



Government of **Western Australia**
Department of **Communities**



Department of Communities

Construction Specification

NATSPEC | BCA Class 2 and 3 buildings

This reference specification has been developed by NATSPEC in conjunction with the Western Australia Department of Communities. The requirements in this specification are generic and are to be read in conjunction with project specific documents from the Design consultant, including drawings, schedules and appendices. It does not cover the requirements for every project situation.

The Design consultants' documents take precedence over this reference specification. Check the consultants' documents for any variations to the requirements of this specification.

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PREFACE

This reference specification has been developed for use on all housing projects by the Western Australia Department of Communities of BCA Class 2 and 3 buildings. It includes framed construction (steel and timber), masonry veneer and full masonry construction. It may include requirements which are not applicable to the project. Read this specification in conjunction with other project specific documents, including drawings, schedules and appendices, and refer/conform to the applicable requirements.

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0131 PRELIMINARIES**1 GENERAL****1.1 PERMITS, FEES AND CONTRIBUTIONS****Applications and approvals**

Contractor's responsibilities: Cover all authority application and approval requirements, including fees and contributions.

Written confirmation of authority approvals: Provide to the principal before installing, including all relevant drawings.

Building applications

Applications: Submit to the Permit Authority a completed Certified Building Permit Application (BA1) and other documents required, including Certificate of Design Compliance (BA3) and Application for Demolition Permit (BA5), if required.

Drawings and specifications submitted with application: Demonstrate compliance with the NCC and provide evidence that other relevant approvals have been obtained, including local government authority approval of public health requirements.

Building and Construction Industry Training Fund (BCITF) levy: Cover all costs and requirements, including additional payments required if the construction costs vary by more than \$25,000. Submit proof of BCITF Levy payment (receipt) with the Certified Building Permit Application (BA1) submission.

Headworks/infrastructure contribution

Requirement: Cover all contribution fees and services connection/reconnection fees required for the project by the utility authority or service provider. Retain proof of payment for reimbursement by the Department of Communities.

1.2 THE SITE**Project signboards**

General: Within 10 working days of commencement of work, provide project-specific signboards and as follows:

- Locate where directed by the principal.
- Maintain in good condition for duration of the work.
- Obtain permission for removal.
- Remove on practical completion.

Other signboards: Obtain approval from the principal before display of advertisements or provision of other signboards.

Reinstatement

Accessways and services: Do not obstruct or damage roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services. Rectify immediately any obstruction or damage to such services and provide temporary services whilst repairs are carried out.

Trees and properties: Do not interfere with or damage trees and properties that are to remain on or adjacent to the site, including adjoining property encroaching onto the site. Rectify immediately any interference or damage to such trees and properties.

Existing services

Service to be continued: Repair, divert or relocate service, as documented.

Trenches: If the existing service crosses the line of a required trench or will lose support when the trench is excavated, provide permanent support for the existing service.

Redundant services: Remove redundant parts and make safe.

Interruptions to services: Minimise the number and duration of interruptions.

Changes to existing services: Submit proposals.

- Purpose of submission: For review.
- Timing of submission: Before starting work to existing services.

Location of services: Verify the location of existing services from the appropriate authority and/or BEFORE YOU DIG AUSTRALIA (see www.byda.com.au), as required.

- Verges: Locate services before start of landscaping.

Damaged services: Rectify or replace services damaged during construction. If required, obtain permits from the appropriate authority.

Use of existing services

General: Existing services may be used as temporary services for the performance of the contract subject to conditions of use, as documented.

Adjoining properties

Notice: At least 10 working days before commencing work, give written notice to owners and occupants of adjoining properties of intention to commence work and an outline description of the type and extent of work.

Revealed encroachments: If the works reveal unknown encroachments of adjoining properties onto the site or of existing site structures onto adjoining properties, immediately notify the principal and seek instructions.

Dilapidation report: For each adjoining property to be recorded:

- Inspect the property with the principal and owner and occupant of the property, before commencement of work.
- Make detailed records of conditions existing within the property, especially structural defects and other damage or defacement.
- Arrange for at least 2 copies of each report, including drawings, written descriptions, and photographs, to be endorsed by the owner and occupant of the property, or their representatives, as evidence of conditions existing before commencement of work.

Endorsed copies: Submit one endorsed copy of each report. Keep the other endorsed copy on site.

- Purpose of submission: For information.
- Timing of submission: Before commencement of work.

Parking

Principal's existing parking areas: Use only designated parking areas.

1.3 PROTECTION OF PEOPLE AND PROPERTY

General

Temporary works: Provide and maintain required hoardings, barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic management until practical completion. Provide all measures required to guard against vandalism of works and materials on site.

Vandalism

Requirement: Provide all measures required to guard against vandalism, including graffiti, of works, materials, plant and equipment on site. Do not claim for costs or loss from vandalism of works, materials, plant or equipment on site.

Removal of graffiti: Remove any graffiti applied to buildings, plant and equipment. If graffiti is not removed within the time nominated by the principal, the Department of Communities, will remove the graffiti and recover the cost from the contract.

Occupied premises

General: For the parts of the site designated as occupied premises:

- Allow occupants to continue in secure possession and occupancy of the premises for the required period.
- Maintain safe access for occupants.
- Arrange work to minimise nuisance to occupants and for their safety.
- Protect occupants against weather, dust, dirt, water or other nuisance.

Proposals: Submit details of proposed methods.

- Purpose of submission: For information.
- Timing of submission: Before commencement of work.

Protective clothing

Requirement: Make available protective clothing for the use of visitors, as follows:

- Safety helmets: Type 1 to AS/NZS 1801 (1997).
- High visibility safety vests: To AS 4602.1 (2011).

Certification: Required.

- Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Safety

Accidents: Promptly notify the principal of the occurrence of the following:

- Accidents involving death or personal injury.
- Accidents involving loss of time.
- Incidents with accident potential such as equipment failure, slides and cave-ins.

Accident reports: Submit reports of accidents.

- Purpose of submission: For information.
- Timing of submission: Within one day after the accident.

Dust, dirt, water and fumes

Protection: Undertake measures to prevent dust, water, and noise from affecting and inconveniencing adjacent properties and the public. Obtain permission from the adjoining property owners/occupants before entering their property.

1.4 BUILDING THE WORKS

Authority application

Watering exemption: Apply to the WA Water Corporation for a temporary watering roster exemption for new lawns and gardens.

Exemption period: 42 days.

Stormwater drainage

Requirement: Liaise with the local government authority for the preferred method of drainage and other stormwater requirements. Install to the authority's requirements.

Survey marks

Definition: A survey peg, benchmark, reference mark, signal, alignment, level mark or any other mark used or intended to be used for the purpose of setting out, checking or measuring the work.

Care of survey marks: Preserve and maintain the principal's survey marks in their true positions.

Rectification: If survey marks are disturbed or obliterated, immediately rectify.

Contractor's representative

General: Must be accessible, and fluent in English and technical terminology.

Contacts: Submit names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract.

- Purpose of submission: For information.
- Timing of submission: At the first site meeting.

Subcontracting

General: Submit a complete list of proposed and selected subcontractors and suppliers.

- Purpose of submission: For information.

Materials

Requirement: All materials must be new, unless documented otherwise.

Items supplied by the principal

General: Materials and other items supplied free of charge to the contractor for installation in the execution of the works. Unload and take delivery, inspect for defects and take care of the items. If defects are found, advise. Return unused items to the principal.

Disposal of waste

Site waste (including food waste): Dispose of in compliance with state regulations and local government authority waste management requirements, including the following:

- *Environmental Protection Act 1986 (WA)*.
- *Environmental Protection Regulations 1987 (WA)*.

- *Health (Miscellaneous Provisions) Act 1911 (WA).*
- *Local Government Act 1995 (WA).*
- *Waste Avoidance and Resource Recovery Act 2007 (WA).*
- The recommendations of the Master Builders *Smart Waste Guide (2014).*

Waste containing asbestos: Handle, transport and dispose of in compliance with state regulations including the following:

- *Environmental Protection (Controlled Waste) Regulations 2004 (WA).*
- *Environmental Protection (Rural Landfill) Regulations 2002 (WA).*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA).*

1.5 COMPLETION OF THE WORKS

Notice of Completion Certificate

Submission: Within 7 days of completing the construction works, submit a Notice of Completion Certificate (BA7) to the Permit Authority with other required documentation.

Occupancy permit

Application: Upon practical completion, apply for Occupancy permit (BA9) or Occupancy permit strata (BA11).

Final cleaning

General: Before the date for practical completion, clean throughout, including interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces. Clean debris from the site, roofs, gutters, downpipes and drainage systems. Remove waste and surplus materials.

Samples: Remove non-incorporated samples, prototypes and sample panels.

Reinstatement

General: Before the date for practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

Adjoining properties

Evaluation:

- At practical completion, inspect each property with the principal, owner and occupant of the property.
- Compare the current condition with the condition before carrying out the work by comparison to the endorsed dilapidation report.
- Identify damage caused by construction and rectify.

Pest eradication

General: Employ suitably qualified pest exterminators. At practical completion, verify that completed works are free of pest types, as documented.

Removal of temporary works and plant

General: Within 10 working days after practical completion, remove temporary works, services and construction plant.

Handover

Keys: Provide the following:

- Individual dwellings: Two keys for each set of locks keyed alike and two keys for each lock keyed to differ, including keys to windows, sliding doors and store room doors.
- Common areas: One key for each set of locks for common services cupboards.

Key register: Provide a key register with the barrel numbers of the keys provided.

Record submission

Warranties: Register with manufacturers, as necessary, and provide copies of manufacturers' warranties.

Instruction manuals: Provide the manufacturers' instruction manuals.

Surveyor's certificate: Provide a certificate which confirms that the work, including boundary fences, has been correctly located.

Authorities' approvals: Provide evidence of approval from the local government authority or principal accredited certifier and statutory authorities whose requirements apply to the work.

Services as-constructed records: At practical completion, submit the services as-constructed drawings to the principal.

- New buildings: Prepare drawings accurately showing the site and the as-constructed location of services including details required for future maintenance.
 - Underground services: Provide a plan which shows the location of underground services.
- Electrical services and TV installations: Submit records with details of the following:
- Layout of submains.
 - Layout of common services circuits.
 - Switchboard layouts.
 - Line diagrams of installations.
 - Route of underground cabling and pit location.

Submission format: Submit records in plastic folders and fix folders inside main switchboard cabinets.

1.6 MISCELLANEOUS

Compliance with the law

General: Give notices and obtain the permits, authority approvals and authorisations, including payment of fees, to complete the works, unless noted otherwise.

0171 GENERAL REQUIREMENTS

1 GENERAL

1.1 PRECEDENCE

General

Order of precedence: If there is conflict or inconsistency between the worksections of this specification, the requirements of worksections take the following order of precedence:

- All worksections other than those listed below.
- *0701 Mechanical systems, 0801 Hydraulic systems, 0901 Electrical systems and 1001 Fire services systems.*
- *018 Common requirements worksections.*
- *0171 General requirements.*

1.2 CROSS REFERENCES

Cross referencing styles

General: Within the text, titles are cross referenced using the following styles:

- Worksection titles are indicated by *Italicised* text.
- Subsection titles are indicated by CAPITAL text.
- Clause titles are indicated by **BOLD CAPITAL** text.
- Subclause titles are indicated by **Bold Sentence case** text.

1.3 REFERENCED DOCUMENTS

General

Precedence: The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

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

Current editions: All referenced documents are the editions, with amendments, current on 1st September 2022.

Exception to current editions: If statutory requirements reference other editions or standards, conform to those other editions or standards.

Maintenance and repair works: If statutory requirements applicable to the maintenance or repair works reference other editions or standards, conform to those other editions or standards.

European standards: Any national European Standard (e.g. BS EN, IS EN or DIN EN) may be used in place of the equivalent referenced European Standard (EN).

1.4 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.

Levels

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

Drawings and manuals for existing services

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

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.
- EN: European Norm (European Standard).
- 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.
- VOC: Volatile Organic Compound.
- WHS: Work Health and Safety.

Definitions

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

- Access for maintenance: Includes access for maintenance, inspection, measurement, operation, adjustment, repair, replacement and other maintenance related tasks.
- Accessible, readily: Readily accessible, easily accessible, easy access and similar terms mean capable of being reached quickly and without climbing over or removing obstructions, using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.
- Accredited Testing Laboratory:
 - . An organisation accredited by the National Association of Testing Authorities (NATA) to undertake the relevant tests; or
 - . An organisation outside Australia accredited to undertake the relevant tests by an authority recognised by NATA through a mutual recognition agreement; or
 - . An organisation recognised as being an Accredited Testing Laboratory under legislation at the time the test was undertaken.

- . An organisation accredited for compliance with ISO/IEC 17025 (2017) to undertake the relevant tests.
- Appropriately qualified person: To NCC (2022) Schedule 1 [NCC (2019) Schedule 3].
- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Baseline data: Data derived from the final design, installation and commissioning, which serve as a basis for verification of results of routine servicing.
- Commissioning: Advancement of an installation from static completion to full working order, including verification that the systems, subsystems, and their components meet the project requirements. This includes all work described as commissioning in referenced documents, even if carried out before static completion.
- 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.
- Design parameters: Information used as the basis for design. It includes design requirements, performance criteria, performance parameters and similar terms.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.
- Economic life: The period of time from the acquisition of an asset to the time 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.
- Errors and omissions: For the design prepared by the contractor, errors and omissions have the same meaning as defects.
- Fire hazard properties: To NCC (2022) Schedule 1 [NCC (2019) Schedule 3].
- 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.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 (2006) after fabrication with coating thickness and mass to AS/NZS 4680 (2006) Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529 (2004).
- 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.
 - . 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 joint (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 premoulded strip.
- Local authority (local council): 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 (2021). Metal thicknesses specified are base metal thicknesses.
 - . Ferrous open sections zinc coated by an in-line process: To AS/NZS 4791 (2006).
 - . Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792 (2006).

- Network Utility Operator: To NCC (2022) Schedule 1 [NCC (2019) Schedule 3]. A person who undertakes the piped distribution of drinking water or non-drinking water for supply; or is the operator of a sewerage system or a stormwater drainage system.
- Northern areas: Sites located north of 27° latitude.
- 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.
- Pre-commissioning: Verifying that the installation of a system is complete and ready for commissioning.
- Professional engineer: To NCC (2022) Schedule 1 [NCC (2019) Schedule 3].
- Proprietary: Identifiable by naming the 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.
- Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.
- Referenced documents: Standards and other documents whose requirements are included in this specification by reference.
- Required: Required by the contract documents, the local 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 workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- Static completion: The state of a system when installation works are complete but have not been commissioned.
- Statutory authority: A public sector entity created by legislation, that is, a specific law of the Commonwealth, State or Territory.
- Supply: Supply, furnish and similar expressions mean supply only.
- Tests - integrated system: Tests conducted on the project as a complete, integrated system to verify successful integration, interaction, and operation of all interrelated systems to the project requirements.
- Tests - production: Tests carried out on an item, before delivery to the site.
- Tests - site: Tests carried out on site.

- Tests - type: Tests carried out on an item identical with a production item, including with respect to materials, material suppliers, manufacturing processes, dimensions and marking.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Utility service provider: Includes Electricity distributor, Network Utility Operator, Gas Network Operator and organisations providing other reticulated utilities including data and telecommunications services.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

2 SUBMISSIONS AND INSPECTIONS

2.1 SUBMISSIONS

General

Requirement: Make submissions, as documented.

Contractor review: Before submitting, review each submission item, and check for coordination with other work of the contract and conformance to contract documents.

Submission times

Default timing: Submit information or other material for information, comment or approval at least 5 working days before ordering products or starting installation of the respective portion of the works.

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

Requirement: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include relevant contract document references.

Non-conformance: Identify proposals that do not conform with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Errors

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

Project requirements

General: Submit the following:

- Authority approvals: Notes of meetings with regulatory authorities and utility service providers whose requirements apply to the work and evidence that notices, fees and permits have been sought and paid, that utility service provider connections are complete and that statutory approvals by the authorities whose requirements apply to the work have been received.
- Baseline data: To **BASELINE DATA**.

- Building penetrations: Details of the methods to maintain the required structural, fire and other properties to **BUILDING PENETRATIONS**.
- Certification: Certificates of conformance to documented requirements.
- Design documentation: Drawings, calculations and specifications as documented.
- Execution details: Execution programs, schedules and details of proposed methods and equipment. For building services include 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.
- Fire performance: Evidence of conformity to requirement for combustibility, fire hazard properties and fire-resistance of building elements.
- Marking and labelling: Samples and schedules of proposed marking and labels to **MARKING AND LABELLING**.
- Operation and maintenance manuals: For the whole of the work to **OPERATION AND MAINTENANCE MANUALS**.
- Products and materials: Products and materials data, including manufacturer's technical specifications and drawings, product data sheets, type tests results, evidence of conformity to documented requirements, product certification, performance and rating tables, service connection requirements and installation and maintenance recommendations.
- Prototypes: Prototypes of components, systems or elements.
- Records: As-built documents, photographs, system diagrams, schedules and logbooks to **RECORD DRAWINGS**.
- Samples: Representative of proposed products and materials and including proposals to incorporate samples into the works, if any to **SAMPLES AND PROTOTYPES**.
- Shop drawings: To **SHOP DRAWINGS**.
- Substitutions: To **SUBSTITUTIONS**.
- Tests: Test reports for testing performed under the contract.
- Warranties: To **WARRANTIES**.

2.2 INSPECTION

Notice

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

Notification times

Minimum notice: As documented.

Light levels

Lighting levels for inspection: To AS/NZS 1680.2.4 (2017).

Attendance

General: Provide attendance for documented inspections and tests.

3 PERFORMANCE

3.1 BUSHFIRE-PRONE AREAS

General

Bushfire Attack Level (BAL): To AS 3959 (2018) and as documented.

3.2 CORROSION RESISTANCE

Atmospheric corrosivity category

General: Atmospheric corrosivity category as defined in AS 4312 (2019) for the site, the AS/NZS 2312 series, and as documented.

Galvanizing

Severe conditions: Galvanize mild steel components (including fasteners) to AS/NZS 1214 (2016) or AS/NZS 4680 (2006) 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).

3.3 NOISE LEVELS

General

Requirement: Install systems to operate within the noise level limits, as documented for the contract design and documented equipment performance.

3.4 STRUCTURE

General

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

- Fixed accessways: To AS 1657 (2018).
- Structural design actions: To the AS/NZS 1170 series.

3.5 ENERGY EFFICIENCY

General

Energy rating:

- Overall: Minimum 7 stars NatHERS rating.
- Individual sole-occupancy units: Minimum 6 stars NatHERS rating.

3.6 WATER EFFICIENCY

General

Design: Incorporate Water Corporation's waterwise practices and products.

4 DESIGN

4.1 DESIGN DEVELOPMENT

General

Requirement: Complete the design of the work, including development of the design beyond that documented.

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.

4.2 DESIGNER

General

Design by contractor: If the contractor provides design, use only appropriately qualified persons.

5 PRODUCTS AND MATERIALS

5.1 GENERAL

Consistency

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

Low VOC emitting paints

Paint types: To the recommendations of AS/NZS 2311 (2017) Table 4.2.

Prohibited materials

General: Do not provide the following:

- Materials, exceeding the limits of those listed, in the Safe Work Australia *Hazardous Chemical Information System* (HCIS) Workplace exposure standards.
- Blowing agents:
 - . Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.
 - . A blowing agent with a global warming potential (GWP) ≥ 700 .

5.2 PROPRIETARY ITEMS

Manufacturer's or supplier's recommendations

General: Provide manufactured items to the manufacturer's or supplier's recommendations.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate to the manufacturer's or supplier's recommendations.

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

Identification of proprietary items

Sealed containers: If items are supplied by the manufacturer in closed or sealed containers or packages, bring them to point of use in the original containers or packages.

