certification shall be provided by a person recognised as a "Competent Fire Safety Practitioner" as defined by the NSW Government Dept. of Fair Trading.

Arrange inspections by the FRNSW and obtain their approval of the installation.

Provide a notice detailing the Fire Brigade's testing procedure.

B.4.15 Other items

- Co-ordination of the fire protection services with all other building services.
- All plant and scaffolding necessary for the execution of the contract other than where permission is granted to use the Builder's scaffolding in position.
- Loading/unloading materials and handling to final position.
- Demonstration of the fire protection system operation for the Regulatory Authority and the Engineer's satisfaction.

B.4.16 Provision for Alterations

The fire services Contractor shall include the cost of the following future alterations.

- Relocation and/or addition of sprinkler heads based on 5% of total sprinkler heads in coordination with the architecture, structure and other building services.

- Relocation and/or addition of smoke detectors based on 10% of total detectors heads in coordination with the architecture, structure and other building services.
- All necessary associated works, such as system drain down, modification of FIP, re-inspection and testing etc, related to the above work.
- Should any costs associated with the above not be expended during the contract period such sums shall be deleted from the total contract sum.

B.4.17 Work by Other Trades

The following works and/or materials will be provided by other trades free of charge to the Sub-Contractor.

Details of these associated works, however, shall be provided to the respective trades by the Sub-Contractor in the form of dimensioned drawings, sketches and memorandums.

B4.17.1 Work Provided by Builder

- Wall, slab, and partition penetrations and making good including fire sealing to match the fire rating of the element being penetrated, as required.
- Build in all sleeves for penetrations and subsequent making good. The fire services contractor to supply all sleeves and provide adequate detailed drawings.
- Removal of tiles and ceiling suspension, as required for removal or installation of sprinklers, detectors and EWIS speakers.
- Removable panels and access hatches in plaster ceilings for access to equipment.
- Use of hoist to raise equipment to upper floors.
- Use of scaffolding when it is in place for Builder's use.
- Security storage and site shed accommodation.
- Temporary lights.
- Temporary 240 Volts power supply.
- Toilets and temporary water.
- Preparation of Contract documents.
- Supply one (1) set of Structural and Architectural drawings.
- Holes as required in ceiling for sprinkler heads and EWIS speakers to detailed drawings supplied by the fire services contractor including cutting ceiling tiles.
- Temporary access platform to sprinkler pipework and heads, smoke detectors and EWIS speakers required in high ceiling/roof areas.
- Assistance setting out.
- Supervision of building services co-ordination.

B4.17.2 Work Provided by Hydraulics Sub-Contractor

- Drawings to other trades for co-ordination.

B4.17.3 Work Provided by Mechanical Services Sub-Contractor

- Controls for air conditioning shutdown from Mechanical Services Switchboard.
- Drawings to other trades for co-ordination.
- Technically competent personnel, instruments and materials, to test air conditioners and air handling equipment start/stop procedures; in co-ordination with the fire services contractor.
- Terminal strips within mechanical services switchboard for connection of input signals between Mechanical Services installation and fire detection system.

B4.17.4 Work Provided by Electrical Services Sub-Contractor

- Drawings to other trades for co-ordination.

B.4.18 Services Interfaces

B4.18.1 Mechanical Services

The following signals are required to be provided to and from the Mechanical Services installation by way of volt-free contacts connected to the Mechanical Services Switchboards:

- General Fire Alarm

B4.18.2 Security Services

The following signals are required to be provided to the Electrical Services installation by way of high level digital interface to the respective Electrical Services Security Control Equipment:

- General Fire Alarm

PART C. TECHNICAL

C.1 GENERAL TECHNICAL REQUIREMENTS

Fire services installation to comply with the current edition of Building Code of Australia (BCA).

- The entire fire services installation shall comply with local Water Authority and FRNSW requirements.
- The entire fire services installation shall comply with current Australian Standards where applicable and particularly the following:

AS 1851 - 2012	Routine Service Maintenance of Fire Protection Systems and Equipment
AS 1668.1 – 2015	The use of ventilation and airconditioning in buildings – Part 1: Fire and smoke control in multi-compartment buildings
AS 1670.1 - 2015	Fire Detection, Warning, Control and Intercom Systems design, installation and commissioning – Part 1: Fire
AS 1670.4 - 2015	Fire Detection, Warning, Control and Intercom Systems design, installation and commissioning – Part 4: Sound systems and intercom systems for emergency purposes
AS 2118.1 - 2017	Automatic Fire Sprinkler Systems – General Requirements
AS 2419.1 - 2005	Fire Hydrant Installation – System Design, Installation and Commissioning
AS 2419.2 - 1994	Fire Hydrant Installation – Fire Hydrant Valves
AS 2419.3 - 1996	Fire Hydrant Installation – Fire Brigade Booster Connections
AS 2444 - 2001	Portable Fire Extinguishers and Fire Blankets
AS/NZS 3000 - 2007	Wiring Rules
AS 3500.1 – 2003	Plumbing and drainage – Part 1: Water Services
AS 4118.1.1 - 1996	Components – Sprinklers and Sprayers
AS 4118.1.2 - 1996	Components – Alarm valves (wet)
AS 4118.1.3 - 1995	Components – Water Motor Alarms
AS 4118.1.4 - 1994	Components – Valve Monitors
AS 4118.1.5 - 1996	Components – Deluge and pre-action valves
AS 4118.1.6 - 1995	Components – Stop Valves and Non-Return Valves
AS 4118.1.7 - 1996	Components – Alarm Valves (Dry)
AS 4118.2.1 - 1995	Components – Piping (General)

C.2 SAMPLES AND DETAILS

Samples of the items listed below shall be submitted for approval at least 2 weeks before approval is required. Samples shall be clearly marked with the manufacturers name and catalogue number.

After approval, samples will be available for incorporation in the works

- Smoke detector.
- Emergency Call Point device.
- EWIS speaker
- WIP phone.
- Sprinkler head (each type proposed and its intended location).

Manufacturers shall be provided for other system equipment and components as requested. Literature shall include detailed specification, physical appearance and size . Information shall be submitted at least 2 weeks before approval is required.

C.3 SHOP DRAWINGS

Refer to the Preliminaries for shop drawing requirements. Allow for the following additional requirements.

- Drawings shall be prepared using AS 1102 drafting standard symbols.
- Drawings shall be provided with a legend of symbols, where applicable.
- Shop drawings shall all be on the same size drawing sheets and shall be to the scale of not less than 1:100 and larger where necessary.
- Shop drawings shall be of the same size as the project drawings.
- Shop drawings shall include equipment nominal sizes and positional information by description or dimension.
- Shop drawings shall cover the following parts of the work:
 - Sprinkler system details and layouts
 - Fire detection and alarm systems
 - EWIS
 - Services support details for fixing to existing masonry and timber structure

Shop drawings shall be submitted electronically in .pdf format. Allow 2 weeks for return of shop drawings with approval and/or comments. When requested amend shop drawings and resubmit.

Note that shop drawings are reviewed for general principle of design only and approval of shop drawings by the Superintendent in no way relieves the Fire Service Contractor of his responsibility to comply with the requirements of this specification and associated drawings.

C.4 MATERIALS AND WORKMANSHIP

All materials, labour and plant shall be provided by the Fire Service Contractor unless otherwise specified. All materials shall be the best of their respective kinds and free from all defects.

Workmanship in each trade shall be carried out in a first class manner and in accordance with the true intent and meaning of this Specification and accompanying Drawings, General Conditions of Contract and to the entire satisfaction of the Architect.

All materials, equipment and work shall comply with the appropriate Australian Standard Specification or Code, or if such have not been prepared with the appropriate British Standard.

All materials, equipment and work shall also comply with the relevant rules and regulations laid down by any Statutory Authority having jurisdiction over such work, and shall conform with the requirements of Insurance Underwriter's Codes.

Any workmanship, materials or installation, which on inspection by such authorities, is found to require modification to be acceptable to the authority concerned shall be replaced, changed, modified, or otherwise put in a form to pass the relevant regulations. Such modifications shall be at the expense of the Fire Service Contractor and at no cost to the Proprietor.

The Fire Service Contractor shall take all necessary precautions with the supply and installation of equipment specified to prevent corrosion.

If, in the opinion of the fire services Contractor, equipment specified cannot be adequately protected against corrosion he shall request an instruction regarding same from the Architect.

Any component or accessory showing signs of rust or corrosion during the maintenance period shall be renewed or otherwise made good in an approved manner.

C.5 CERTIFICATION

The Fire Services Contractor shall engage the services of a person(s) recognised as a "Competent Fire Safety Practitioner" as defined by the NSW Government Dept. of Fair Trading, to inspect and certify the essential services fire systems under this contract and shall pay all associated costs to suit the construction program.

Certification attesting to compliance of the installation shall be obtained from the Competent Fire Safety Practitioner(s) and submitted upon completion of the works.

C.6 FIRE SPRINKLER SYSTEM

C.6.1 General Technical

Provide and maintain complete fully operational fire sprinkler system to the building in accordance with AS 2118.1:2017.

C.6.2 Areas to Be Protected

All areas of the ASN Co Bay 5 shall be protected in accordance with the requirements of the relevant Codes and Statutory Authorities and in accordance with the BCA compliance reports.

The fire services Contractor shall note that the specification and drawings indicate the minimum number of sprinklers required and the arrangement of sprinkler heads in the areas to be protected for tendering and co-ordination purposes only.

In ceiling sprinkler protection has not been fully coordinated with other services. The contractor shall make allowance for the provision of additional heads as required for compliance with AS 2118.1.

The Contractor shall obtain from the Architect and Builder final Architectural drawings and details of other services prior to final design of sprinkler head layout and pipework sizes and arrangement, which shall be in accordance with AS 2118.

C.6.3 Sprinkler Head Locations

Sprinkler head locations in all areas shall be as shown on the drawings.

Where head locations are dimensioned, the fire services contractor shall install the heads to the dimensions shown.

The fire services Contractor shall be responsible for all liaison and co-ordination with other trades to ensure that no clashes with other services occur. No variations to the Contract, due to negligence on the part of the fire services contractor in this respect, will be accepted.

Where clashes with other services occur, they shall be referred to the Architect for resolution prior to any fabrication and installation.

Notwithstanding the above, the Contractor shall be responsible for ensuring that the locations of all heads comply with the requirements of all Codes and Statutory Authorities referenced herein.

Discrepancies between this specification and the Codes and Statutory Authorities' requirements shall be referred to the Superintendent for resolution prior to any fabrication or installation. Variations due to abortive work resulting from failure to comply with this requirement will not be accepted.

C.6.4 Ancillary Work

The Contractor shall supply and install all ancillary pipework, wiring and equipment, other than that indicated necessary to form a complete installation.

C.6.5 Equipment

All equipment supplied shall comply with AS 2118 and AS 4118 and shall meet the following requirements.

C.6.6 Sprinkler Heads

Sprinkler heads shall be of the glass bulb fast response type.

Sprinkler heads shall be of Viking or Tyco/Grinnell manufacture, or approved equivalent.

All sprinkler heads shall be of one manufacture and the number of models or types used shall be kept to the practicable minimum.

The fire services Contractor shall supply to the Superintendent spare sprinkler heads of each type, in quantities in accordance with the recommendations included in AS 2118.

In addition, the fire services Contractor shall supply to the Superintendent a complete set of spanners or special tools required for removal and replacement of sprinkler heads.

Type	Location	Description
(a)	Ceiling (Tiled/Plasterboard)	15mm 68°C flush pattern type with coverplate soldered to head holders. Coverplate to be white, satin chrome finished or other colour approved

Type	Location	Description by Architect.
(b)	Exposed to view and/or affixed directly to pipe	15mm 68°C fast response low profile type.
(c)	Exposed to view and/or affixed directly to pipe located beneath roof	15mm 93°C fast response low profile type..

C.6.7 Sprinkler Guards

All sprinklers located less than 2,300 mm above the finished floor level, beneath stairs, or located in areas subject to damage, shall be provided with protective hard-wire chrome plated guards.

C.6.8 Stock of Spare Sprinklers

A stock of spare sprinklers shall be provided within the valve room complete with the necessary spanners required for replacement.

The sprinklers shall be stored with the spanners in a suitably sized sheetmetal cabinet painted to AS 2700 "Signal Red" No. 537 and labelled in white 25mm high letters with the words "SPARE SPRINKLERS".

Spare sprinklers shall be stocked for all types and/or temperature ratings installed within the protection systems but in any case shall not be less than the requirements of AS 2118.1.

C.6.9 Valves, Pipework and Fittings

See Separate Section for this item.

C.7 FIRE HYDRANT SYSTEM

C.7.1 Generally

Provide and maintain complete fully operational fire hydrant system to the building in accordance with AS 2419.1.

Provision of internal fire hydrant valves as shown on the drawings to provide coverage to all areas via a 10 metre hose stream issuing from 30 m of internal hose.

Provision for reticulated fire service from the fire main riser to all fire hydrant locations and incorporating monitored isolation valves interfaced with the main fire indicator panel.

C.7.2 Design Criteria

The fire hydrant system shall be capable of the minimum flow and pressure at the most disadvantaged point in the system, in compliance with the requirements of the Building Code of Australia and the relevant Australian Standards.

C7.2.1 Hydrants

The hydrant system flow rate and residual pressure shall satisfy the requirements of AS 2419.1 Table 2.1 to 2.3 and Table E2 respectively.

C7.2.2 Pipework

The hydrant pipework installation shall include all equipment sized to achieve the flows and pressure specified.

C.7.3 Fire Hydrants

Provide Fire Brigade approved 65 mm BIC pattern hydrant valves located at each level within the isolated staircase and as shown on the drawings. Install valves with spindle uppermost and hose connection orifice axis at 90° to ring main fire riser. Set valves with hose connection centre 1,000 mm above floor. Provide clip immediately under each hydrant valve and brace back to rigid structure.

C.7.4 Testing

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

Subject the adjusted system to performance tests as required by the Fire Brigade. Wait on and liaise with the Fire Brigade testing officers including fire pump manufacturer attendance at all Fire Brigade acceptance tests.

Subject the entire fire service to visual sighting and hydrostatic tests as required by the Water Corporation.

C.8 PORTABLE FIRE EXTINGUISHERS

Handheld fire extinguishers with signage shall be provided throughout all the buildings on site and located to AS 2444. Methods for fixing fire extinguishers to existing building fabric to be approved.

C.9 PIPEWORK AND FITTINGS

C.9.1 General

Acceptable materials and jointing procedures are defined below. Alternative materials and/or jointing procedures may be employed in accordance with AS 4118.

1. Pipework of 50mm nominal diameter or less:
Medium weight galvanised steel to AS 1074, screwed and socketed.
2. Pipework above 50 mm nominal diameter:
Medium weight galvanised steel to AS 1074 flanged and welded.
3. Drain pipework:
medium weight galvanised steel to AS 1074 screwed and socketed.

This section of the Specification covers the supply and installation of all piping systems including valves and associated fittings.

The drawings indicate the size of pipes and the manner in which the various systems are to be run. They do not, however, purport to show all minor pipework offsets, hangers, method of fixing and clearances, all of which must be co-ordinated with other trades, measured on site or ascertained from the drawings. Such co-ordination will include allowance for light fittings, ductwork structure, plumbing and other services. All piping arrangements shall be shown in detail on shop drawings and approved in general detail prior to commencement of installation.

All piping systems shall be complete with all valves, supports, vents, anchors, drains and fittings necessary for the full operation of the system and shall be connected to such items as pumps, tanks and ancillary equipment to the recommendation of the equipment manufacturers and in accordance with the requirements of the Regulatory Authorities, good engineering practice and to approval.

Irrespective of the need or otherwise for flexible connections, connection to pumps and similar equipment shall be arranged in such a manner as to eliminate undue strains and vibration in piping and equipment.

Prior to installation, all pipework shall be thoroughly cleaned and during installation, all open ends shall be kept covered in an approved manner to prevent the ingress of dust and general building debris. Responsibility shall be accepted for all damage to equipment due to dust and debris left in the pipework during installation.

All work shall be installed in an approved manner to meet structural and architectural conditions. Special care shall be taken to achieve a neat and workmanlike appearance and arrangement with all necessary provision for concrete shrinkage, thermal movement, grading, alignment and access for maintenance, to approval. All pipework shall be laid out and constructed such that it will be adequately free for contraction and expansion and shall be located with at least 50mm clearance between external surfaces of pipes, adjacent services or building structures. Provisions shall be made for replacement of each piped service without disturbing other services and that support hangers and brackets are independent.

C.9.2 Schedule of Piping and Materials

C9.2.1 General

The piping systems to be provided under this specification shall conform with the following requirements.

Service	Material	Grade Code	Fittings Jointing	Design Pressure	Working Pressure
Sprinkler	Galvanised Mild Steel coupling	AS 1074 "medium" Welded or Rollgrove	Screwed, Flanged, Rollgroove	2000kPa	1100kPa
Fire Hydrant	Galvanised Mild Steel coupling	AS1074 "medium" or Rollgrove	Flanged, Welded Rollgroove.	1700 kPa	1200kPa

All piping shall be of the best available quality and shall be supplied clean in full standard straight lengths, free from any defects such as mill scale, rust, burns, dents, kinks and with all ends sealed against the ingress of foreign matter and protected against mechanical damage. All piping shall be kept in a clean condition at all times during storage, fabrication, installation and testing.

Where electro fusion welding is proposed qualified tradesmen are to have current competence certification from the manufacturer.

C9.2.2 Steel Piping

All steel tubing shall be of the ERW, continuous weld, butt weld or hot finished seamless carbon steel type complying with the requirements of AS 1074, AS 1835 and AS 1836, ATSM 53 Grade 'B', ASTM 106 or APL 15L Grade 'B' as appropriate.

All steel piping shall have wall thicknesses as suitable for the design working pressure specified. Steel tubes shall be of Australian origin where possible

Where pipework is fabricated by way of welding it shall be hot-dip galvanised. It shall be cold formed and electric resistance welded mild steel pipe made from hot-rolled steel strip and then Hot-dip galvanising after forming, welding and cutting to length shall protect the pipe internally and externally.

The wall thickness of pipes shall exceed those specified in Table 3.1.2 of AS 4118.2.1 - 1995, giving them a suitable pressure rating for use in AS 2118-conforming sprinkler systems.

The steel used to manufacture shall conform to the relevant requirements of ASTM A 135-01, providing improved resistance to impact at 0°C.

The hot-dip galvanised coating of pipes shall conform to the requirements of AS/NZS 4792. Coating Class HDG300, the minimum coating mass being 300 grams/m².

The pressure rating shall be suitable for use in sprinkler systems in accordance with AS 2118.1 and fire hydrant installations in accordance with AS 2419.1

Pipes shall be suitable for use with rolled-groove type couplings and fittings of suitable diameter and groove profile, also suitable for joining by shouldered-end couplings, or by butt-welding.

Hot-dip galvanised fire sprinkler and hydrant pipe shall comply with the requirements of;

1. SSL Active Fire Listing Scheme.
2. AS 4118.2.1-1995, Australian Standard, Fire Sprinkler Systems, Part 2.1: Piping-General.
3. Underwriters Laboratories Test Procedures and Follow-up Service.

C.9.3 Pipe Supports

Pipework shall be independently supported and not utilise supports, hangers or brackets provided for other services, such as ductwork, electrical cabling and ceiling suspension grids.

All pipes shall be adequately and substantially supported and appropriately restrained both horizontally and vertically by use of hangers, brackets, pedestals, clips and anchors designed to suit the requirements of each piping system. All fixing details to be submitted for approval.

All piping exposed to view shall be supported from common supports and shall be run in neat groups.

Where pipe supports and associated fittings are exposed to moisture or the external elements, they shall be hot dip galvanised after fabrication to AS 1650 and shall be isolated by non-conductive materials between dissimilar metals to approval.

Contact between dissimilar metals shall be prevented by non-conductive isolating materials between contact surfaces to approval.

C9.3.1 Support Loadings and Spacings

All piping shall be supported with hangers or pedestals designed to withstand the combined weight of pipe, pipe fittings, valves, fluid in the pipes and service and erection stresses and loads and shall be capable of keeping the pipe in proper alignment and shall not exceed the following recommended spacing.

Where rolled grooved coupling joints of approved type are installed, pipework supports shall be provided at both sides of each coupling joint.

Spacings may be adjusted on approval, to other than specified where allowed by relevant standard codes or where recommended by the piping materials manufacturer.

All pipework shall be laterally restrained in a similar manner to maintain alignment under all conditions (at not greater than 6000 centres).

In addition to the above, consideration shall be given to providing supports at no further than 1m from any change of direction and at other specific locations as follows:

Pipework Function	Location of Support
Range pipe	Not more than 2m from distribution or riser pipework connection and 1m from end of range run.
Distribution pipe	Not more than 2m from main pipework connection and 1m from end of distribution run.
Mains pipe	Not more than 1m from end of run.
Riser pipe	May utilise supports from horizontal distribution pipework if support within 300mm of riser.
Pipe Joints	Refer to specific requirements for Rolled Grooved couplings

C9.3.2 Pipe Clamps and Saddles

All clamps shall be rated for full load of pipe plus its fluid contents, flanges, valves and fittings. Where necessary, particularly in respect of pipe sizes of 200mm and larger, the spacings of the supports shall be reduced as necessary to be compatible with the rated carrying capacities of any selected clamps or saddles to the manufacturers specification.

All individual hanging pipes shall utilise 'U' clamps, pipe bands, shallow/deep clips, girder or beam clamp and saddle bracket in accordance with AS 2118 and manufacturers specifications.

Hook bolt type supports shall not be used for any pipe sizes. Similarly, slip lock pipe hangers shall only be restricted to supporting pipework ranges up to 50mm.

Allowance for movement due to thermal expansion and contraction shall be in the method of support, e.g. hanger rods or rollers and not between the pipe and the saddle or clamp. Vibration shall be absorbed by the use of anti-vibration hangers.

C9.3.3 Hanger Rods

All hanger rods and associated fittings shall be fabricated from hot dip galvanised or zinc plated mild steel bar.

C9.3.4 Fixed Supports

Where no allowance need be made for expansion, contraction or vibration, hanger rods may be fixed direct to floor slabs, structural members or to support brackets fixed to floor slabs, walls or structural members. Alternatively, the pipes may be clamped directly on to support brackets fixed to floor slabs, walls or structural members.

Where two or more pipes are to be run in parallel and adjacent to each other, they may be supported from common channel section rigid brackets or trapeze type supports fixed to floor slabs, structural members or walls as appropriate for pipe sizes up to and including 100mm. For pipe sizes larger than 100mm the supports shall be of standard rolled steel channel sections.