Other items: Marked to show the following, as applicable:

- Manufacturer's identification.
- Brand name.

- Product type.
- Quantity.
- Reference code and batch number.
- Date of manufacture.

5.3 SUBSTITUTIONS

General

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the identified item, 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:

- Product, method or system identification.
- Manufacturer's contact details.
- Detailed comparison between the properties of the documented product and proposed substitution.
- Details of manufacturer and/or installer warranty.
- Statement of NCC compliance, if applicable.
- Evidence of conformity to a cited standard.
- Evidence that the performance is at least equal to that specified.
- 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.

5.4 SAMPLES AND PROTOTYPES

General

Incorporation of samples: Only incorporate samples that have been endorsed for inclusion in the works. Do not incorporate other samples.

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

Unincorporated samples: Remove on completion.

5.5 SHOP DRAWINGS

General

Documentation: 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 prepare dimensioned set-out drawings.

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

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

Commissioning requirements: Show provisions for testing and commissioning on the drawings.

Access for maintenance: Show space and provisions for access for maintenance.

Building work drawings for building services: On dimensioned drawings show the following:

- 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.

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

6 ANCILLARY BUILDING WORK

6.1 WALL CHASING

Holes and chases

General: If holes and chases are required in masonry walls, make sure structural integrity of the wall is maintained. Do not chase walls with a fire-resistance level or an acoustic rating.

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

Chasing blockwork: Only chase core-filled hollow blocks or solid blocks which are not documented as structural.

Concrete blockwork chasing table

Block thickness (mm)	Maximum depth of chase (mm)
190	35
140	25
90	20

6.2 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.

6.3 BUILDING PENETRATIONS

Penetrations

Requirement: Maintain the required structural integrity, fire performance, waterproofing performance and other properties when penetrating or fixing to the following:

- 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.

Sealing

Fire-resisting building elements: Seal penetrations with a system conforming to AS 4072.1 (2005).

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, cables or conduits penetrate 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 building elements): Sufficient to provide a ring shaped space around the pipe or pipe insulation of at least 12 mm.
- Ferrous surfaces: Prime paint.
- Sealing: Seal between pipes or conduits and sleeves to prevent the entry of vermin.
- Terminations:
 - . Cover plates fitted: Flush with the finished building surface.
 - . Fire-resisting and acoustic rated building elements: 50 mm beyond finished building surface.
 - . Floors draining to floor wastes: 50 mm above finished floor.
 - . Other locations: 5 mm beyond finished building surface.
 - . Termite management: To AS 3660.1 (2014).
- Thickness:
 - . Metal: 1 mm or greater.
 - . PVC-U: 3 mm or greater.

6.4 SUPPORT OF PLANT AND EQUIPMENT

Concrete plinths

General: Provide concrete plinths as documented and under all equipment located on concrete floor slabs as follows:

- Surround: Zinc (hot-dipped) coated steel, at least 75 mm high and 1.6 mm thick. Fix to the floor with masonry anchors. Fill with concrete.
- Height: 75 mm or greater, as documented.
- Reinforcement: Single layer of F62 fabric.
- Concrete: Grade N20.
- Finish: Steel float, flush with top edge of the surround.

Support of ground level plant and equipment

Ground level: Conform to the following:

- If the ground slope is 15° or more, or the area of the plant and equipment is extensive, obtain the advice of a professional engineer for the documentation of a suitable slab or platform.
- In all other cases, provide proprietary plastic or concrete supports installed with falls that achieve a raised, impervious and water shedding bearing surface.

Balustrades: If balustrades or screening are required, obtain the advice of a registered architect.

Support of plant and equipment mounted on roofs or elevated platforms

Platforms: If a platform is required, or the area of the plant and equipment mounted on roofs or elevated platforms is extensive, obtain the advice of a professional engineer for the documentation of a suitable platform.

Balustrades: If balustrades or screening are required, obtain the advice of a registered architect.

Roof level support: If any of the following apply to roof level support, obtain the advice of a professional engineer:

- The total load from any unit of plant or equipment exceeds 500 kg.
- The load from a unit of plant or equipment to any single support point exceeds 100 kg.
- The average loading of plant and equipment over the area extending 1 m on all sides beyond the plant and equipment exceeds 25 kg/m².

7 BUILDING SERVICES

7.1 SERVICES CONNECTIONS

Connections

General: Connect to utility service provider services or service points. Excavate to locate and expose connection points. Reinststate the surfaces and facilities that have been disturbed.

Utility service provider requirements

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

Service cabinets

Requirement: Provide service cabinets as required for the housing of equipment, as documented.

Construction: Aluminium, weatherproof cabinet with dustproof door seals and fitted with keyed alike locks, as documented.

Colour: As documented.

Number of keys: 2 for each cabinet.

General purpose socket outlets: 10 amp, 240 volt socket outlets of sufficient quantity to power the equipment mounted in the cabinet.

Metering

Requirement: Provide meters, including for water, gas and electricity, to the utility service providers' requirements.

- Individual dwellings: One meter for each dwelling.
- Common areas:
 - . Water service: Install reticulation valve between master and sub-meters for common landscaped areas.
 - . Other services: Common smart meter for each service.

Water Corporation approved sub-meter

Inspection: Once water meter is installed, conform to the following:

- Arrange for inspection by the Water Corporation to verify compliance and acceptance of payment for takeover.
- Submit a completed *Sub-meter Application Form* and *Works Request Form* and pay all application costs. These forms can be obtained from the Water Corporation. See www.watercorporation.com.au/Developing-and-building/Subdividing/Strata-and-green-title-subdivisions/Strata-subdivisions/Metering-options-for-stratas.

Verification: Submit a copy of the payment receipt for the application and registration of the meters as confirmation that sub-meters have been accepted by the Water Corporation. The fees will be reimbursed to the contractor on receipt of proof of payment.

7.2 SERVICES INSTALLATION

General

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

Installation: Install equipment and services as follows:

- Plumb and securely fixed.
- Allow for movement in both structure and services.
- Arrange services running together, parallel to each other and adjacent building elements.

Concealment: Conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards or documented to be exposed. If alternative routes are available, do not locate on external walls.

Lifting: Provide heavy items of equipment with permanent fixtures for lifting to the manufacturer's recommendations.

Suspended ground floors: Keep all parts of services suspended under ground floors at least 150 mm clear of the ground surface. Make sure services do not impede access.

Dissimilar metals

Joining: 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 as follows:

- If practicable, long radius elbows or bends and sets, and swept branch connections.
- If pipes are led up or along walls and then through to fixtures, provide elbows or short radius bends.
- Do not provide mitred fittings.

Vibration: Arrange and support piping to prevent vibration whilst permitting necessary movement. 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.

Support and structure

Requirement: Provide incidental supports and structures to suit the services.

Pipe 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 designed for the mass of the pipe and its contents.

Saddles: Provide saddle supports only on DN 25 or smaller pipes.

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 fasteners 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.

Support spacing: As follows:

- Cold and heated water pipes: To AS/NZS 3500.1 (2021) Table 5.6.4. Provide additional brackets, clips or hangers to prevent pipe movement caused by water pressure effects.
- Sanitary plumbing: To AS/NZS 3500.2 (2021) Table 10.2.1.
- Fuel gas: To AS/NZS 5601.1 (2013) Table 5.5.
- Other pipes: To AS/NZS 3500.1 (2021) Table 5.6.4.

Hanger size table

Nominal pipe size (DN)	Minimum hanger diameter for single hangers (mm)
50 maximum	10
65 to 90	12
100 to 125	16
150 to 200	20

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.

7.3 PLANT AND EQUIPMENT

General

Location: Locate so 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.

Safe tray and an overflow pipe: Provide to each tank, hot water heater and storage vessel.

7.4 ACCESS FOR MAINTENANCE

General

Requirement: Provide access for maintenance of all items requiring inspection, measurement, operation, adjustment, repair, replacement and other maintenance-related tasks.

Standards: Conform to the relevant requirements of AS 1657 (2018), AS 1892.1 (2018), AS 2865 (2009) and AS/NZS 3666.1 (2011).

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

Refrigerated or cooling plant: If the space is a refrigerated or cooling chamber inside a duct, air handling plant or similar, provided with an access door or personnel access panel and of sufficient

size for a person to enter, provide the following to BCA (2022) G1D3 [BCA (2019) G1.2]:

- An access door.
- Internal lighting with external indicator lamp.
- An alarm.

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 (2013).

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

Manufacturer's standard equipment: If necessary, modify manufacturer's standard equipment to provide the plant access documented.

Clearances

Minimum clearances for access: Conform to the following:

- Vertical clearance: ≥ 2100 mm, vertically above horizontal floors, ground and platforms.
- Horizontal clearance: Preferably ≥ 750 mm clear, but in no case less than 600 mm between equipment or between equipment and building features including walls.
- If tools are required to operate, adjust or remove equipment, provide sufficient space so the tools can be used in their normal manner and without requiring the user to employ undue or awkward force.
- Hinged or removable components: To the manufacturer's recommendations.
- Within plant items: Conform to the preceding requirements, and not less than the clearances recommended in BS 8313 (1997).

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 (2018).
- 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 (2018).
- Access class C: Locate plant so temporary means of access conforming to Work Health and Safety regulations can be provided.

Temporary means of access: Make sure there is adequate provision in place which is safe and effective.

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 six monthly: Access class A or B.

- Access required less frequently than six monthly: 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.
- 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 large and/or heavy items can be moved with the minimum 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 for maintenance, arrange it to allow for removal and replacement without damage.

Piping

Requirement: Conform to the following:

- 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 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.

Electrical equipment and controls

Electrical equipment: Provide clearances and access space to AS/NZS 3000 (2018).

Switchboards and electrical control equipment: Locate near the main entrance to plant space and with switchboards visible from the plant being operated.

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

7.5 VIBRATION SUPPRESSION

General

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

Standard

Machinery noise and vibration: Vibration severity in Zone A to ISO 20816-1 (2016) and ISO 10816-3 (2009).

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 to prevent placing stress 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 to the following:

- Construction: Steel or steel-framed reinforced concrete with reinforcing bars welded between base sections. 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 \geq 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: \geq 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: \geq 150% of the designated minimum static deflection.
- Ratio of mean coil diameter to compressed length at the designated minimum static deflection: \geq 0.8:1.
- Snubbing: Snub the springs to prevent bounce at start-up.
- 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.

7.6 FINISHES TO BUILDING SERVICES

General

Requirement: If exposed to view (including in plant rooms), paint building services and equipment.

Surfaces painted or finished off-site: Conform to *0183 Metals and prefinishes*.

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 (2017) Sections 3, 6 and 7 or AS 2312.1 (2014) Sections 6, 7 and 8, as applicable.

Inaccessible surfaces: If surfaces are inaccessible after installation, complete finish before installation.

Powder coating

Coating: To *0673 Powder coatings*.

Painting systems

General: Conform to the following:

- New unpainted interior surfaces: To AS/NZS 2311 (2017) Table 5.1.
- New unpainted exterior surfaces: To AS/NZS 2311 (2017) Table 5.2.

Corrosive environments, atmospheric categories C4, C5 and T: Galvanized or stainless steel.

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

Requirement: Provide corrosion protection for the following:

- Underground ferrous piping.
- Underground non-ferrous metal piping in chemically aggressive soils and environments.

Corrosion protection: 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 (2015).
- Continuous wrapping using proprietary petroleum taping material.
- Impermeable flexible plastic coating.
- Sealed polyethylene sleeve.

Aggressive soils: If metallic piping or components are installed in chemically aggressive soil, provide additional protection as follows:

- Material: Continuous polyethylene sleeve to ASTM D1248 (2016) with a minimum thickness of 0.25 mm.
- Installation: Wrap or sleeve pipes and components. Tape joints between sections of polyethylene and between polyethylene and piping.

Repairs to finishes

Requirement: Repair damaged finishes to restore their corrosion protection, appearance and service life.

Painting of pipe threads: After pipe installation and before other finishes or insulation are applied, paint exposed threads in metallic-coated steel pipe with zinc rich paint.

7.7 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 (1995) 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.

Label samples and schedules

Requirement: For each item or type of item, prepare a schedule of marking and labelling, including the following:

- A description of the item or type of item for identification.
- The proposed text for marking or labelling.
- The proposed location of the marking and labelling.

Submission timing: Before marking or labelling.

Electrical accessories

Circuit identification: Label isolating switches and outlets to identify circuit origin.

Operable devices

Requirement: Mark to identify the following:

- Controls.
- Indicators, gauges, meters.
- Isolating switches.
- Services control switches.
- Temperature and humidity sensors.

Equipment concealed in ceilings

Location: Provide a label on the ceiling, to indicate the location of each concealed item requiring access for routine inspection, maintenance and/or operation and as follows:

- Tiled ceilings, locate the label on the ceiling grid closest to the concealed item access point.
- Flush lined ceilings, locate adjacent to closest access panel.

Concealed equipment: Items to be labelled include the following:

- 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.

Points lists

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

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.

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 (1994).

Colours: Generally to AS 1345 (1995) 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.

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 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 10 mm.
- Switchboards, sub assembly designations: Minimum 15 mm.
- Valves:
 - . \geq DN65: Minimum 25 mm.
 - . $<$ DN65: Minimum 10 mm.
- Self-adhesive flexible plastic labels:
 - . Labels less than 2000 mm above floor: 5 mm.
 - . Labels minimum 2000 mm above floor: 10 mm.
 - . Other locations: Minimum 5 mm.

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

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.

Vapour barriers: Do not penetrate vapour barriers.

8 COMPLETION

8.1 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 visible labels not required for maintenance.

Removal of material

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

8.2 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.

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.

Principal's responsibilities: Submit details of responsibilities of the principal required to keep warranties in force.

9 TESTING AND COMMISSIONING

9.1 TESTING - GENERALLY

Inspection and testing plan

Requirement: Provide inspection and testing plan consistent with the construction program including details of test stages and procedures.

Notice

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

Inspection: Give sufficient notice for inspection to be made of the commissioning, testing and verification tests on completion of commissioning.

Attendance

General: Provide attendance at tests.

Suppliers: If necessary to carry out documented tests, arrange equipment suppliers to assist.

Testing authorities

Requirement: Have tests carried out by an Accredited Testing Laboratory, accredited for the documented test method, except for site tests or test methods that do not have an accredited testing laboratory.

Test equipment

Accuracy: Use testing equipment designed to test and/or measure system performance within the documented tolerances.

Calibration: Use only instruments that have current calibration certificates issued by an Accredited Testing Laboratory. Tag or label instruments with calibration date and calibration authority name. Provide copies of certification if requested.

Maximum period since last calibration: As recommended by the manufacturer but less than 12 months, except as documented.

Recalibration: If dropped or damaged, recalibrate instruments.

Testing equipment: Provide test equipment and tools to perform documented tests as follows:

- Special testing equipment: If documented, provide special equipment, tools and instruments required for testing or calibration.

- Other testing equipment: Provide standard testing equipment.

Testing procedures

Verification: Verify test procedures by:

- Manual testing.
- Monitoring performance and analysing results using the control system trend logs.
- A combination of the above methods.

Sampling: Sampling may be used subject to the following:

- Use a sampling strategy only for multiple identical pieces of non-life-safety or otherwise non-critical equipment.
- If at any point, more than one identical item has failed, stop testing, determine the cause, rectify and document changes made to remaining units, before continuing with functional testing of the remaining units.

Type tests

Type test reports: Required, as evidence of conformance of proprietary equipment.

Sound pressure level measurements

Requirement: Conform to the following:

- Correction for background noise: To AS/NZS 2107 (2016) Table B1.
- External: To AS 1055 (2018).
- Internal: To AS/NZS 2107 (2016).
- 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. For large equipment items including chillers, measure at 2 m and 7 m from the equipment item.
- 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 outcome

Requirement: Test as documented and achieve the following:

- Pass the documented Pass/Fail test, and/or
- Values that meet documented requirements, and/or
- Verification of manufacturer's claimed performance.

Failure of multiple items

Requirement: If 10% or 3, whichever is greater, of identical pieces (size does not constitute a difference) of equipment fail to perform as documented for any reason, treat all identical units as having failed. Submit notice of failure and conform to the following:

- Within one week of notification, examine all other identical units and record the results. Submit a

report of the findings within two weeks of the original failure notice.

- Within two weeks of the original failure notification, submit a signed and dated explanation of the problem, including the cause of failure, the proposed solution, full equipment details and any other information. Do not exceed the documented requirements of the original installation with the proposed solution.

Rectification of failure under test

Requirement: If an item fails a documented test, rectify the cause of failure and repeat the test.

Submissions: If submission of test results is documented, submit results of both successful and unsuccessful tests.

Test reports

Requirement: Include the following:

- Documented performance criteria including, if documented, tolerances.
- Observations and results of tests and conformance or non-conformance with documented requirements.

Test validity period

Requirement: As documented or, if no validity period is documented, no older than 5 years.

Controls

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

Circuit protection

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

Certification

General: On satisfactory completion of the installation, testing and commissioning and before the date for practical completion, certify that each installation is operating correctly.

Integrated system tests

Requirement: Conduct integrated system tests as documented.

Tests: Provide the following:

- Test the integrated operation of the systems listed in each mode documented.
- Restoration of the systems to their pre-test condition on completion of the tests above.

Failure: If any of the systems fails to perform as documented, including return to normal operation, rectify the cause and repeat the integrated system test.

Deferred and seasonal tests

Deferred tests: If documented testing cannot be completed at the scheduled or documented time, the Superintendent may direct that they be deferred to a later time but as soon as possible after the scheduled or documented time.

Seasonal tests: If documented tests are dependent on specific weather conditions, they may be deferred to a time when weather conditions are close to the documented test conditions. Complete seasonal testing as soon as possible but no later than one month before the end of the defects liability period.

Functional tests

Function: Carry out functional and operational tests on each energised equipment item and circuit.

9.2 COMMISSIONING**Standard**

Requirement: Conform to SA TS 5342 (2021).

Static completion

Requirement: Systems, components and building elements are statically complete when:

- Their construction and installation is complete and as documented, including completion of all systems, components and building elements on which they are dependent for commissioning.
- All pre-commissioning tests have been successfully completed.
- They are safe and ready for commissioning.
- All cleaning that may adversely affect commissioning is complete.
- They have been inspected and all outstanding remedial work that may adversely affect commissioning is complete.
- All spaces required for access for commissioning are safe to use and cleared of obstructions that may adversely affect commissioning.

Commissioning plan

Requirement: Provide a commissioning plan to SA TS 5342 (2021) including the following:

- A summary of the work covered by the commissioning plan.
- The parties responsible for this work and any commissioning interrelationships.
- The basis of the design.
- General sequence of commissioning.
- Project specific commissioning methodologies for each system and building element to be commissioned.
- Pre-commissioning requirements.
- Project specific commissioning procedures for each commissioning activity including integrated system tests, deferred and seasonal tests
- A project specific building tuning plan for all commissioned systems. Include building tuning procedures and tuning team members.
- Requirements for witnessing of tests and documented demonstrations of completion of commissioning.
- Commissioning program to **COMMISSIONING, Commissioning program.**

Commissioning program

Submissions: Submit a program consistent with, and forming part of, the construction program as follows:

- Set out the proposed program for completion, commissioning, testing and instruction.
- Identify related works and timing of the works prerequisite to successful and timely completion of the works.

Revisions: Submit revisions of the program as the project proceeds.

Plant operating period: Include time in the program for the documented plant operating period before the date for practical completion.