All proprietary type channel sections shall be installed and used strictly in accordance with the manufacturer's recommendations particularly in respect of maximum allowable loadings and within permissible stress limitations of AS 1250.

All supports shall comply with all appropriate Codes and Statutory requirements and all loadings on buildings floor slabs, structural members and walls shall be to the approval of the appropriate authority in this matter and no fixings to the building floor slabs, structural members or walls shall be made until such approval has been obtained.

All supports, brackets, pedestals and other ferrous fixings shall be fully detailed on shop drawings for approval prior to manufacture.

Pedestals for supporting pipes on the underside in the plantrooms and on roof areas shall be fabricated from mild steel, hot dip galvanised after fabrication and fixed firmly to floor slabs, structural members or wall brackets as appropriate and all to approval.

C9.3.5 Anti-Vibration Hangers

Where vibration from equipment may be transmitted via the pipework, the pipework shall be supported from anti-vibration hangers.

Where an acoustic report specifies vibration isolation it shall be adhered to.

The minimum being anti-vibration hangers shall contain a spring and double deflecting neoprene cups in series. Neoprene cups shall have a minimum deflection of 9mm. Spring pitch diameters shall not be less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid, equal to 50% of the rated deflection. Hangers shall have a minimum total deflection of 15mm. All components of anti-vibration hangers, except the spring, shall be hot dipped galvanised.

The first three anti-vibration hangers adjacent to and for not less than 5000mm from vibrating equipment shall be as previously specified except that they shall be provided with the additional capability of holding the piping at a fixed elevation during the installation and shall also have a secondary adjustment to transfer the load to the spring and maintain the same position. Deflection shall be clearly indicated by means of a pointer and scale.

Shop drawings shall indicate the location and type of all anti-vibration hangers and shall include weights and selection procedure for each hanger.

C9.3.6 Anchors

Anchors shall be provided where necessary to provide reactions for expansion devices and flexible type connections to prevent excessive expansion or contraction forces in pipework from being transmitted to equipment.

On steel pipes, anchors may be either fully welded to pipe unless otherwise indicated on the drawings.

C.9.4 **Pipe Expansion**

Provision shall be made in all piping arrangements for expansion under operating conditions and for dimensional alterations to the building structure due to such factors as concrete shrinkage, wind loadings and earthquake codes as applicable to current regulations.

Where the above operating conditions are applicable and the pipe runs are straight in any direction for a distance of 30m or more, on one side of an anchor point, pipe deviations shall be provided to approval.

Where required, solid anchorages of welded structural steel construction shall be provided (set in concrete if necessary).

Where it is not practicable owing to space limitations to provide allowance for expansion as previously described, approved type stainless steel bellows may be used subject to these meeting the system pressure and temperature requirements.

C.9.5 Pipe Penetrations

Sleeves shall be provided at all pipe penetrations. Where pipework passes through walls, galvanised steel sleeves of 1.6mm minimum thickness shall be installed. Where pipework penetrates floor slabs, galvanised steel sleeves shall be installed which extend at least 100mm above the floor.

Where acoustic seals are required or necessary, the space between the pipe and the wall or floor sleeve shall be filled with high-density mineral wool or fibreglass insulation as an acoustic seal. The acoustic rating of the seal shall be equivalent to the partition through which the pipe passes or to achieve the noise level required in the quieter area.

Where pipes pass through firewalls or floors, all sleeves shall be removed and the space between the piping and the building structure shall be sealed with fire resistance seal of rating equal to that of the structure as approved by all Local Authorities.

C.9.6 Jointing

C9.6.1 General

Joints may be made by any one of the following methods. Where a particular type of joint is shown on the drawings, this type shall be employed. Joints shall not be made within the thickness of walls of slabs.

C9.6.2 Galvanised Steel Pipe

- Screwed and socketed, up to 50mm size.
- Screwed and/or flanged, 65mm diameter or over.
- Mechanical grooved coupling, all pipe sizes.

C9.6.3 Screwed Joints

Screwed joints shall comply with AS 1722 and AS 1572. Threads shall be accurately cut to match the profile length and taper of the joining valve on fitting.

Screwed joints shall be made with fine hemp and an approved compound.

C9.6.4 Welding

All welding and welding procedures shall conform to the following codes and requirements:

- AS 1554 Metallic Arc Welding for mild steel construction.
- AS 1674 Fire Precautions in Cutting, Heating and Welding Operations.
- AS 1796 Certification of Welders and Welding Supervisors.

Welding shall be done only by qualified welders.

Any welder may be asked by the Superintendent to carry out a test weld. Should the test weld not meet the required standard the welder shall be removed from the project.

Welding or branch piping shall not protrude into the main pipe, which may cause flow restriction.

C9.6.5 Mechanical Grooved Coupling

Mechanical grooved couplings shall be approved by the Water Authority and the relevant Fire Authority.

Roll grooved couplings shall not be mechanically cut.

Gaskets shall be approved synthetic rubber, inserted in the groove using lubricant approved by the manufacturer. The roll Grooved coupling shall be capable of withstanding the pressure requirements of AS 2118 or other Codes relevant to that particular pipe material and pressures involved in the system.

C9.6.6 Flanges

Flanges shall comply with AS 2129 Flanges for Pipes, Valves and Fittings Code. Minimum pressure/temperature rating in accordance with Table 'E'.

Welded-on flanges shall be done with the pipe demounted. Screw threads of screwed flanges shall finish just inside the back of the flange boss.

Flanges and bolts shall be galvanised when joining galvanised piping.

C.9.7 **Drains and Vents**

All piping shall be installed so that the system can be drained. All drains and vents shall be valved, clearly labelled and installed in easily accessible locations.

Adequate drains and vents shall be provided in all pipes to permit complete emptying of pipes for service and the proper operation and testing of the installation. Drains shall be provided where the pipework is below the installation drain valves and also shall be provided at the lowest point of in-rack sprinkler piping.

C9.7.1 Drains

Drainpipes shall be run to the nearest waste point. All drip trays, pump gland wells, flow switches and parts of equipment in which water needs to be disposed of during normal operation shall be drained to waste with galvanised steel or copper pipe of at least 25mm nominal size.

Drain outlets over floor wastes shall be visible and run into a tundish if required, so that leakage may be observed.

All drainpipes shall be arranged to permit cleaning either by dismantling or rodding through. Union connections shall be provided where necessary to facilitate dismantling.

C9.7.2 Vents

Manual air vents shall be 10mm diameter.

All high points of pipework systems shall be vented.

C.9.8 **Flexible Connections**

Where installed flexible expansion joints shall be of the stainless steel bellows flanged or screwed end type, meeting the system pressure, temperature and vibration requirements and be installed in complete accordance with the recommendations of the manufacturer.

C.9.9 Valve Identification & Locks

All valves shall be marked for identification purposes. Each valve provided with operating handwheel shall have a circular aluminium or brass disc fixed under the valve handwheel retaining nut. The valve identification mark shall be stamped on the disc in symbols 10mm high.

Valves which have no operating handwheels shall be marked by aluminium or brass straps attached by wire to the bodies of the valves. The straps shall be 20mm wide by 90mm long, stamped in the same manner as the valve identification discs.

Details of all proposed identification marking numbers shall be submitted for approval at the appropriate time.

Where valves are required to be locked to comply with the relevant code, leather straps and padlocks shall be provided to approval. All locking facilities shall meet the requirements of the relevant Local Authority.

C.9.10 Gauge and Instrument Fittings

Pressure gauge tappings, pressure gauges and flow measurement fittings as shown on drawings, or where necessary, shall be installed for the successful operation, commissioning and recording of each system in accordance with all relevant Codes.

Approved pockets shall be installed in pipework for all gauges and instruments in positions where no adverse effects occur to flow conditions and of such material that electrolytic action is avoided (mild steel, bronze, stainless steel or brass as appropriate).

Bosses for pressure gauge tappings and similar purposes shall be of the standard inside fitted type, welded at right angles to the pipes and tapped as required for each application. The lengths and outside diameter of pipe bosses shall be kept to a minimum consistent with pipe sizes.

C9.10.1 Gauge Panels

All gauges on pump assemblies and similar equipment shall be neatly installed on to a pressed galvanised sheetmetal gauge panel painted to approval, located clear of vibrating equipment and where required, incorporate pulse snubbers or siphon connecting tubes.

Pet cocks or gate valves shall be used for isolation of pressure gauge connections and incorporate handles suitable for padlocking in "open" position to the requirement of the relevant Codes.

C9.10.2 Pressure Gauges

Pressure gauges shall be selected with scales suitable for the system pressure range, with normal standing or operating pressures located within the mid-point zone of the scale range and identified with red adjustable point.

C.9.11 Valves and Fittings

C9.11.1 General

All valves and fittings shall be the standard products of approved valve manufacturers as scheduled. A list of the proposed valves shall be submitted for approval prior to installation and in some cases, sample valves may be required to be inspected for approval.

Valves shall be entirely suitable and correctly sized for each application and unless otherwise shown shall be of pipeline size.

All valves and fittings shall be suitable for the system design pressure and in any case, not less than 1000 kPa design pressure.

All valves and accessories shall be installed in positions easily accessible for operation and maintenance. Pressure gauges and similar instruments shall be readily visible after installation. Valve packings shall be suitable for the duty and, upon completion of piping system and before placing it in service, such packings shall be examined and where necessary replaced.

The connection between each valve and adjacent lines shall be made with either flange or union to permit removal of the valve without dismantling piping. Flanges shall be suitable for the system design pressure and in any case, not less than Table 'E' of AS 2129.

All valves for services under the jurisdiction of a Regulatory Authority, shall be stamped with the approval of that Authority.

C9.11.2 Isolating Valves

- 50mm diameter or less:
 - Wedge type gate valves with cast gunmetal body, brass stem and gunmetal wedge of approved manufacture.
 - Full flow ductile iron butterfly valve.
- Above 50mm diameter:
 - Wedge type gate valves with cast iron body, brass stem, cast iron wedge with bronze disc ring seats and bronze seat of approved manufacture.
 - Full flow ductile iron butterfly valve.
 - Micro switch shall be provided to indicate the "On/Off" status of each isolation valve.
 - The electrically monitored valves shall be equipped with micro switch mounting bracket for detection of hand wheel movement.
- Each stop valve shall be secured with "Open/Close" by a strap and padlock under the master key system and suitably labelled to identify the area of protection they control.

C9.11.3 Check Valves

Check valves shall be of the full swing type check type with bronze body and stainless steel disc and seat of approved manufacture. Check valves shall be of Tyco Manufacture Model CV-F1 or approved equal.

Check valves of 50mm nominal diameter or larger may be of the spring loaded, double-disc type subject to approval by the Architect.

C9.11.4 Flow Switches

Flow switches shall be of the double-acting, paddle type.

Flow switches shall initiate zone alarms in the main FIP.

Provide flow switches in the branch mains and to specific fire zone areas.

The flow switches shall be designed for 24 volt DC.

All flow switches shall be readily accessible for servicing.

Flow switches shall be of the glandless magnetic pole type incorporating a time delay to guard against false alarms due to pressure fluctuations in the system, Potter Manufacture VSR-FE- 2 on large diameter pipe and VSR-S on smaller diameter or approved equal.

Flow switches shall be installed in such a manner as to provide positive operation without restriction to water flow. Provide pipe enlargements if necessary.

The unit shall contain an adjustable 0-60 seconds instant recycling retarding device to prevent false alarm from surges.

C9.11.5 Flow Switch Test Valves

A flow switch test valve shall be installed downstream of each flow switch. Test valves shall be lever operated ball valves or plug cocks and shall be piped to discharge water to drain.

Flow switch test valves shall be installed in approved accessible locations.

C9.11.6 End of Line Test Valves

An end of line test valve shall be installed after furthest sprinkler head. It shall be a locked closed ball valve.

C9.11.7 Pressure Gauges

Pressure gauges shall be of the Bourdon tube type complying with the requirements of AS 1349.

Maximum scale reading and graduation intervals shall be in accordance with AS 2118.

C.9.12 **Painting and Corrosion Protection**

All pipework and equipment covered by this Specification shall be cleaned and have remedial touch up paint to the Architect's approval.

Cleaning shall be carried out using approved solvents and surface wire brush treatment as required to provide a satisfactory base for painting.

Galvanised pipework shall be primed with an approved acid-etch metal primer prior to applying cold gal touch up paint.

Any finishes that is deemed by the Architect to be defective or to have experienced excessive deterioration during the Maintenance Period, shall be made good to the Architect's satisfaction at the fire services Contractor's cost.

C.10 **PORTABLE FIRE EXTINGUISHERS**

C.10.1 **Generally**

C10.1.1 Fire Extinguishers

Supply and install fire extinguishers as indicated on the drawings, including approved mounting brackets and signage. Final location shall be determined on site to approval.

Extinguishers shall comply with AS/NZS 1841 and AS 2444.

C.11 FIRE DETECTION AND ALARMS

C.11.1 General

Supply and install a new fully addressable fire alarm installation throughout the ASN Co Bay 5 building. The system shall be an extension from the existing ASN Co building Fire Alarm system.

The fire alarm installation shall be carried out in accordance with the requirements of the FRNSW and the following Australian Standards, where applicable.

AS 1668.1:2015	The use of ventilation and air conditioning in buildings. Fire and Smoke control in multi-compartment buildings.
AS 1670.1:2015	Fire detection, warning, control and intercom systems. System design, installation and commissioning.
AS/NZS 3000	Wiring Rules.
AS 2118.1:2017	Automatic Fire Sprinkler Systems.

The Fire alarm installer shall be registered members of the Fire Protection Association of Australia (FPAA).

C.11.2 Detection Zones

Each of the following areas shall be configured as separate zones:

- Each Sprinkler Alarm Valve
- Each Level of the Building (all detectors)
- Each Fire-Isolated Stairwell
- Each Flow Switch

C.11.3 Smoke Detectors

Detectors shall be addressable type.

Smoke detectors shall be of the photo-optical type and mounted on plug-in type bases to allow easy replacement of detectors and shall be complete with LEDs to provide local visual indication when the detector initiates an alarm.

Where air sampling devices are required provide cut-outs in the ductwork as necessary and seal around the device after installation to prevent air leakage.

Detectors shall be the approved type and listed with ActivFire.

The location of smoke detectors as shown on the drawings is approximate only and may vary up to 2 metres from location shown to accommodate other services.

C.11.4 Additional Detectors

Allow to supply and install additional 10% of total installed photo-optical type smoke detectors (each complete with 20m of cabling) in addition to those shown on the drawings.

If a quantity of these additional detectors are not required then at the completion of the contract the contract sum will be adjusted in accordance with the schedule of unit rates.

C.11.5 Cabling

The fire alarm system shall be wired in stranded TPS cables with red sheath or in fire-rated cabling (Radox FR or Pyrotenax) where control functions are nominated. Ensure that any conduits required be embedded in concrete or built in during the course of the contract.

All cables entering the fire indicator board shall be coded with plastic ferrules indicating the relevant zones / loop. Each detector location shall consist of a deep conduit junction box finished flush with the underside of the ceiling or roof onto which the detectors shall be fitted. Full provisions shall be made on the Fire Indicator Board for the addition of a further eight (8) zones at some future date.

The FIP shall be complete with sealed lead acid batteries providing battery backup in accordance to Clause 8.2 AS 1670.

Supply and install all cable access and enclosures as required including cable trays, conduiting, and cable blockouts.

C.11.6 Mechanical Services Fire Mode

Provide cabling to initiate operation of the mechanical services generally in accordance with AS 1668 Fire Precautions in Buildings with Air Handling Systems. All cabling shall be Radox FR or Pyrolex.

The mechanical Services Contractor shall arrange for the mechanical services plant to shutdown in the event of a fire alarm.

Provide and terminate fire control circuits at terminal strips in the Mechanical Services Control Panels.

Closely co-ordinate and plan the installation with the Mechanical Services Contractor. Shop drawings for the Mechanical Services Fire Mode Controls shall be inspected and accepted by the Mechanical Services Contractor prior to submission for approval.

C.12 BUILDING OCCUPANT WARNING SYSTEM

An Occupant Warning System (OWS) or similar approved shall be installed throughout the ASN Co Bay 5 in accordance with this specification. The system shall be an extension from the existing ASN Co building Fire Alarm system.

The prime function of an OWS is to transmit alert signals, evacuation signals and verbal address clearly and reliably via speakers in emergency zones.

The OWS shall automatically initiate evacuation procedures within different areas of the building dependent on the origin of the alarm (i.e. "EVACUATE" in the active zone, or "ALERT" -> "EVACUATE" in the non-active zone).

The OWS shall automatically initiate evacuation procedures or be manually operated. The OWS shall also be used for non-emergency functions.

The system shall be provided with a microphone to enable announcements via a PA facility, and shall allow manual override control.

C.12.1 Rules and Regulations

The OWS shall comply with the current requirements of:

- AS1670.4:2015

- AS3000
- Building Code of Australia

C.12.2 Emergency Warning System

Each evacuation zone shall have amplifier(s) and a number of associated speakers. In sections of the building where background noise is high, visual alarm devices shall be used in addition to speakers. Each evacuation zone may have one of four audio channels. These channels are PA, Alert signal, Evac signal and Off. The Off channel shall be configured on site (via a jumper) on a zone basis to one of the following sources:

The OWS system shall have a microphone for the PA input, and a tone generator module (TGM), which is responsible for generating the alert and evacuation signals.

The OWS shall have two possible types of alarm signal inputs to indicate that an emergency condition is occurring in the building. These are:

- Emergency Alarm Initiating Devices (EAIDS)
- Fire Alarm

These inputs shall be grouped according to the building evacuation zones.

When an input initiates an alarm signal, the OWS if in automatic mode, shall initiate a preset evacuation sequence. The evacuation sequence shall sound the alert and the Evac signals to the evacuation zones within the building (and activating the visual alarm devices if installed) according to the pre-programmed evacuation sequence. The manual override shall cease the pre-programmed evacuation sequence, and output alert and Evac signals to evacuation zones as dictated via the OWS panel control switches.

The OWS shall provide full system status and fault indication facilities.

C12.2.1.1 Speakers

All ceiling speakers shall:

- Have an overall maximum diameter of 100mm
- Have a multi-tap transformer
- Be supplied with a matching grill

All horn speakers shall:

- Have a minimum power rating of 10 watts
- Be reflex horn type with a multi-tap transformer

C12.2.1.2 Testing

The system shall be tested in accordance with AS1670.1 requirements and the results submitted to this office as part of the as installed drawings.

C.13 EMERGENCY WARNING AND INTERCOM SYSTEM (EWIS)

C.13.1 Automatic System Operation

An input alarm signal from the FIP shall initiate delivery of Alert tone to the associated zones for Stage 1 Alarm and following a pre-alert time delay of 120 seconds (adjustable from 0 to 300 seconds). Expiry of the pre-alert timer shall also initiate an alert timer set for normally 120 seconds and capable of adjustment from 20-200 seconds.

Should the alarm signal not be acknowledged at the MECP before time out of the alert timer, Alert tone shall be delivered to the zone and Evacuate tones shall be delivered to the adjacent zones.

Delivery of warning tones shall continue to progress through the building until reset from the MECP/ECPs, notwithstanding restoration of the initiating FIP alarm signal.

Further FIP alarm signals shall cause the sequence of events as described above for such FIP alarms regardless of the number of other FIP alarms concurrent.

Evacuation Tone shall take precedence over Alert Tone.

C.13.2 Manual System Operation

From an MECP it shall be possible to manually initiate or reset the delivery of Action tone, Alert tone or Public Address announcements to any combination of, or all zones. Such manual selections shall override any automatically initiated signals.

All functions shall be subject to the following hierarchy of precedence, which shall not be capable of being overridden:

- Emergency PA Announcement (from ECP)
- Action Tone
- Alert Tone
- Local Zone Level (volume) Controls (where provided)
- Local and General PA Announcement
- Background Music
- The MECP shall be able to override the ECP.

C.13.3 Intercommunication

From an ECP it shall be possible to call and communicate with all or selected WIPs.

C.14 WIRING

Fire services wiring will comply with AS 3000 and the following specific requirements.

C14.1.1 General

All cable shall be unconditionally guaranteed and such guarantee shall cover replacement of faulty cable and full reimbursement of all costs involved.

Unless otherwise specified all cable shall have copper conductors and V75 grade PVC insulation, and sheathed where required as set out below.

TPS cables shall be used unless specified or noted otherwise.

In ceiling spaces, TPS cables shall be clipped to the roof structure or slab at a maximum distance of 900 mm between clips. Elsewhere, unless otherwise specified, TPS or PVC insulated cable shall be installed in conduit.

In all cases every cable shall be installed in a manner such that it is replaceable at any time without damage to the building.

All wiring shall be carried out under the loop in system and no joints or connectors will be allowed.

Unless otherwise specified wiring shall be carried out with 2.5mm² (7/067) for power circuits or 1.5 mm² (7/0.50) cable for indication/control circuits.

Generally, all wiring shall be concealed. Where unavoidably exposed, conduit shall only be installed as directed by the Architect.

At all times refer to drawings and requirements of other trades and services in particular plumbing and mechanical services and install all cables, cable ducts, conduits and fire services equipment clear of same.

C14.1.2 MIMS Cables

MIMS cables shall be 600V/600V class. All MIMS cable fittings shall be supplied and installed in accordance with the manufacturer's recommendations.

Accessories, tools and junction boxes shall be as recommended by the manufacturer and shall be similar to "Pyrotenax" manufacture.

PVC covered type MIMS cables and fittings shall be used where exposed to the weather, dampness or corrosion or where installed in contact with dissimilar metals.

Cables shall not be cut and left unsealed during installation. Immediately after cable is cut to length the end shall be sealed, if necessary temporarily.

All cables shall be fixed by means of brass or copper clips or saddles secured by brass pins or screws, which will not cause electrolytic corrosion with the cable or the support to which it is fixed. Bushes shall be provided where cables pass through dissimilar metallic materials.

Clips or saddles shall be spaced not more than 150mm on either side of a fitting, accessory or right angle bend and not more than 600mm apart elsewhere.

MIMS cables shall be properly dressed into neat and symmetrical forms.

MIMS cables may be run in the same duct or on the same tray as PVC/PVC cables. In such cases allowance shall be made for derating the PVC cables and an air gap of at least 25mm shall be maintained between MIMS and PVC cables.

C.14.2 Cable Enclosures and Materials

CONDUITING: galvanised steel conduit shall be used.

The minimum size conduit shall be 20mm. Except where conduit size is specified, conduits shall have capacity for one additional circuit.

Conduits exposed to view, shall be run square and plumb with building lines and as directed by the Architect. All

One make of conduit, fittings and connecting solution shall be used throughout.

All joints in galvanised conduits and water pipe installations shall be made waterproof by use of "thread Seal Tape" or similar.

The ends of conduits shall be internally reamed clear of sharp edges and projections.

All spare conduits shall be provided with a suitable, durable draw-wire.

C.15 FIRE SYSTEMS COMMISSIONING

C.15.1 General

All necessary competent personnel, equipment and materials shall be provided to carry out testing and commissioning of the installation covered by this Specification, at a time agreed with the head contractor/superintendent.

All tests shall be carefully pre-planned and scheduled to ensure that they are co-ordinated with the work of other relevant trades involved and that they are carried out in a safe and efficient manner with the minimum of inconvenience to all concerned.

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

The owners and/or management of the building shall be advised regarding the nature of the tests, which shall be co-ordinated with them to minimise any possible hazards or inconvenience that may arise. In addition, the Engineer shall be notified at least 7 days before commencement of commissioning so that a representative may attend as necessary. Allow to attend on the tests of other interfacing trades where such trades require the operation of equipment or systems installed under this Specification.

Complete commissioning tests shall be carried out including:

- Water Systems - Static, flow and pressure tests.
- Automatic Fire Detection Alarm System.
- Electrical Systems - Controls and power circuits.
- Test required by the Regulatory Authorities.
- EWIS operation.
- Interface with Air Handling Equipment and Security systems.

All other testing, checking and adjusting shall demonstrate that the capacity of the installed equipment and systems complies with the Specification, Drawings, applicable Codes, Statutory requirements and Regulations.

All such commissioning and testing shall be completed prior to the certification of Practical Completion. Each item of equipment individually and each system as a whole, shall be checked and adjusted to approval to verify compliance with the design duties and generally as follows:

C.15.2 Testing of Piping

Each pipework system shall be tested as a whole or in sections as the work proceeds in accordance with all appropriate Regulatory Authorities and Australian Standard Code requirements and as follows.

Test pressures shall be applied during the construction period and prior to the pipelines being painted with each section being blanked until further tests are made.

Where necessary, all equipment shall be "blanked off" to prevent excessive pressures to equipment, seals or other similar parts of the system.

Care shall be taken that the pressures used do not overstress any part of the system due to working pressure or static head. If such is likely to occur, permission shall be obtained to vary the test condition.

Leaking joints in welded and silver soldered pipes shall be remade in accordance with the appropriate Australian Standard for the system being tested. Leaking joints in screwed fittings shall be fully remade and shall not be caulked. All faulty joints shall be retested after rectification and tests repeated as necessary until the entire system is satisfactory.

C.15.3 Water Systems

Flush out and thoroughly clean all water systems and equipment prior to start-up of all Plant.

All water piping and connections to equipment shall be pressure tested to the requirements stated on the relevant Australian Standards.

All pressure and flow actuated controls, relief devices, bleeds, vents and drains shall be checked and proved to approval.

All water flow rates shall be adjusted to within 5% of the specified flow rates and in a manner to the approval of the Regulatory Authority.

Manufacturer's test certificates shall be provided for all proprietary manufactured items (such as tanks, pumps, diesel sets, system pressure vessels) required to operate under pressure and such certificates shall comply with the appropriate Clauses of this Specification and all applicable Codes, Statutory Requirements and Regulations.

C.15.4 Hydrant System commissioning tests

Commissioning shall be completed in accordance with the requirements of AS 2419 "Section 7, Testing" with all tests witnessed to the satisfaction of the Regulatory Authorities.

Subject the commissioned fire system to a series of pre-inspection tests during which time all necessary adjustments are to be undertaken to achieve perfect operation in accordance with Fire Brigade requirements.

C.15.5 Sprinkler System commissioning tests

Commissioning shall be completed in accordance with the requirements of AS 2118, "Appendix B Completion Certificate" with all tests witnessed to the satisfaction of the Regulatory Authorities.

C.15.6 Combined System commissioning tests

Subject the adjusted system to performance tests as required by the Fire Brigade. Wait on and liaise with the Fire Brigade testing officers including fire pump manufacturer attendance at all Fire Brigade acceptance tests.

Subject the entire fire service to visual sighting and hydrostatic tests as required by the Water Corporation.

Tests shall be in accordance with those prescribed for independent fire hydrant systems but further incorporating additional tests as follows:

- Hydrostatic test to each pressure zone at the most hydraulically advantaged hydrant, i.e. highest point in a multi-storey installation per zone, to not less than 1000 kPa.
- Concurrent flow of both sprinkler and hydrant systems utilising an annubar or "specific sprinkler test millcock" located adjacent to the hydrants.
- An end of line test per pressure zone, i.e. most remote section of the sprinkler system.

Any major adjustment necessary to water flow rate shall be made by changing pump impeller sizes. Minor adjustments shall be by installation of orifice plates to approval. Equipment used to regulate final flows shall be clearly and permanently marked as to position or orifice size. Suitable spacers shall be provided at each pump discharge line for the installation of orifice plates as required.

C.15.7 Fire Pumps Testing Procedure

Testing procedures shall be carried out strictly in accordance with AS 2941 where the pump sets are to be tested via a direct discharge to drain.

The solenoid test per floor is not a correct procedure for pump testing; which may result in development of excessive pressures as a result of sprinkler/hydrant design.

Testing procedures shall be arranged as follows:

- Pump Test - start up from fall in combined reticulation system pressure, only from opening discharge valve to drain. The pumps should then be isolated.
- Floor Test - multiple testing of all floors to confirm pressure switch alarm.
- One pressure switch shall be tested for direct brigade alarm in a sequential manner, per week with all other pressure switches verifying only a floor identification at the FIP. This test shall be, carried out by operating the manual 15mm test valve to the floor system. It is also a requirement that the valve set serving that floor system is physically inspected.
- All remaining pressure switches shall be tested via the remote test panel.
- Test solenoids to be reset to allow automatic jacking pump to revert system to selected standing pressure. The 25mm bypass valve around the 3mm orifice can be opened to increase the rate of rise in pressure. Pump sets to be placed back on auto after standing pressure is achieved, to avoid over pressurisation/automatic starting.

C.15.8 Gauges and Instrumentation

All controls shall be adjusted and activated by competent personnel provided by the manufacturer or his authorised agent. A complete log of the settings and readings of all controls, gauges and instruments shall be maintained at suitable intervals throughout the commissioning period. These must include readings from all permanently installed gauges, ammeters and similar instruments.

In addition, portable instruments as necessary shall be provided to check the log readings for which permanent gauges or instruments may not have been provided including: Ammeter readings for all motors; Megger tests of all electrical

equipment; Voltage tests; Speeds of all rotating equipment; Water flows and pressures in each system; Gas flows and pressures in each system; System response time.

Insulation resistance tests in accordance with AS 3000 shall be recorded for all new and/or altered alarm circuits as required in Appendix D, AS 1670.

Using a voltmeter with an accuracy of better than 0.5% of reading test battery charger output voltage under the following conditions:

- Input voltage of nominal - 10% - full load
- Output voltage shall vary by no more than 2% during these tests.
- The output current of the battery charger under short circuit conditions shall be measured and shall be not more than 120% of rated full load current.
- With the battery charger voltage plus 3% test the fire indicator board for correct operation by operating every switch on the board to every position.
- With the mains supply switched off and a voltage equivalent of 2.1 volts per cell applied to the battery leads, test the fire indicator board for correct operation by operating every switch on the board to every position. Verify operation of the ancillary equipment controls as applicable.

C.15.9 Electrical Systems

All materials and equipment shall be tested in accordance with the relevant publications of the Standards Institution both at the manufacturer's works and on site as applicable. Certificated manufacturer's test certificates shall be provided in duplicate within two weeks after the equipment leaves the manufacturer's works.

The complete installation shall be progressively and finally tested to ensure that it complies with the specification, is mechanically and electrically safe and that it will operate correctly under normal, emergency and fault conditions.

All control, protection and operative devices shall be checked for correct adjustment and rating. All test equipment shall be provided as required.

Record of test results shall be kept and two copies shall be provided at the completion of the work. The format shall be to approval.

All faulty materials and equipment shall be rectified free of charge. Faulty manufactured items shall be rectified by the manufacturer, again free of charge.

C.15.10 Tests on Site

The following tests shall be undertaken on site:

- All clamps, fixings and terminations shall be mechanically checked;
- All power and control equipment shall be put into operation and tested under normal, emergency and fault conditions (power fault conditions may be simulated);
- All defective equipment including all faulty lamps shall be replaced.
- All phase identifications shall be checked to ensure they match throughout the installation. In this regard correct phase sequence will not be deemed sufficient proof.

- Long runs of conduits shall be checked to ensure that there are no expansion problems.
- MIMS cables shall be tested for insulation resistance immediately after installation and again at Practical Completion with a 500 V Megger and where readings of less than infinity are obtained, the termination shall be remade until a satisfactory reading is obtained, or the cable replaced.
- The operation all motors, starters, electrical interlocks, indicating/recording instruments, associated equipment, status indicating lights, associated flashers, relays and the like shall be checked with operation proven under working conditions.
- Resistance measurements on all motors and starters, including all new and/or altered alarm circuits, shall be carried out in accordance with AS 3000 and recorded as required in Appendix D, AS 1670.

C.15.11 Automatic Fire Detection Alarm Systems

Fire conditions shall be simulated for all detectors installed. Operation of all alarms, electrical relays and detectors shall be verified with smoke intensities with time delays suitably recorded. Detectors that fail to operate normally after two consecutive tests shall be rejected and replaced with a new detector.

Commissioning shall be completed in accordance with the requirements of AS 1670, complete with the appropriate following reports, records or statements, referred to therein, completed prior to granting of Practical Completion.

C.15.12 EWIS

Testing shall include as a minimum, all tests required by AS 1670.4 including:

- Sound level tests including adjustment of speaker levels.
- Indicator and control function confirmation.
- Full load battery tests.
- Functional and performance test of all WIPS.
- Tests of all alarm initiating devices and visual warning signals.
- Test of interface to the FIP.
- Test of all paging functions.
- Attendance at Authority tests.

C.15.13 Test Records

Test log sheets proposed to be used during the performance tests shall be submitted for approval at least 4 weeks prior to the commencement of the tests.

C.15.14 Test and Installation Instruments

All instruments and appliances necessary to complete the performance tests specified shall be supplied for the duration of the tests.

Gauges and instruments provided as permanent parts of the installation may be used during performance testing.

Test instruments proposed for use during performance testing shall all be checked for accuracy by the manufacturer or an approved laboratory. Calibration certificates shall be provided for each of the instruments to be used prior to the commencement of tests.

All instruments provided as part of the installation shall be checked and calibrated as specified above and again after 6 months of normal operation. Any instrument, which will not hold calibration shall be replaced.

C.15.15 Commissioning and Performance Data

Copies of all data recorded during commissioning of the installation shall be provided together with all necessary inspection certificates from authorities having jurisdiction and appropriate manufacturer's pressure test certificates and performance curves or tables for the following items:

- All pumps (including Q-H, NPSH and BkW curves applicable to the diameters and speeds of the installed impellers together with details of the installed, minimum and maximum impeller diameters).
- Manufacturing guarantees in respect to motors, tanks and other items requiring performance.
- Data covering all other specific items of equipment installed.
- Noise level tests.

Practical Completion will not be granted until all data, certificates and performance curves referred to above have been received and approved.

C.15.16 Handing Over

The following procedure shall be adopted prior to handing over the installation:

- All preliminary testing, checking, adjusting and verification of interlocks of the installation shall be carried out before forwarding notification that the installation is considered to have reached Practical Completion.
- After inspection and when the Regulatory Authority is satisfied and agrees that the installation is ready for handing over, the plant shall be finally commissioned and Operating and Maintenance Manuals, together with "as installed" drawings shall be provided.
- All spare sprinklers, spanners, engine spares and test instruments shall be supplied and in position.

Practical Completion will be certified only after the plant has been inspected and approved and the above requirements fulfilled.

C.15.17 Installation Block Plan

A block plan diagram shall be provided in the form of a permanent diagram constructed to resist water and fading. The diagram shall include the following information:

- The layout of the protected buildings and adjacent streets.
- A diagram of water supplies including sizes and locations of Supply Authority mains and valves (dimensioned), storage tanks (capacity and locations) and pump duties.
- The location of control valves, subsidiary stop valves, tail-end air valves, antifreeze devices, drains, air release valves, orifice plates, external sprinklers and any unusual features of the installation.

- The location and telephone number of the fire station to which the system is connected.
- The location of the main switchboard, distribution boards and starters and ratings of electrical services associated with all pumps and details of auxiliary power supply, if applicable.
- The location of the stock of replacement sprinklers.
- The year of installation of the system and of any major extension thereto.
- The height in metres above the installation gauge of the highest sprinkler used for the purpose of sizing the distribution pipework for each installation and hazard class the pressure/flow requirements when carrying out proving tests and details of the flow measuring devices installed to test each installation or section of the works.
- Where a sprinkler system is an extension or addition to an existing building, the block plan diagram shall clearly indicate the fire-protected areas of the whole building.

C.15.18 "As Installed" Drawings

At Practical Completion three (3) complete copies of all "as installed" drawings shall be supplied, correctly brought up to date to present true and accurate representation of the actual installation and to a scale of not less than 1:100.

The following shall be included in these drawings:

- Complete layout drawings showing fire and smoke alarms' actual size and locations of all pipes, sprinklers, valves, outlets and gauges and the final measured pressures at all relevant locations.
- Complete plantroom and/or equipment layout drawings with full identification of each and every item of equipment.
- Complete piping layout drawings showing the actual size and locations of all water and other lines applicable to the system(s).
- Complete electrical wiring schematics clearly showing terminal numbering system. Include on the drawings settings (actual and scale) of all time delays and overloads.
- Complete schematic flow and control diagrams of all water and electrical systems incorporated in the installation. The drawings shall show all motorised, automatic and hand-operated controls such as valves, relief valves, cutouts, flow measuring devices, solenoid valves, bleeds, vents, drains, strainers, gauges, bypasses, sight glasses and all similar items pertinent to the functioning of the installation.
- Where applicable the drawings shall include the settings, throttling ranges and differential bands of all controls, cutouts and other variable or adjustable items. All items must be clearly identified as to type and function.
- Also included should be readings of all pressure gauges across each item of equipment, including strainers.

The above drawings shall be neatly prepared and bound in the Installation Operating and Maintenance Manual, with one additional copy supplied on CAD (.dwg) file to suit the computer system advised during the construction period by the Engineer.

Where the quantity of drawings involved is too great to conveniently bind in the Operating and Maintenance Manual, then a separate matching cover shall be supplied for each of the drawing sets. Application can be made for approval to use full size drawings in this arrangement.

C.15.19 Operating and Maintenance Manual

On completion of satisfactory performance tests supply, prior to Practical Completion, three (3) copies of Operating and Maintenance Manuals.

The Manual shall include a full description of the installation and function of the various systems involved and instructions to cover every action necessary for the efficient operation and maintenance of the installations. The Manual shall be neatly prepared and bound in a blue vinyl hard-back folder with stamped lettering on the front

In addition, the words "OPERATING AND MAINTENANCE MANUAL" and the project name and the year of installation shall be stamped in lettering along the spine of each folder.

The contents of the Manual shall be in the following general format:

C15.19.1 Section 1 Index

The Index shall subdivide each section including lists of drawings, equipment and similar for quick reference.

C15.19.2 Section 2 General Description and Capacities

This section shall be subdivided between mechanical system and electrical system components.

Full details of each water system, automatic fire detection and alarm system, emergency warning system, electrical system, special hazards fire protection systems and equipment designed criteria/capacities and similar information shall be included as applicable. Such information shall also include the operating and maintenance requirements specifically detailed within the appropriate Australian Standards applicable for design, installation maintenance of these systems.

Copies of all data relating to commissioning testing/records shall be included as a sub-subsection of the individual system sub-sections applicable.

In particular, the electrical system sub-section shall include specific details of FIP/SIP and MECP/ECP equipment as applicable and incorporate the hard copies of microprocessor programme data, floppy disk copy and other associated documentation.

C15.19.3 Section 3 "As Installed" Drawings

This section shall include all "as installed" post contract drawings (minimum 1 x A3 set and USB/CD with soft copy).

C15.19.4 Section 4 Equipment

This section shall be subdivided as for Section 2 and shall list all system items of equipment installed complete with manufacturer's name, model and/or type no., serial no., size design ratings (i.e. all relevant data necessary for re-ordering or replacing).

All major pump equipment shall be broken down to individually identifiable items such as motors, engines, drive belts, bearings, glands and similar components.

C15.19.5 Section 5 Installation Maintenance & Operating Instructions

This section shall be subdivided as for Section 2 and manufacturer's installation, maintenance and operating instructions shall be included for each item of equipment, such as motors and pumps. A comprehensive maintenance schedule to be followed throughout the Maintenance and Defects Liability Period shall also be included.

C15.19.6 Section 6 Routine Testing Procedure

This section shall be subdivided into sub-sections, one for each system or functional sub system. Each sub-section shall describe, in clear English understandable to a non-technical person, the extent and frequency of routine tests to be undertaken pursuant to the applicable codes and requirements of the Authorities having jurisdiction. The latter requirements shall specifically include all particular requirements for the building concerned as specified by the Fire and/or Building Authorities. Liaise with interfacing trades to ensure description is consistent for all services.

C15.19.7 Section 7 Plant Operating Instructions

This section shall be subdivided as for Section 2 and a complete description and correct sequence of all actions necessary to start-up, operate and shutdown all plant for emergency operation shall be included. These instructions shall include full information on such items as normal and abnormal gauge readings, instrument settings and control points, differential time delays, oil levels, water temperatures and all similar relevant variable and adjustable items, to permit checking and adjustments where practicable and identification of hazardous conditions or malfunction of the plant. In addition, the instructions shall include information on the immediate action to be taken in the event of hazardous conditions arising and conclude with the following sentence in large lettering.

C15.19.8 Section 8 Certification and Warranties

Provide copies of all self certification, third party certification and plant and equipment warranties.

"FOR SERVICE - CALL (TELEPHONE NO.)"

C.15.20 Principal Instruction

The services of the Fire Protection Services Commissioning Engineer shall be required for up to 5 full working days during the Test and Commissioning period, to instruct the Principal's nominated representative in all details of the plant operation.

C.15.21 Power, Fuel and Water for Testing

All power, fuel, water and other facilities consumed prior to Practical Completion, shall be included in the works covered by this Specification.

Power, fuel and water consumed after Practical Completion will be provided free of charge by others.

C.15.22 Certification Approvals

Supply, compile and co-ordinate all requirements associated with the certification of essential services as required by BCA. This shall include submission to the Approving Authority, together with payment of fees, correlation of installers certified forms.

Obtain approval certificates from the local Municipal Council, Fire Brigade and all Regulatory Authorities.

The certified requirements shall be submitted to the Approving Authority with due consideration of programme for practical completion and/or handover to the Proprietor in order to obtain a Certificate of Occupancy/Classification.

C.16 TESTING AND MAINTENANCE

C.16.1 General

Testing, commissioning and maintenance of the entire installation, including all specified and required procedures during the construction period and for the duration of the Maintenance Period.

C.16.2 Testing

The Sub-Contractor shall:

- Make all necessary adjustment such that the complete installation is left in a satisfactory and reliable operating condition.
- Record adjustment particulars in the log book.
- On completion, but prior to leaving the site, test each circuit and all detectors.
- Service the whole of the system at his own expense during the defects liability period and construction period.
- Perform all tests as required by AS 2118, AS 2419 and AS 1670.

C16.2.1 Testing of Electrical Equipment

Test the completed installation in compliance with SAA Wiring rules “Testing of Installation” and other relevant clauses. Such tests shall include:

- Insulation between conductors
- Insulation between conductors and earth
- Earth resistance of connection equipment
- The Sub-Contractor shall also test and show that all outlets and fittings are correctly circuited.

The Fire Services-Contractor shall demonstrate the correct functioning of any emergency power system or equipment by isolating the normal power supply. Allow to carry out this test outside normal working hours.

The Fire Services Contractor shall carry out tests of the fire alarm installation after completion, in the presence of the Superintendent and as further required by the FRNSW.

These tests shall include:

- Smoke tests on all smoke detectors
- Alarm tests for all groups
- Fail-safe tests for all groups
- Isolation tests for all groups
- Any other tests deemed necessary by the Superintendent.

The results of all tests shall be entered in a logbook provided by the Sub-Contractor.

The Fire Services Contractor shall provide all necessary testing equipment and any costs involved shall be borne by the Fire Services Contractor.

C16.2.2 Pipework Testing

All pipework and equipment comprised in the Fire Sprinkler system shall be subject to a hydrostatic pressure test in accordance with AS 2118 and AS 2419.

Pipework sections shall be tested during construction prior to building in and/or painting.

Upon completion, each installation shall be similarly hydrostatically tested.

C.16.3 **Commissioning**

Upon completion of the installation, the entire system specified herein shall be fully tested and commissioned to the satisfaction of the Architect's representative and the relevant Authorities.

The commissioning and testing procedures shall include but not be limited to the following:

- Hydrostatic testing of all pipework systems as specified in "Pipework Testing" above.
- Flow and pressure tests on all installations.
- Functional testing of all flow, smoke and thermal alarms.
- Functional testing of the Fire Indicator Panel, including all group alarms, alarm output signals and plant control functions.

C.16.4 **Proprietor Instruction**

Provide experienced personnel to instruct the Proprietor's nominated representatives in the operation of the fire service equipment and systems.

C.16.5 **Maintenance**

Provide corrective maintenance and repair to all fire equipment and systems which become defective, or is found to be defective, during the Defects Liability Period, including the making good of any resulting damage.

In addition, provide preventative maintenance of the fire services for the full duration of the Defects Liability Period, in accordance with this section.

Prepare and retain copies of all service reports, including details of all preventative and corrective maintenance work carried out and copies of log book entries. At the completion of the maintenance period or at any other time when requested submit a copy of all records to the Architect.

C16.5.1 Preventative Maintenance

Generally, the routine preventative maintenance shall include the inspections, testing and such other checking as may be considered necessary at the time.

Notify the Proprietor's representative on arrival and log details of all visits.

Preventative maintenance shall be in accordance with AS1851-2005 and shall include all weekly, monthly, six-monthly and annual maintenance activities.