Commissioning activities

Requirement: Provide the following to SA TS 5342 (2021):

- Manage the commissioning process.
- Establish and manage the completion process.
- Review design documents for commissionability. Submit a report including any recommended changes.
- Review documented commissioning requirements. Submit a report including any recommended changes.
- Review construction documents for commissionability. Submit a report including any recommended changes.
- Develop, review and update the commissioning plan and commissioning program.
- Develop, review and update commissioning methodologies.
- Develop, review and update commissioning procedures.
- Report on interdependencies between trades that may affect commissioning.
- Develop, review and update procedures for initial start-up of systems.
- Develop, review and update integrated system test procedures.
- Carry out pre-commissioning activities. Record results and submit pre-commissioning records.
- Conduct commissioning activities to the commissioning methodologies and procedures. Record and submit commissioning records.
- Facilitate and conduct integrated system tests and demonstrations. Record and submit integrated system test records.
- Conduct documented demonstrations of completion of commissioning.
- Report on the progress of commissioning work.
- Report on conformance to the commissioning plan and program.
- Report on commissioning defects and issues and progress on their resolution.
- Develop, review and update commissioning report.
- Develop, review and update operation and maintenance manuals to **OPERATION AND MAINTENANCE MANUALS.**
- Manage and report deferred and seasonal testing activities to **TESTING - GENERALLY.**
- Management and reporting of building tuning process.
- Periodically review performance data.

Verification of commissioning

Requirement: On completion of commissioning of the equipment or system, provide additional tests to verify that it is fully commissioned and operating to documented requirements.

9.3 BUILDING TUNING

General

Standard: To SA TS 5342 (2021).

Frequency: Three monthly or more frequently.

Duration: Until the end of the maintenance period.
Provide last building tuning in the month before the end of the maintenance period.

Requirement: Provide the following:

- Review data from all recording systems against documented requirements.
- Review of building occupant feedback.
- If discrepancies are identified from the above, take corrective action to rectify them.
- Report on the findings of the reviews, corrective action and effect of corrective action.
- Recommend other action to improve the effectiveness, reliability and efficiency of systems.

10 PROJECT RECORDS

10.1 RECORD DRAWINGS

General

Requirement: Prepare 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

Requirement: Record changes made during the progress of the works on a set of drawings kept on site for that specific purpose.

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 **SUBMISSIONS**.

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

Services record drawings

General: To **RECORD DRAWINGS, 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.
- Single line wiring diagrams.
- Acoustic and thermal insulation.
- Access provisions and space allowances.
- Fasteners.
- 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.

Subsurface services: Record information on underground or submerged services to the documented quality level, conforming to AS 5488.1 (2022).

10.2 BASELINE DATA

General

Requirement: Provide baseline data to permit routine service of fire protection systems and equipment to AS 1668.1 (2015), AS 1670.1 (2018), AS 1851 (2012) and AS/NZS 2293.1 (2018). Include baseline data for the following:

- Active fire and smoke systems including automatic fire sprinkler systems, fire pumpsets, fire hydrant systems and water storage tanks for fire protection systems.
- Fire detection and alarm systems.
- EWIS, exit signs and emergency lighting.
- Standby generator sets and batteries.
- Lay flat fire hose, fire hose reels, portable and wheeled fire extinguishers and fire blankets.
- Passive fire and smoke systems including vertical and horizontal fire and smoke elements including walls, floors, ceilings, access panels and hatches, structural fire-resistant elements - beams, columns, girders, trusses, fire-resisting doorsets - hinged, pivoted and horizontal sliding, smoke doors - hinged and pivoted, fire shutters, fire-resisting glazing, ducts and dampers.
- Fire and smoke control features of mechanical services.
- Emergency planning in facilities.

Format: Provide baseline data in a format that facilitates the carrying out and recording of routine service tasks including drawings showing the extent and location of items to be serviced, schedules of items and unique identification of each item.

10.3 OPERATION AND MAINTENANCE MANUALS

General

Standard: To SA TS 5342 (2021).

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 worksections require submissions of manuals, include corresponding material in the operation and maintenance manuals.

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

Revisions: Amend operation and maintenance manuals to include changes made to the installation during the construction and maintenance.

Contents of manual

Table of contents: Include a table of contents in each volume. Title to match cover.

Directory: Include names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.

Record drawings: Include complete set of record drawings, full size.

Drawings and technical data: Include as necessary for the efficient operation and maintenance of the installation.

Installation description: Include a general description of the installation.

Systems descriptions and performance: Include a technical description of the systems installed including the basis of design, the interrelation with other systems and the building and mode of operation, presented in a clear and concise format readily understandable by the principal's staff.

Identify function, normal operating characteristics, safety features and limiting conditions.

Baseline data: Include the baseline data to **BASELINE DATA**.

Documentation: To AS 1851 (2012) including the schedule of essential functionality and performance requirements.

Equipment: Include schedules with the following details for installed equipment:

- Item code for use on record and diagrammatic drawings, and spare parts schedule.
- Equipment name plate data including serial number, if any.
- Name and contact details of the manufacturer and supplier.
- Catalogue list number(s).
- Location.
- Function.
- Performance figures and capacity data.
- Date of manufacture.
- Manufacturer's product data sheets including only relevant matter for the project. Mark each product data sheet to clearly identify specific products and

component parts used in the installation, and data applicable to the installation.

- Additional information and commentary to illustrate relations of component parts.

Certificates:

- Certificates from authorities.
- Product certification.
- Test certificates for each service installation and all equipment.
- Warranties.

Trends: 7 day record of all trends at commissioning.

Operation procedures: Include for systems installed:

- Manufacturer's technical literature as appropriate.
- Safe starting up, running-in, operating and shutting down procedures. Include logical step-by-step instructions for each procedure.
- Control sequences and flow diagrams.
- Legend for colour-codes services.
- Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- Procedures for seasonal changeovers.

Building occupants' guide: Include a concise guide written and illustrated for building occupants with no technical background. Include the following:

- Security provisions.
- Safety and access.
- Environmental features, including energy and water efficiency and waste management.
- Occupant relevant information on design and operation.
- Information for occupants on environmental systems that rely partially or wholly on local controls for heating, lighting, cooling, and ventilation.
- Contact details for faults, maintenance and emergencies.

Maintenance procedures:

- Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work with 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 instructions for each procedure.
- Schedule of spares, recommended to be held on site, for those items subject to wear or deterioration and that 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.

- Instructions for use of tools and testing equipment.
- Troubleshooting procedures.
- Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- Safety data sheets (SDS).
- Instructions and schedules conforming to AS 1851 (2012), AS/NZS 3666.2 (2011), AS/NZS 3666.3 (2011) and AS/NZS 3666.4 (2011).

Maintenance records:

- Prototype routine service records conforming to AS 1851 (2012) prepared to include project specific details.
- Prototype periodic maintenance records and report to AS/NZS 3666.2 (2011), AS/NZS 3666.3 (2011) and AS/NZS 3666.4 (2011) as appropriate, prepared to include project specific details.
- Hard copies: Binders to match the manuals, containing 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 date for 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

General: Provide in electronic format by email or an online file transfer service.

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

Format – hard copies

General: Provide one hard copy of the building occupants' guide for each dwelling.

Format: 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 *APPLIANCE 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.
- 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.

Date for submission

Draft submission: 4 weeks before the date for practical completion.

Final submission: Within 2 weeks after practical completion.

11 MAINTENANCE

11.1 STATUTORY INSPECTIONS AND MAINTENANCE

General

Duration: From the time systems and equipment are put into service to the end of the maintenance period.

Requirement: Provide inspections and maintenance of safety measures required by the following:

- AS 1851 (2012).
- 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.

Annual inspection: Perform an annual inspection and maintenance immediately before the end of the maintenance period.

Site control

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

0181 ADHESIVES, SEALANTS AND FASTENERS**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Requirements: Conform to the following:

- Fitness for purpose: Suitable for particular use, capable of transmitting imposed loads, sufficient to maintain 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.

1.2 SUBMISSIONS**Products and materials**

Adhesives and sealants: Submit product data sheets.

Samples

Visible joint sealants: Submit colour samples.

Tests

Compatibility testing: Submit adhesion and compatibility testing data demonstrating that adhesive, sealant or fastener is compatible with materials to be fixed and is suitable for the project conditions.

Warranties

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

1.3 INSPECTION**Notice**

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

2 PRODUCTS**2.1 ADHESIVES****Standards**

Gypsum plaster adhesive: To AS 2753 (2018).

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, 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.

Total VOC limits

Requirement: Conform to the following maximum limits:

- General purpose adhesives: 50 g/L.
- Structural glazing adhesive, timber flooring and laminate adhesives: 100 g/L.

2.2 SEALANTS**Standards**

General: To ISO 11600 (2002).

External masonry joints

General: Provide sealant and bond breaking materials which are non-staining to masonry. 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.

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

Total VOC limits

Requirement: Conform to the following maximum limits:

- General purpose sealants: 50 g/L.
- Acoustic sealants, architectural sealants, waterproofing sealants: 250 g/L.
- Wood flooring and laminate sealant: 100 g/L.

2.3 FASTENERS**General**

Masonry anchors: Proprietary expansion or bonded type anchors.

Plain washers: To AS 1237.1 (2002).

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

Plugs: Proprietary purpose-made plastic.

Stainless steel fasteners: To ASTM A240/A240M (2022).

Steel nails: To AS 2334 (1980).

- 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 (1999).

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

Bolts

Coach bolts: To AS/NZS 1390 (1997).

Hexagon bolts Grades A and B: To AS 1110.1 (2015).

Hexagon bolts Grade C: To AS 1111.1 (2015).

Corrosion resistance

Atmospheric corrosivity category: To 0171 *General requirements*.

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 category to AS 4312 (2019)	Threaded fasteners and anchors		Powder actuated fasteners
	Material	Minimum local metallic coating thickness (µm)	Material
C1 and C2	Electroplated zinc or Hot-dip galvanized	30	Stainless steel Type 316
C3	Hot-dip galvanized	45	Stainless steel Type 316
C4	Stainless steel Type 316	-	Stainless steel Type 316

Note: For categories C5, CX and T to the AS/NZS 2312 series, seek specialist advice.

Finishes

Electroplating:

- Metric thread: To AS 1897 (2016).
- Imperial thread: To AS 4397 (2007).

Galvanizing:

- Threaded fasteners: To AS/NZS 1214 (2016).
- Other fasteners: To AS/NZS 4680 (2006).

Mild steel fasteners: Galvanize if:

- Embedded in masonry.
- In external timbers.
- Exposed to or in air spaces behind the external leaf of masonry walls.

- In contact with chemically treated timber other than CCA treated timber.

Epoxy coated: CCA treated timber.

Nuts

Hexagon chamfered thin nuts Grades A and B: To AS 1112.4 (2015).

Hexagon nuts Grade C: To AS 1112.3 (2015).

Hexagon nuts Style 1 Grades A and B: To AS 1112.1 (2015).

Hexagon nuts Style 2 Grades A and B: To AS 1112.2 (2015).

Screws

Coach screws: To AS/NZS 1393 (1996).

Hexagon screws Grades A and B: To AS 1110.2 (2015).

Hexagon screws Grade C: To AS 1111.2 (2015).

Hexagon socket screws: To AS 1420 (2008).

Self-drilling screws: To AS 3566.1 (2002).

Self-tapping screws:

- Cross-recessed countersunk (flat – common head style): To AS/NZS 4407 (2015).
- Cross-recessed pan: To AS/NZS 4406 (2015).
- Cross-recessed raised countersunk (oval): To AS/NZS 4408 (2015).
- Hexagon: To AS/NZS 4402 (2015).
- Hexagon flange: To AS/NZS 4410 (2015).
- Hexagon washer: To AS/NZS 4409 (2015).
- Slotted countersunk (flat – common head style): To AS/NZS 4404 (2015).
- Slotted pan: To AS/NZS 4403 (2015).
- Slotted raised countersunk (oval – common head style): To AS/NZS 4405 (2015).

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.

3 EXECUTION

3.1 ADHESIVES

General

Requirement: Install to the manufacturer's recommendations.

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.

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.

Application to copper, brass, plasticised vinyl and hydrophilic surfaces such as glass and ceramics in a high humidity environment: Conform to manufacturer's recommendations.

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

Application temperature: Generally above 10°C and to the manufacturer's recommendations.

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

3.2 JOINT SEALING

General

Requirement: Install to the manufacturer's recommendations.

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.

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 (2010) Section 4.

Self-drilling screws: To AS 3566.1 (2002) for timber and steel substrates.

Masonry anchors

Installation: To the manufacturer's recommendations.

0182 FIRE-STOPPING**1 GENERAL****1.1 STANDARDS****General**

Service penetration fire-stopping systems: To BCA (2022) C4D15 [BCA (2019) C3.15].

Control/construction joint fire-stopping systems: To AS 4072.1 (2005) and BCA (2022) C4D16 [BCA (2019) C3.16].

1.2 SUBMISSIONS**Certification**

General: Submit evidence of conformity with the recommendations of AS 4072.1 (2005) Appendix B.

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

- List form: To AS 4072.1 (2005) Figure B1.
- Schedule form: To AS 4072.1 (2005) Figure B2.

Products and materials

Type tests: Submit type test reports from an Accredited Testing Laboratory as evidence of conformance for each combination of fire-stopping system, application, type of service, substrate, penetration orientation and drawings of tested details. Include for the following:

- Service penetration fire-stopping systems: Fire-resistance tested to AS 1530.4 (2014).
- Fire-stop mortars: Resistance to explosive spalling to AS 1774.36 (2019).
- Control joint fire-stopping systems: Fire-resistance tested to AS 1530.4 (2014).

Samples

Sample panels: Supply a sample panel of each fire-stopping assembly, on representative substrates. If built into the works, identify by marking it as a control sample.

Size: 500 mm run for junction seals and 500 x 500 mm area for penetration seals.

Subcontractors

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

Warranties

Proprietary fire-stopping products and systems: Submit the manufacturer's published product warranties.

1.3 INSPECTION**Notice**

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

- Service penetrations completed and ready for fire-stopping.
- Control/construction joints completed and ready for fire-stopping.
- Finished fire-stopping, before being concealed.

2 PRODUCTS**2.1 MATERIALS****Control joints**

General: To AS 4072.1 (2005) clauses 2.3 and 4.7 and Appendix C.

Toxicity

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

Toxicity in fire: Non-toxic.

Product certification

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 FIRE-STOPPING PRODUCTS**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: To AS/NZS 4859.1 (2018) Section 7.

Intumescent fire pillows

Material: Self-contained self-locking intumescent fire pillows for medium to large openings, where no additional support is required.

Fire-stop composite sheets

Material: Composite system comprised of a number of components, including a fire-resistive elastomeric sheet, bonded on either side with layers of sheet steel and/or steel-wire mesh covered with aluminium foil.

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.

Cavity barriers

Cavity barrier: Formed compressible fire-stopping strip.

Intumescent cavity barrier: Formed fire-stopping strip with high expansion intumescent seal.

2.3 COMPONENTS

Fire-stop collars

Material: Mechanical device with incombustible intumescent fillers covered with sheet steel jacket. Airtight and watertight.

Fire-stop pillows

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

Multi-service cable transit box

Material: Mechanical device consisting of a sheet steel sleeve containing heat reactive intumescent polymer, including intumescent seals and smoke rated brushes. The insulation rating can be increased by the incorporation of other fire-stopping products.

Control joint insert – elastomeric foam strip

Material: Elastomeric foam strip laminated with a graphite based intumescent compound on both sides, which is a water resistant seal that expands when exposed to heat.

Accessories

Primer: To the manufacturer's recommendations for each substrate.

Permanent dam material: Non-combustible.

Installation accessories: Provide clips, collars, fasteners, stainless steel cable ties, temporary stops and dams, backing rods and other devices required to position, support and contain fire-stopping and accessories.

3 EXECUTION

3.1 PREPARATION

Substrates

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

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

Primer: 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 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 such as expansion joints, and junctions between fire-resisting elements.

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.

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).

Penetrations: Provide structural support around the opening.

3.3 FIRE-STOPPING SYSTEMS

Control joint insert – elastomeric foam strip

Site conditions: Make sure that the application area is free from dust, oil, solvents or any other foreign substances.

Fire-stop mortars

Ambient conditions: Do not install below 5°C.

Formulated compound of incombustible fibres

Installation: To the manufacturer's recommendations for project requirements to completely close and seal openings.

Fibre stuffing

Installation: Compress to 40% of its uncompressed volume.

Fire-stop composite sheets

Installation: To the manufacturer's recommendations for project requirements to completely close and seal openings.

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: To the manufacturer's recommendations for project requirements to completely close and seal openings.

Fire-stop pillows

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

Cavity barriers

Installation: To the manufacturer's recommendations.

Multi-service cable transit box

Installation: To the manufacturer's recommendations for project requirements to completely close and seal openings.

3.4 COMPLETION

Cleaning

Requirement: Clean the finished surfaces and remove spilled and excess fire-stopping materials without damaging other work.

Labelling

Requirement: To the recommendations of AS 4072.1 (2005) Appendix B.

Additional marking: Include the following text in addition to the above: CAUTION – FIRE BARRIER MUST REMAIN SEALED.

Location: Attach labels to cables, conduits, pipes and ducts on both sides of and close to, the control joint or penetration. On large items, provide multiple labels.

0183 METALS AND PREFINISHES

1 GENERAL

1.1 RESPONSIBILITIES

Performance

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

2 PRODUCTS

2.1 METALS

Metallic-coated steel

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

Electrogalvanized (zinc) coating on ferrous hollow and open sections: To AS 4750 (2003).

- Ferrous open sections by an in-line process: To AS/NZS 4791 (2006).

- Ferrous hollow sections by a continuous or specialised process: To AS/NZS 4792 (2006).

- Steel sheet and strip: To AS 1397 (2021).

- Steel wire: To AS/NZS 4534 (2006).

Stainless steel

Bars: To ASTM A276/A276M (2017).

Plate, sheet and strip: To ASTM A240/A240M (2022).

Welded pipe (plumbing applications): To AS 1769 (1975).

Welded pipe (round, square, rectangular): To ASTM A554 (2021).

3 EXECUTION

3.1 GENERAL

Metal separation

Incompatible sheet metals: Prevent direct contact between incompatible 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, non-metallic separation layer such as polyethylene film, adhesive tape, neoprene, nylon or bituminous felt.

Incompatible fixings: Do not use.

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

Brazing

Lap-joints: Make sure brazed lap-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 (2005).

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/NZS 1665 (2004).

Stainless steel: To AS/NZS 1554.6 (2012).

Steel: To AS/NZS 1554.1 (2014).

3.2 STAINLESS STEEL FINISHES

General

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

Pre-assembly

Bead blasted finish: Provide a uniform non-directional low reflective surface by bead blasting. Do not use sand, iron or carbon steel shot. Blast both sides of austenitic stainless steel to equalise induced stress.

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: Provide an electro-chemical process to stainless steel Type 316.

Brushed electropolish finish: Conform to the following:

- Pre-assembly finish: No. 4 polished.
- Post-assembly finish: Provide an electro-chemical process to achieve a surface roughness R_a , no greater than 0.50 μm .

Mirror finish: Conform to the following:

- Pre-assembly finish: 2B cold-rolled finish.
- Post-assembly finish: Apply a polishing and buffing process 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.

3.3 ELECTROPLATED FINISHES

Electroplated coatings

Chromium on metals: To AS 1192 (2004).

- Service condition number: At least 2.

Nickel on metals: To AS 1192 (2004).

- Service condition number: At least 2.

Zinc on iron or steel: To AS 1789 (2003).

3.4 ANODISED FINISHES

General

Standard: To AS 1231 (2000).

Thickness grade: To the recommendations of AS 1231 (2000) Appendix H.

3.5 POWDER COATED FINISHES

General

Coating thickness: To the manufacturer's recommendations for protection in the documented atmospheric corrosivity category.

Standards

Application to aluminium and aluminium alloy substrates for architectural applications: To AS 3715 (2002) and AAMA 2603 (2021), AAMA 2604 (2021) and AAMA 2605 (2020) as appropriate.

Application to metal substrates other than aluminium for architectural applications: To AS 4506 (2005).