PART D. APPENDICES

D.1 APPENDIX A - TENDER SUMMARY

TENDER SUMMARY

Tenderers shall submit a breakdown of the total tender price including administration cost and profit for each section of the works. The amounts included in the Total Tender sum including overhead costs and profit margins are as follows:

(a) Fire Sprinkler System to ASN Co Bay 5	\$ _____
(b) Hydrant system to ASN Co Bay	\$ _____
(c) Fire Detection System to ASN Co Bay 5	\$ _____
(d) Emergency Warning and Intercom System	\$ _____
(e) Portable Fire Extinguishers	\$ _____
(f) Testing and Commissioning	\$ _____
TOTAL TENDER AMOUNT (EXCLUDING GST)	\$ _____
GOODS & SERVICES TAX (10%)	\$ _____
TOTAL TENDER AMOUNT (INCLUDING GST)	\$ _____

NAME OF TENDERER: _____

SCHEDULE OF INFORMATION REQUIRED WITH TENDER

Previous Experience

Similar projects recently completed

<u>Project</u>	<u>Date</u>	<u>Value</u>

Personnel

PROJECT ENGINEER:

Name of Licensed Tradesman _____

Qualification _____

Experience (list previous projects responsible for and value of same)

D.2 APPENDIX B - SCHEDULE OF CONTRACT RATES

Schedule of Contract Rates

Tenderers shall submit the following Schedule to allow assessment of variations:

Composite Rates:

The following rates shall include for the supply and delivery of all materials, transport, erection and labour to complete the installation of the following elements in the works:

Description	Unit	Cost/Unit	GST	Total/Unit
Stand-down of Works	Day			

Hourly Labour Rates (including GST):

Period	Labour 1	Labour 2	Labour 3	Labour 4	Labour 5	Labour 6
Ordinary Time						
Time and a Half						
Double time						

NAME OF TENDERER: _____

CONTRACT: _____

Piping Systems

Unit rates including the supply and installation of straight lengths of pipework per metre run:

Pipe Diameter (mm)	Medium Black	Medium Galvanised
25	\$ _____	\$ _____
32	\$ _____	\$ _____
40	\$ _____	\$ _____
50	\$ _____	\$ _____
65	\$ _____	\$ _____
80	\$ _____	\$ _____
100	\$ _____	\$ _____
150	\$ _____	\$ _____

Sprinkler System

Unit rates shall include the supply and installation of each sprinkler head c/w 3m of pipe, fitting and support:

ITEM	DESIGN PHASE	CONSTRUCTION PHASE	POWER/WATER ON PHASE (TENANCY)
Fire sprinkler including 3m of pipe, fitting and support:			
Ceiling	\$ _____	\$ _____	\$ _____
Exposed/ceiling space	\$ _____	\$ _____	\$ _____
Exposed relocation	\$ _____	\$ _____	\$ _____
Semi-recessed Relocation	\$ _____	\$ _____	\$ _____
Flush Relocation	\$ _____	\$ _____	\$ _____
Concealed Relocation	\$ _____	\$ _____	\$ _____

Fire Hydrant, Valves and Flow Switches

Unit rates including the supply and installation of each item of equipment:-

ITEM	DESIGN PHASE	CONSTRUCTION PHASE	POWER/WATER ON PHASE
Relocate Hydrant Outlet	\$ _____	\$ _____	\$ _____
New Hydrant Outlet	\$ _____	\$ _____	\$ _____
150ø valve	\$ _____	\$ _____	\$ _____
100ø valve	\$ _____	\$ _____	\$ _____
80ø valve	\$ _____	\$ _____	\$ _____
65ø valve	\$ _____	\$ _____	\$ _____
50ø valve	\$ _____	\$ _____	\$ _____
150ø monitored valve	\$ _____	\$ _____	\$ _____
100ø monitored valve	\$ _____	\$ _____	\$ _____
80ø monitored valve	\$ _____	\$ _____	\$ _____
65ø monitored valve	\$ _____	\$ _____	\$ _____
50ø monitored valve	\$ _____	\$ _____	\$ _____
Flow Switch	\$ _____	\$ _____	\$ _____

Fire Detection and Alarm Installation

Unit rates including the supply and installation of each item of equipment:-

ITEM	DESIGN PHASE	CONSTRUCTION PHASE	POWER/WATER ON PHASE
Smoke detectors including 10m of cable:	\$ _____	\$ _____	\$ _____
Ceiling	\$ _____	\$ _____	\$ _____
Exposed/ceiling space	\$ _____	\$ _____	\$ _____
Detector circuit	\$ _____	\$ _____	\$ _____



ASN Co Building, Bay 4-5, 3 Hickson Rd, The Rocks

Vertical Transportation Services Specification

Prepared by

Stephen Meleady
Project No. 33307-SYD-M

Date:
5 February 2018

Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
T: (02) 8484 7000 F: (02) 8484 7100 E: wge@wge.com.au W: www.wge.com.au

REVISION

Revision	Date	Comment	Prepared By	Approved By
A	20/12/17	Preliminary	SJM	SJM
B	23/2/18	Tender	SJM	SJM

CHECKED AND APPROVED BY PROJECT ENGINEER

NAME: Stephen Meleady

SIGNATURE:



CONTENTS

PART A.	PRELIMINARIES	3
PART B.	GENERAL	4
B.1	DESCRIPTION OF THE PROJECT	4
B.2	HEAD CONTRACT	4
B.3	PRE-TENDER INSPECTION	4
B.4	DEFINITIONS AND ABBREVIATIONS	4
B.5	CONSTRUCTION PROGRAMME	5
B.6	COMPREHENSIVE MAINTENANCE AND DEFECTS LIABILITY	5
B.7	OPTIONAL COMPREHENSIVE MAINTENANCE	6
B.8	LIFT TOOLS AND SOFTWARE	6
B.9	ONGOING SERVICE ASSISTANCE	6
B.10	PRACTICAL COMPLETION	6
B.11	TRANSPORT AND STORAGE	6
B.12	CRANAGE/LIFTING/HAULING	6
B.13	PROTECTION	6
B.14	GUARANTEES	7
B.15	INTERPRETATION OF APPROVAL	7
B.16	DISCREPANCIES	7
B.17	QUALITY ASSURANCE	7
B.18	QUALITY ASSURANCE	8
B.19	SAMPLES AND DETAILS	13
B.20	SHOP DRAWINGS	13
B.21	'AS INSTALLED' DRAWINGS	14
B.22	MATERIALS AND WORKMANSHIP	14
B.23	POWER SUPPLY	14
B.24	CORROSION	14
B.25	AUTHORITY APPROVALS AND CERTIFICATION	15
B.26	FIRE STOPPING	15
B.27	RADIO FREQUENCY INTERFERENCE	15
B.28	PERMITS AND FEES	15
B.29	NOISE AND VIBRATION	15
B.30	EARTHQUAKE RESTRAINTS	15
B.31	FINISHES	15
B.32	DAMAGE TO EQUIPMENT	16
B.33	LIFT REQUIRED FOR CONSTRUCTION USE	16
PART C.	DESCRIPTION OF THE WORK	17
C.1	GENERALLY	17
C.2	DESIGN RESPONSIBILITY	17
C.3	DESIGN AND AUTHORITY COMPLIANCE	18
C.4	SPACE ALLOCATION	18
PART D.	WORK BY OTHER TRADES	19
D.1	GENERAL	19
D.2	WORKS BY BUILDER/HEAD CONTRACTOR	19
D.3	WORK BY ELECTRICAL TRADE	19
D.4	WORK BY FIRE PROTECTION TRADE	19
D.5	DESIGN LIFE AND DURABILITY	19
D.6	QUALITY OF RIDE CRITERIA	20
D.7	DOOR OPERATION TIMES	20
D.8	ACOUSTICS	20
D.9	CAR OPERATION AND CONTROL	21
D.10	LOAD WEIGHTING	22
D.11	DOOR CONTROL	22
D.12	OUT OF SERVICE SIGNAL	23
PART E.	LIFT AUXILIARY CONTROLS	23
E.1	FIRE SERVICE CONTROL	23

E.2	MAINTENANCE CONTROL	23
E.3	EXCLUSIVE SERVICE	23
E.4	STANDBY POWER OPERATION	23
PART F.	LIFTS GENERALLY.....	25
F.1	GENERAL.....	25
F.2	FACILITIES FOR PERSONS WITH DISABILITIES.....	26
F.3	LIFT SWITCHBOARD.....	26
F.4	WIRING GENERALLY	26
F.5	POWER DRIVE SYSTEM.....	26
F.6	CONTROLLER	28
F.7	DIAGRAMS.....	28
F.8	LIFTWELL AND PIT	28
F.9	PIT ACCESS LADDERS	29
F.10	LIFTWELL AND PIT LIGHTING AND POWER	29
F.11	LANDING EQUIPMENT.....	29
F.12	DOORS AND DOOR HARDWARE.....	29
F.13	LIFT CAR CONTROLS AND INDICATIONS.....	30
F.14	TRAINING.....	32
PART G.	TESTING AND COMMISSIONING.....	32
G.1	GENERAL.....	32
G.2	PRE-TEST.....	32
G.3	REQUIRED TESTS	33
PART H.	COMPREHENSIVE MAINTENANCE	35
H.1	GENERALLY	35
H.2	SCOPE OF WORK	35
H.3	MAINTENANCE PROGRAMME.....	35
H.4	MANUFACTURERS RECOMMENDATIONS	36
H.5	REPAIRS TO EQUIPMENT	36
H.6	ATTENDANCE TO CALLOUTS.....	36
H.7	SERVICE REPRESENTATIVE.....	36
H.8	SPARE PARTS	36
H.9	SITE REPORTING	37
H.10	EQUIPMENT SURVEYS AND REPORTS	37
H.11	OWNERS INSPECTION	37
H.12	ROUTINE MAINTENANCE ATTENDANCES.....	37
H.13	PAINTING.....	38
H.14	ACCESS TO EQUIPMENT	38
H.15	INITIAL PERFORMANCE EVALUATION	38
H.16	PERFORMANCE AND BREAKDOWN REPORT.....	38
PART I.	COMPREHENSIVE MAINTENANCE PERFORMANCE SCHEDULE	39
PART J.	OPERATING AND MAINTENANCE MANUALS	45
J.1	REQUIREMENT	45
J.2	FORMAT	45
J.3	INCLUDED DETAILS	45
J.4	LIFT REGISTRATION CERTIFICATE	46
PART K.	VTS UNIT SCHEDULES	47
K.1	PASSENGER LIFTS	47

PART A. PRELIMINARIES

Refer to Head Contract for Preliminaries.

project specific information

PART B. GENERAL

The contractor is to allow for all systems to come complete with all minor items for a fully functional and commissioned system, whether detailed on the drawings or not. Final coordination, spatial etc shall form part of the detailed design phase. The successful design and construct contractor will be responsible for the final design coordination, acoustic, spatial and system performance.

The Contractor shall be deemed to have carefully examined all Tender Documents including, without limitation, this Specification and associated Drawings, prior to tender submission. If the contractor has any doubt as to the meaning of any portion of these documents he shall, before submitting a tender, set forth the particulars thereof, and submit them in writing, in order that such doubt may be removed. The Tenderer must carefully consider local conditions, visit the site of the proposed work, and make any field survey necessary for proper planning and execution of the work. Failure to do so shall in no way relieve the Tenderer of responsibility for changes or unanticipated costs due to field conditions. The Contractor shall examine carefully the Architectural, Structural and relevant documentation of any other disciplines and satisfy itself that the work under his contract can be satisfactorily carried out without changes to the building as shown on drawings. Following any acceptance of your tender submission, the responsibility for any misunderstanding or error shall rest with the Contractor.

B.1 DESCRIPTION OF THE PROJECT

Offices base build works

The works include refurbishment of an existing building to provide office base build services.

The lift contractor will be responsible for the following installations.

- Building Bay 4-Lifts one and two. 2 No. Lifts

Lift interiors shall be a selection from the Lift Contractors standard fit out range. Allow for the top level choices. Allow for the highest quality standard finish available. 2 No. lift are to be provided within existing shafts.

The manufacture and delivery of lifts are to be scheduled to coincide with the building works programme.

Contractor to allow for removal of existing lift cars and redundant lift motor room plant/machinery.

All lift works to be staged to ensure one lift remains in operation during the works.

B.2 HEAD CONTRACT

The Head Contractor and VTS Contractor shall be deemed to have read, understood and be fully conversant with the terms and provisions of the Head Contract as amended and the Project Preliminaries and shall comply with all the requirements thereof.

B.3 PRE-TENDER INSPECTION

It is important that each tenderer makes at least one detailed site inspection to fully establish the scope of work required.

B.4 DEFINITIONS AND ABBREVIATIONS

Unless the context otherwise requires, the following apply:

- Unit: means lift.
- Supply: 'supply', 'furnish' means 'supply only'.

- Install: 'install', 'fix' means 'install only'.
- Provide: 'provide' means 'supply and install'.
- Proprietary: 'proprietary' mean identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Samples: includes samples, prototypes and sample panels.
- | | |
|-------|---------------------------------------|
| ACA: | Australian Communications Authority |
| AS: | Australian Standard |
| BCA: | Building Code of Australia |
| BMCS: | Building Management Control System |
| FESA: | Fire and Emergency Services Authority |
| LMR: | Lift Machine Room |
| COP: | Car Operating Panel |
| VTS: | Vertical Transportation Services |

B.5 CONSTRUCTION PROGRAMME

Three weeks after the Contract is awarded, the Head Contractor shall submit to the Superintendent a detailed Construction Programme, or Work Schedule, showing when all items must be completed in order to meet the required installation dates.

The programme shall nominate milestone dates for each unit and shall include, but are not limited to, the following:

- Approval of shop drawings.
- Manufacturer period.
- Delivery period.
- Installation period.
- Testing and Commissioning.
- Completion date for required builder's works.
- Date for completion of power supply, mechanical, fire protection and other trades works.

The Contractor shall revise the programme in line with any architectural changes made during design and the builder's construction programme.

The Contractor shall re-issue two copies of the initial programme and all subsequent revisions to the Superintendent.

B.6 COMPREHENSIVE MAINTENANCE AND DEFECTS LIABILITY

The Contractor shall be responsible for comprehensive maintenance for all units for the defects liability period.

Rectify any work and replace components in order to make good any faults or defects which become apparent during testing and commissioning or during in-service operation.

Contractor shall issue emergency contacts numbers for 24 hr / 7 day access during DLP.

Comprehensive maintenance shall be carried out in accordance with the requirements of this specification.

B.7 OPTIONAL COMPREHENSIVE MAINTENANCE

The contractor shall provide annual maintenance costs for an optional 5 year period commencing at completion of the defects liability period.

Optional comprehensive maintenance shall be carried out in accordance with the minimum requirements of this specification.

B.8 LIFT TOOLS AND SOFTWARE

All tools and software programs that are required for maintaining and fault finding the complete lift installations shall be handed over at the end of defects liability period.

Alternatively, the lift controller may incorporate dedicated software and a display unit that provides access to an event log that includes diagnostic functions. In this case, all associated codes and passwords shall be also handed over; in both hardcopy and electronic formats.

The contractor shall not be required to handover copies of proprietary lift controller dispatch algorithms and other associated software.

The tenderer shall confirm in the tender submission acceptance of these requirements.

At the end of the defects liability period, the lift contractor shall instruct the Building Lift Maintenance Provider in the use of all tools, diagnostic software, fault finding and maintenance procedures, passwords and access codes.

B.9 ONGOING SERVICE ASSISTANCE

The contractor shall confirm in the tender submission that he agrees to provide all future assistance to the Building Lift Maintenance Provider, in the event that access to proprietary software is necessary for any reason.

Such reasons shall include callouts, fault finding and maintenance diagnostic assistance.

Costs for such assistance shall be agreed between the contractor and maintenance provider, and do not form part of this specification and associated work.

B.10 PRACTICAL COMPLETION

Practical Completion shall not be given until all testing and commissioning has been completed and the Operating and Maintenance Manuals and As Constructed drawings provided and approved.

B.11 TRANSPORT AND STORAGE

The contractor shall be responsible for provision of all transport and storage of all units, equipment and components, both off site and on site, at all stages of the work.

B.12 CRANAGE/LIFTING/HAULING

The contractor shall provide all crantage, hoisting and all other lifting and hauling works, which are required for manufacture, transport, storage and installation of the units.

B.13 PROTECTION

The Contractor shall be entirely responsible for any loss or damage which may occur to apparatus, equipment and appurtenances furnished by him or his Sub-Contractors in connection with this work, and shall take special care to protect all parts thereof in such manner as may be necessary, or as directed.

B.14 GUARANTEES

Where guarantees provided by manufacturers of specified equipment do not extend for the defects liability period, the Contractor shall include for extending such guarantees to provide complete cover for such equipment for the maintenance period stated above.

The Principal shall have full and unrestricted use of each unit during the maintenance and defects liability period without prejudice to this Clause.

B.15 INTERPRETATION OF APPROVAL

Where the Specification uses the term "approved" or "to approval" this shall be interpreted as requiring submission of fully descriptive details and/or drawings, at the time of tendering, so that the Superintendent may give approval in writing.

If the tender is accepted without making specific mention of any details submitted in writing and incorporated in the tender, this shall imply that approval has been given for such details.

If no such details are given at the time of tendering, the successful Contractor will be required to submit this information prior to commencement of the work requiring such approval. However, the Contractor shall not be entitled to claim for extras arising from modifications deemed necessary by the Superintendent before giving his approval.

Any work installed by the Sub-Contractor without prior approval having been given, shall, if not deemed satisfactory by the Superintendent, be rectified to his entire satisfaction at no extra cost.

In the event that details submitted at the time of tendering are not acceptable to the Superintendent, in accordance with the requirements of this clause, the Superintendent will draw attention to the unsatisfactory features. The tenderer will be at liberty to amend these details as required by the Superintendent without change to the tendered amount or alternatively to withdraw his tender.

B.16 DISCREPANCIES

The Contractor shall immediately notify the Superintendent of any discrepancy he discovers between the documents and shall obtain their instruction as to how the discrepancy is to be resolved.

Any queries regarding the installation shall be referred to the Superintendent.

B.17 QUALITY ASSURANCE

B17.1 General

Plan and develop a quality assurance programme which assures that all of the lift services work including management, design and technical responsibilities for quality are integrated and executed effectively in accordance with AS/NZS ISO 9001, Quality system for design development, production installation and servicing.

Prepare and submit for acceptance by the Contractor before the contract is let, a quality assurance manual that has been approved.

Periodically review and update the manual to reflect current quality assurance policies and documented quality programme procedures.

B17.2 Organisation

The manual shall define management policies, objectives and responsibilities for quality assurance, including the responsibility of each division within a multi-divisional organisation. The responsibility and authority for quality of those managing and performing the work and of those auditing and verifying conformance to quality requirements shall be defined and their relationship shown on organisation charts.

B17.3 Inspection and Test Plan

The manual shall identify the group responsible for the inspection and test plan, and define how the plan shall be developed. The plan shall include inspection and test activities throughout the construction process including work, which is subcontracted. The plan should also indicate mandatory hold points established by a jurisdiction or the Contractor or both, which require their witnessing or verification of selected characteristics of an item or process and beyond which the work shall not proceed.

Witness and hold points to be inspected by the superintendent.

B17.4 System Function Procedures

Documented procedures for system functions which include design assurance, contract review, purchasing, incoming inspection, in-process inspection, final inspection, identification and traceability, special processes, quality records and measuring and testing equipment shall be prepared and implemented.

B17.5 Audit

Procedures for auditing the quality assurance programme shall be detailed. The audit plan shall define the functional areas to be audited, the frequency of audits and the method of reporting findings and recommendations.

B.18 QUALITY ASSURANCE

The Contractor shall produce and submit to the Superintendent verified records as follows to confirm that the specified requirements have been achieved.

Item	Record	Frequency/Comments
Work Schedule	Work Schedule	One per lift, as specified.
Shop Drawings	Shop Drawings	As specified
Samples and Equipment Details	Sample/Equipment Details Certificate	As specified. Separate certificates to be submitted with each sample or equipment detail. Use standard certificate from this specification.
Progress Claims	Progress claim and progress claim certificate	As specified. Separate progress claim certificates for each progress claim. Use standard certificate from this specification.
Commissioning and Testing	Commissioning and Testing records	As specified.

Item	Record	Frequency/Comments
As Constructed Drawings	As Constructed Drawings	As specified.
Practical Completion	Practical Completion Certificate	One per project at Practical Completion. Use standard certificate from this specification
Maintenance and Operating Instructions	Provision of Maintenance and Operating Instructions	As specified.
Maintenance	Maintenance log book	As specified.
Final Completion	Final completion certificate	One per project, two weeks prior to final completion. Use standard certificate from this specification.

The Contractor shall note on the record where any item fails to meet the specified requirements and the planned remedial action to be taken.

If the Contractor has accreditation to the relevant AS 39000 series Quality Standard then the Contractors Quality Assurance procedures may be used provided that records are submitted covering the above items.

LIFT SERVICES

QUALITY ASSURANCE CERTIFICATE

SAMPLE OR EQUIPMENT DETAIL

Project:

WGE Project No:

Contractor: _____

Description of Sample or Equipment Detail:

Manufacturer/Supplier: _____

Model No/Catalogue No: _____

Does sample or equipment proposed meet the requirements of the
specification and drawings?

YES/NO

If no, provide details and reasons for deviations.

Contractors Signature: _____

Date: _____

LIFT SERVICES

QUALITY ASSURANCE CERTIFICATE

PRACTICAL COMPLETION

Project:

WGE Project No:

Contractor: _____

We confirm that:

The Lift Services installation is complete and ready for operation

YES/NO

If no, attach details of any work that is incomplete.

The Lift Services installation complies with the specification, drawings,
instructions and variations.

YES/NO

If no, attach details of any deviations

Lift Services commissioning and testing has been completed
and results recorded.

YES/NO

Lift Services As Constructed Drawings and Operating and
Maintenance Manuals have been provided

YES/NO

Contractors Signature: _____

Date: _____

LIFT SERVICES

QUALITY ASSURANCE CERTIFICATE

FINAL COMPLETION

Project:

WGE Project No:

Contractor: _____

Date of Practical Completion: _____

Date of Final Completion: _____

We confirm that:

All Lift Services defects brought to our attention have been rectified

YES/NO

If no, attach details of any defects that have not been rectified.

We have recently inspected the lift services installation and it is in
efficient working order.

YES/NO

Date of inspection: _____

Lift Services maintenance has been carried out in accordance with
the specification and we have retained copies of records of all
preventative and corrective maintenance work.

YES/NO

Contractors Signature: _____

Date: _____

B.19 SAMPLES AND DETAILS

Samples or brochures of the items listed below shall be submitted for approval prior to purchase, at least 2 weeks before approval is required. Samples shall be clearly marked with the manufacturers name and catalogue number.

After approval, samples will be available for incorporation in the works

- Car operating panels and push buttons.
- Landing push buttons and car position indicators.
- Lift car fitout materials.
- Lift monitoring system.
- Car and counterweight brackets.
- Contractor to use existing concrete penetrations where possible

B.20 SHOP DRAWINGS

Prepare and submit for approval shop drawings before commencing manufacture or installation.

Drawings shall be prepared using AS 1102 drafting standard symbols, and include a legend of symbols, where applicable.

Shop drawings shall all be on the same size drawing sheets and shall be to the scale of not less than 1:100 and larger where necessary.

Shop drawings shall include the following parts of the work:

- Lift switchboard; plan, section, elevation, equipment schedule.
- The general arrangement of the lift equipment in plan and section, and the layout of the equipment in the machine room and pits.
- Equipment details, finishes, control panels, buttons and display units.
- Static and dynamic loads on the building structure.
- Design heat loads and power supply demands of all equipment.
- Dimensional set out drawings showing clearances required.
- Coordination of associated works.
- Detailed drawings of lift superstructures
- Lift car interior including fitout and finishes.
- Interface connection locations for power supply, telephone system.
- Wiring diagram equipment layout and interconnection details for the Programme Information Display and Remote Lift Monitoring Systems.
- Car and counterweight brackets.

Four copies of shop drawings shall be submitted. Allow 2 weeks for return of shop drawings with approval and/or comments. When requested amend shop drawings and resubmit. Provide electronic copy to the Superintendent in .pdf and .dwg formats.

Note that shop drawings are reviewed for general principle of design only and approval of shop drawings by the Superintendent in no way relieves the Contractor of his responsibility to comply with the requirements of this specification and associated drawings.

B.21 'AS INSTALLED' DRAWINGS

All shop drawings shall be progressively amended to suit the final installation at practical completion.

B.22 MATERIALS AND WORKMANSHIP

All materials, labour and plant shall be provided by the Contractor unless otherwise specified. All materials shall be the best of their respective kinds and free from all defects.

Workmanship in each trade shall be carried out in a first class manner and in accordance with the true intent and meaning of this Specification and accompanying Drawings, General Conditions of Contract and to the entire satisfaction of the Superintendent.

So far as it is reasonably and economically practicable and where it is not prejudicial to the Proprietor to do so, the Contractor shall in the performance of the Contract use labour, materials, plant, equipment, supplies and services available within the State of New South Wales.

All materials, equipment and work shall comply with the appropriate Australian Standard Specification or Code, or if such have not been prepared with the appropriate British Standard.

All materials, equipment and work shall also comply with the relevant rules and regulations laid down by any Statutory Authority having jurisdiction over such work, and shall conform with the requirements of Insurance Underwriter's Codes.

Any workmanship, materials or installation, which on inspection by such authorities, is found to require modification to be acceptable to the authority concerned shall be replaced, changed, modified, or otherwise put in a form to pass the relevant regulations. Such modifications shall be at the expense of the Contractor and at no cost to the Principal.

B.23 POWER SUPPLY

Power supply for the Vertical Transportation Services shall be 415V nominal 50 Hz and all equipment supplied shall be suitable for this supply.

The Contractor shall connect each submain cable to the respective lift controller/switchboard.

In order to allow for voltage drop the supply cables for each unit will be larger than the load current. The contractor shall make provision to reduce the conductor size to suit the controller, but not less than the protective device setting.

Exact power supply requirements, locations and method of connection to the equipment shall be obtained and co-ordinated on site with the electrical services Contractor prior to installation.

The passenger lift shall be provided with battery backup to allow for default operation in the occurrence of a power failure.

B.24 CORROSION

The Contractor shall take all necessary precautions with the supply and installation of equipment to prevent corrosion.

Any component showing signs of rust or corrosion during the maintenance period shall be renewed or otherwise made good in an approved manner.

If, in the opinion of the Contractor, equipment specified cannot be adequately protected against corrosion he shall request an instruction regarding same from the Superintendent.

B.25 AUTHORITY APPROVALS AND CERTIFICATION

Obtain all approvals and arrange for sufficient inspections required by an independent certifier at various stages and at completion of each unit installation.

Original documents evidencing approval by the independent certifier shall be submitted to the Head Contractor and copies included in the operating and maintenance manuals.

B.26 FIRE STOPPING

Penetrations through fire-rated barriers shall be sealed and packed with fire stopping materials which are approved under the respective current standards. Ensure that the integrity of the fire rating specified for the respective barrier is maintained. The method of fire sealing shall be in accordance with the requirements of relevant statutory authorities, the Building Code of Australia and manufacturer's recommendations.

All penetrations and fire stopping sealing works to be inspected and certified by the superintendent, or approved delegate.

B.27 RADIO FREQUENCY INTERFERENCE

Use equipment which generates interference within limits set by AS/NZS 1044. If necessary, provide suppression devices. If appropriate, shield equipment to AS/NZS 1044.

B.28 PERMITS AND FEES

Make application for all permits required by each relevant authority and pay all associated fees.

B.29 NOISE AND VIBRATION

Limits: The acceptable limits for motors, machines, converters and the like shall be as follows:

Noise: to AS 2107 Table 1.

Vibration: to AS 2670.2 Fatigue-decreased proficiency boundary.

B.30 EARTHQUAKE RESTRAINTS

Restrain mechanical and electrical components and their attachments to resist horizontal earthquake forces.

Comply with the requirements of AS 1170.4 Section 5 with the following coefficients:

- acceleration coefficient, a : 0.10
- site factor S : 1.25
- importance factor I : 1.00.

Resiliently mounted plant shall be equipped with purpose-made restraints or with proprietary 'snubbers' of approved manufacture. Restraints shall be located adjacent to each of the spring or rubber plant mounts. Restraints shall not restrict or impede normal motion of resiliently mounted plant on its mounts, but shall prevent excessive displacement beyond normal movement limits.

Static plant shall be fixed rigidly and securely to the building structure, both at the base and at the top of plant such as switchboards.

B.31 FINISHES

All equipment shall be factory painted prior to delivery to site and shall be coated with protective material to minimise damage and corrosion.

After affection, damaged paintwork shall be repainted.

During shipment and installation, every necessary precaution shall be taken to preserve the decorative metal finishes, which shall be protected by wax coatings or protective wrapping. At practical completion the surfaces so treated shall be cleaned and where required replaced or polished.

Stainless steel shall be finished with an approved sealant or polish to diminish finger marking.

B.32 DAMAGE TO EQUIPMENT

Do not install equipment included in the contract until all other prerequisite or associated construction and finishing in the area is complete. Damage to any essential or operating system or services shall be made good as soon as possible, using all available resources and the fastest method of transport, in a way which will permit both immediate interim restoration and subsequent permanent repair.

It is the responsibility of the lift Contractor to adequately protect the lift if used by the other Trades, and the Contractor shall make good at no cost to the Contractor any damage caused to cars, frames, doors and fittings.

B.33 LIFT REQUIRED FOR CONSTRUCTION USE

The Contractor will be permitted, with the agreement in writing of the Superintendent, to use one of the lifts during the building construction works. Lift be shared with building users at all times. The Contractor shall liaise with the Head Contractor regarding the lift to be used and the conditions of use of the lift. Doors will be inspected for damage prior to the lifts being handed over. The Contractor will then fully protect door frames with masonite or equal to the Contractor's approval to prevent ongoing damage.

The following minimum works shall be carried out by the Contractor in order to maintain any lift used during the construction period, and to restore the construction lift to full service at practical completion:

- Carry out comprehensive maintenance on all associated lift equipment throughout the period of use.
- Fully clean the lift installation of all construction debris, dust etc., inclusive of timer beams, door locks, tracks, car enclosure, counterweights etc., to ensure an as new installation.
- Re-grease and clean all moving parts on landing doors and check for wear and replace any items if necessary.
- Re-adjust all landing doors and check for alignment and clearances. Replace contacts if necessary.
- Check and re-adjust, if necessary, all lifting rope tensions.
- Check and re-tension compensator ropes.
- Check all lifting ropes for wear and replace if necessary.
- Check governor rope. Check tension sheaves, clean and re-grease.
- Check and adjust/replace roller guides if necessary on lift car.
- Check and adjust/replace roller guides if necessary on counterweight.
- Check operation of slowdown boxes and replace worn contacts.
- Check machine and clean down completely. Re-grease sheave.
- Remove brake and clean. Check operation and replace.
- Clean down converters and replace any worn contactors/relays, etc.
- Electrically re-tune the lift.
- Re-adjust and complete static balance after new car finishes are installed.
- Re-tune and adjust load weighing devices.
- Remove any squeaks or noises from unit while in operation.
- Provision of lift certification, warranty, and guarantee.

PART C. DESCRIPTION OF THE WORK

C.1 GENERALLY

Carry out vertical transportation services (VTS) work as detailed and in accordance with this section of the specification and drawings, the whole of which shall be deemed to constitute one document.

Whether or not the words "supply and install" appear in the instructions, drawing and schedules of this specification understand that, unless clearly excluded, equipment for the complete VTS installations is required and must be supplied, delivered to site and installed. The following units are included:

- Two No. VVVF machine roomless passenger lift.

The work includes, but is not limited to, the following main elements:

- Design and Manufacture.
- Transport, Storage, Delivery to Site and Installation.
- Testing and Commissioning.
- Making Good.
- As Installed Drawings and Manuals.
- Comprehensive Maintenance and Defects Liability for the defects liability period.

C1.1 Specific Scope of Works by Contractor

- Site visit to measure existing shafts
- Include for demolition/ removal of all existing equipment
- Coordinate equipment with existing landings and doors etc.
- Supply and installation of all lift equipment, including motors, control panels, wiring
- Coordination and commissioning of final lift position at each level served.
- Certification of compliance of completed lift installation.

In addition to the work specified and shown on the drawings, include all work and materials required by AS 1735, AS 3000 and the particular requirements of WorkCover NSW, the Building Code of Australia and Australian Communications Authority which are necessary to produce a safe, efficient and fully operative installations.

Units shall be registered with WorkCover NSW; Pay all required fees and registration costs for the first twelve months.

C.2 DESIGN RESPONSIBILITY

The VTS specification and associated drawings (contract documents) are generally performance based documents, for the detailed design, documentation and installation of the lift.

The contract documents depict the schematic intent and minimum performance outcomes for the lift.

The VTS contractor shall be responsible for full development of the schematic design, in accordance with the intent of the contract documents. In particular, the contractor shall:

- Attend design meetings as required with the architect, structural engineer and builder in order to resolve the final design.
- Review the architectural and structural drawings.
- Prepare shop drawings for review and comment by the above mentioned parties.
- Modify shop drawings as required and resubmit for final approval.

- Co-ordinate the final lift designs with the building design including architectural, structural and other trade elements.

The VTS contractor's design responsibility includes, but is not limited to, the following:

- Design development to shop drawing stage.
- Interface details with other trades.
- Size and location of penetrations
- Co-ordination of the lift installations with building and other trades works.
- Location for rail brackets and mounting plates.
- Mounting plate details including size and hole details. (Use existing holes where possible)
- Existing Landing doorway header and sill beam locations, including mounting plates and hole details.
- Landing door sill interface.
- Landing push button and indication plate openings.

Note: Unless otherwise specified, mounting plates are supplied and installed by the builder.

C.3 DESIGN AND AUTHORITY COMPLIANCE

The VTS contractor shall be fully responsible for developing the final design to achieve design compliance, and registration with the appropriate authority. The final design shall include all additional works not explicitly stated on the contract documents that are required for authority compliance.

Design compliance shall be to AS 1735 including parts 1 and 2, or to AS 1735 part 1 and BS EN81, and relevant sections of AS 1735 Part 12.

Where required, the VTS contractor shall make a formal application to the relevant Authority for dispensation from a particular AS 1735 or BS EN81 requirement which cannot be complied with.

C.4 SPACE ALLOCATION

Ensure that equipment offered can be accommodated within the physical constraints shown on the drawings. The nominal dimensions are as shown on Architectural drawings.

If the space requirements of the proposed equipment are different from those shown on the drawings, ensure that the tender sum allows for relevant work, and disclose the dimensional differences at time of tender.

PART D. WORK BY OTHER TRADES

D.1 GENERAL

The following work associated with the VTS services will be carried out by other trades. The descriptions below are not intended to be a full specification of the work involved and indicate the general extent of work only. Liaise with the other trades indicated to ensure that the work is properly coordinated.

D.2 WORKS BY BUILDER/HEAD CONTRACTOR

D2.1 General

- Provision of temporary light and power facilities for construction purposes.
- Provision of all barricades and screens to guard all openings for the protection of workmen.
- Provision of accurate grid and datum lines for the all equipment.

D2.2 Pits

- Construction of clean, dry, waterproof lift wells and pits.
- Sump and cover in pits.

D2.3 Blockwork Liftwell

- Building in of inserts flush with face of finished lift well walls for fixing rail brackets and door frame assemblies (inserts to be supplied by Lift Services Trade).
- Blockouts in lift well walls for landing boxes.
- Penetrations as required.
- Sealing of all penetrations through fire rated walls using fire retardant, and sign-off of fire proofing works
- Painting after installation of equipment.

D.3 WORK BY ELECTRICAL TRADE

D3.1 Lifts

- Power supply submain to each liftwell at the controller location. Final connection by lift contractor.
- Telephone cable to each liftwell at the controller location.

D.4 WORK BY FIRE PROTECTION TRADE

- Fire detection to liftwell. Sign-off of works.

D.5 DESIGN LIFE AND DURABILITY

Lifts shall be designed to operate without undue maintenance, based on the following usage pattern.

- 24 hours per day / 7 days per week.
- Cars and landing doors systems, buttons, indicators and controls and finishes in lift cars - 20 years.
- Basic mechanical components, motors - 25 years.

D.6 QUALITY OF RIDE CRITERIA

- Horizontal vibration front to back and side to side : 15 milli-G peak to peak.
(1-10 Hz frequency range)
- Vertical vibration : 15 milli-G peak to peak.
- Acceleration/Deceleration rate : 1.0m/s^2
- Jerk rate level : $<1.8\text{m/s}^3$
- Levelling accuracy : $\pm 6\text{mm}$

D.7 DOOR OPERATION TIMES

- Door opening time : 1.8 seconds (Adjustable 1-10 seconds)
- Door closing time : 2.5 seconds (Adjustable 1-10 seconds)
- Door dwell time : adjustable between 1.0 to 20.0 seconds (set 6 seconds to AS 1735 Part 12)
- Door nudging time (seconds) : adjustable between 10.0 to 60.0 seconds (set 10 seconds)

D.8 ACOUSTICS

The following noise levels are determined from the 5 second fast response Leq, except where noted as being maximum levels Lmax.

If the noise is tonal, adjustments in accordance with AS 2107 shall be made to the figures below.

INSIDE CAR (FAN OFF)

- Car Running at Contract Speed : 50 dB(A)
- Car During Acceleration or Deceleration : 60 dB(A)
- Car During Levelling with Doors Opening : 60 dB(A)
- Car Stationary (Fan On) : 45 dB(A)

IN LIFT LOBBY

- Car Passing at Contract Speed : 50 dB(A), one metre from door

- Door Opening or Closing : $L_{\max}$ 60 dB(A)
OTHER
- Inside Liftwell : 70 dB(A)

D.9 CAR OPERATION AND CONTROL

D9.1 General

Each lift shall be capable of operating as a single unit or automatic group operation. The system shall be two-button full collective control.

The equipment shall provide for all calls from the car or landings to be recorded and held immediately they are made, and answered in correct sequence according to the direction of travel of the car, irrespective of the order in which they have been registered, provided that they have occurred sufficiently in advance of the arrival of the car at the floor to permit a stop to be made.

The car shall respond only to 'car' and 'up' calls when ascending and only to 'car' and 'down' calls when descending, except where such 'up' and 'down' call is the highest or lowest call registered in which case the lift shall ascend in response to a 'down' call and descend in response to an 'up' call.

The call recording system shall be independent of the main control circuits and arranged so that the operation of any safety device will not cancel any calls on the system, therefore allowing the lift to resume normal service when the power is restored.

When the car is idle and landing calls are registered both above and below its position, the car shall proceed towards the landing corresponding to the first call registered. Calls registered for the landings for the opposite direction of travel shall not be answered until the car has answered the furthest call (landing or car) in the direction in which it has started by the first call registered.

Controllers shall have provision for on-site testing facilities for system analysis.

D9.2 Drive and braking control

The Drive and Braking Control system shall provide the following characteristics:

- Close speed control and accurate floor stops are maintained with widely varying loads.
- Smooth automatic step-less acceleration, retardation and levelling of the lifts in both directions of travel.

D9.3 Floor finding

Floor finding shall be obtained by means of a distance measuring processor operated from an encoder located on the machine drive and so arranged that the relation of the encoder to the car in the well is positively and correctly maintained. The encoder shall be self-correcting at terminal floors, and shall be so designed that the registration of late calls will not interfere with normal retardation of the cars.

D9.4 Floor levelling

Final levelling shall be achieved by the operation of levelling transducers located in the lift well and in conjunction with a distance pendant function, cars shall be brought to a smooth and accurate stop at the desired floor level under power from the hoisting motor.

The levelling transducers shall correct both under-travel and over-travel of the cars, and provide re-levelling to compensate for rope stretch and contraction and changes in car load due to loading and unloading shall be provided.

Re-levelling shall be imperceptible, smooth and bump-free.

D.10 LOAD WEIGHTING

Load weighting shall be provided, fitted to the car platform, to be used in conjunction with programs for:

- Peak traffic determination.
- Car overload indication.
- Car dispatching.
- Car nuisance calls.
- Landing calls by-pass.
- Load weighting shall be adjustable and to one person accuracy.
- Machine brake sensors if fitted will detect the car load and resultant brake torque to adjust the starting torque, or load weighting car be used to perform this function.

If the number of passengers exceeds the car passenger rates by 10% the car will not start and the door to remain open and a continuous buzzer to sound and the display to indicate 'CAR OVERLOADED'.

D.11 DOOR CONTROL

D11.1 Automatic Opening and Closing

The Door Control system shall be automatic and incorporate pre-opening, that is open the doors automatically as the lift is levelling to a landing, and close again automatically after a predetermined period of time. The door control system shall allow for pre-opening to be disabled or turned off.

D11.2 Door Close Button

Operation of a door close button shall cause the doors to close provided the door passenger protection devices indicate the entrance is clear.

D11.3 Door Open Button

Operation of a door open button while the lift is standing at the landing shall cause the doors to re-open if closed or closing and remain open until the button is released or until nudging operation commences.

When the lift is standing at a landing, the pressing of that landing's button which corresponds to the direction in which the lift is set to travel shall cause the closing doors to open, or the open doors to remain open until the button is released or until nudging operation commences.

When the lift is standing at a landing the pressing of either button when the direction of travel is not established shall cause the closing or closed doors to open or the open doors to remain open until the button is released or until nudging operation commences.

The door open time interval shall become effective under conditions of closed or closing doors.

D11.4 Passenger Protection

Provide 3D infra red sources between the car and lobby doors to control door closing.

The doors shall not close whilst the entrance is obstructed and shall retract if obstructed after closing has commenced. The doors shall then re-close after a two-second delay.

If the obstruction remains for a period of approximately 30 seconds (capable of being varied), a buzzer in the car shall operate and the doors shall close at a reduced speed. Under this situation of nudging, the Passenger Protective Device shall be rendered inoperative.

D11.5 Door Nudging

Should the doors be delayed in closing and locking for a predetermined period of time due to interference with the door re-opening devices, then a warning buzzer shall sound in the car.

If the passenger protective device has exceeded the preset time, then the scanning device shall become inoperative, and the doors shall close at a greatly reduced speed with the buzzer sounding to nudge the passenger out of the doorway. Only the Door Open button in the car control panel(s) shall remain operative to re-open the doors.

If the door open button has exceeded the preset time, then the door open button shall become inoperative, and the doors shall close at a greatly reduced speed with the buzzer sounding to nudge the passenger out of the doorway. Only the passenger protective device shall remain operative to re-open the doors.

D11.6 Parking

When the lifts are on "Automatic" control they shall park with the doors closed.

D.12 OUT OF SERVICE SIGNAL

The lift controller shall automatically illuminate an 'Out of Service' message on the COP display, and each landing display, for the following conditions:

- Lift failure to start
- Fireman's service operation
- Exclusive service operation

PART E. LIFT AUXILIARY CONTROLS

E.1 FIRE SERVICE CONTROL

Provide Fire Service control to each lift installation in accordance with the BCA and AS 1735.2.

E.2 MAINTENANCE CONTROL

On the top of the lift car, supply and install top of car operating buttons in accordance with AS 1725.2.

E.3 EXCLUSIVE SERVICE

The use of the key operated exclusive service switch provided in the car operating panel shall:

- Remove the lift from the full group control, whereby it does not respond to or cancel registered landing or 'homing' calls and does not illuminate landing indicators.
- Allow car button registration to be made in the normal manner, and with respect to further travel of the lift, shall set the direction of travel.
- Park the lift with doors open at the destination landing.
- Illuminate the lobby "out of service" indicator for the passenger/goods lift indicating that the lift is being used in the 'Exclusive Service' mode of operation.

E.4 STANDBY POWER OPERATION

When standby generator supply is available, all lifts shall consecutively return to the ground floor and open the car and landing doors. One group of two lifts shall park and remain out of service until normal supply is restored.

The remaining lift group shall continue to operate normally in group control.

When normal supply is restored all lifts shall return to group control.

PART F. LIFTS GENERALLY

F.1 GENERAL

F1.1 Authorities and Regulations

The work shall comply with the relevant requirements of all relevant authorities including:

- Office of Energy
- Fire and Emergency Services (FESA)
- WorkCover NSW
- Australian Communications Authority
- Occupational Health, Safety and Welfare Regulations

F1.2 Standards

All design, maintenance and materials for the work shall be carried out in compliance with all relevant Australian Standards including:

- AS/NZ 1939
- AS/NZ 3000:2000
- AS 1735 including Parts 1,2 and 12
- BS EN81.1:1998 to Appendix A of AS 1735 Part 1.

F1.3 Referenced Documents

Use referenced documents which are editions, with amendments, current three months before the closing date for tenders, except where other editions or amendments are required by regulatory authorities.

F1.4 Maintainability/Sustainability

Lifts are to be configured and installed in such a fashion that allows routine maintenance of all lift components.

Energy saving management of lifts shall be controlled via the master controller and the BMS. This includes the shutdown of lights, motors etc while lifts are idle. Also energy saving brownout and black out power modes shall be used.

F1.5 Acoustic/Vibration Treatment

Provide specific acoustic and vibration treatments to all lift installations to minimise noise and vibration transfer, and intrusion from the lift wells and machine rooms into adjacent rooms.