Substrate pre-treatment and application

Power coating to aluminium: To AS 3715 (2002) Appendix G.

Power coating to metals, other than aluminium: To AS 4506 (2005) Appendix I.

Thermoset powder coating system

Standards: To AS 3715 (2002) and AAMA 2604 (2021).

Thermoset fluoropolymer powder coating system

Standards: To AS 3715 (2002) and AAMA 2605 (2020).

3.6 HOT-DIP GALVANIZING

Standards

Coating: To AS/NZS 4680 (2006).

Durability: To AS/NZS 2312.2 (2014).

Metal finishing

Steel preparation methods: To AS 1627 series.

Coating mass/thickness minimum: To AS/NZS 4680 (2006).

Surface preparation

Surface contaminants and coatings generally: Chemical clean, then acid pickle.

Chemical cleaning: To AS 1627.1 (2003).

Acid pickling: To AS 1627.5 (2003).

- Inhibitor: Required.

Abrasive blast cleaning: To AS 1627.4 (2005) clause 4.2 and clause B2.4.

- Grade: Sa 2½ to AS 1627.9 (2002).

Coating process

General: To AS/NZS 4680 (2006) Section 6.

Post treatment

General: Passivate.

Drilling after completion of hot-dip galvanizing

Repair: Prime drill hole surfaces to AS/NZS 4680 (2006) clause 8 before the surfaces begin to corrode.

Surface finish

Standard: To AS/NZS 4680 (2006) clause 7.

Coating quality: Continuous and as smooth and evenly distributed as possible. Free of blisters, roughness, sharp points, flux residues and any defects that may affect the end use of the article.

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 (2006) Section 8, reject the galvanizing.

Extent and methods: To AS/NZS 4680 (2006) Section 8.

Preparation of galvanized surfaces for paint finishes

Coarse preparation: Remove spikes, and make sure edges are free from lumps and runs.

Light sweep blasting before painting: Required.

Site coating reinstatement

Rejection: If any item has damaged areas exceeding the limits specified for repair in AS/NZS 4680 (2006) clause 8.1, reject the item.

Method: To AS/NZS 4680 (2006) Section 8.

3.7 PREPAINTED FINISHES**Air-drying enamel**

Application: Spray or brush.

Finish: Full gloss.

General use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13 (1997).
- Top coats: 2 coats to AS 3730.6 (2006).

Oil resistant use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13 (1997).
- Top coats: 2 coats to AS/NZS 3750.22 (2008).

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 (2008), two coats.
- Prime coat to metal surfaces generally: To AS/NZS 3750.19 (2008) or AS/NZS 3750.20 (2008).
- Prime coat to zinc-coated steel: To AS 3730.15 (2006) or AS/NZS 3750.16 (1998).
- Undercoat: To AS/NZS 3750.21 (2008).

Prepainted metal products

Standard: To AS/NZS 2728 (2013).

Product type: To AS/NZS 2728 (2013): Not lower than the type appropriate to the documented atmospheric corrosivity category.

Stoving enamel

Application: Spray or dip.

Two-pack liquid coating

Application: Spray.

Finish: Full gloss.

Primer: Two pack epoxy primer to AS/NZS 3750.13 (1997).

Topcoat:

- Internal use: Proprietary polyurethane or epoxy acrylic system.
- External use: Proprietary polyurethane system.

3.8 COMPLETION**Damage**

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

Repair

Anodising: Use sprayers or pens for minor scratches and mitre cuts as required.

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 (2009).

Cleaning

General: On completion, clean all surfaces. Do not use abrasive cleaners.

0184 TERMITE MANAGEMENT**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Requirement: Building protection from termite attack.

1.2 STANDARD**General**

Termite management systems: To AS 3660.1 (2014).

1.3 SUBMISSIONS**Certification**

Installation: On completion, submit certificate to AS 3660.1 (2014) clause A3.

Tests

Site tests: Submit results, as follows:

- Chemical termite management systems.

Warranties

Management system warranty: Submit the manufacturer's warranty.

1.4 INSPECTION**Notice**

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

- Completed earthworks or substrate preparation before system application or installation.
- Completed termite management system before concealing.
- Termite management system at the end of the defects liability period.

2 PRODUCTS**2.1 PHYSICAL SYSTEMS****Termite caps, collars and sheeting**

General: To AS 3660.1 (2014) Section 5.

Collars: To AS 3660.1 (2014) clauses 4.3.2.4.2 and 5.3.6.

Granular materials

Standard: To AS 3660.1 (2014) Section 6.

2.2 CHEMICAL SYSTEMS**General**

Standard: To AS 3660.1 (2014) Section 7.

System assessment: To AS 3660.3 (2014) Section 5.

2.3 CHEMICALLY IMPREGNATED PHYSICAL SYSTEMS**Impregnated polymer sheeting**

Material: Flexible composite blanket, geotextile, fibre sheeting or membrane incorporating a termiticide.

Testing: To AS 3660.3 (2014) clause 5.5.

Impregnated accessories

Material/product: Extrusions, collars, foams and sealants incorporating a termiticide.

Testing: To AS 3660.3 (2014) clause 5.8.

3 EXECUTION**3.1 GENERAL****Concrete slabs**

Standard: To AS 3660.1 (2014) Section 4.

3.2 PHYSICAL SYSTEMS**Termite caps, collars and sheeting**

General: To AS 3660.1 (2014) Section 5.

Collars: To AS 3660.1 (2014) clauses 4.3.2.4.2 and 5.3.6.

Granular materials

Standard: To AS 3660.1 (2014) Section 6.

3.3 CHEMICAL SYSTEMS**General**

Standard: To AS 3660.1 (2014) Section 7.

Soil treatments

Restrictions on areas of application: To AS 3660.1 (2014) clause 7.3.

Application areas: Hand spray chemical treatment to the entire dwelling perimeter and subfloor to AS 3660.1 (2014) clause 7.7 including the following:

- Footings.
- Carport subfloors.
- Verandah subfloors.

Soil and environmental condition: Do not treat soil that is water saturated or when it is raining.

Application method

Application: To AS 3660.1 (2014) clause 7.5.

Application timing: To AS 3660.1 (2014) clause 7.6.

Protection: Protect treated area as follows:

- If a treated area is not scheduled to be covered with a vapour barrier on the same day, protect treated area with a waterproof covering such as polyethylene sheeting. Provide protection until the slab is installed.
- Prevent soil disturbance and keep off treated area until the soil is completely dry.

Reapplication: Reapply soil treatment to areas disturbed by subsequent excavation, grading, landscaping and other construction activities following the application.

Chemically impregnated physical systems

Installation: In conformance with the manufacturer's recommendations.

3.4 TESTING**Site tests**

Chemical systems: To AS 3660.1 (2014) Appendix E.

3.5 COMPLETION

Termite management system notice

Signage: Permanently fix a durable notice in a prominent location to BCA (2022) B1D4(i)(ii) [BCA (2019) B1.4(i)(ii)].

Cleaning

Requirement: Clean progressively and remove from the site waste building materials that could attract termites.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and installer.

Type: Renewable.

3.6 MAINTENANCE

Inspection

Requirement: At the end of the defects liability period, inspect the termite management system to AS 3660.2 (2017) clause 3.3.2.2. Prepare a report on the efficacy and status to AS 3660.2 (2017) clause 3.4.

0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Appropriate for durability and fire-resistance.
- Appropriate certification for the finishing applications.

1.2 STANDARDS

General

Sawn and milled products:

- Hardwood: To AS 2796.1 (1999).
- Softwood: To AS 4785.1 (2002).

Reconstituted wood based panels:

- Particleboard: To AS 1859.1 (2017).
- Dry process fibreboard: To AS/NZS 1859.2 (2017).
- Decorative overlaid wood panels: To AS/NZS 1859.3 (2017).
- Wet process fibreboard: To AS/NZS 1859.4 (2018).

Plywood:

- Structural: To AS/NZS 2269.0 (2012).
- Interior: To AS/NZS 2270 (2006).
- Exterior: To AS/NZS 2271 (2004).
- Marine: To AS/NZS 2272 (2006).

Glued laminated timber: To AS/NZS 1328.1 (1998).

Laminated veneer lumber: To AS/NZS 4357.0 (2022).

1.3 SUBMISSIONS

Products and materials

Chain of custody of forest products: Submit the following as evidence of conformity to **CERTIFICATION, Timber source certification:**

- Third party certification of supplier's chain of custody management system.
- Formal claim of chain of custody by supplier.

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

Timber source certification

Requirement: Use timber products originating from sustainably managed forests to the recommendations of the Forest Products

Commission's *Wood Encouragement Policy for Western Australia*.

Certification: Forest management and chain of custody to any of the following:

- Responsible Wood (Australian Forestry Standard (AFS)).
- PEFC (Programme for the Endorsement of Forest Certification).
- FSC (Forestry Stewardship Council).

Engineered timber product certification and identification

Certification:

- Glued laminated timber: To the S Mark product certification scheme to AS/NZS 1328.1 (1998).
- Plantation timber: To the Engineered Wood Products Association of Australasia (EWPAA) Plantation Timber Certification Scheme.
- Plywood: To the EWPAA Plywood and LVL Product Certification Scheme.
- Wet process fibreboard, dry process fibreboard, particleboard: To the EWPAA Particleboard and MDF Product Certification Scheme.

Branding: Brand timber products under the authority of a certification scheme applicable to the product. Locate the brand on faces or edges which will be concealed in the works.

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

2.3 FIRE-RESISTANCE

General

Timber structures: To AS/NZS 1720.4 (2019).

Bushfire-prone areas

Standard: To AS 3959 (2018).

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 (2005).

Naturally termite-resistant timbers: To AS 3660.1 (2014) Appendix C.

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.

Untreated sapwood: If used, place to the outside of joints or in locations exposed to higher levels of ventilation.

Preservative treatment

Wood-based products: To AS/NZS 1604.1 (2021).

Verification requirements: To AS/NZS 1604.2 (2021).

Test methods: To AS/NZS 1604.3 (2021).

Moisture content

Moisture content:

- Seasoned timber < 15% moisture content.
- Unseasoned timber ≥ 15% moisture content.

Test: Methods as follows:

- Timber: To AS/NZS 1080.1 (2012).
- Plywood: To AS/NZS 2098.1 (2006).
- Reconstituted wood-based products: To AS/NZS 4266.1 (2017).

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

Termite treatment

Requirement: To AS 3660.1 (2014) Appendix D.

Timber posts and stumps installed in the ground: To AS 3660.1 (2014) clause 3.3.4(b).

2.5 FINISHING

Production finish

Hardwood: To AS 2796.1 (1999) Table B1.

Softwood: To AS 4785.1 (2002) Table B1.

Surface coating

Painting and staining: To *0671 Painting*.

Application: To the manufacturer's specification.

2.6 RECYCLED TIMBER

General

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 treatment. Make sure the inside of bolt holes and the end grains of the timber are coated.

Water retention: Avoid details that may trap water including housing or birdsmouth joints.

Fasteners: To prevent chemical treatments reacting with fasteners, install to manufacturer's recommendations.

3.2 SHRINKAGE RESTRAINT

General

Requirement: Use seasoned timber, if possible, to avoid shrinkage restraint, particularly where timber elements are integrated with steel and/or concrete.

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

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

Connections: Use connections that allow for movement without adversely affecting the performance of the connection.

Unseasoned timber: Provide as follows:

- Drill holes 10% oversize.
- Use species with similar shrinkage values to reduce movement and shrinkage.
- For 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.

0193 BUILDING ACCESS SAFETY SYSTEMS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide building access safety systems, as documented.

Performance

Roofing and cladding: Maintain waterproofing integrity without damage or distortion. Maintain the structural integrity of the supporting elements.

1.2 DESIGN

Requirements

General: To DESIGN in *0171 General requirements*.

Access: Provide a system for three workers at any one time, to access the following:

- Full extent of gutters.
- Roof mounted plant and equipment.
- Roof areas within 2.5 m of fall hazards not otherwise protected by parapets or guard rails.
- External facade areas including glazing.
- External lighting.
- Aerials and telecommunications equipment.

1.3 STANDARDS

General

Personal equipment for working at height: To AS/NZS 1891.1 (2020), AS/NZS 1891.2 (2001), AS 1891.3 (2020), AS/NZS 1891.4 (2009) and AS 1891.5 (2020).

Rope access system: To AS/NZS 4488.1 (1997), AS/NZS ISO 22846.1 (2020) and AS/NZS ISO 22846.2 (2020).

1.4 INTERPRETATION

Abbreviations

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

- PPE: Personal protective equipment.

Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 1891.1 (2020), AS/NZS 5532 (2013) and AS/NZS ISO 22846.1 (2020) apply.

1.5 SUBMISSIONS

Certification

General: Submit certification of installed system.

Design documentation

General: To *0171 General requirements* and the following:

- Calculations: Submit calculations by a professional engineer experienced in building access safety systems.

- Certification: Submit certification by a professional engineer experienced in building access safety systems design as evidence of conformance to documented requirements.
- Drawings: Submit the following drawings:
 - . Layout of anchors and system components in plan and elevation.
 - . Proposed methods of fixing to each substrate type in the building.

Products and materials

Manufacturer's data: Submit manufacturer's data including the following:

- Product data sheets.
- Installation and maintenance recommendations.

Type tests: Submit results, as follows:

- Personal equipment for working at height.
- Rope access systems.
- Fixed ladders.
- Single point anchors.

Subcontractors

General: Submit names and contact details of proposed suppliers and installers as recommended by the manufacturer.

Tests

Site tests: Submit results of proof load tests of drilled-in anchors.

1.6 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.
- Commencement of shop or site welding.
- All equipment attachments with concealed fixings, before they are covered.
- Site erected assemblies on completion of erection, before applying finishes.
- Steel surfaces prepared for, and immediately before, site applied finishes.

Installation inspector: Registered height safety inspector or engineer.

2 PRODUCTS

2.1 GENERAL

Product identification

General: Marked to show the following:

- Manufacturer's identification.
- Installer's contact details.
- Intended location.
- Load rating and direction.
- Current inspection/service date.
- Batch number or serial number of the components.

2.2 FALL PROTECTION SYSTEMS

Anchors

Single point anchors: To AS/NZS 5532 (2013).

Vertical lifeline and ladder systems

Product: Vertical rail systems including cables, fixed ladders, guides and fall arrestor trolleys.

Fixed ladders: To AS 1657 (2018).

Personal protective equipment (PPE)

Harness: Supply two full body harnesses to AS/NZS 1891.1 (2020) with shock absorbing lanyards to AS 1891.5 (2020).

Storage: PPE storage holdall supplied by the manufacturer.

Tests

Personal equipment for working at height: Tested as follows:

- Harnesses: To AS/NZS 1891.1 (2020) Section 4.
- Horizontal lifeline and rail systems: To AS/NZS 1891.2 (2001).
- Lanyard assemblies and pole straps: To AS 1891.5 (2020) clause 3.4.

Rope access systems:

- Rope grabs and descenders: Static load test to AS/NZS 4488.1 (1997) Appendix A.
- Back-up type rope grabs and descenders: Dynamic load and performance test to AS/NZS 4488.1 (1997) Appendix B.

3 EXECUTION

3.1 INSTALLATION

Standards

Personal equipment for working at height: To the AS/NZS 1891 series.

Rope access systems: to AS/NZS 4488.1 (1997).

Subcontractor

Installer: Registered installer, approved by the manufacturer.

Labels and signage

General: To AS/NZS 1891.4 (2009) clause 2.2.9.

3.2 TESTING

Proof load test for anchors

Drilled-in anchors: Load test drilled-in anchors used in shear and not in axial tension (direct pull-out) before use.

3.3 COMPLETION

Reinstatement

Extent: Repair or replace damage to the roofing and rainwater system. If the work cannot be repaired satisfactorily, replace the whole area affected.

Touch up: If it is necessary to touch up minor damage to prepainted metal roofing, do not overspray onto undamaged surfaces.

Cleaning

Roofing and rainwater drainage system: Remove debris, metal swarf, solder, sealants and unused materials.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the installer.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier and the installer.

3.4 MAINTENANCE**General**

Preventative and mandatory system maintenance: By an Accredited Height Safety Inspector/Certifier, in conformance with AS/NZS 1891.4 (2009) Section 9 and manufacturer's maintenance/recertification recommendations.

Checklist for all inspections: To AS/NZS 1891.2 Supp 1 (2001) Table 8, and AS/NZS 1891.4 (2009) Section 9 and Appendices C and D.

The installer/competent person: To AS/NZS 1891.4 (2009) clause 1.4.2.

Regular scheduled periodic inspections

Standard: To AS/NZS 1891.4 (2009) Section 9.

Completion certificate:

- Provide inspection, testing and certification by an Accredited Installer and/or Accredited Height Safety Inspector:
 - . Upon completion of the installation at the date for practical completion.
 - . Upon the expiry of the defects liability period or 12 months after completion of the installation, whichever is the lesser, and valid for a further 12 months period.
- Record the date of the next system inspection and period of validity and display the certificate at the access points of the work area or on the individual system components where provision is made.

Inspection after a fall or other event

Standard: To AS/NZS 1891.4 (2009) clause 9.5.

Ongoing maintenance

Certificate: Submit the completion certificates and notify the proprietor of the requirement for continued interval testing.

0201 DEMOLITION**1 GENERAL****1.1 PERMITS, FEES AND CONTRIBUTIONS****Applications and approvals**

Contractor's responsibilities: Cover all authorities application and approval requirements, including fees and contributions.

Demolition Permit: Submit a completed Application for Demolition Permit (BA5) to the Permit Authority in conformance with the *Building Act 2011 (WA)*.

1.2 STANDARDS**Demolition**

Standard: To AS 2601 (2001).

1.3 EXISTING SITE CONDITION**Services**

Redundant/disused septic tanks: Locate and allow for decommissioning and removal to **DEMOLITION - BUILDING SERVICES, Existing septic tanks.**

Existing services: Disconnect, cap off and peg. If removal is required, remove to the junction.

Backfilling to excavations: If required, conform to *0222 Earthwork*.

Existing vegetation

Approval: Do not remove any existing plants or trees without approval.

1.4 ASBESTOS REMOVAL**Discovery of asbestos**

Identification: If suspected asbestos containing material has been identified, conform to the following:

- Isolate the contaminated area and prevent access.
- Do not disturb the material.
- Cease work on site until safe removal can be arranged.

Water supply: Maintain water supply to the contaminated area until all asbestos products have been removed.

Materials containing asbestos

Transport and disposal cost: Pay for all costs of removing the asbestos waste.

Verification: Where asbestos products are found and removal required, submit written evidence of asbestos waste disposal at a waste facility licensed to accept asbestos.

Removal contractor: A WorkSafe (WA) Class A Asbestos Removal Licence holder listed at: www.wa.gov.au/service/business-support/business-registration-and-licensing/find-licensed-asbestos-removalist.

Asbestos disposal facilities

Metropolitan areas: Use facilities listed by the Waste Authority at: www.wasteauthority.wa.gov.au.

Non-metropolitan areas: For facilities outside the Perth metropolitan areas, use facilities recommended by the local government authority.

State regulations

Disposal: To the *Environmental Protection (Controlled Waste) Regulations 2004 (WA)*.

Form submission: Provide copies of submitted WorkSafe (WA) Notification of Asbestos Removal forms and evidence that all fees have been paid.

Forms are available at:
wise.commerce.wa.gov.au/wise-online/nar.

1.5 SUBMISSIONS

Authority approvals

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

- Requirements of authorities relating to the work under the contract have been obtained.
- A permit to demolish has been obtained from the appropriate authority.
- A scaffold permit has been obtained from the appropriate authority (if scaffolding is proposed to be used).
- Certification that each person having access to the construction site has completed site-specific WHS induction training.
- Precautions necessary for protection of persons and property have been taken and suitable protective and safety devices have been 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.