The noise levels specified in the schedules form the basis of the acoustics for the lifts. The noise levels should be determined by measuring the 10 second fast response Leq levels except where noted as being the maximum levels.

Vibration control measures shall include, but not limited to, the use where appropriate of:

- Lift rail isolators.
- Larger than standard lift guide rollers.
- Shearflex multi-layer pad isolators for lift machines.
- Inertia base for lift machines.

Noise associated with lifts shall not intrude into noise sensitive spaces. Voice systems in the lifts shall not operate whilst doors are open.

F1.6 Audible Alarm

Supply and install alarm bells in accordance with AS 1735 Clause 32.4.4.

F.2 FACILITIES FOR PERSONS WITH DISABILITIES

Each lift shall include facilities for persons with disabilities in accordance with Clause E3.6 of the Building Code of Australia, and additional items listed below. Each item shall comply with the relevant provisions detailed in AS 1735 Part 12.

- Main and auxiliary car operating panels.
- Hand rail on each car side wall, (Section 5).
- Automatic oral information announcements, in the English language, inside each lift car (Section 8).
- Indication of travel direction, both visible and oral to each landing (Section 8).
- Passenger doorway protection (Section 4.2 (b)).
- Car and landing buttons (Section 7), including Braille indication.

F.3 LIFT SWITCHBOARD

Lift switchboards shall be free standing, floor mounted, front connected type with main isolating switches and circuit-breakers, and shall be provided with suitable terminations for accepting the incoming submains.

Switchboards and circuit breakers shall give satisfactory performance under all variations of load and site conditions as may be met with in service. They shall be capable of withstanding all fault levels, overloads and short circuit conditions without causing any mechanical or electrical damage to busbars, wiring or equipment associated with the switchboard.

Lift circuit breakers shall be fitted with overload protection in all phases and shall be designed and rated to individually protect the respective motor.

All switchboard equipment shall be labelled, the labels to be engraved white lettering on black plastic, fitted with chrome-headed escutcheon pins or screws.

Install lightning surge diverter protection on each lift switchboard.

Replacement of lift switchboards shall be carried out "AFTER NORMAL SITE WORKING HOURS".

F.4 WIRING GENERALLY

- All wiring shall be carried out in a neat and tidy manner,
- Power and control wiring shall be run in separate ducts or conduits.
- Ducting and conduits shall be run in horizontal and vertical planes only.
- Ducts shall be of rigid construction and securely fixed and supported over their entire length. Suitable suspension hangers shall be provided as required.
- Ducts shall be thoroughly cleaned, free of all dirt and debris and sealed.

F.5 POWER DRIVE SYSTEM

F5.1 General

Solid state electronic systems for control of acceleration, deceleration and full speed running to pre-set patterns. Acceleration patterns, deceleration patterns and reference feed back devices shall ensure smooth speed transitions and a soft final stop.

Dynamic braking shall be utilised; the machine brake shall not be used in the deceleration or stopping process.

The power drive system for each lift shall include the following features and controls:

- High power factor at all loads.
- Under normal stopping reduce the speed to zero before applying the mechanical brake.
- Under emergency stopping, effectively but without undue harshness, stop the lift.
- Prevent abrupt starting sequences.
- Reduces the running speed to below contract speed should the lift be loaded in excess of its rated load and travelling in the down direction.
- Self diagnostics built into the system.
- Lift contract speed monitored by a speed measuring and correcting pulse generator in a closed loop configuration.
- Control circuits designed to provide for automatic restarting of the lift on resumption of emergency or normal power supply after power failure and power supply change over sequences.

The system offered shall provide efficient flight profiles and allow these to be altered by reprogramming after handover of the installation to suit the proprietors requirements.

F5.2 Isolation and Protection

The solid state drive unit shall be electrically isolated from the main supply by a suitable isolation filter network and transformer to prevent harmonic and electromagnetic feed back. A ripple filter shall also be incorporated to reduce harmonic distortion to the machine and to ensure long life of the machine.

Power supply, under voltage, phase reversal protection and comprehensive and complex line filtering and protection shall be installed.

Drive system shall be efficient in design and have a power factor of not less than 0.85 with a full car travelling in the up direction.

F5.3 Distortion/Noise/Filters

Limit overall distortion factor at the point of lift electrical submain connection to electrical distribution system to a maximum of 3% including compensation for the following:

- Harmonic distortion.
- Flicker.
- Line notching.

Minimise inductive coupling occurring between control and power wiring.

Limit the "electrical noise" from the installation and provide written guarantee that equipment will not interfere with any equipment connected to the buildings electrical distribution system.

Filtering systems shall be provided on each system to prevent line pollution, radio interference, harmonics and noise to the driving machine or back into the mains supply system to the satisfaction of the Engineer and local regulations.

Harmonics vibration and electrical noise shall not be transferred to the motor from the solid state power supply.

F5.4 Components

Solid state devices shall be conservatively rated for the duty with adequate provision for short term overload situations. control cabinets shall be adequately ventilated and the principal heat emitting components shall be located at the top in a louvred enclosed cabinet with dual fans for forced ventilation.

F.6 CONTROLLER

Each lift shall be provided with a fully electronic solid state main controller incorporating motion controls, computer based processors and measuring devices. The controller cabinet shall be constructed of mild steel of approved design and shall be permanently fixed on level 4. The Controller shall incorporate the following features:

- Maximum solid state and electronic componentry and circuitry is a requirement.
- All main current contacts shall be copper or approved equal to carbon with Arc Shutes-Blow Out Coils where required. All auxiliary contacts shall have silver tops, moving contacts shall be mounted on approved spring control contact fingers and make with a positive wiping action. All sensitive type relays shall be enclosed with dust proof covers. All items of equipment on the controller shall be clearly labelled in an approved manner with reference number or letter.
- All bolts and screws, except those in approved terminal blocks, shall be fitted with washers, nuts and locknuts or spring washers.
- On all control circuits flexible wire connections where used between fixed and moving contacts shall be constructed and terminated such that no undue strain is imposed on them during normal operation.
- Equipment shall be mounted on the controller, both at the back and front, so as to provide clear access to all parts and connections.
- Thermal protective devices, where used, shall not be subject to heat rising from rectifiers and resistances. Solid state devices shall be conservatively rated for the duty with adequate provision for short term overload situations. control cabinets shall be adequately ventilated and the principal heat emitting components located at the top.
- A controller shall be complete with all necessary equipment and accessories for the efficient operation of the lift and shall include overload, phase failure and phase reversal protection.
- Thermal points shall be permanently marked by approved means.
- Fan ventilation shall be provided to prevent equipment overheating.
- Incorporate a computer memory which cannot be violated by loss of power supply or electrical pollution.

F.7 DIAGRAMS

One complete set of circuit and connection diagrams for the whole of the lift installation shall be provided.

Switch and relay operating times and other relevant information such as dispatch intervals, and similar times shall be set out in appropriate schedules in a manner which will permit the easy checking of the functioning of the equipment against the original setting.

All diagrams shall be placed, unfolded, in individual protective clear polythene envelopes. The diagrams shall hang from suitable supports fixed to the machine room wall or stored in the controller panel.

F.8 LIFTWELL AND PIT

F8.1 Guide Rails and Fixing

Guide rails shall be Tee shaped steel sections with tongue and groove flush joints fixed with connecting splice plates.

Particular attention shall be made to alignment accuracy of fixing and trueness of the guide rails.

F8.2 Trailing Cables

Provide additional cables to each trailing cable system to allow for future security and access control functions.

F8.3 Flushing and Screening

Provide flushing and screening between the nominated lift wells. Screening shall be permanently installed and remain in place at completion of the work.

F.9 PIT ACCESS LADDERS

Supply and install an access ladder for each lift pit. All metal work shall be painted to architects approval.

F.10 LIFTWELL AND PIT LIGHTING AND POWER

Provide lighting and power in accordance with AS 1735.

F.11 LANDING EQUIPMENT

F11.1 Lobby Push Buttons

Up and down push buttons shall be installed at the intermediate floor and single buttons at the top and bottom floors served.

Buttons shall be of the touch button type and shall remain illuminate after operation until the call is served. Buttons shall be set in a satin finish stainless steel flush plate with concealed screw fixings and smooth levelled edges. Mount over recessed metal boxes in the lift well wall.

Flush plates shall be engraved with a warning against the use of lifts in a fire in accordance with the Building Code of Australia Part E.

F11.2 Landing Direction Indicators

Digital dot matrix units with up and down direction arrows for each lift at the intermediate floor and single direction indicating arrows for each lift at the top and bottom floors served.

Install at each lift door opening, above the door or landing buttons, as approved by the Superintendent. The unit shall also include automatic, audible indication, complying with AS 1735 Part 12.

The arrows shall show by illumination the direction in which a car will leave the appropriate floor provided that a stop will occur at that floor.

F.12 DOORS AND DOOR HARDWARE

F12.1 General

Existing landing door reveals to remain. A copy of a certificate from a recognised Testing Authority certifying this rating.

F12.2 Door Panels and Frames

Provide full depth landing frame for each liftwell opening complete with transome panels, as required.

Car and landing door panel and frames shall be finished, to match the existing landing door frames for cars and landing. Provide samples for approval by architect and superintendent.

Surfaces shall be perfectly flat and free from scratches or dents. All door frames shall be machined, bent and folded and joints shall be welded, ground smooth and relinished. Until Practical Completion, the Contractor shall be responsible for protecting these surfaces against damage.

Sill clearance between car and landing doors shall not exceed 25mm.

F.13 LIFT CAR CONTROLS AND INDICATIONS

F13.1 General

Each car shall be provided with control and indicator panels containing operating buttons, switches, indicators, etc., corresponding to the floors served as scheduled.

The panel shall be minimum 2.6 mm thick stainless steel complete with concealed fixings and hinged supports. Finish to match existing.

The lift car capacity lift identification number and no smoking sign shall be engraved and colour filled to approval in the upper sections of the car control panel.

Equipment and cover plates shall be engraved and colour filled to approval. All equipment visible from within the cars shall be of the flush panel type conforming in design and finish with the interior of the cars.

Alarm, emergency stop, door open and door close buttons shall be arranged so that persons standing against the panel cannot inadvertently operate the buttons.

Buttons shall illuminate when operated and remain so until the call is served.

F13.2 Car Operating Panels

Each lift car shall be fitted with a main and auxiliary car operating panel, which shall contain the following minimum equipment.

- Engraved lift number, maximum load and passenger signs. (Main panel only)
- Direction of travel and car position display. (Main panel only)
- Out of Service indicator. (Main panel only)
- Alarm and emergency communication system.
- Push buttons for landings served.
- Door open and door close buttons.
- Ventilation fan switch (key operated). (Main panel only)
- Exclusive service switch (key operated). (Main panel only)
- Fireman's service switch (key operated). (Main panel only)
- Car light switch (key operated). (Main panel only)
- Security card reader. (Main panel only)
- Automatic voice announcing of floors on arrival. (Main panel only)

F13.3 Car Position and Direction of Travel Display

A combined digital dot matrix car position and direction of travel display unit shall be provided and located in the car operating panel. The display shall comply with AS 1735 Part 12 and include:

- Directional up or down arrow
- Car floor position

A sample of the above unit or drawings showing the designs and arrangement of the unit shall be submitted for approval, prior to manufacture.

F13.4 'Out of Service' Indicator

The indicator shall be part of each lift car's control panel and shall operate automatically. The words 'Out of Service' shall be displayed. Where combined with the car position and direction of travel display, it is acceptable for the letters 'OOS' to be displayed.

F13.5 Car Push Button Labels

The main car operating panel shall incorporate, directly adjacent each push button for the landings served, a typeset label. Each label shall be constructed as detailed below or approved equivalent:

- Dimensions: each approximately 30 mm high by 100 mm long with radiused corners and two off 60 mm x 1,000 mm.
- Lens: a clear ABS or lexan lens shall be fixed flush with the surface of the control panel.
- Label Holder: a holder with tension springs suitable for holding in place an engraved or photo etched label behind the lens.

Labels: allow to provide one set of four colour photo etched labels including 'logo' graphics, text and line work to the approval of the Superintendent.

F13.6 Communications

Provide an emergency communication facility in each lift car in accordance with AS 1735.

The emergency communication system shall consist of a loudspeaker and microphone telephone unit flush mounted behind a fixed stainless steel grille in the COP, connected to a 24 hour monitoring station via the telephone connection.

Telephone will be "hot Keyed" (automatically connected) to security (out of normal hours) and to the switchboard (during normal office hours).

Make application to Telstra on behalf of the Principal for the telephone connection, and pay all associated account fees.

All work to comply with ACA requirements.

F13.7 Emergency Lighting

Provide separate single point, emergency lighting to the lift car interior and car top. Emergency lighting fittings shall comply with requirement of AS 2293 and automatic test circuits and controls shall be provided.

F13.8 Exhaust Fan

Provide a car exhaust fan on the car enclosure complete with sound isolated supports. Fan to be single phase 150mm diameter propeller fan connected to an automatic socket outlet.

F13.9 Socket Outlet

Allow for a single phase 10A socket outlet in the lift car. Outlet is to have a stainless steel fascia plate and fixing screws.

F13.10 Car Interior

Lift car interior fit out shall be as per the Architect's / Interior Designer's documentation. The Contractor shall review the Architect's/Interior designer's documentation and provide written advice of any fitout design or element that does not comply with AS 1735.12.

All materials shall be in accordance with AS 1735.2 and AS 1735.12.

Generally allow for the following fitout to the main building lift cars as a minimum (final approval by architect). If there is any discrepancy, allow to follow architect's documentation:

- Landing doors and shall be finished, stainless steel with fire rated level FRL -/60/-. Landing doors to match existing frames.
- Car door panels and frames shall be finished, linished, stainless steel.
- White polycarbonate backlit panel ceiling, fluorescent lighting behind.
- Linished stainless steel to side walls in cars.

- Linished stainless steel skirting as required (100mm high) in cars.
- Handrail at 900mm above floor level for side walls. Linished stainless steel 50mm diameter circular handrail on linished stainless steel handrail and bracket.
- Slip resistant tiles.

Provide support hooks in each lift car and one set of protective blankets per lift car to protect the lift car wall finishes when the lift car is being used to transport building materials. Allow a separate blanket for each wall.

F.14 TRAINING

Provide training for a minimum of the persons nominated in the correct practice of operation, routine adjustment and maintenance of the works. Training shall be on site as required during the period of operation preceding the date for practical completion. Allow for a minimum of two training sessions.

Prepare and submit for approval, prior to undertaking training, a comprehensive training plan identifying:

- Personnel responsible for training
- Topics for discussion
- Location of training
- Proposed training dates
- Training durations
- Any attachments.

PART G. TESTING AND COMMISSIONING

G.1 GENERAL

Provide competent personnel together with all proper equipment, instruments and weights required to test and commission the lifts covered by this specification.

If during the testing and commissioning the lift(s) fail to comply with the specified requirements, make such alterations and adjustments as may be necessary to make the lift(s) comply with the specification at no cost to the Contractor.

All testing and commissioning works shall be carefully pre-planned and scheduled to ensure that they are coordinated with the work of other relevant trades and that they are carried out in a safe and sufficient manner with the minimum of inconvenience to all concerned.

Notify the Head Contractor at least five working days prior to commencement of any testing and commissioning.

For each required test or commissioning activity, provide a report or certificate in a form suitable for inclusion in the operation and maintenance manual, signed and dated, legibly typed or printed, recording:

- The test or commissioning activity.
- The activity procedures
- The apparatus and instruments used
- The date, time and place of the test/
- The ambient and other relevant conditions
- The name, status, function and signature of each person present
- The activity results
- Where applicable, calculations, instrument readings, control settings, name plate ratings, and the like.
- Variations to the specification, if any.

G.2 PRE-TEST

Confirm size, rating and settings of all circuit protective devices.

Provide an approved form of communication between LMR and lift car during testing.

G.3 REQUIRED TESTS

Unless otherwise approved by the Contractor the following tests shall be made to each lift at the time of the final inspection.

G3.1 Full Load Run Test

The lift shall be subjected to a test for a period of one hour continuous running with full contract load in the car. During the test, the car shall be stopped at each floor on the up and down trips, during which the doors shall be fully opened and closed. Stops at the lower terminal landing shall be of one minute duration and at the other floors only sufficient duration to permit the opening and closing of the doors.

G3.2 Speed Test

The actual speed of the lift car shall be determined in both directions of travel both with full contract load and no load in the car. The test shall be carried out both before and after the full load run test and the maximum difference in the speeds obtained shall not exceed 10% of the contract speed.

G3.3 Balance Test

The lift shall run in both directions of travel with balanced loads in the car and instrument readings taken in order to determine that the percentage of contract load required to counterbalance the counterweight is as specified.

G3.4 Levelling Test

The car levelling device shall be tested for accuracy at all floors with no load and full load in the lift car before and after the full load run tests. Levelling accuracy shall be within that specified in the schedule.

G3.5 Overload Test

A test shall be made to ensure that the equipment will safely lower and stop and hold the lift car when loaded up to 25% in excess of the contract load. The lift will not be required to attain the rated load performance under this overload. Also test the load weighting performance along with the warning displays/audible alarms.

G3.6 Protective Equipment Tests

Tests shall be made to check the effective operation of circuit breakers, overload devices, reverse phase relays and similar protective equipment.

G3.7 Safety Device Switches

All switches operated by safety devices shall be tested for effective mechanical and electrical operation.

G3.8 Door Locks and Contacts

All door locks and door contacts, their circuitry and protective fuses, shall be checked and tested for effective operation.

G3.9 Dynamic Braking Test

A test shall be carried out to ascertain that the effect of dynamic braking will not permit the car speed to exceed 120% of the contract speed while the lift is lowering 125% of the contract load.

G3.10 Buffer Test

All oil buffers shall be tested under contract load and contract speed conditions to check that they are effective and that they return to their normal position after operation.

G3.11 Speed Governor Test

Tests shall be carried out to determine the tripping speed of the governor, the relationship between the pull through pressure required to slip the governor rope through the clamping device on the governor stand and the pressure required to initiate the operation of the safety gear.

G3.12 Safety Gear Tests

Overspeed tests shall be carried out with no load and full load in the car in order to confirm that the lift equipment complies with the Relevant Codes and Regulations.

The necessity to perform drop tests on lifts will only arise if the Contractor is dissatisfied with the results of the aforementioned overspeed test, or if these tests are required by the regulatory authorities.

G3.13 Loss of Power Tests

Demonstrate operation of the lift and control systems under the following conditions:

- Loss of nominal supply
- Running on standby generator supply
- Return of normal supply

G3.14 Other Tests

Carry out any other tests required by the Contractor or regulatory authorities.

G3.15 Electrical Supply

Measure power factor, line voltage and line current, for both directions of travel with varying loads up to full load placed in the lift car.

G3.16 Commissioning

Prior to handover of the lifts and on satisfactory completion of all tests, carried out and witnessed by the an independent certifier, carry out any other tests to prove that the lift services complies with the specification requirements.

G3.17 Overall Speed Performance Tests

Overall speed performance of each lift shall be reviewed by taking into consideration operation of the car and landing doors, compatible with the comfort of the passengers during periods of acceleration and deceleration and the limitations of the specified maximum car speeds and door speeds within the limits permitted by the regulatory authorities.

For comparison of performance, tenderers shall state in the 'Schedule of Technical Data' the time taken for the car to travel from one floor to the adjacent floor inclusive of door closing and opening times.

Timings on this sequence of operations will be taken with various car loadings up to full load in both directions.

G3.18 Overall Performance

Comprehensive tests shall also be applied to the bank of lifts individually and collectively to ensure that the equipment meets all specified requirements in regard to automatic programme selection, traffic timing and despatching etc., under various load and traffic conditions. At the same time, tests shall be conducted on items of equipment, such as door timing and protective devices, load weigher, car door protective devices, communication systems.

PART H. COMPREHENSIVE MAINTENANCE

H.1 GENERALLY

Experienced and qualified technicians shall attend on site at regular intervals as required for comprehensive maintenance and required testing. Carry out all service, routine adjustments, replacements, cleaning and lubrication needed to keep the lift installation operating in a first class condition.

Make good any defect in workmanship or materials that arise during the defects liability period. Send a technician immediately to site within nominated response time throughout the period to meet any emergency calls for service at any time. Work continuously during all hours of any day as required to effect the fastest possible restoration of normal system operation in the event of breakdown.

Attend to all stoppages and malfunctions reported by the Contractor or building manager at any time. If attendance is required outside normal working hours, only such adjustments and minor temporary repairs will be effected as then can be carried out by the attending service mechanic, and other work will be carried out during normal working hours.

H.2 SCOPE OF WORK

Comprehensive maintenance shall include regular maintenance servicing and attendance to callouts in accordance with the requirements of this Specification:

- Carry out scheduled preventative maintenance work and regular servicing of the lifts in accordance with the manufacturers recommendations, the requirements of AS 1735 and any NSW statutory requirements.
- Provide a 24 hour call-out service with all call-outs being attended to within the guaranteed maximum response time declared in the performance schedule.
- The lift installations shall maintain the specified performance requirements.
- Supply and replace all failed lamps in lift cars, lift wells, machine and secondary rooms.
- All defects and outstanding work noted at date of practical completion shall be completed within one (1) month of date of practical completion.
- Removal of rubbish and keep clear lift pits, machine and secondary rooms.
- Keeping of records (logbook) relating to service visits, call outs, faults rectified and repairs carried out. Provide a statement detailing such information when requested by the Principal.
- Provide an on-site log book recording all attendances and nature of work carried out.
- Maintain and update all essential data (wiring diagrams, drawings, etc.) necessary to maintain the lift services.
- Equipment which fails as a result of incorrect servicing, faulty workmanship, materials or design shall be immediately replaced free of charge to the customer. Replacement equipment manufactured overseas shall be air-freighted.

H.3 MAINTENANCE PROGRAMME

The Contractor shall submit a comprehensive maintenance programme for all the equipment listed in the equipment schedules. Subsequent programmes for any extended periods of the Contract shall be supplied prior to the commencement of any such programmes.

The maintenance programme shall be specific to the scheduled equipment and include all routine maintenance service activities together with the following:

- a) Frequency of maintenance visits
- b) Individual maintenance activities
- c) Maintenance procedures
- d) Duration of each maintenance activity

H.4 MANUFACTURERS RECOMMENDATIONS

The Contractor shall obtain, wherever available, the Manufacturer's recommended maintenance instructions for each item of equipment.

If a defect occurs which is attributable to the Contractor failing to follow the Manufacturer's instructions, unless authorised by the Owner, the Contractor shall repair the equipment at his own cost.