Execution details

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan including laboratory analysis of hazardous substance.
- Investigation and work plan.

Off-site disposal locations: Submit details of the proposed locations for the disposal of material required to be removed from the site, and evidence of conformance with the requirements of relevant authorities.

Recycling: Submit details of the proposed recycling facility.

- Certification: Submit evidence of disposal of recycled materials.
- Concrete crushing: If proposed on site, submit details of plant and environmental controls.

Stockpile locations: Submit details of the proposed locations of on-site stockpiles for demolished materials for recycling in the works. Coordinate with the locations for storage of other waste streams, and prevent mixing or pollution.

Notice of Completion Certificate

Submission: Within 5 days of completing the demolition works, submit a Notice of Completion Certificate (BA7) to the Permit Authority with other required documentation.

Records

Dilapidation record:

- Before demolition: Submit to each owner of each adjacent property, a copy of the part of the record relating to that property and obtain their written agreement to the contents.
- Rectification work: Submit written acceptance of rectification works from the owner of each adjoining property affected.

Tests

Requirement: Submit test results of compliance tests for building service components to be re-used.

1.6 INSPECTION

Notice

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

- Adjacent structures before starting and at completion of demolition.
- Services before disconnection or diversion.
- Trees documented to be retained, before starting demolition.
- Services after reconnection or diversion.

2 PRODUCTS

2.1 DEMOLISHED MATERIALS

Demolished material classes table

Class	Requirement	Ownership
Recovered items for delivery to the principal	Recover without damage items identified for recovery.	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified for recycling.	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified for recycling off-site.	Contractor
Demolish for removal	Remove from the site demolished materials identified. Do not burn or bury on site Transit: Prevent spillage of demolished materials in transit	Contractor

3 EXECUTION

3.1 PROCEDURAL

Work, health and safety

Requirement: To the *Work Health and Safety Act 2020 (WA)*.

Unexpected finds

Requirement: Give notice and close off affected site area with barrier tapes and warning signs to prevent access. Unexpected finds include asbestos and other hazardous or volatile contaminants, archaeological finds and items of heritage value.

3.2 HAZARDOUS SUBSTANCES**Identified hazardous substances**

Register: Prepared by the principal for hazardous substances identified as present on site.

Availability: Contact the principal.

Asbestos in the workplace: To *How to manage and control asbestos in the workplace (2020)* by Safe Work Australia.

Audit

Requirement: Prepare a Hazardous Substances Management Plan to AS 2601 (2001) clause 1.6.1. 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.

Hazardous materials removal

Standard: To AS 2601 (2001) clause 1.6.2.

Asbestos removal: To AS 2601 (2001) clause 3.3.2 and *How to safely remove asbestos (2020)* by Safe Work Australia.

3.3 INVESTIGATION AND WORK PLAN**General**

Requirement: Before demolition or stripping work, prepare the work plan to AS 2601 (2001) Section 2. Include the checklist items appropriate to the project from AS 2601 (2001) Appendix A, and the following:

- Method of protection and support for adjacent property.
- Locations and details of service deviations and terminations.
- Sequence of work.
- If the demolition program results in components temporarily cantilevered, provide a certificate from a professional engineer.
- Proposals for the safe use of mobile plant on suspended structural members including provisions for the protection of lower floors in the event of structural failure.
- If implosion methods are proposed, provide a separate report of methods and safeguards.
- Wheel loads of tipping or loading vehicles.

3.4 PRE-DEMOLITION**Engineering survey**

Structural assessment: If required, carry out a survey by a professional engineer on the structural

elements being removed and their effect on adjacent structures before starting demolition.

Scheduling and planning

Site access: Plan demolition activities so that interferences with roads, streets, walks, walkways and adjacent facilities are minimised.

Pest management

Survey of infestation: 6 weeks before starting demolition, survey the site and surrounding areas to identify for signs and extent of infestation.

Infestations: If identified, appropriately treat before starting demolition.

Baiting: Minimum 5 days before starting demolition, bait all rooms/sections in the buildings, including concealed spaces such as the roof space and subfloors. If required, continue baiting until all pests have been eradicated.

Redundant drains and sewers: Cap off to isolate redundant sewers and grub out if required.

Waste storage: Store waste in pest resistant, closable containers in suitable locations and remove regularly.

Fencing removal

Adjacent property owner: Before removing boundary fencing, notify adjoining property owners of commencement and anticipated completion date. Obtain consent before undertaking work.

Notice: Issue a Notice and Request for Consent Form (BA20A) to adjacent property owners and obtain consent for boundary fencing removal in conformance with the *Building Act 2011 (WA)*.

Removal of fences: Remove all wing fences and gates and any fence erected on the lot that will not form, in part or whole, a boundary fence with an existing lot.

3.5 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.

3.6 PROTECTION

Encroachment

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

Weather protection

General: If walls or roofs are opened for alterations and additions, or the surfaces of adjoining buildings are exposed, provide temporary covers to prevent water penetration. Provide covers to protect existing plant equipment and materials intended for re-use.

Dust protection

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

Security

General: If walls or roofs are opened for alterations or 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 sheathed with 12 mm plywood and painted. Seal the junctions between the screens and the openings.

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 starting demolition, locate and mark existing underground services in the areas which will be affected by the demolition operations.

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

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

Recovered items

General: If items are documented for recovery and re-use, minimise damage during removal and recover all associated components required for their re-use.

Cultural and Aboriginal heritage items

Requirement: Conform to the *Aboriginal Heritage Act 1972 (WA)*. Protect and prevent damage or loss of items of cultural heritage or Aboriginal sites and artefacts.

Notice: If any item is suspected to be an artefact of heritage value, relic or material that is Aboriginal or belonging to early settlement, give notice.

Action: Stop construction work that might affect the item and protect the item from damage or disturbance.

3.7 DEMOLITION – BUILDING WORKS

Encroachment

General: If encroachments from adjacent structures are encountered and are not documented, give notice and obtain instructions.

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. Do not overcut at corners.

Material below grade

Remaining voids: Stabilise and provide barriers.

Explosives

General: Do not use explosives.

3.8 DEMOLITION – BUILDING SERVICES

General

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

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

Demolition of refrigeration systems

Standard: To AS/NZS 5149.4 (2016).

Existing septic tanks

Requirement: Conform to the *Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA)*.

Redundant/disused tanks: Decommission tanks as follows:

- Completely empty tanks, leach drains and soak wells using a licensed liquid waste contractor.
- After emptying septic tanks, leach drains and soak wells, and fully remove from the project site.
- Hose down and disinfect tanks, drains and wells as required.
- Fill up excavations, tank, drains and soak wells with clean fill such as yellow sand and compact.

Local authority approval: After decommissioning, submit certification and documentation to the local government authority health officer's requirements.

3.9 COMPLETION

Notice of completion

General: Give at least 5 working days' notice of completion of demolition so that adjacent structures may be inspected following completion of demolition.

Reinstatement

Assessment of damage: Use the dilapidation record to assess the damage and rectification work arising from the demolition work.

Rectification: Repair 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: Remove at completion of demolition.

0221 SITE PREPARATION**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide site preparation, as documented.

1.2 SUBMISSIONS**Certification**

Vermin: Submit pest exterminator's certification as evidence that the completed site works are free from vermin.

Execution details

Requirement: Submit details of methods and equipment proposed for the following:

- Clearing and grubbing.
- Tree removal and transplanting.
- Protecting ground within and adjacent to tree driplines from compaction by proposed earthworks machinery.

1.3 INSPECTION**Notice**

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

- Enclosures around trees requiring protection.
- Trees requiring removal.

2 EXECUTION**2.1 COMMUNITY LIAISON****Notification**

General: Notify residents about construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- Description of the work.
- The reason for the work.
- The expected duration.
- Changes to traffic arrangements and property access.
- The 24-hour contact number of the representative responsible.

2.2 EXISTING SERVICES**General**

Requirement: Before starting earthworks, locate and mark existing underground services in the areas affected by the earthworks operations including clearing, excavating and trenching.

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

Excavation: Do not machine excavate within 1000 mm of existing services.

Existing service lines: If required, divert services detected during excavation, clear of the building, and reconnect to the utility service provider requirements.

2.3 SITE CLEARING

Extent

Requirement: Clear only areas occupied by works such as structures, paving, excavation, regrading and landscaping or other areas documented for clearing.

Contractor's site areas: If not included within the areas documented above, clear only to the extent necessary for the performance of the works.

Clearing and grubbing

Clearing: Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, timber, stumps, boulders and rubble.

Soil: Turn up soil to a minimum depth of 700 mm.

Grubbing: Grub out stumps and roots over 75 mm diameter to a minimum depth as follows:

- Below subgrade under buildings, embankments or paving: 500 mm.
- Below finished surface in unpaved areas: 300 mm.

Backfilling: Fill holes remaining after grubbing with sand material to prevent ponding of water. Compact the material to the relative density of the existing adjacent ground material.

Redundant/decommissioned works: Remove works no longer required, including slabs, foundations, paving, drain, and access chambers and covers within the works zone.

Batters

Temporary protection: If the change in level between crest and toe is more than 1500 mm, protect from erosion with geofabric, hessian and tar or heavy duty black polythene sheet cover.

Securely fix down at crest and toe.

Surplus material

Topsoil and excavated material: Remove unwanted stripped soil and other material from the site as the work proceeds, including any material dropped on footpaths or roadways.

2.4 STORMWATER AND SEDIMENT CONTROL

Erosion control

General: Plan and carry out the work to avoid erosion, contamination, and sedimentation of the site, surrounding areas, and drainage systems.

Dewatering

Requirement: Keep earthworks free of water. Provide and maintain slopes, crowns and drains for excavations and embankments to make sure there is free drainage. Construct, including placing fill, masonry, concrete and services, on ground from where free water has been removed. Prevent water flow over freshly laid work.

Water quality

Wash out: Prevent wash out from entering waterways or stormwater drains.

Cross connection: Prevent cross connections between stormwater and the public sewerage system.

Backflow prevention: To AS/NZS 3500.1 (2021) and the requirements of the network utility operator.

Waterways and drains

Waterways: If required, temporarily divert ditches, field drains and other waterways affected by excavation and reinstate on completion.

Stormwater drains: Divert drains detected during excavation, clear of the building, and reconnect as documented or obtain approval.

2.5 EXISTING WORKS TO REMAIN

Marking

Requirement: Identify existing works to remain with 1000 mm high, 50 x 50 mm timber stakes connected by yellow plastic tape to prevent accidental damage.

2.6 TREE REMOVAL

Designation

Marking: Identify trees and shrubs for removal by tagging 1000 mm above ground level.

Tags: Select from the following:

- 100 x 50 mm zincanneal tags, painted yellow and lettered to conform to the tree number on the drawings. Secure tags to trees using loose galvanized steel wire bands.
- Surveyor's ribbon.
- Road marking paint.

2.7 TREE PROTECTION

General

Warning signs: In a prominent position at each entrance to the site, display warnings that trees and plantings require protection during the contract. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high to AS 4970 (2009) Appendix C.

Protection measures: Provide before starting the earthworks.

Trees to remain

Extent: Trees not marked for removal.

Tree protection

Tree protection zone (TPZ): To AS 4970 (2009) Section 3.

Tree protective measures: To AS 4970 (2009) Section 4.

Monitoring and certification: To AS 4970 (2009) Section 5.

Work near trees

Materials placement: Conform to the following:

- Keep the area within the dripline of trees free of sheds and paths, construction material and debris.

- Do not place bulk materials and harmful materials within the dripline of trees.
- Do not place spoil from excavations against tree trunks.
- Prevent wind-blown materials such as cement from harming trees and plants.

Damage: Prevent damage to tree bark. Do not attach stays, guys and similar material to trees.

Work under trees: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees, give notice. Minimise period and extent of excavation within the dripline.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If excavation is required within the dripline, use hand methods so that root systems remain intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. If required to cut tree roots, use cutting methods that do not excessively disturb the remaining root system. Immediately after cutting, water the tree and apply a liquid rooting hormone to stimulate the growth of new roots.

Backfilling: Backfill excavations around tree roots. Place the backfill in layers of 300 mm maximum depth and compact to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Backfill material:

- Mix proportions (topsoil: well-rotted composts) by volume: 3:1.
- Neutral pH value.
- Free from weed growth and harmful materials.

Compacted ground: Do not compact the ground or use skid-steer vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect ground adjacent to the tree dripline.

Watering: Water trees as necessary, including where roots are exposed at ambient temperature more than 35°C.

Mulching: Spread 100 mm thick organic mulch to the whole of the area within the dripline of all existing trees to remain.

2.8 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1200 mm.

Maximum post spacing: 5000 mm.

Component sizes

Corner and gate posts: Hardwood or preservative-treated softwood, 250 mm diameter.

Intermediate posts: Star picket.

Gate: Provide a suitable hinged gate with a gate latch.

Wire: Top, intermediate and bottom rows of 3.2 mm plain galvanized steel wire. Thread the top wire through pieces of plastic tube and through corner posts.

Removal

Completion: Remove the fence at the end of the planting establishment period.

2.9 COMPLETION

Site restoration

Requirement: Reinstate undeveloped ground surfaces to the condition existing at the commencement of the contract.

Clean up

Progressive cleaning: Keep the works clean and tidy, and regularly remove from the site, waste and surplus material arising from execution of the work.

Waste disposal: As documented and as follows:

- Spoil: Remove cleared and grubbed material from the site and dispose of legally.

Vermin management

Requirement: Employ a suitably qualified pest exterminator to remove vermin found during site preparation.

0222 EARTHWORK**1 GENERAL****1.1 RESPONSIBILITIES****General**

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

1.2 STANDARDS**General**

Earthworks: Conform to the recommendations of those parts of AS 3798 (2007) that are referenced in this worksection.

Description and classification of soils: To AS 1726 (2017).

1.3 INTERPRETATION**Abbreviations**

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

- GTA: Geotechnical testing authority.

Definitions

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

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Rock: Monolithic material with volume greater than 0.3 m³ that cannot be removed until broken up by rippers or percussion tools.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 (2018) and is free from the following:
 - . Stones more than 25 mm diameter.
 - . Clay lumps more than 50 mm diameter.
 - . Weeds and tree roots.
 - . Sticks and rubbish.
 - . Material toxic to plants.
- Subgrade: The trimmed or prepared earth material on which the pavement, footing or slab is constructed. Generally taken to relate to the upper line of the earth material.
- 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.

1.4 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.
- Pavement subgrades: +0, -40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces: ±50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

1.5 SUBMISSIONS**Design documentation**

Calculations: Submit calculations by a professional engineer showing the stability and safety of proposed excavations and temporary supports, including supports required for adjacent structures.

Execution details

Site records: Submit the following to AS 3798 (2007) clause 3.4 and Appendix B:

- Geotechnical site visit record.
- Earthworks summary report or daily geotechnical reports.

Products and materials

Imported fill: Submit certification or test results by a GTA registered laboratory of the imported fill as evidence of conformity with the contract, including the source.

Tests

Compaction: Submit certification and/or test results in conformance with the documented level of inspection and testing to AS 3798 (2007).

1.6 INSPECTION**Notice**

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

- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Excavation completed to contract levels or founding material.
- Filling completed to contract levels.

2 PRODUCTS**2.1 FILL MATERIALS****General**

Suitable material: To AS 3798 (2007) clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use fill defined as unsuitable by AS 3798 (2007) clause 4.3.

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

Re-use of excavated material: Only re-use suitable material to AS 3798 (2007) clause 4.4.

Stockpiles

General: Segregate the earth and rock material and stockpile for re-use in backfilling operations.

Location: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along drainage channels.

2.2 BORROW OR IMPORTED FILL**General**

Borrow or imported material: Use only when suitable excavated material from site is not available.

- Suitable material: To AS 3798 (2007) clause 4.4.

Borrow pits:

- Locate more than 3000 mm from any fence line, boundary, edge of excavation or embankment.
- Strip and stockpile topsoil.
- Provide erosion protection during winning operations of material and make sure drainage is maintained.
- On completion of winning operations grade abrupt changes of slope, respread topsoil, and apply and maintain hydroseeded grassing.

2.3 GEOTEXTILE**General**

Material: UV stabilised, permeable, polymeric, woven or non-woven textile material used in contact with soil/rock material.

Identification and marking: To AS 3705 (2012).

3 EXECUTION**3.1 GEOTECHNICAL****As found site conditions**

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

- Bad ground.
- Discrepancy in expected conditions.
- Rock.
- Springs, seepages.
- Topsoil more than 100 mm deep.

Inspection and testing

Level of inspection and testing: Level 2 sampling and testing to AS 3798 (2007) clause 8.3 by a GTA.

Frequency of testing: To AS 3798 (2007) Table 8.1.

3.2 RECORDS OF MEASUREMENT**Excavation and backfilling**

Agreed quantities: If a schedule of rates applies, provisional quantities are documented, or there are variations to the contract levels or dimensions of excavations, do not backfill 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.

Rock

Level and class: If rock is measured for payment purposes, either 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 REMOVAL OF TOPSOIL**General**

Extent: Areas of cut or fill and areas occupied by structures, pavements and embankments.

Maximum depth: 200 mm.

Disposal: Remove topsoil unsuitable for re-use from the site to AS 3798 (2007) clause 6.1.8.

Topsoil stockpiles

General: Stockpile site topsoil intended for re-use.

Stockpile maximum height: 1.5 m.

Identification: Mark and label stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth that occurs during storage.

Protection: Conform to the following:

- Provide drainage and erosion protection.
- Do not allow traffic on stockpiles.
- If a stockpile is to remain for more than four weeks, sow with temporary grass.
- Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

3.4 EXCAVATION**Extent**

Site surface: Excavate the site to the levels and profiles required for the documented structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

Footings, pits, wells and shafts: Excavate to the required sizes and depths. Confirm that the foundation conditions meet the design bearing capacity.

Bearing surfaces

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

Rock

General: Do not use explosives.

Existing footings

Requirement: If excavation is required within the zone of influence of an existing footing, provide supports to the footing sufficient to prevent damage arising from the works. Use methods including temporary shoring or underpinning.

Existing services

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

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

Excavation: Do not excavate by machine within 1000 mm of existing services.

Proof rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the presence of bad ground.

Proof rolling method and equipment: To AS 3798 (2007) clause 5.5.

Requirement: If excessive settlement, rebound or heaving is encountered, provide test pits or trenching to determine the extent of bad ground.

Disposal of excess excavated material

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

Standard: To AS 3798 (2007) clause 6.1.8.

3.5 REINSTATEMENT

Deterioration of bearing surfaces

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

Subgrades affected by moisture

Requirement: If, due to high moisture content, the subgrade cannot support construction equipment or the overlying pavement cannot be compacted, perform one or more of the following:

- Allow the subgrade to dry until it provides support for equipment and allows compaction.
- Scarify the subgrade to a depth of 150 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory.
- Excavate the wet material and remove to spoil, and backfill excavated areas.

Over excavation

Requirement: If excavation exceeds the required depths, reinstate to the correct depths, levels and bearing capacity.

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 or pavements: Rectify the over excavation as follows:

- Generally: Provide selected fill compacted to the documented density.
- Less than 100 mm: Do not backfill. Increase the thickness of the layer above.

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

3.6 SUPPORTING EXCAVATIONS

Removal of supports

General: Remove temporary supports progressively as backfilling proceeds.

Voids

General: If voids occur outside sheeting or sheet piling, fill and compact voids to a dry density similar to that of the surrounding material.

3.7 ADJACENT STRUCTURES

Temporary supports

General: If required, provide supports to adjacent structures, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support with shoring.

Vertical supports: If required, provide vertical support with piling or underpinning or both.

Permanent supports

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

Encroachments

General: If encroachments from adjacent structures are encountered and are not documented give notice and obtain instructions.

3.8 ROCK BOLTING

General

Requirement: For temporary or permanent support of rock faces, provide proprietary high strength steel bars or tubes anchored into holes drilled in the rock and tensioned against plates bearing on the rock face. Schedule the installation to conform to systematic bolting or calculated relief, as documented.

Standard: To AS 4678 (2002).

Protection

General: Protect permanent rock bolts by grouting the drilled hole with cement grout after tensioning the rock bolt. Protect the bearing plate and the exposed portion of rock bolt and anchorage with a protective coating or by embedment in concrete.

3.9 GEOTEXTILE

General

Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Installation: Lay the fabric flat, not stretched tight, and secure with anchor pins. Overlap joints 300 mm minimum.

3.10 PREPARATION FOR FILLING

Preparation

Stripping: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements to AS 3798 (2007) clause 6.1.5. Remove material that inhibits or prevents satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS 3798 (2007) clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation, to a minimum depth of 150 mm, to the minimum relative compaction in AS 3798 (2007) Table 5.1.

Ground treatment or improvement methods:

- Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture-condition and compact to AS 3798 (2007) Section 5.
- Impact roller and impact compaction: Use an approved method.

Slope preparation: If fill is placed on a surface steeper than 4:1 (horizontal:vertical), bench the surface to form a key for the fill. As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps more than 1 m in width and more than 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

Under earth mounds

General: Cultivate the ground to a depth of 200 mm before mound formation.

Under slabs, paving and embankments

General: If required, loosen the ground to a depth of more than 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

Rock ledges

General: Remove overhanging rock ledges.

3.11 PLACING FILL

General

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

Layers: Place fill in near-horizontal layers of uniform thickness no greater than 150 mm after compaction, deposited systematically across the fill area.

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. If required, limit the size of compaction equipment or compact by hand.

Protective covering to membranes: Do not disturb or damage during backfilling.

Placing at structures

Fill adjacent structures and trenches: To AS 3798 (2007) clause 6.2.6.

Requirement: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Commence compacting each layer at the structure and proceed away from structure.

Over the top of structures: Carefully place first layers of fill.

Retaining walls: Do not place fill against concrete retaining walls until the concrete has been in place for 28 days unless the structure is supported by struts.

Compaction

General: Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation. Shape surface to provide drainage and prevent ponding.

Maximum rock and lump size in layer after compaction: To AS 3798 (2007) 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 (2007) Table 5.1.

3.12 PLACING TOPSOIL

Stockpiled topsoil

Cultivation: Rip subgrade to a depth of 100 mm or to the depth of rippable subgrade if less. Cultivate around services and tree roots by hand. Trim to allow for the required topsoil depth.

Herbicide: Apply before placing topsoil.

Placing: Spread and grade evenly.

Compaction: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

Edges: Finish topsoil flush with abutting kerbs, mowing strips and paved surfaces. Feather edges into adjoining undisturbed ground.

Disposal of excess topsoil

On-site: Dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

Off-site: Remove excess topsoil from the site and dispose of legally.

3.13 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 (2017) or AS 1289.5.2.1 (2017), as appropriate, to achieve the required density.

3.14 TESTING

Site tests

Compaction control tests: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).

Test frequency: To AS 3798 (2007) Table 8.1.

3.15 COMPLETION

Grading

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

Subfloor areas: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

Site restoration

Requirement: If 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.

0223 SERVICE TRENCHING

1 GENERAL**1.1 DESIGN****Requirements**

Responsibility: Design and coordinate all trenching required for proposed in-ground services, as documented.

1.2 STANDARDS**Trenching**

Earthworks: To AS 3798 (2007).

Electrical services: To AS/NZS 3000 (2018).

Hydraulic services: To the AS/NZS 3500 series.

Communication services: To AS/CA S009 (2020).

1.3 TOLERANCES**Surface levels**

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

- Under building slabs and load bearing elements: +0, -25 mm.
- Pavement subgrades: +0, -40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces: ± 50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

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

- Subbase: +10 mm, -25 mm.
- Base: +10 mm, -5 mm.

Finished pavement or paving surface: Conform to the documented level within the following tolerances:

- Asphalt: ± 10 mm.
- Concrete: +10 mm, -0 mm.
- Paving:
 - . Finished level: ± 8 mm.
 - . Height deviation between adjacent units (lippage): ± 2 mm.
- Granular surfaces: ± 10 mm.
- Lippage between restored surface and adjacent existing surface: ± 5 mm.

1.4 SUBMISSIONS**Records**

As-built location: Upon completion submit to the relevant authority, as-built documentation to show the location of the installed services.

1.5 INSPECTION**Notice**

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

- Items to be measured as listed in **GROUND CONDITIONS, Records of measurement**.
- Services laid in trenches and ready for backfilling.

2 PRODUCTS**2.1 FILL MATERIALS****General**

Requirement: Provide fill materials including borrow or imported fill to **FILL MATERIALS** in 0222 *Earthwork*.

2.2 SURFACE RESTORATION MATERIALS**General**

Re-use: If possible re-use the existing surface materials that were removed during trench excavation, whilst conforming to the documented material requirements.

Subbase and base

Requirement: Provide crushed rock material configured in layers and depths to match existing and adjacent work, as follows:

- Base: 20 mm nominal size.
- Subbase: 40 mm nominal size.

Pathways and paved surfaces generally

Requirement: Provide materials consistent with those of the existing surface before service trenching works commenced.

Concrete surfaces

Material requirements: Normal-class to AS 1379 (2007).

Concrete strength grade: N25.

Slump: Maximum 100 mm.

Asphalt surfaces

Aggregate: To AS 2758.5 (2020) or to AS 2758.2 (2021) for sprayed bituminous surfaces.

Asphalt: To AS 2150 (2020).

Medium cut back bitumen: To AS 2157 (1997).

Bitumen emulsion: To AS 1160 (1996).

Bitumen binder: Class 170.

Pavers

Concrete and clay pavers: To AS/NZS 4455.2 (2010).

Bedding and joint filling sand: Well-graded sand, free of deleterious material such as soluble salts which may cause efflorescence.

Stone pavers and setts: Provide sound stone pavers and setts of uniform quality. Reject any with defects liable to affect strength and durability.

Bedding mortar mix (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

3 EXECUTION

3.1 EXISTING SERVICES

Location

Requirement: Before commencing service trenching, locate and mark existing underground services in the areas which will be affected by the service trenching operations.

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

Excavation

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

3.2 EXISTING SURFACES

Concrete and asphalt pavements

Method: Sawcut trench set out lines for the full depths of the bound pavement layers except where the set out line is located along expansion joints.

Removal of concrete and asphalt: Break out concrete or asphalt pavement material between the trench set out lines, remove and dispose of off-site.

Paving

Removal: Take up paving units both full and cut by hand, between the trench set out lines, and neatly stack on wooden pallets.

Concrete edging: Break out, remove and dispose of off-site.

Concrete subbase: If present, sawcut along the trench set-out lines.

Grass

Removal method: Neatly cut grass turf between trench set-out lines into 300 mm squares.

Grass suitable for re-use: Take up and store the turf and water during the storage period.

Unsuitable grass: Remove and dispose of off-site.

Small plants, shrubs and trees

Remove for re-planting: Take up and store. Wrap the rootball in a hessian or plastic bag with drain holes and water during the storage period.

Unsuitable vegetation: Remove and dispose of off-site.

3.3 GROUND CONDITIONS

As found site conditions

General: To **GEOTECHNICAL** in *0222 Earthwork*.

Records of measurement

Excavation and backfilling: If records of measurement are required, to **RECORDS OF MEASUREMENT** in *0222 Earthwork*.

3.4 EXCAVATION

General

Requirement: Excavate for underground services in conformance with the following:

- To required lines and levels, with uniform grades.
- Straight between access chambers, inspection points and junctions.
- With stable sides.

- Width tolerance: ± 50 mm, unless constrained by adjacent structures.

- Tree protection: To AS 4970 (2009).

Adjacent structures

Existing footings: 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.

Temporary supports: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works, as follows:

- Lateral supports: Provide lateral support using shoring.

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

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

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

Trench widths

General: Keep trench widths to the minimum, consistent with the laying and bedding of the relevant service and construction of access chambers and pits.

Trench depths

General: As required by the relevant service and its bedding method.

Obstructions

General: Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

Dewatering

General: Keep trenches free of water. Place bedding material, services and backfilling on firm ground, free of surface water.

Pumping: Provide pump-out from adjacent sumps or install well points.

Adjacent subsidence: Provide recharge points to isolate the dewatering zone.

Excess excavation

General: If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilised with 1 part of cement to 20 parts of sand by volume.

Stockpiles

Topsoil removal: Stockpile topsoil intended for re-use to a maximum height of 1500 mm.

Excavated material for backfill: If required, segregate the earth and rock material and stockpile, for re-use in backfilling operations.

Locations: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation.

Disposal: If stockpiling is not permitted, dispose of excavated material off-site.

Unsuitable material

Disposal: Remove unsuitable material from the bottom of the trench or at foundation level and dispose of off-site. Replace with trench backfill material.

Boring

Subcontractor: If boring is required instead of trenches, engage a suitably qualified subcontractor to do the work.

3.5 TRENCH BACKFILL

General

Place fill: To AS 3798 (2007) clauses 6.2.2 and 6.2.6.

Timing: Backfill service trenches as soon as possible after laying and bedding the service, if possible on the same working day.

Removal of supports: Remove temporary supports progressively as backfilling proceeds.

Marking services

Marking tape: Provide marking tape above service, with appropriate labelling, to AS/NZS 2648.1 (1995).

Bedding, haunch, side and overlay zones

Installation and material: To the particular utility authority or utility service requirements. Secure pipes against floatation.

Bedding of services: Surround pipes or conduits on all sides with a minimum of 75 mm compacted bedding sand, or as documented.

Overlay zone thickness: Maximum 300 mm immediately over the utility service.

Trees

Backfill at trees: Backfill minimum 300 mm thick, around tree roots with a topsoil mixture. Place and compact in layers of 150 mm minimum depth to a dry density equal to that of the surrounding soil.

Original surface level: Do not place backfill above the original ground surface around tree trunks or over the root zone.

Watering: Thoroughly water immediately after backfilling the tree root zone.

Compaction

Control moisture within backfill: To AS 3798 (2007) clause 6.2.3.

Layers: Compact all material in layers not exceeding 150 mm compacted thickness. Compact each layer to the required relative compaction before starting the next layer.

Compaction: To AS 3798 (2007) Section 5.

Frequency of testing: To AS 3798 (2007) clause 8.7.

Precautions: Use compaction methods which do not cause damage or misalignment to utility services.

Density tests

Testing authority: Carry out density tests of pipe bedding and backfilling by an Accredited Testing Laboratory.

Test methods: Conform to the following:

- Compaction control tests: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).
- Field dry density: To AS 1289.5.3.2 (2004) or AS 1289.5.3.5 (1997).
- Standard maximum dry density: To AS 1289.5.1.1 (2017).
- Dry density ratio: To AS 1289.5.4.1 (2007).
- Density index: To AS 1289.5.6.1 (1998).

3.6 SURFACE RESTORATION

Subbase and base

Compaction: Uniformly compact each layer of the subbase and base courses over the full area and depth within the trench to a relative compaction of 100% when tested in conformance with AS 1289.5.4.1 (2007).

Compacted layer thickness:

- Maximum: 200 mm.
- Minimum: 100 mm.

Compaction test frequency: Minimum 1/every second layer/50 m² of restoration surface area.

Concrete surfaces

Construction: Conform to the following:

- Prime coat the cut edges of the existing surfaces with cement slurry. Lay and compact concrete so that the edges are flush and the centre is cambered 5 mm above the adjoining existing surfaces.
- Surface finish and pattern: Match existing adjoining work.
- Minimum thickness: 75 mm or the adjacent pavement thickness, whichever is thicker.
- Reinforcement and dowels: If required, provide steel reinforcement with dowels into the adjacent concrete.
- Expansion joints: 15 mm thick preformed jointing material of bituminous fibreboard placed in line with joints in existing concrete.
- Control joints:
 - . Form control joints strictly in line with the control joints in existing concrete.
 - . Around service poles: Terminate the concrete paving 200 mm from the pole and fill the resulting space with cold mix asphalt.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions. Protect surface from rain damage, if required.

Compaction: Compact as follows:

- Thickness 100 mm or less: Compact by placing, screeding and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.
- Thickness more than 100 mm and downturns: Use an immersion vibrator.

Curing: Cure by keeping continuously wet for 7 days.

Asphalt surfaces

Placement: To AS 2150 (2020).

Operations: Spread the asphalt mix in layers covering the full width of the trench.

Thickness: Match the adjoining asphalt surface.

Finish: Compact to a smooth even surface.

Sprayed bituminous surfaces: To AS 3727.1 (2016) Section 8.

Pavers

Materials and installation: To *0276 Paving – sand bed*:

- Laying: Re-lay to match the pattern and surface levels of the existing paving.
- Damaged pavers unsuitable for relaying: Replace with new pavers of the same material, type, size and colour as the existing.

Landscaped areas

In topsoil areas: Complete the backfilling with topsoil for at least the top 100 mm.

Grass: Re-lay stockpiled turf. If existing turf is no longer viable, re-sow grass over the trench and other disturbed areas.

Planted areas: Overfill to allow for settlement.

3.7 COMPLETION**General**

As-built documentation: Upon completion, record the location of all installed services on the as-built documentation.

0241 LANDSCAPE – WALLING AND EDGING**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.
- Does not form a safety hazard.

1.2 INSPECTION**Notice**

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

- Set-out before starting construction.
- Geotextiles and subsurface drainage in place before backfilling.

2 PRODUCTS**2.1 TIMBER****Durability**

Natural durability class to AS 5604 (2005): Class 1.

Hazard class: To AS/NZS 1604.1 (2021).

Preservative treatment

Timber type: Provide only timbers with preservative treatment appropriate to the Hazard class.

Cut surfaces: Provide supplementary preservative treatment to all cut and damaged surfaces.

CCA or LOSP treated timber: If proposed, provide details.

Hardwood

General: To AS 2796.1 (1999) Section 2.

Softwood

General: To AS 4785.1 (2002) Section 2.

2.2 STEEL**Steel tubes**

Posts, rails, stays: To AS/NZS 1163 (2016).

- Grade: C350L0.

2.3 CONCRETE**General**

Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 (2018) Table 4.4.

2.4 BRICK**General**

Requirement: To *0331 Brick and block construction*.

2.5 SLEEPER WALLS

Sleepers

Hardwood: Sound durability class or preservative treated hardwood sleepers to AS 3818.2 (2010).

Softwood: Sound preservative treated softwood sleepers.

Concrete: Proprietary system of concrete sleepers and concrete or galvanized steel posts.

2.6 EARTH REINFORCEMENT

General

Type: Proprietary system of galvanized steel strips, steel mesh strips or polymeric mesh placed in layers with compacted selected fill and connected to precast concrete facing panels to form vertical retaining walls. Provide the necessary accessories including levelling pad, bearing pads, and joint fillers or covers to keep the selected fill material out of the panel joints.

2.7 GEOTEXTILES

General

Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705 (2012).

2.8 EDGING

Concrete

Standard: To AS 1379 (2007) – Grade N20.

Steel

Finish: Hot-dip galvanized.

3 EXECUTION

3.1 GENERAL

Set-out

General: Set out the position of walls and edging and mark the position of furniture.

Geotextiles and subsurface drainage: Complete subsurface drainage installation and secure geotextile in place before backfilling.

Clearing

Extent: Except for trees or shrubs to be retained, clear vegetation within 1 m of the landscape walls. Grub out stumps and roots of removed trees or shrubs and trim the grass to ground level, but do not remove the topsoil.

Excavation

Extent: Excavate for foundations and footings.

Geotextiles

Storage and handling: Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

3.2 SLEEPER WALLS

Construction

Timber sleeper wall: Erect sleeper posts at 2 m centres, buried one third. Brace wall at half height above ground with sleepers returned into embankment, spiked to posts. Lay sleepers in stretcher bond behind the verticals and securely spike together at joints and at 2 m centres. Back with geotextile and place a 100 mm draining layer of coarse sand or fine gravel between the fabric and backfill.

Concrete sleeper wall: To manufacturer's recommendations.

Backing: Backfill to ground level with compacted fine crushed rock or gravels.

3.3 EARTH REINFORCEMENT

Construction

Requirement: Construct walls to the manufacturer's recommendations.

3.4 EDGING

Concrete

Edging strip: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level. Provide control joints, filled with resilient bituminous material, at 3 m maximum centres.

Concrete kerb: Fixed form, extrusion or slip forms to AS 2876 (2000).

Spade edge

Edges: Define mass planting beds by cutting through soil with garden spade at approximately 70° to vertical. Remove sods from garden beds and spread throughout grassed areas.

Finish: Free from kinks in alignment with one curve grading evenly into the next, and free of straight sections.

0242 LANDSCAPE – FENCES AND BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

1.2 DESIGN

Wind regions C and D

Requirement: To BCA (2022) Schedule 11 WA B2 [Not in NCC 2019], AS/NZS 1170.2 (2021) and AS 4055 (2021), as appropriate.

Designated design Wind Regions: C or D.

Designated design Terrain Category: TC1.

1.3 SUBMISSIONS

Design documentation

Wind regions C and D: Submit documentation of fencing details, supports and connection by a professional structural engineer.

1.4 INSPECTION

Notice

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

- Set-out before construction.
- Completion of installation.

2 PRODUCTS

2.1 TIMBER

Durability

Natural durability class: To AS 5604 (2005).

Hazard class: To AS/NZS 1604.1 (2021).

Preservative treatment

Timber type: Provide only timbers with preservative treatment to the documented Hazard class.

Cut surfaces: Provide supplementary preservative treatment to all cut and damaged surfaces.

CCA treated timber: If proposed to be used, provide details.

Posts and rails

Hardwood: To AS 2082 (2007).

Softwood: To AS 2858 (2008).

Pickets and palings

Hardwood: To AS 2796.1 (1999) Section 8.

- Grade to AS 2796.2 (2006): Select.

Softwood: To AS 4785.1 (2002) Section 7.

Seasoned cypress pine: To AS 1810 (1995) Section 5.

2.2 STEEL

Steel tubes

Posts, rails, stays and pickets: To AS/NZS 1163 (2016).

- Grade: C350L0.

Post and rail finish: Hot-dip galvanized.

Fencing wire

Chainwire, cable wire, tie wire and barbed wire: To AS 2423 (2002).

2.3 CONCRETE

General

Standard: To AS 1379 (2007) - Grade N20.

Exposure classification: To AS 3600 (2018) Table 4.3.

2.4 COMPONENTS

Steel panel fencing

Steel framing: Zinc-coated or aluminium/zinc alloy coated steel to AS 1397 (2021).

Steel sheeting: Prepainted to AS/NZS 2728 (2013).

Timber fencing

General: Conform to the timber members in the **Timber fencing sizes table**.

Timber fencing sizes table

Member	Preservative treated soft wood picket (mm)	Preservative treated soft wood paling/lap and cap (mm)	Hardwood or cypress pine paling/lap and cap (mm)
Maximum height	1200	1800	1800
End/corner gate posts	90 x 90	100 x 100	125 x 125 or 100 x 100
Intermediate posts	90 x 90	140 x 45 or 100 x 75	125 x 50 or 100 x 75
Maximum post spacing	2400	2400/2700*	2700*
Rails	70 x 40	75 x 50 or 100x 38	75 x 50 or 100x 38
Picket/paling size	70 x 19	75, 100 or 150* x 15	100 or 150* x 13
Capping	-	125 x 35	100 x 50
Concrete footing size (diameter x depth)	300 x 600	300 x 600	300 x 600
Earth footing size (diameter x depth)	200 x 600	250 x 600	250 x 600

* Three rail fences only

Gates

General: As documented.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Set-out

General: Set out the fence line and mark the positions of posts, gates and bracing panels.