The Contractor shall advise the Owner during the course of the Contract of any changes to the Manufacturer's recommended maintenance instructions.

H.5 REPAIRS TO EQUIPMENT

The Contractor shall programme in the replacement of parts or components showing signs of wear or potential failure. Such repairs or replacements shall be scheduled during normal hours of work. When such repairs or replacements necessitate the placing of the equipment out of service the Contractor shall notify the Owner of the anticipated duration of the stoppage, and arrange to complete the work at a time which in the opinion of the Owner will cause a minimum of inconvenience to the Site and users of the equipment.

Breakdowns involving replacement or repair of major components or requiring work in excess of four hours, will be completed during normal hours of work.

H.6 ATTENDANCE TO CALLOUTS

The Contractor shall attend to call-outs in the event of breakdown or stoppages to the equipment during the whole twenty four hour period of every day of each year for the duration of this Contract. In the event that a passenger is trapped, the time to attend shall not exceed time period nominated in the performance schedules. The Owner shall not be responsible for any further payment for the service other than the contract price.

If extended attendance to stoppages and malfunctions is required, such attendance shall be without further charge to the Owner, provided that such stoppage or malfunction does not arise from wilful misuse or vandalism.

If attendance is required outside the normal hours of work, only such work as can be carried out by the attending employee will be carried out, Any further work will be deferred to the next normal business day.

The total number of call-outs during this period, excluding nuisance calls, shall not exceed the number stated in the performance schedule. Should the call-outs exceed the number specified pro rata on a monthly basis, the Lift Contractor shall carry out a full investigation and report at no cost.

H.7 SERVICE REPRESENTATIVE

The Contractor shall assign a service representative to the site, who will periodically visit the site and will be available for consultation on any matter relating to the maintenance of the units. The appointed service representative will be available to discuss the owner needs in the areas of modernisation, traffic handling ability, recommendations and requirements of code authorities and proper use and care of the units.

The service representative shall have sufficient command of the English language, including building and equipment terminology.

H.8 SPARE PARTS

The Contractor shall maintain a reasonable stock of spare parts and supplies to service each item of equipment.

H.9 SITE REPORTING

The Contractor shall provide a Log Book, which shall be kept on site in a designated location, and shall enter in the Log Book all site attendances and details of work carried out.

The Contractor shall record the following details in the log:

- (a) Time of arrival and departure
- (b) Reason for attendance; breakdown, routine maintenance etc
- (c) Details of repairs or replacements carried out
- (d) Details of all call out attendances and nature of fault rectified
- (e) Details of all tests and adjustments carried out.

All routine maintenance items are to be initialled and dated in the appropriate column in the Maintenance Schedule by the person carrying out the work.

The Contractor shall on every visit report to the Owner or in his absence such other persons nominated from time to time by the Owner, before commencing work and on completion of work.

If a fault or malfunction notice has been issued to the Contractor by the Owner, this shall be initialled by the attending employee of the Contractor, and filed in the log.

H.10 EQUIPMENT SURVEYS AND REPORTS

The Contractor shall carry out the following annual surveys at the date stated in the performance schedules and issue a separate report for each item of equipment to the Owner within one month:

Annual Condition Survey – Annually, carry out a survey of each item of equipment which summarises the current condition. The annual condition report shall include any recommendations for improvement of the equipment functionality and performance.

Annual Safety Survey - Annually, carry out a survey of each item of equipment covering the safety aspects of the equipment. The annual safety inspection shall clearly highlight all additional requirements, relating to equipment and/or personal safety, that have been incorporated into AS 1735, or OHS regulations since the original equipment manufacture.

Stoppages, Malfunctions and Irregularities – Provide a report to the Owner on each equipment stoppage, malfunction or irregularity, including cause and repair affected. The Owner shall not be required to maintain records of such events.

H.11 OWNERS INSPECTION

The Contractor shall provide full access and assistance to the Owners representative, for the purposes of carrying out an independent inspection of each item of equipment.

The inspection shall be carried out annually, during normal “Hours of Work”.

The Contractor shall provide access to machine rooms ,pits, lift wells, remove access covers, and isolate and operate equipment as directed.

H.12 ROUTINE MAINTENANCE ATTENDANCES

The Contractor shall provide sufficient Routine Maintenance attendances in order to fulfil requirements of each item of equipment, and meet the performance criteria listed in the Performance Schedule.

Minimum routine maintenance attendances as listed in the Performance Schedule.

H.13 PAINTING

The Contractor will keep clean, de-rust and paint all steel work during the term of the Contract with the exception of the interior surfaces of lift cars.

H.14 ACCESS TO EQUIPMENT

The Owner shall permit the Contractor access to the Equipment including landings, lobbies and motor rooms associated with the equipment for the fulfilment of the Contractor's obligations. The Contractor shall comply with any reasonable directions of the Owner, or any authorised representative of the Owner relating to access to the Site.

H.15 INITIAL PERFORMANCE EVALUATION

Within the nominated date, the Contractor shall evaluate the performance of each lift. The purpose of the evaluation is to establish performance criteria against which the ongoing performance of the lifts will be compared.

The evaluation shall include the following measurements:

- a) Full speed
- b) Flight time, from sheave start to sheave stop, for one floor run, two floor run, top to bottom in both up and down directions.
- c) Acceleration and deceleration for the typical floor runs in both up and down directions.
- d) Horizontal acceleration, front to back and side to side.
- e) Jerk rate
- f) Vertical vibration
- g) Noise level in car
- h) Levelling accuracy
- i) Group control performance
 - Percentage of landing calls on 30 seconds
 - Percentage of landing calls on 60 seconds
 - Percentage of landing calls on 90 seconds
- j) Average waiting times
 - 7.00 am to 6.00 pm
 - 7.00 am to 9.00 am
 - 9.00 am to 12.00 pm
 - 12.00 pm to 2.00 pm
 - 2.00 pm to 4.00 pm
 - 4.00 pm to 6.00 pm

H.16 PERFORMANCE AND BREAKDOWN REPORT

At the frequency stated in the Performance Schedule, the Contractor shall measure and record the data specified in the initial performance evaluation. The results of the initial and current performance shall be compared, and comment made on any difference outside the allowable variations nominated in Performance Schedule.

The report shall also summarise the total number of stoppages and malfunctions of each lift, the number of call backs per lift and comment on the number of call outs per lift per annum.

Monthly automated reports shall be provided to the client.

PART I. COMPREHENSIVE MAINTENANCE PERFORMANCE SCHEDULE

1.	INSPECTIONS & REPORTS	
a)	Minimum routine maintenance visits per individual equipment	: One per month/equipment
b)	Date for annual survey and condition report	: Anniversary of Contract
c)	Frequency of lift performance and breakdown reports	: Six monthly
d)	Group control performance reports	: Six monthly
e)	Date for submission of maintenance programme from commencement of Contract.	: 21 days
f)	Date for submission of initial condition and safety report	: Not Applicable
g)	Date for initial performance evaluation of each lift	: 3 months
2.	RESPONSE TIMES TO CALLOUTS	
a)	The response time to callouts for stoppages and malfunctions considered by the Owner to require urgent attention, shall not exceed: During normal site working hours Outside normal site working hours	: 20 minutes : 40 minutes
b)	The response time to call outs for stoppages and malfunctions, considered by the Owner not to require urgent attention, shall not exceed: During normal site working hours Outside normal site working hours	: 30 minutes : 60 minutes
3.	INCIDENCE OF CALL OUTS	
a)	Maximum number of call outs averaged over a period of 12 months	: 8 per lift per year
4.	PERFORMANCE VARIATIONS	

	The following variations shall be applicable to the measured initial performance evaluation	
a)	Variation of lift speed, up or down direction	: $\pm 5\%$
b)	Variation of acceleration/ deceleration in up or down direction	: $\pm 5\%$
c)	Variation in flight time, sheave start to sheave stop, between typical floors	: $\pm 5\%$
d)	Levelling accuracy	: ± 6 mm
5.	RIDE QUALITY	: MAINTAIN INITIAL MEASURED VALUES
6.	NOISE	: Maintain initial measured values

Lift Maintenance Schedule

Task	Frequency
1. Contact building representative –note any comments, rectify as required. 2. Ride in Lift- • Check lift car indication • Test emergency stop button • Check floor levels • Clean and test door protection device, test closing force 3. Clean motor room/secondary floor 4. Inspect lift controllers 5. Check oil levels/ empty drip trays 6. Inspect floor selectors, lubricate where necessary 7. Check and clean m/g, hoist motor and inspect brushes. 8. Inspect brakes/governor etc. 9. Lift car alarm and emergency phone is to be checked and found operational every month. 10. Lift car lights and emergency lighting to be checked and found operational every month.	Monthly /or on request
1. Check operation of car top control station/test car top safeties. 2. Clean top of car/check operation car top lighting. 3. Inspect guide shoes/rollers, for wear and adjustment.	3 monthly/ or on request
1. Clean down and lubricate floor selector, check advancer motor brushes/gears 2. Test pawl magnets, check hook switches and all contacts/flexes for wear 3. Inspect all V belts on motors and m/g sets 4. Perform brush gear maintenance to all hoists, m/g sets, tacho generators, damping motors etc. 5. Ensure brushes move freely in holders, spring tension is correct, brush holder settings are correct and all connections are tight 6. If undue sparking, grooving of comm. Is found, report to your supervisor. 7. Grease all grease nipples on motors, m/g sets and any auxiliary motors. 8. Test operation of all pit safeties. 9. Ensure all guards are fitted and pit lighting operational. 10. Clean pit area and report any signs of water to principal, and your supervisor. 11. Inspect all pit sheaves and lubricate bearings. 12. Check all bearing keeper plates are secure. 13. Check adjustment of governor idle sheave/ rope tension. 14. Test operation and oil levels of car, cwt. Buffers. 15. Check compensator clearance from floor, and rope tension. 16. Check cwt. Buffer clearance. 17. Check car/ cwt rails lubricate where necessary.	6 monthly/ or on request

18. Grease all car, cwt and diverter sheave bearings, check keeper plate tightness. 19. Visually check flexes for wear, secure hitching and screens fitted. 20. Clean and check all door locks for correct mechanical/electrical adjustment 21. Inspect all landing door guides and clean landing tracks. 22. Inspect and clean door hangars and tracks, check rollers, adjust upthrusts. 23. Inspect all door chains, air cords, door closers. 24. Check power door operator, lubricate pivot points, inspect door flexes. 25. Clean door motor, check brushes, V belts and adjust car door upthrusts. 26. Check operation of all switches and pdo limits, tighten all connections. 27. Examine all inductors, levelling switches, check lubricate selector tape. 28. Test operation of all top slowdown limits, switches, rollers and ramps. 29. Check all levelling vanes, plates are secure. 30. Inspect lift controllers, replace any worn parts and burnt contacts. 31. Inspect all flexible leads, check air gap on main relays/contactors. 32. Check all capacitor/diode connections, tighten main resistor taps. 33. Clean out controllers and check all failure prone components. 34. Check all fuses for correct amp rating. 35. Test all timers and check oil damped overloads. 36. Conduct trip test trip on all applicable equipment RCD's. Replace any RCD that fails test. 37. Discharge all Lift emergency lighting for a minimum period of 2 hrs. Repair/replace if fails test. 38. Ensure lift car is at top floor before working on brakes- • Dismantle brake magnet assy. Remove plunger, polish and lubricate plunger and sleeve, check brake adjustment after re assembly. • Inspect brake linings; ensure rivets etc are not worn. • Lubricate all pivot pins and ball joints.	6 monthly/ or on request
1. Inspect all ropes and fixtures and record and report any of the following to the supervisor • Rifling of rope groove on sheaves • Uneven rope groove wear • Ropes low in groove • Signs of significant erosion/rust • Small pieces of rope around machines • Signs of fracturing splintering 2. Conduct a trip and time/load test of associated Lifts Residual Current Devices. All results to be recorded in a log book. 3. Test under car lighting and check load weigh switches. 4. Check guide shoes/rollers on bottom of car and cwt for wear, adjustment and bearing noise. 5. Test operation under car safety switches	12 monthly/ or on request

6. Clean car cwt safety gear and associated equipment and check for correct settings and rail clearance. 7. Check compensator rope hitches/tensions, under car and cwt. 8. Test operation of bottom slowdown limits/switches and check ramps 9. Inspect all ropes and fixtures and record and report any of the following to the supervisor • Rifling of rope groove on sheaves • Uneven rope groove wear • Ropes low in groove • Signs of significant erosion/rust • Small pieces of rope around machines • Signs of fracturing splintering 10. Conduct a trip and time/load test of associated Lifts Residual Current Devices. All results to be recorded in a log book. 11. Test under car lighting and check load weigh switches. 12. Check guide shoes/rollers on bottom of car and cwt for wear, adjustment and bearing noise. 13. test operation under car safety switches 14. Clean car cwt safety gear and associated equipment and check for correct settings and rail clearance. 15. Check compensator rope hitches/tensions, under car and cwt. 16. Test operation of bottom slowdown limits/switches and check ramps 17. Inspect all ropes and fixtures and record and report any of the following to the supervisor • Rifling of rope groove on sheaves • Uneven rope groove wear • Ropes low in groove • Signs of significant erosion/rust • Small pieces of rope around machines • Signs of fracturing splintering 18. Test under car lighting and check load weigh switches. 19. Check guide shoes/rollers on bottom of car and cwt for wear, adjustment and bearing noise. 20. Inspect all ropes and fixtures and record and report any of the following to the supervisor • Rifling of rope groove on sheaves • Uneven rope groove wear • Ropes low in groove • Signs of significant erosion/rust • Small pieces of rope around machines • Signs of fracturing splintering 21. Conduct a trip and time/load test of associated Lifts Residual Current Devices. All results to be recorded in a log book. 22. Test under car lighting and check load weigh switches. 23. Check guide shoes/rollers on bottom of car and cwt for wear, adjustment and bearing noise. 24. test operation under car safety switches 25. Clean car cwt safety gear and associated equipment and check for correct settings and rail clearance. 26. Check compensator rope hitches/tensions, under car and cwt.	12 monthly/ or on request

27. Test operation of bottom slowdown limits/switches and check ramps 28. Check flexes for wear and secure Hitchings 29. Ensure flex screens and cwt, screens are fitted. 30. Clean underside lift car 31. Inspect and rectify any rattles/noises. 32. Inspect car superstructure and buffers 33. Inspect all mounting bolts, ensure they are tight. 34. Inspect car top, cwt guide shoes/rollers for wear, adjustment, worn bearings 35. Check all hitch points of lifting/ compensator ropes, check correct tensions. 36. Ensure all top, cwt, guards are fitted and clean. 37. Ensure clamps and fish plates on both car/cwt. Rails are secure. 38. Check all well flushing is secure 39. Check rail to roof clearance (must have at 50mm clearance from slab). 40. Yearly safety inspections- • Test operation of safety gear on slow speed • Ensure all jaws/ cams are free, clean and lubricate all pivot points. • Inspect governor jaws and sheaves for wear. • Test operation of all car switches, including security and lift isolation • Test fire service operation/ inform supervisor. • Perform full indication check including- Lift car indication, landing/ landing button indication, hall lantern indication and gong check.	12 monthly/ or on request

PART J. OPERATING AND MAINTENANCE MANUALS

J.1 REQUIREMENT

Supply three bound sets of the 'as installed', block plans, drawings and diagrams together with concise operating and maintenance instructions, schedules, commissioning records and log books as specified below.

The manuals shall give a clear, comprehensive description of lifts and associate the equipment, components and subcomponents, principle of operation, method of operation and maintenance procedures. The descriptions shall be accompanied by flow diagrams, line diagrams and any other illustrations necessary to achieve the required objective.

Contractor shall provide 2 hard copies and one electronic copy on CD.

J.2 FORMAT

Operation and maintenance manuals and associated drawings shall be supplied as a quality publication and shall be as follows.

- White A4 sized hard cover, 4D ring vinyl covered binder with main title in '30 Times Roman' secondary lettering in '12 and 10 Uni' upper and lower case as appropriate.
- Bind in clear vinyl or plastic folder.
- Titles for the manuals shall be:

OPERATING AND MAINTENANCE MANUAL
LIFT SERVICES
FOR
ASN Co, Bay 4-5, Hickson Road
(year of installation)

- Spine: ASN Co, Bay 4-5, Hickson Road- LIFT SERVICES

Title cover for the drawings shall be: ASN Co, Bay 4-5 Hickson Road- LIFT SERVICES DRAWINGS

All material contained in the manual shall be printed by an approved process on approved quality paper. This requirement includes all illustrative material.

J.3 INCLUDED DETAILS

Include the following type and range of data and information in the manual.

- General description and performance data for all equipment;
- Manufacturer's catalogues of the equipment.
- Parts list—a schedule of parts duly illustrated and showing name of manufacturer, part number and quantity.
- Installation instructions—to describe original installation procedures, alignment diagrams and figures, fit tolerances, and future removal and replacement procedures for all major equipment.
- Operating instructions—include all details necessary for correct start up procedure and sequence of operation.
- Maintenance instructions—include all phases of preventive maintenance including such items as a detailed lubrication chart, grade and type of lubricant, correct quantities of oils and greases, and procedures for drain and refill.
- Bearings—include a complete list of bearings for all systems, services or special plant items. Include the make, type, bearing number and location of each bearing.

- Imported equipment—include certified data from the manufacturer for works accepted equivalents, winding diagrams and conductor details for imported electric motors.
- Maintenance schedules—include detailed schedules of periodic checks and maintenance and replacement procedures.
- Test data—include copies of all test certificates including physical test of materials, as well as machine performance data, noise and vibration test figures and all progressive test data obtained during construction and installation.
- Drawing list—a complete list of drawings and numbers showing final revision suffix with their titles.

J.4 Lift Registration Certificate

Provide Certificate of Plant Item Registration with WorkCover NSW for each new lift, including the following details:

LIFT REGISTRATION CERTIFICATE - (Group 1)

(1) by Lift Manufacturer

Certificate to state the following as a minimum:

- Code Compliance with WorkCover of NSW
- Registration Number:
- Issue Date:
- Expiry Date:
- Controller:
- Trading as:
- Postal Address:
- Item Type (ie. Passenger Lift)
- Description of Item: (inclusive of Lift Type, Manufacturer, Contract/Serial Number, Drive Chain, Control Type, Suspension, Maximum SWL Rated Load (kg), Maximum Speed (m/s), Maximum Travel (m) and Maximum Number of Passengers
- Location:
- any Special Conditions

PART K. VTS UNIT SCHEDULES

K.1 PASSENGER LIFTS

(A) GENERAL	
Lift Numbers	Lift 1 and 2
Classification	Passenger
Number of Lifts	2 off KONE or equivalent
Rated Capacity	900 kg/12 people
Machine	Electric traction, gearless, (MRL)
Rated Speed	1 m/s
Speed Control	TBC
Traffic Performance	TBC
Clear Car Internal	2400mm high x 1400mm wide x 1500mm deep
Car Entrances/ levels served	1 / 5 (GF, L1 to L4)
Car/Landing Doors (clear)	To match existing opening size
Stretcher Capable	No
Facilities for persons with Disabilities	Lift car and landing control buttons and lighting complying with AS 1735.12.
DDA Compliant	Yes
Emergency Lift to Building Code	No
WIP Phone	Yes
(B) OTHER	
CWT Safety	TBC
Security Services Equipment	Swipe card readers within the lift cars.
Standby Power Operation	N/A
Landing Frame Type	Full Depth Profile Frame
Lift submain size	Refer to electrical drawings.
(C) Shaft width x Length available	1950mm wide x 1800mm deep

Overrun	3580mm
Pit Depth	1150mm
Travel	Less than 12m (as existing)
(D) Energy Savings	Incorporate regenerative Drives

Site Address: 1-5 Hickson Rd, The Rocks, NSW 2000
Survey Date: 22nd June 2012
Assessor: John Crockett and Derrick Scott
Age (Circa): 1884

Levels: 5
Approx. area (m²): ~4,000
Roof Type: Slate
External Walls: Sandstone blocks and brick

Internal Walls: Sandstone, brick, blockwork, plaster and fibre cement sheeting
Ceilings: Plaster
Floor: Timber and concrete
Floor Coverings: Carpet, ceramic tiles and vinyl floor tiles

Prensa Pty Ltd.
Level 1, 50 Yeo Street
Neutral Bay, NSW 2089
Ph.: (02) 9033 8634

Level / Area	Room & Location	Feature	Item Description	Hazard Type	Sample No.	Sample Status	Friability	Disturb. Potential	Condition	Risk Status	Quantity	Recommendations & Comments	Control Priority	Reinspect date
Exterior	Throughout	Windows	Window caulking	Asbestos	50325-006-009	Negative	-	-	-	-	-	-	-	-
Exterior Ground level	Throughout	Walls	Pointing material	Asbestos	50325-006-001	Negative	-	-	-	-	-	-	-	-
Interior	Throughout	Floor	Concrete screed	Asbestos	50325-006-002	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4	Central fire stair	Fire doors	Internal insulation	Asbestos	Not sampled - sealed units	Suspected negative	-	-	-	-	-	-	-	-
Interior Bay 2-4	Southern fire stair	Fire doors	Internal insulation	Asbestos	Not sampled - sealed units	Suspected negative	-	-	-	-	-	-	-	-
Interior Bay 2-4	Lifts	Black - floor covering	Vinyl floor tiles	Asbestos	50325-006-005	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4	Lifts (all levels)	Exterior doors	Internal insulation	Asbestos	Not sampled - sealed units	Suspected positive	Friable	Low	Good	Low	~10 units	Confirm status, remove under controlled friable asbestos removal conditions as soon as practicable by a Class A licensed asbestos removal contractor.	P3	Jun-17
Interior Bay 2-4 Ground level	Throughout	Walls	Pointing material	Asbestos	50325-006-006	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Ground level	Lift lobby	Floor	Bituminous material	Asbestos	50325-006-007	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 1	Main distribution/comms room	Walls	Fibre cement sheeting	Asbestos	Same as: 50325-006-003	Assumed negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 1	Amenities	Partition walls	Fibre cement sheeting	Asbestos	Same as: 50325-006-003	Assumed negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 2	Amenities behind reception	Partition walls	Fibre cement sheeting	Asbestos	50325-006-003	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 2	Kitchen behind reception	Red - floor covering	Vinyl floor tiles	Asbestos	50325-006-004A	Negative	-	-	-	-	-	-	-	-