Property boundaries: Confirm by survey.

Clearing

Fence line: Except for trees or shrubs to be retained, clear vegetation within 1 m of the fence alignment. Grub out the stumps and roots of removed trees and shrubs, and trim the grass to ground level. Do not remove the topsoil.

Excavation

Posts: Excavate post holes so that they have vertical sides and a firm base. Spread surplus material on the principal's side of the fence.

Earth footings

Base: Place 100 mm of gravel in the footing base under posts.

Compaction: Backfill with earth around posts, compacting firmly by hand or machine in 150 mm deep layers.

Concrete footings

In ground: Place mass concrete around posts to protect posts from waterlogged conditions and finish with a weathered top falling 25 mm from the post to ground level.

On slabs: Provide welded and drilled post base flanges for fixing with masonry anchors to the concrete.

Erection

Line and level: Erect posts vertically. Set heights to follow the contours of natural ground, unless documented otherwise.

3.2 GATES

General

Construction: Construct gates as follows:

- Ledges and braces: Match fence rails.
- Pickets or palings: Match fencing.

Pedestrian entry gates

General: Provide the following:

- Lockable gates with 180 degree opening range.
- Hinges with smooth operation and adjustment for future sagging.

Separate courtyard entry gates

Hardware: Provide the following:

- Drop bolt and ferrule to each leaf of double gates.
- Latch to one leaf of double gates.
- Provision for locking by padlock.
- Hinges with smooth operation and adjustment for future sagging.

Hand access: Where required, provide hand holes to give access from outside to reach locking provision.

3.3 TIMBER FENCING

Installation

General: Mortice posts, taper splice rails and nail twice in mortices. Set pickets and palings clear of the ground.

Picket fence: Nail twice to each rail.

Plain paling fence: Provide 2 rails for fences up to 1800 mm high, and locate 200 mm from the tops and bottoms of the palings. Close butt palings and nail twice to each rail.

Lap and cap paling fence: Provide 2 rails for fences up to 1800 mm high, and locate 200 mm from the bottoms of the palings and abutting the tops of palings. Close-butt larger palings and nail twice to each rail. Fix smaller palings over joints and nail twice to each rail. Nail capping to the top rail.

Timber gates

Ledges and braces: Match fence rails.

3.4 STEEL FENCING

Steel fencing

Footing type: Concrete.

Steel picket fencing installation

General: Fit tightly fittings caps to steel posts. Attach panels to posts with fixing clips and galvanized M8 x 75 mm hexagon head bolts before concreting footing.

Steel panel fencing

Protection: Make sure bottom rails are at least 50 mm clear of the ground.

3.5 CHAIN LINK FABRIC FENCING

Security fencing and gates

General: As documented.

Standard: To AS 1725.1 (2010).

3.6 WELDED MESH FENCING

Welded mesh fencing

General: As documented.

Footing type: Concrete.

Installation

General: Fit tightly fittings caps to steel posts. Attach panels to posts with fixing clips and galvanized M8 x 75 mm hexagon head bolts before concreting footing.

0250 LANDSCAPE – GARDENING

1 GENERAL**1.1 RESPONSIBILITIES****Performance**

Plants: Grown to a standard that allows rapid establishment and growth to maturity.

Maintenance: Encourage and maintain healthy growth for the duration of the contract.

Program: Provide a suitable irrigation, pruning, fertiliser and monitoring program for all plant materials held by the supplier. Take precautions to safeguard the health and well-being of all plant materials before and including their delivery to the project site.

1.2 INTERPRETATION**Definitions**

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

- Imported topsoil: Similar to local natural soil, suitable for the establishment and ongoing viability of the selected vegetation, free of weed propagules and of contaminants, and classified by texture to AS 4419 (2018) Appendix K Table K1, as follows:
 - . Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
 - . Medium: Sandy loam, fine sandy loam.
 - . Coarse: Sand, loamy sand.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.
- Site rock: Rocks selected for salvage.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 (2018) and is free from the following:
 - . Stones more than 25 mm diameter.
 - . Clay lumps more than 50 mm diameter.
 - . Weeds and tree roots.
 - . Sticks and rubbish.
 - . Material toxic to plants.
- Soil blend: A landscape soil derived from the blending of two or more of sand, natural soil material or organic materials, and with a bulk density and organic matter content to meet site specific requirements.
- Top dressing: A soil which is suitable for surface application to turf and lawns.
- Topsoil: Includes landscape soil, low density soils and soils for turf and lawns.

1.3 SUBMISSIONS**Certification**

Plant species: Submit the supplier's certification as evidence that plants are true to the required species and type, and free from diseases, pests and weeds at the time of delivery.

Turf: Submit the supplier's certification as evidence that turf is free from diseases, pests and weeds at the time of delivery.

Execution details

Irrigation plan: Before installation, submit an irrigation plan in pdf format and hard copy.

Products and materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Samples

General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, submit a 1 kg sample of each type documented with required test results.

Subcontractors

General: Submit names and contact details of proposed suppliers and evidence of the following, if appropriate:

- Experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Lead times for delivery of materials to the site.

1.4 INSPECTION**Notice**

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

- Grassing or turfing completed.
- Plant material set out before planting.
- Planting, staking and tying completed.

2 PRODUCTS**2.1 TOPSOIL****General**

Requirement: Topsoil containing organic matter, able to support plant life and free from stones, contaminants and weeds.

Standard

Site and imported topsoil: To AS 4419 (2018).

Composts, soil conditioners and mulches: To AS 4454 (2012).

Source

General: If the topsoil of documented quality cannot be provided from material recovered from site, provide imported topsoil.

Mix proportion (loam:sand): 1:1.

Imported topsoil particle size table (% passing by mass)

Sieve size (mm)	Soil textures		
	Fine	Medium	Coarse
2.36	100	100	100
1.18	90 – 100	90 – 100	90 – 100
0.60	75 – 100	75 – 100	70 – 90
0.30	57 – 90	55 – 85	30 – 46
0.15	45 – 70	38 – 55	10 – 22
0.075	35 – 55	25 – 35	5 – 10
0.002		2 – 15	2 – 8

Imported topsoil nutrient level table

Nutrient	Unit	Sufficiency range
Nitrate-N (NO ₃)	mg/kg	> 25
Phosphate-P (PO ₄) – P tolerant	mg/kg	43 - 63
Phosphate-P (PO ₄) – P sensitive	mg/kg	< 28
Phosphate-P (PO ₄) – P very sensitive	mg/kg	< 6
Potassium (K)	mg/kg	178 - 388
Sulfate-S (SO ₄)	mg/kg	39 - 68
Calcium (Ca)	mg/kg	1200 - 2400
Magnesium (Mg)	mg/kg	134 - 289
Iron (Fe)	mg/kg	279 - 552
Manganese (Mn)	mg/kg	18 - 44
Zinc (Zn)	mg/kg	2.6 - 5.1
Copper (Cu)	mg/kg	4.5 - 6.3
Boron (B)	mg/kg	1.4 - 2.7
Method References		
pH in H ₂ O (1:5), pH in CaCl ₂ (1:5) and Electrical Conductivity (EC) by Rayment & Higginson (1992) method 4A2, 4B2, 3A1.		
Soluble Nitrate-N by APHA 4500.		
Soluble Chloride by Rayment and Lyons 2011 modified method 5A2.		
Extractable P by Mehlich 3 – ICP.		
Exchangeable cations – Ca, Mg, K, Na by Mehlich 3 – ICP.		
Extractable S by Mehlich 3 – ICP.		
Extractable trace elements (Fe, Mn, Zn, Cu, B) by Mehlich 3 - ICP.		

2.2 GRASS SURFACES**Turf**

Supplier: A specialist grower of cultivated turf.

Quality: Provide turf of even thickness, free from weeds, pests, disease and other foreign matter.

Turf properties: Provide turf with the following properties:

- Consisting of 25 mm deep dense, well-rooted, vigorous grass growth in 25 mm deep topsoil.
- Species: Couch grass (*Cynodon dactylon*), including the Wintergreen variety.

Turf dimension:

- Roll width: Minimum 300 mm, in sound unbroken condition.
- Length: Minimum 1.5 m.

2.3 GRASS REINFORCING**Grass reinforcement**

Description: Lightweight interlocking plastic cellular paving system suitable for pedestrian and occasional vehicular traffic including emergency vehicles.

2.4 MULCH**General**

Type: Free of deleterious and extraneous matter including soil, weeds, plastic, metal, paint and sticks. Do not include fine mulch.

Particle size, physical and chemical contaminants: To AS 4454 (2012) Table 3.1(A).

- Organic mulches: Free of stones.

Organic mulch types

Brush chippings and leaf litter: Vegetative material processed through a chipper to pieces not larger than 75 x 50 x 15 mm as follows:

- Material permitted: Leaf matter and tree loppings from *Eucalyptus*, *Tristania* and *Pinus* species.
- Material not permitted: Leaf matter and tree loppings from privet, camphor laurel, coral tree, poplar, willow, and declared (noxious) weeds.

Pine bark: From mature trees, graded in size from 50 x 50 x 25 mm to 25 x 15 x 15 mm, free from wood slivers.

Pine flake: Pinus species sapwood slivers in size range 250 x 25 mm to 30 x 3 mm, including fragments of pine bark.

Straw: Cereal straw, wood fibre, or other suitable vegetative material (but not meadow hay) free from weeds and seeds, applied in conjunction with a bitumen emulsion or polymer binder.

Inorganic mulch types

Washed river pebble: Uniform size or graded material in the size range 6 to 10 mm.

Decomposed granite gravel: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour and low plasticity.

Crushed quartz: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour.

Marble chip gravel: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour.

Slate: Plum slate slivers in the size range 5 to 25 mm.

Shale: Uniform size or graded material, no particles smaller than 0.1 mm diameter.

Scoria: Uniform size or graded material.

Binders

General: Materials suitable for cold spray application to stabilise mulched or seeded surfaces on banks or high erosion areas.

2.5 FERTILISER**General**

Description: Proprietary fertilisers, delivered to the site in the manufacturer's labelled and unopened bags or containers.

Application rate: Vary the application rate to allow for the plant-available immediate fertiliser equivalence value of the soil conditioning compost.

2.6 PLANTS

General

Requirement: Supply plants with the following properties:

- Stress: Free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.
- Site environment: Grown and hardened off to suit anticipated site conditions at the time of delivery and prevent dieback.
- Pests and disease: Free from attack by pests or disease.
- Native species with a history of attack by native pests: Restrict plant supply to those with evidence of previous attack to less than 15% of the foliage and make sure actively feeding insects are absent.

Supply and delivery: Supply plants from a nursery with Nursery Industry Accreditation Scheme Australia (NIASA) accreditation and deliver to site with a label displaying the botanical name.

Species: If possible, use plants identified as waterwise by Water Corporation for the particular region. (See www.watercorporation.com.au/Waterwise/Waterwise-plants).

Labelling

General: To the recommendations of the *National Plant Labelling Guidelines (2013)*.

Label type: To withstand transit without erasure or misplacement.

Root system

Requirement: Supply plant material with a root system as follows:

- Well-proportioned in relation to the size of the plant material.
- Conducive to successful transplantation.
- Free of any indication of having been restricted or damaged.

Root inspection: If investigative inspection is required, sample as follows:

- For more than 100 samples: Inspect 1%.
- For less than 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in investigative inspection.

Rejection: Do not provide root bound stock.

Stakes

Material: Hardwood, straight, free from knots or twists, pointed at one end.

Installation: Drive stakes into the ground at least one-third of their length, avoiding damage to the root system.

Stake sizes and quantities:

- For plants \geq 2500 mm high: Three 50 x 50 x 2400 mm stakes per plant.
- For plants 1000 to 2500 mm high: Two 50 x 50 x 1800 mm stakes per plant.

- For plants < 1000 mm high: One 38 x 38 x 1200 mm stake per plant.

Ties

General: Provide ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant. Attach ties loosely so as not to restrict plant growth.

Tie types:

- For plants \geq 2500 mm high: Two strands of 2.5 mm galvanized wire neatly twisted together, passed through reinforced rubber or plastic hose, and installed around stake and stem in a figure eight pattern.
- For plants < 2500 mm high: 50 mm hessian webbing stapled to the stake.

2.7 IRRIGATION

General

Requirement: Provide and commission automatically controlled, fixed irrigation systems.

Performance: Provide systems as follows:

- That achieve the documented flow rates over the irrigated area.
- Meet statutory requirements for backflow prevention.
- Meet Water Corporation's waterwise reticulation requirements.

Backflow prevention device

Product/type: A Water Corporation approved brass dual check valve device installed immediately below a Water Corporation approved isolation valve.

Irrigation controllers

Type: Automatic controllers that are easily programmed and include the following:

- Manual cycle and individual control valve operation.
- Manual on/off operation of irrigation without loss of program.
- \geq 4 on/off cycles per day.
- Day omit.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- \geq 24 hour battery program backup.
- Power surge protection.
- Mounted in a lockable cabinet of minimum IP54 to AS 60529 (2004) in external locations.
- Electrical connection: If connected to wall outlets, provide 3 core 10 A, 240 V flexible cord and plug. Provide an isolating switch at the controller.

Power supply: For developments with multiple dwellings, connect to the common power source, not the power supply of individual dwellings.

- Metering: Connect to the common supply meter.

Number of stations in the controller: \geq number of stations in the reticulation systems.

Number of controllers: Do not use more than one controller without the approval of the principal.

Controller type/product: Do not install without approval from the principal.

Underground piping and PVC-U fittings

PVC-U pipes: To AS/NZS 1477 (2017).

Mainline piping: Minimum Class 12 PVC-U.

Lateral piping: Minimum Class 9 PVC-U.

PVC-U fittings: Minimum Class 18 PVC-U.

Low density polyethylene pipes: Minimum 19 mm when used with drippers.

Micro-irrigation systems

Tubing: Polyethylene micro-irrigation pipe.

Emitter type: Dripper and sprays.

Drip irrigation systems

Integrated drip line systems: Tubing with integral drippers inserted into the tube during manufacture.

Discrete drip emitter systems:

- Tubing: Polyethylene micro-irrigation pipe.
- Drippers: Turbulent flow types, easily dismantled for cleaning.

Fittings

Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Valve boxes

Requirement: Provide the following in each valve box:

- Automatic control valve.
- Isolating valve.
- Filter:
 - . Micro-irrigation systems: 200 µm.
 - . Drip irrigation systems: 100 µm.
- Pressure-reducing valve with 170 kPa outlet pressure.

Construction: UV-resistant high impact plastic with high impact snap lock plastic cover and adequately sized for clear access.

3 EXECUTION**3.1 PREPARATION****Weed eradication**

Herbicide: Eradicate weeds using environmentally acceptable methods conforming to the *Health (Pesticides) Regulations 2011 (WA)*, such as a non-residual glyphosate herbicide, at the recommended maximum rate.

Manual weeding: Regularly remove weed growth by hand throughout grassed, planted and mulched areas. Remove weed growth from an area of 750 mm diameter around the base of the trees in grassed areas. Continue weeding throughout the course of the works and during the planting establishment period.

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

3.2 ROCK WORK**New rock work**

Erosion control: Bury rock two-thirds by volume or as appropriate for effective erosion control, with

weathered faces exposed. Protect the weathered faces from damage.

Site rock: Stockpile for future placement and accessibility for lifting. Dispose of other rock off site.

Imported rock: Provide rock which has been selected before delivery.

Placing rock: Place while ground formation work is being carried out, as documented.

3.3 EARTH MOUNDS**Construction**

Placing: Place clean fill in layers approximately 150 mm thick compacted to 85% of the dry density ratio of the surrounding soil tested to AS 1289.5.4.1 (2007). Minimise slumping and further compacting.

Edges: Construct changes in grade over a minimum width of 500 mm to smooth, gradual and rounded profiles with no distinct joint.

Existing trees: Maintain the natural ground level under the canopy.

Pipes, culverts and associated structures: Construct mounding to avoid unbalanced loading.

Drainage: Construct mounds to allow free drainage of surface water and to eliminate ponding.

3.4 SUBSOIL**Ripping**

General: Rip parallel to the final contours. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Subsoil: Rip the subsoil to the following typical depths:

- Compacted subsoil: 300 mm.
- Heavily compacted clay subsoil: 450 mm.

Planting beds

Excavated: Excavate to reduce the subsoil level to at least 300 mm below finished design levels.

Shape the subsoil to fall to subsoil drains, if required. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, rubbish and other debris. Reduce the planting bed level to 75 mm below finished design levels.

Wetting agent: Apply to manufacturer's recommendations.

Cultivation

Minimum depth: 100 mm.

Services and roots: Do not disturb services or tree roots. If required, cultivate these areas by hand.

Cultivation: Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 25 mm, clods of earth exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

Additives

General: Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil as documented.

Gypsum: Incorporate at the rate of 0.25 kg/m².

Herbicides

General: Before spreading topsoil apply a herbicide treatment.

3.5 TOPSOIL**Placing topsoil**

Site topsoil: Do not incorporate site topsoil into the works until soil testing results have been approved. Remove unauthorised material from the site.

Spreading: Spread the topsoil on the prepared subsoil and grade evenly, making allowances, if appropriate, for the following:

- Required finished levels and contours after light compaction.
- Grassed areas finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.

Steep batters: If using a chain drag for spreading, make sure there is no danger of batter disturbance.

Finishing: Feather edges into adjoining undisturbed ground.

Consolidation

General: Compact lightly and uniformly in 150 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- Finished to design levels.
- Smooth and free from stones or lumps of soil.
- Graded to drain freely, without ponding, to catchment points.
- Graded evenly into adjoining ground surfaces.
- Ready for planting.

Topsoil depths

General: Spread topsoil to the following typical depths:

- Excavated planting areas:
 - . For organic mulch: 225 mm.
 - . For gravel mulch: 250 mm.
- Irrigated grassed areas generally: 150 mm.
- Irrigated grassed areas, heavy use (e.g. playing fields, playgrounds and public parks): 200 mm.
- Non-irrigated grass areas: 100 mm.
- Earth mounds:
 - . Mass planted surfaces: 300 mm.
 - . Grassed surfaces: 100 mm.
- Top dressing: 10 mm.

Surplus topsoil

General: Spread surplus topsoil on designated areas on-site or dispose off-site.

Shrub planting areas

Ground level: Level planting areas to the following levels:

- 100 mm below grassed area.
- Minimum 1 brick course below the damp-proof course of buildings.
- Levelled with concrete driveways.

3.6 TURFING**Preparation for turfing**

Requirement: Keep free of rubbish, rubble stones and roots.

Watering: Keep moist to 100 mm deep before planting.

Planting area preparation: Prepare planting area for turfing as follows:

- Rotary hoe: To a minimum depth of 150 mm and provide runners with minimum 50 mm soil cover.
- Wetting agent: Apply to manufacturer's recommendations.
- Light rolling: Lightly roll to form an even, levelled surface without wheel ruts.

Supply

Elapsed time: Deliver the turf within 24 hours of cutting, and lay within 36 hours of cutting. Prevent turf from drying out between cutting and laying. If not laid within 36 hours of cutting, roll turf out on a flat surface with the grass up, and water as required to maintain a healthy condition.

Fertilising

Requirement: Mix the fertiliser thoroughly into the topsoil before placing the turf with a slow release fertiliser applied to the manufacturer's recommendations.

Application

Requirement: Do not install turf on slopes steeper than 1:3.

Method: Lay the turf as follows:

- Stretcher bond pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas, and with contours on slopes.
- Finish flush, after tamping or rolling, with adjacent finished surfaces of ground, paving edging, or grass seeded areas.

Laying: Close butt the end joints and space the turf strips 300 mm apart. Lay top dressing between the turf strips. Finish with an even surface.

Tamping or rolling: Lightly tamp or use a turf roller to provide an even surface immediately after laying.

Stabilising on steep slopes: Peg the turf to prevent downslope movement. Remove the pegs when the turf is established.