Level / Area	Room & Location	Feature	Item Description	Hazard Type	Sample No.	Sample Status	Friability	Disturb. Potential	Condition	Risk Status	Quantity	Recommendations & Comments	Control Priority	Reinspect date
Interior Bay 2-4 Level 2	Kitchen behind reception	Red - floor covering	Adhesive under vinyl floor tiles	Asbestos	50325-006-004B	Negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 3	Kitchenette	Red - floor covering	Vinyl floor tiles	Asbestos	Same as: 50325-006-004A	Assumed negative	-	-	-	-	-	-	-	-
Interior Bay 2-4 Level 3	Amenities	Partition walls	Fibre cement sheeting	Asbestos	Same as: 50325-006-003	Assumed negative	-	-	-	-	-	-	-	-
Interior Bay 5 Level 2	Cinema service corridors	Walls	Fireproofing	Asbestos	50325-006-008	Negative	-	-	-	-	-	-	-	-
Interior Bay 5 Level 2	Cinema service corridors	Fire doors	Internal insulation	Asbestos	Not sampled - sealed units	Suspected negative	-	-	-	-	-	Suspected negative due to age and appearance.	-	-
Interior Bay 1 Ground level	Toilets	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 1 Level 2	West office kitchenette	Water boiler	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 1 Level 3	West bathroom	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 1	Kitchen	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 1	Kitchen	Water boiler/chiller	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 2	North	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 2	Ceiling space	Air conditioning ductwork	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	~50m	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 2	Kitchen behind reception	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 2	Kitchen behind reception	Water boiler	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-

Level / Area	Room & Location	Feature	Item Description	Hazard Type	Sample No.	Sample Status	Friability	Disturb. Potential	Condition	Risk Status	Quantity	Recommendations & Comments	Control Priority	Reinspect date
Interior Bays 2-4 Level 3	Kitchenette	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 3	Kitchenette	Water boiler	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 4	Roof/ceiling	Air conditioning ductwork	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	~50m	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bays 2-4 Level 4	Main classroom area	Water chiller	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 5 Ground Level	Bathroom	Hot water heater	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 5 Level 1	Cinema	Walls	Insulation material	SMF	-	Suspected positive	-	Low	Good	Low	~500m ²	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 5 Level 2	Rear office	Water chiller	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	1 unit	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 5 Level 2	Cinema	Walls	Insulation material	SMF	-	Suspected positive	-	Low	Good	Low	~500m ²	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior Bay 5 Level 3	Roof space	Air conditioning ductwork	Internal insulation	SMF	-	Suspected positive	-	Low	Good	Low	~50m	Maintain in good condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-	-
Interior	Throughout	Fluorescent light fittings	Capacitors	PCB	-	Suspected negative	-	-	-	-	-	PCB-containing capacitors are unlikely to be present due to age and appearance of light fittings. Confirm PCB status prior to refurbishment or demolition works.	-	-
Exterior	Throughout	Doors	Beige - upper coloured paint system	Lead Paint - Swab	-	Negative	-	-	-	-	-	-	-	-
Exterior	Throughout	Door frames	Red - upper coloured paint system	Lead Paint - Swab	-	Negative	-	-	-	-	-	-	-	-
Exterior	Throughout	Window frames	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP001	Positive - 14%	-	Low	Good	Low	~500m	>1% lead content, maintain in current condition, over paint with a lead-free paint as part of ongoing maintenance. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-
Exterior	Throughout	Windows	Cream - upper coloured paint system	Lead Paint - Chip	50325-006-LP002	Positive - 9.6%	-	Low	Good	Low	~500m	>1% lead content, maintain in current condition, over paint with a lead-free paint as part of ongoing maintenance. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-

Level / Area	Room & Location	Feature	Item Description	Hazard Type	Sample No.	Sample Status	Friability	Disturb. Potential	Condition	Risk Status	Quantity	Recommendations & Comments	Control Priority	Reinspect date
Interior Bay 1 Ground level	Toilets	Door frames	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP003	Positive - 11%	-	Low	Good	Low	~15m	>1% lead content, maintain in current condition, over paint with a lead-free paint as part of ongoing maintenance. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-
Interior Bay 1 Ground level	Toilets	Doors	Cream - upper coloured paint system	Lead Paint - Chip	50325-006-LP004	Negative - <0.05%	-	-	-	-	-	<1% lead content, not lead containing paint as described in AS 4361.2:1998 Guide to lead paint management	-	-
Interior	Throughout	Door and window timberwork	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP005	Positive - 13%	-	Low	Good	Low	~1000m ²	>1% lead content, maintain in current condition, over paint with a lead-free paint as part of ongoing maintenance. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-
Interior	Throughout	Skirting	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP006	Positive - 2%	-	Low	Good	Low	~500m ²	>1% lead content, maintain in current condition, over paint with a lead-free paint as part of ongoing maintenance. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-
Interior	Throughout	Brick walls	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP007	Negative - 0.087%	-	-	-	-	-	<1% lead content, not lead containing paint as described in AS 4361.2:1998 Guide to lead paint management	-	-
Interior	Throughout	Brick walls	Cream - upper coloured paint system	Lead Paint - Chip	50325-006-LP009	Positive - 4.5%	-	Medium	Fair	Medium	~100m ²	>1% lead content, remove flaking sections and over paint with a lead-free paint. Remove under controlled conditions in accordance with AS 4361.2:1998 Guide to lead paint management prior to renovation or demolition works.	-	-
Interior Ground level	Throughout	Sandstone walls	White - lower coloured paint system	Lead Paint - Chip	50325-006-LP010	Negative - <0.05%	-	-	-	-	-	<1% lead content, not lead containing paint as described in AS 4361.2:1998 Guide to lead paint management	-	-
Interior Bay 1	Throughout	Plaster walls	Purple - upper coloured paint system	Lead Paint - Chip	50325-006-LP008	Negative - 0.13%	-	-	-	-	-	<1% lead content, not lead containing paint as described in AS 4361.2:1998 Guide to lead paint management	-	-
Exterior Bay 1	Roof	Air conditioning units (Deakin)	R22	Ozone Depleting Substances	-	Positive	-	Low	Good	Low	~2 unit	Hydrochlorofluorocarbon (HCFC), ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989.	-	-
Interior Bay 5 Level 2	Cinema service corridors	Air conditioning unit (Apal)	R22	Ozone Depleting Substances	-	Positive	-	Low	Good	Low	1 unit	Hydrochlorofluorocarbon (HCFC), ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989.	-	-
Interior Bay 5 Level 2	Plant room with mezzanine	Air conditioning unit (Apal)	R22	Ozone Depleting Substances	-	Positive	-	Low	Good	Low	1 unit	Hydrochlorofluorocarbon (HCFC), ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989.	-	-

Level / Area	Room & Location	Feature	Item Description	Hazard Type	Sample No.	Sample Status	Friability	Disturb. Potential	Condition	Risk Status	Quantity	Recommendations & Comments	Control Priority	Reinspect date
Interior Bay 1 Level 3	Cleaners store	Ceiling space	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to height restrictions	-	-
Interior Bays 2-4 Ground level	Lift lobby	Electrical distribution cupboard x3	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bays 2-4 Level 1	Lift lobby	Electrical distribution cupboard	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bays 2-4 Level 2	Lift lobby	Electrical distribution cupboard	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bays 2-4 Level 3	Lift lobby/reception	Electrical distribution cupboard	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bays 2-4 Level 4	Lift lobby/reception	Electrical distribution cupboard x3	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bays 2-4 Level 4	Main classroom area	Small store	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to locked door	-	-
Interior Bay 5 Level 2	Main showroom	Cupboard under stair	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to stored stock	-	-
Interior Bay 5 Level 3	Main showroom	Ceiling space	-	-	-	-	-	-	-	-	-	No access at the time of the assessment due to height restrictions	-	-

ASN Bay 5 - Ground floor services trench extension Review of Archaeological Implications

Nature of Works

New drainage works are proposed that affect the ground floor of Bay 5 of the ASN Building, the Rocks. This Review looks at the nature of the site and past building works to establish if the area has the potential to retain archaeological remains. It has been written for TKD Architects. Jocelyn Jackson, TKD Practice Director, provided comments on drafts of this Review.

Area's Historic Background¹

According to Grimes Plan of Sydney, the land now occupied by the ASN Co. Building was originally part of a 1.5 acre (6070sqm) lease to John Baughan authorised by Lieutenant Governor Grose in December 1794 for fourteen years. Adjacent areas to the north, comprising 2½ acre (10117sqm) on the southern shore of the little cove (now Campbell Cove) and the sloping hillside above was held by Captain Waterhouse, a naval officer who came to the colony with the first fleet. In 1798 Robert Campbell, arrived in Sydney with a cargo of general merchandise. He saw opportunities for developing an export and import trade and immediately applied for the lease of land on which to establish a merchant warehouse. Campbell obtained the lease (and eventually the grant) of Baughan's land adjacent to deep water on the west side of Sydney Cove. Planning further development he also approached Captain Waterhouse. Robert Campbell was granted some three acres on the western side of Sydney Cove in 1819. By this time he had already erected several large buildings on the site, including wharfage and stores.

By 1801 Robert Campbell erected storehouses and wharf on the western side of the Sydney Cove and by 1802 completed Wharf House for his family (Figure 1). This house occupied the site of the present ASN Co. Building and was an elegant landmark, prominent in many early photos and sketches of the harbour. An inventory of Campbell's property made in 1810 described the home as a nineteen-room dwelling "finished in and elegant manner with Colonnades and two fronts", which, together with stables and coach houses, was valued at £5,450. The grounds on which the houses stood included a garden, a paddock, and two wells. These grounds had been drained and cleared of rocks, and some of the land had been expensively reclaimed with broken rock.

¹ Extracted from City Plan Heritage, *ASN Building CMP*, 2009.



Figure 1: Robert Campbell's Wharf House at the Rocks, Sydney, c1887, Robert Hunt, University of Sydney, albumen print. HP81.106.15.



Figure 2: Site of Wharf House on 1865 Trig survey. Source: CMP.

The Australasian Steam Navigation Company purchased Campbell's Wharf and adjoining land for £50,000. Subsequently the company altered and used the residence as its docking office until 1883, when Wharf House was demolished. In 1884, the Australasian Steam Navigation Company erected new offices and warehouse on the site of Robert Campbell's residence. The building had taken 18 months to complete and had included the excavation of some three million cubic feet (85,000 cubic metres) of stone from the site to form its building platform and basement levels off Hickson Road.² This would have led to substantial if not complete cutting down of the site, from the level formerly occupied by Wharf House.

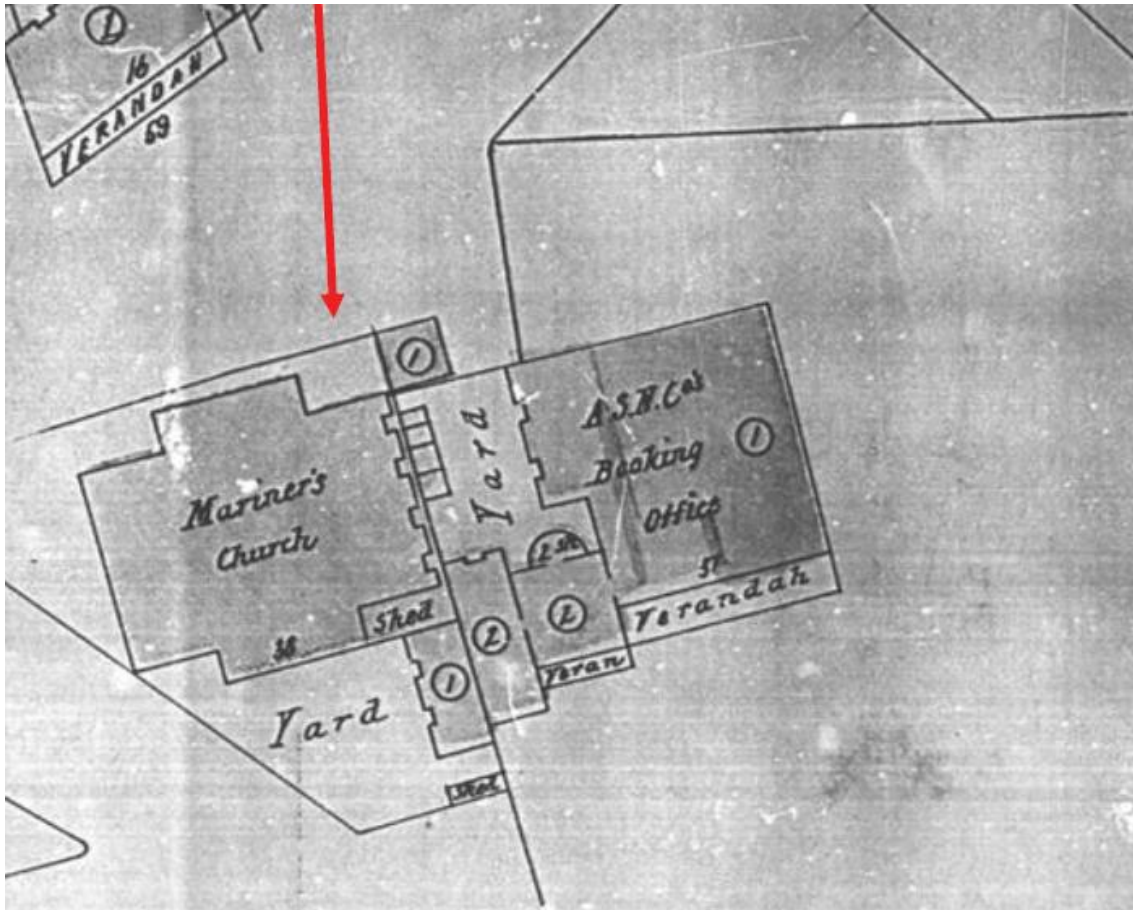


Figure 3: Campbell's Wharf House being used by the ASN Company as a booking office.
Source: CMP.

² City Plan Heritage, *ASN Building CMP*, 2009, p.26.

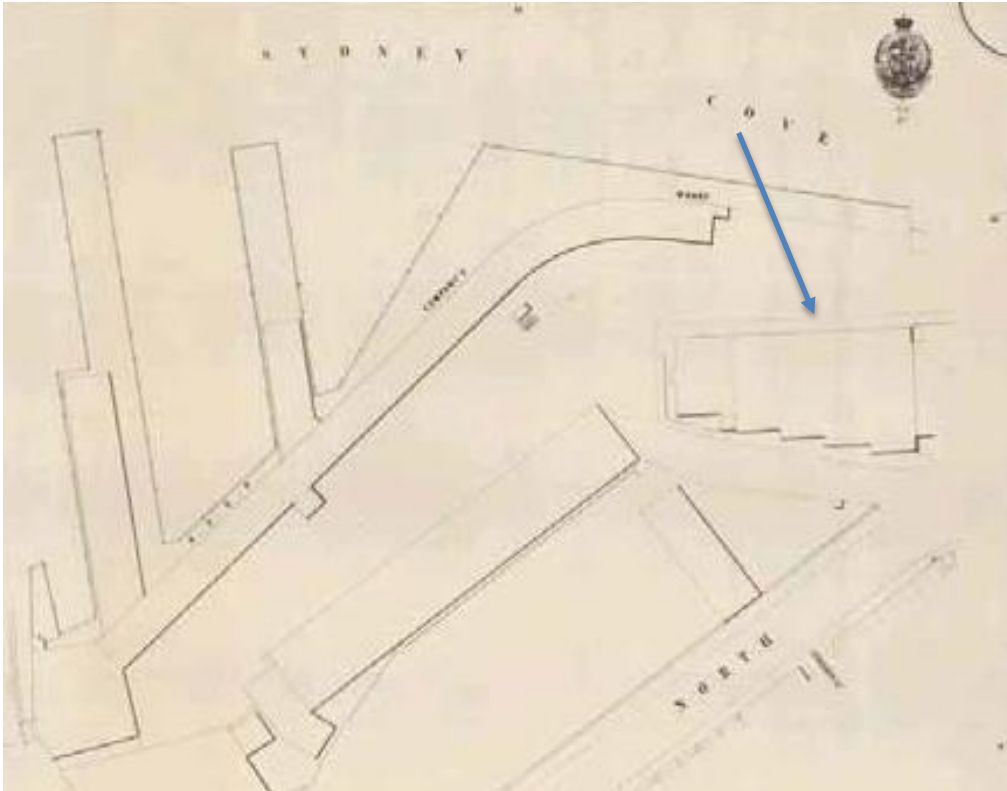


Figure 4: The newly-built ASN building, and the Mariners Church at southern end. Source: CMP.

Area's Archaeological Potential

Archaeological Potential is the potential for a site to retain archaeological remains of State or Local significance that are protected under the provisions of the *Heritage Act 1977*. Previous assessment of the site has considered the site as being 'mostly disturbed' in terms of the likelihood of there being intact archaeological remains. This was on the basis of:

Physical Condition...Warehouses cut into hill slope from Circular Quay West. Basements below George Street / Hickson Road level (from S170 register listing – <http://www.environment.nsw.gov.au/heritageapp/visit/ViewAttractionDetail.aspx?ID=5053141#>).

and

Research Potential.... The archaeological potential for below ground deposits would be mostly destroyed, and thus the site has a low likelihood of providing new relics; however, any archaeological relics potentially found in the future could possibly be of high significance. (http://www.shfa.nsw.gov.au/sydney-About_us-Heritage_role-Heritage_and_Conservation_Register.htm&objectid=62)

The Rocks and Millers Point Archaeological Management Plan (1991) assessed the site's archaeological potential as:

Integrity/Intactness: Archaeology: Mostly disturbed. Much of the original fabric of the building is intact.

The Plan, however, did list it as an 'area of archaeological sensitivity', presumably referring to its potential to retain industrial relics.

In conclusion, the construction of the ASN Building is likely to have removed or disturbed most, if not all, evidence of the previous uses of the site, especially of Wharf House and its outbuildings etc. It is possible that deeper subsurface remains such as

wells might have survived these impacts. Although not considered 'relics', they often contain relics.

Archaeological remains could therefore be:

- Evidence for modification of the natural bedrock.
- The lower sections of deeper sub-surface features such as wells. These could have been backfilled with artefacts relating to the use of the area.

Artefacts belonging to the industrial use of Bay 5 are not expected to be found under the small section of the concrete floor slab that will be removed but would be of heritage significance if they were present.



Figure 5: Internal photograph of Bay 5.

Proposed works with Archaeological Implications

The proposed works are relatively minor in terms of the proportion of the Ground Floor that will be disturbed by the proposed works (Figure 6). The new drainage line will connect to an existing service inside an existing conduit running east-west (Figure 7, Figure 8), which runs into an existing pit (Figure 6, blue rectangle). At the eastern end of this service the new drainage will be inserted above the existing concrete floor, so that no excavation is required. The existing pit at the western end will be expanded to the south by a new pit measuring 1.4 x 0.74m (Figure 6, red rectangle). The area of excavation will be 1.07 sq.m.

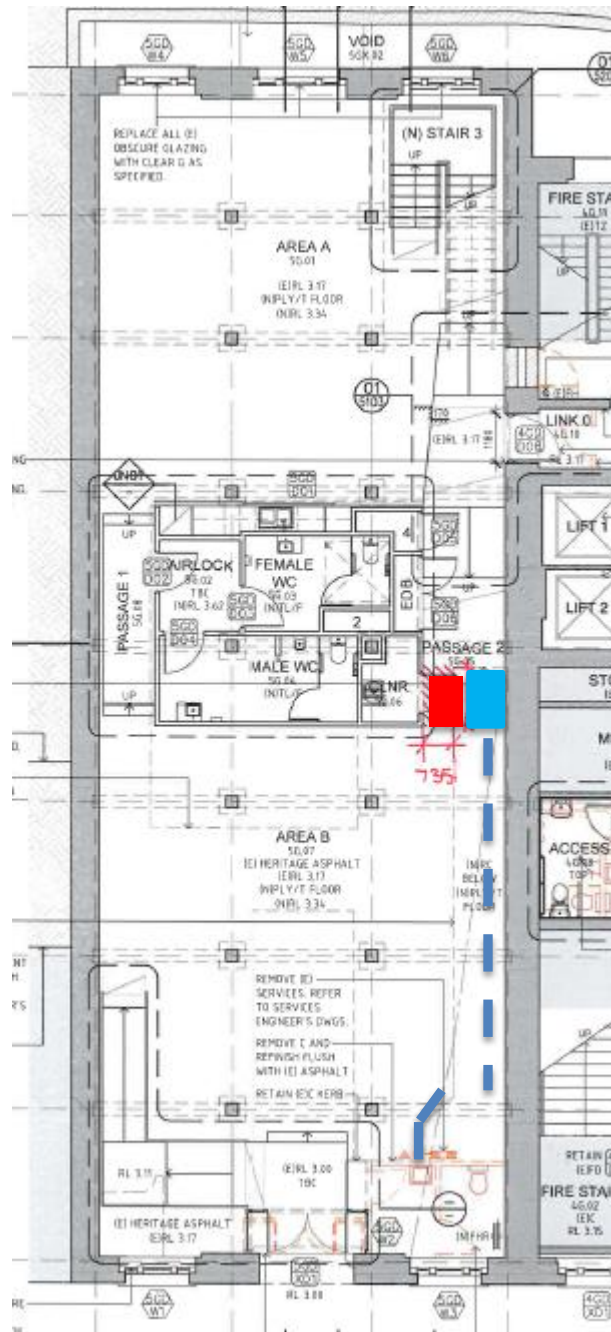


Figure 6: Ground Floor plan showing the service trench route. The broken blue line indicates an existing service that the new service will connect to at the blue rectangle, which is an existing pit. The red rectangle indicates a new pit required for the new pipe connections.



Figure 7: Looking north. The western end of the existing services trench is at right.



Figure 8: Looking west, showing the existing services trench running adjacent to north wall.

Archaeological Methodology and Recommendations

The new service pit is small in dimension which limits its ability to expose underlying strata and features, even if they were present. The area to be excavated, however, should be inspected by the archaeologist once the concrete slab is removed to confirm that bedrock lies immediately beneath the slab. If fill is encountered, the archaeologist should be present during the initial excavation of the pit until bedrock is reached. They should also be at call to attend site should potential archaeological remains or artefacts are found.

The location of the new pit may need to be adjusted should substantive remains be found, although this review indicates the whole site is likely to have been cut down into bedrock, so removing previous evidence of site usage.

The archaeological recording of the underlying strata should be subject to an illustrated report to inform future works that penetrate beneath the floor slab. Any artefacts that are recovered should be catalogued by appropriate experts and included in the report.

TONY LOWE**DIRECTOR**

Casey & Lowe

Archaeology & Heritage Pty Ltd

tony.lowe@caseyandlowe.com.au

0409 988 846

15 January 2018