Watering

General: Water immediately after laying until the topsoil is moistened to its full depth. Maintain moisture to this depth.

Initial establishment

General: Maintain turfed areas until there is a dense continuous sward of healthy grass over the whole turfed area, evenly green and of a consistent height.

Failed turf: Lift failed turf and replace with new turf.

Levels: If levels have deviated from the design levels after placing and watering, lift turf and regrade topsoil to achieve design levels.

Top dressing: Mow the established turf and remove cuttings. Lightly top dress to a depth of 10 mm. Rub

the dressing into the joints and correct any unevenness in the turf surface.

3.7 GRASS REINFORCING

Installation

Preparation: Excavate to required levels and compact subgrade.

Base course: Place and compact either of the following:

- Non-calcareous, free-draining washed sand, comprising 80% 0.1 to 1.0 mm grading.
- 1.0 to 5.0 mm gravel aggregate.

Base course depth:

- Pedestrian walkways: 100 mm.
- Passenger vehicles: 150 mm.
- Heavy vehicles: 250 mm.

Growing media: 80:20 (sand:organic sandy soil) mix.

Grass reinforcement: Place on base course and interlock. Spread growing media over grass reinforcement to heights as follows:

- Turfed areas: 5 mm.

Protection: Prevent traffic until the root system is established and anchored to the base course.

3.8 PLANTING

General

Plant location and spacing: If necessary to vary plant locations and spacings to avoid service lines, or to cover the area uniformly, or for other reasons, give notice.

Planting conditions

Weather: Do not plant in unsuitable weather conditions, including extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering

Timing: Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

Preparation

Individual plantings in grassed areas: Prepare for planting as follows:

- Excavate a hole twice the diameter of the rootball and at least 100 mm deeper than the rootball.
- Break up the base of the hole to a further depth of 100 mm.
- Loosen compacted sides of the hole to prevent confinement of root growth.

Placing

General: Place plants as follows:

- Remove the plant from the container with minimum disturbance to the rootball. Make sure that the rootball is moist.
- If required, root prune to make sure all circling roots have been either severed or aligned radially into the surrounding soil.
- Place the plant in its final position, in the centre of the hole and plumb, and with the topsoil level of

the plant rootball level with the finished surface of the surrounding soil.

Fertilising

Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

Backfilling

General: Backfill with topsoil mixture. Lightly tamp and water to eliminate air pockets. Make sure that topsoil is not placed over the top of the rootball, so the plant stem remains the same height above ground as it was in the container. Avoid mixing mulch with topsoil.

Watering basins for plants in grassed areas

Location: To each individual plant not located in irrigated grassed areas or naturally moist areas.

Watering basin: Construct around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

3.9 IRRIGATION

General

Requirement: Conform to local water restrictions.

Performance

Performance and efficiency of the system: Conduct a flow and pressure test and rectify system if inadequate.

Precipitation: Allow for minimum 40 mm precipitation per week throughout all sections of the irrigation system.

Reticulation

Extent: To all landscaped areas.

Type: Provide as follows:

- Lawn areas: Rotator sprinklers.
- Individual plants: Drippers.

Prevention of overspray: Position sprinklers so that:

- Those in verge areas do not overspray onto roads.
- There is no overspraying onto buildings.
- Those in garden beds do not overspray onto driveways.

Sprinkler spacing: As recommended by the manufacturer for the pressure and water volume.

Water supply: From a separate cut in within 2 m of the master mains water meter, with a 25 mm tested gate valve fitted with an approved backflow prevention device.

Reticulation sleeves: Provide as follows:

- 100 mm PVC-U sleeve 300 mm below driveways, as documented. If not documented, provide sleeve at the junction of driveway and carport floor.
- Provide a 90° elbow to each end, 300 mm out from the ground, visible for the landscaper.
- Fit sleeves in one straight length under the driveway to allow draw wires to be easily drawn through the sleeve.

Solenoid conduit: Provide 15 mm diameter PVC conduit with draw wire from the garden reticulation

cabinet, adjacent paths, hardstands and driveways to the nearest garden bed.

Garden reticulation cabinet: Provide cabinet if documented. Install a 10 amp 250 volt socket outlet in the cabinet.

- Supply conduit and draw wire to the reticulation cabinet.
- Position labelled socket outlet at the bottom right hand corner of cabinet and connect to common services power circuit.
- Label socket outlet: SUPPLIED BY COMMON SERVICES POWER CIRCUIT.

Underground piping and PVC-U fittings

PVC-U pipe system installation: To AS/NZS 2032 (2006).

PVC-U fittings: Allow for changes in pipework direction using fittings. Do not install pipes with excessive bending.

Micro-irrigation systems

General: Connect micro-tube laterals with proprietary push in or screw in fittings.

Drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Microsprays: If microsprays are required, mount microsprays 300 mm above ground on stakes and connect to the piping with appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

Drip irrigation systems

Discrete drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

Valve box installation

Requirement: Install with top of box flush with the surface.

Clearance: Allow 100 mm minimum clearance from filters and 50 mm min clearance from valves.

Base: Concrete plinth or crushed rock.

Sprinkler head protection

Sprinklers along kerbs: Where installed along roads, driveways or parking areas, set sprinkler head in 90 mm thick concrete, extending minimum 300 mm diameter around the head.

Sprinklers in lawn/grassed area: Set sprinkler head in 80 mm thick concrete, extending minimum 200 mm diameter around the head.

North West and Goldfields region

Sprinkler installation: Provide plastic sprinkler surrounds to all sprinklers to protect from lawn mower damage.

3.10 MULCHING

Placing mulch

General: Place mulch to the required depth and clear of plant stems, so that after settling it conforms to the following:

- Smooth and evenly graded between design surface levels.
- Flush with the surrounding finished levels.
- Sloped towards the base of plant stems in plantation bed.
- For gravel mulches: Not closer to the stem than 50 mm.

Extent: Provide mulch to 750 mm diameter to surrounds of plants planted in riplines and grassed areas.

Depths:

- Organic mulch: 75 mm.
- Gravel mulch: 50 mm.

Installation:

- In ripline and grassed areas: Place mulch to 750 mm diameter around plants.
- In mass planted areas: Place after the preparation of the planting bed but before planting and other work.
- In smaller areas (e.g. planter boxes): Place after the preparation of the planting bed, planting and other work.

3.11 TREATMENT

General

Pest attack or disease: If evidence of pest attack or disease of plant material is discovered, immediately give notice.

Physical removal

General: Remove pest infestation and diseased plant material by hand if appropriate.

Pesticide

Product: Spray with insecticide, fungicide or both, as required.

3.12 STAKES AND TIES

Stakes

Requirement: Provide for all new trees and shrubs.

Installation: Drive stakes into the ground at least one third of their length, avoiding damage to the root system. Position stake on the prevailing wind side of the plant.

Ties

General: Provide 50 mm hessian webbing ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant. Attach ties loosely so as not to restrict plant growth.

Protectors

Individual plantings in grassed areas: Fit with plastic stem protectors.

Trunk protection: Collar guards:

- 200 mm length of 100 mm diameter agricultural pipe split lengthways.

3.13 VERGES AND STREET TREES

Dimension and level

Level and grade: Do not alter from existing levels.

Setback: Set verge 1500 mm from the road frontage, including for verges without footpaths.

Planting

Turf species: Use a species approved by the local government authority for verge treatments.

Plant dimensions: Select plant varieties that meet the following requirements:

- Maximum height: 750 mm.
- Impact on the public: The plant does not pose a hazard to (such as is toxic or an irritant) or obstruct pedestrians.

Irrigation: Install as follows:

- Water source: From a point beyond the water meter and inside the site boundary, passing through a backflow prevention device.
- Reticulation pipes: Provide piping installed at minimum 300 mm below the surface ground level and rotator sprinkler system with conduits installed under footpaths.

3.14 ESTABLISHMENT

Planting

Requirement: Make sure the general appearance and presentation of the landscape and the quality of plant material at the date of practical completion is maintained for the planting establishment period.

Plant replacement: Replace failed, dead and/or damaged plants at maximum 3 weekly intervals as necessary throughout the plant establishment period.

Pruning: To AS 4373 (2007) and as documented.

Application of fertiliser: Apply either an all-purpose fertiliser or a 12 month slow release fertiliser, in two rows and cultivated into soil to a depth of 100 mm.

- Program: September and March according to seasonal growth requirement.

Weeding: Remove unwanted broad-leaf plants and grasses considered invasive to the locality.

Remulching: Maintain the original ground levels around the base of plants.

Watering: Minimum 3 complete waterings, soaking to a depth of 150 mm at fortnightly intervals for the first 6 weeks of plant establishment irrespective of natural rainfall.

Grass surfaces

Preparation: Remove litter and fallen branches before mowing.

Mowing:

- Grass height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year. Do not remove more than one-third of the grass height at any one time.
- Program: Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions. Carry out last mowing not more than 7 days before end of plant establishment period.

- Clippings: Remove grass clippings from the site after each mowing.

- Raking: Once every month before mowing during the mowing season, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Weeding: Remove unwanted broad-leaf plants and grasses considered invasive to the locality.

- Program: Quarterly, and as required to maintain the general lawn condition.

Edge trimming: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

Top dressing for established lawns: Weed-free imported sandy topsoil to a depth of 5 mm.

- Program: The spring following initial establishment.

Application of fertiliser: Apply lawn fertiliser at the completion of the first and last mowings of the plant establishment period, and at other times as required to maintain healthy grass cover.

3.15 COMPLETION

Irrigation

Requirement: On completion of the irrigation system, carry out the following:

- Flush system thoroughly. Check heads, sprays and drippers and clean if blocked.
- Clean strainers.
- Adjust for even distribution with no dry areas.

Cleaning

Stakes and ties: Remove those no longer required at the end of the planting establishment period.

Temporary fences: Remove temporary protective fences at the end of the planting establishment period.

0271 PAVEMENT BASE AND SUBBASE

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Surface level: Provide a finished surface level which is free draining and evenly graded between level points.

1.2 TOLERANCES

Surface level

Subbase: +10 mm, -25 mm.

Base: +10 mm, -5 mm.

Base abutting gutters: ±5 mm from the level of the lip of the gutter, minus the design thickness of the wearing course.

Surface deviation

Base: ≤ 5 mm from a 3 m straightedge laid on the surface.

1.3 SUBMISSIONS

Products and materials

Source of material: Submit the supplier name, material type (crushed rock, natural gravel, recycled concrete aggregate) and source quarry or recycling site.

Conformance: Submit type test results for each material listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited Testing Laboratory as evidence of material conformance.

Alternative materials: If proposed, submit type test results for the relevant properties listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited Testing Laboratory as evidence of material conformance.

Tests

Compaction tests: Submit results of compaction testing to **TESTING, Site tests**.

1.4 INSPECTION

Notice

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

- Prepared subgrade.
- Proof rolling of subbase before spreading of base.
- Proof rolling of base before sealing.

2 PRODUCTS

2.1 BASE AND SUBBASE MATERIAL

Granular material

Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability

and are uniform in grading and physical characteristics.

Crushed rock

Requirement: Provide crushed rock as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Recycled materials

Requirement: Provide recycled materials as follows:

- Base and subbase: Conform to the **Limits on use of recycled and manufactured materials as constituent materials table** and the **Undesirable material properties table**.

Natural gravel

Requirement: Provide unbound natural gravel materials as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Subbase material properties and test methods table

Property and test method	Differentiating criteria	Material requirements	
		Crushed rock	Natural gravel
Particle size distribution or grading (% passing through sieve) to AS 1289.3.6.1 (2009)	Sieve size (mm)	—	—
	53.0	100	100
	37.5	90 - 100	95 - 100
	26.5	74 - 96	80 - 97
	19.0	62 - 86	—
	13.2	—	—
	9.5	42 - 66	48 - 85
	4.75	28 - 50	35 - 73
	2.36	20 - 39	25 - 58
	0.425	8 - 21	10 - 33
0.075	3 - 11	3 - 21	
Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1) to AS 1141.52 (2019)	—	min 1.0 MPa	min 1.0 MPa
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1 (2014)	—	min 30%	min 30%

Limits on use of recycled and manufactured materials as constituent materials table

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Iron and steel slag	100%	100%
Crushed concrete*	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash**	10%	10%

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%
Notes:		
* For pavements using high percentages of crushed concrete, take into account the amount of available cement which will rehydrate when subjected to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.		
** For pavements using fly ash, take into account the possibility of hydration and binding when subject to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.		

Undesirable material properties table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Undesirable constituent materials (% retained on a 4.75 mm sieve) to RMS T276 (2012)	Material type	—	—	—
	Type I - Metal, glass, stone, ceramics and slag	—	max 2.0 %	—
	Type II - Plaster, clay lumps and other friable material	—	max 0.5%	—
	Type III - Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	max 0.1%	—

Base material properties and test methods table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Particle size distribution or grading (% passing through sieve) AS 1289.3.6.1 (2009)	Sieve size (mm)	—	—	—
	26.5	100	100	100
	19.0	95 - 100	95 - 100	93 - 100
	13.2	77 - 93	78 - 92	—
	9.5	63 - 83	63 - 83	71 - 87
	4.75	44 - 64	44 - 64	47 - 70
	2.36	29 - 49	30 - 48	35 - 56
	0.425	13 - 23	13 - 21	14 - 32
	0.075	5 - 11	5 - 9	6 - 20
CBR (98% modified compaction) to AS 1289.6.1.1 (2014)	—	min 80%	min 80%	min 80%

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Unconfined compressive strength to AS 5101.4 (2008)	—	max 1.0 MPa	max 1.0 MPa	—

3 EXECUTION

3.1 SUBGRADE PREPARATION

General

Requirement: Prepare the subgrade to 0222 Earthwork.

3.2 PLACING BASE AND SUBBASE

General

Weak surfaces: Do not place material on a surface that is weakened by moisture and is unable to support, without damage, the construction plant required to perform the works.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Compacted layer thickness: 200 mm maximum and 100 mm minimum. Provide layers of equal thickness in multilayer courses.

Joints

General: Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by a minimum of 300 mm.

Start of shift: Remix last 2 m of previous days' work for continuity of compaction.

Final trimming

General: Trim and grade the base course to produce a tight even surface with no loose stones or slurry of fines.

3.3 BASE AND SUBBASE COMPACTION

General

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation.

Unstable areas: If unstable areas develop during rolling or are identified by proof rolling, open up, dry back and recompact, to the requirements of this worksection. If dry back is not possible, remove for the full depth of layer, dispose of and replace with fresh material.

Minimum relative compaction table

Item description	Minimum dry density ratio (modified compaction) to AS 1289.5.2.1 (2017)
Subbase	95%
Base	98%

Compaction requirements

General: Apply uniform compactive effort over the whole area to be compacted, until the required density is achieved or until failure is acknowledged. If failure is acknowledged, conform to **Rectification**.

Equipment: Use rollers appropriate to the materials and compaction requirements documented.

Moisture content

General: During spreading and compaction, maintain material moisture content within the range of -2% to +1% from the optimum moisture content (modified compaction).

Spraying: Use water spraying equipment to distribute water uniformly, in controlled quantities, over uniform lane widths.

Dry back: Allow materials to dry to 60 to 80% of the optimum moisture content before applying the seal or wearing course.

Rectification

General: If a section of the pavement material fails to meet the required density or moisture content after compaction, remove the non-conforming material, dispose of off-site or rectify for re-use, replace with fresh material, re-compact and test.

Level corrections

General: Rectify incorrect levels as follows:

- High areas: If the area can be rectified by further trimming to produce a uniform, hard surface by cutting without filling, trim so that the rectified area conforms to **TOLERANCES**.
- Low areas and high areas not rectifiable by further trimming: Remove layers to a minimum depth of 75 mm and replace with new material and re-compact.

3.4 TESTING**Site tests**

Compaction control tests: To AS 1289.5.4.1 (2007) and AS 1289.5.4.2 (2007).

Frequency of compaction control tests: Not less than the following (whichever requires the most tests):

- 1 test per layer per 100 lineal metres for two-lane roads.
- 1 test per layer per 2000 m² for car parks.
- 3 tests per layer.
- 3 tests per visit.

0274 CONCRETE PAVEMENT**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Requirement:

- Free draining and evenly graded between level points.
- Even and smooth riding surfaces.

Conformance: Conform to the local authority requirements for levels, grades and minimum thickness, reinforcement and concrete strength for pavements within the kerb-and-gutter property boundaries.

1.2 STANDARDS**Concrete**

Specification and supply: To AS 1379 (2007).

Materials and construction: To AS 3600 (2018).

Residential pavements: To AS 3727.1 (2016).

Slip resistance

Classification: To AS 4586 (2013).

1.3 TOLERANCES**General**

Surface abutting gutters: ± 5 mm from the level of the gutter edge.

Rigid pavement surface:

- From design level: +10 mm, -0 mm.
- From a 3 m straightedge placed anywhere on surface: 5 mm.

Horizontal position of outer concrete edge: ± 20 mm from documented position.

Joint locations in plan: 10 mm from documented position.

1.4 SUBMISSIONS**Execution details**

Surface repair method: If required, submit details of the proposed method before commencing repairs.

Products and materials

Reinforcement: Submit the manufacturer's certificate of compliance with AS/NZS 4671 (2019), or submit test certificates from an Accredited Testing Laboratory.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), and the following:

- 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.

Tests

Requirement: Submit test results, as follows:

- Slip resistance test of completed installations.

1.5 INSPECTION**Notice**

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

- Base or subgrade before covering.
- Concrete formwork, reinforcement and dowels in position.
- Evaluation of surface finish.

2 PRODUCTS**2.1 REINFORCEMENT****Steel reinforcement**

Standard: To AS/NZS 4671 (2019).

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

Storage: Store reinforcement above the surface of the ground and protect from damage and from deterioration by exposure.

Dowels

General: Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs.

Standard: To AS/NZS 4671 (2019).

Grade: 250R steel bars 450 mm long.

Tie bars

Type: Deformed bar, 12 mm diameter, grade 500N, 1 m long.

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

Supports

Standard: To AS/NZS 2425 (2015).

2.2 CONCRETE MIX**Standard**

Concrete mix and supply: To AS 3600 (2018) clause 17.1 and AS 1379 (2007).

Properties

Slump: Maximum 100 mm.

Drying shrinkage: Maximum 450 μe after 21 days of air drying.

2.3 AGGREGATE**Characteristics**

Standard: To AS 2758.1 (2014).

Durability: Tested to AS 1141.22 (2019):

- Wet strength not less than 80 kN.
- 10% Fines Wet/Dry variation not to exceed 35%.

Recycled concrete aggregate (RCA): If blending coarse RCA with natural aggregates, make sure substitution rates are below 30%.

2.4 CEMENT**General**

Standard: To AS 3972 (2010).

Age: Less than 6 months old.

Moisture: Protect from moisture until used. Do not use caked or lumpy cement.

Storage: Store cement bags in a dry, under cover and above ground environment.

Supplementary cementitious materials

Fly ash: To AS/NZS 3582.1 (2016).

Slag: To AS 3582.2 (2016).

Amorphous silica: To AS/NZS 3582.3 (2016).

2.5 WATER**General**

Mixing water: To AS 1379 (2007) clause 2.4.

Requirement: Clean potable water, free from any material which may be harmful to the concrete or reinforcement including oil, acid, alkali, organic or vegetable matter.

Limits of impurities in mixing water: To AS 1379 (2007) Table 2.2 and the following:

- Chloride ion: Maximum 30 parts per million to AS 1478.1 (2000) Appendix C.
- Sulfate ion: Maximum 400 parts per million to AS 1289.4.2.1 (2020).

2.6 ADMIXTURES**General**

Standard: Chemical admixtures to AS 1478.1 (2000), used to the manufacturer's recommendations.

Quality: Free from calcium chloride, calcium formate, triethanolamine or any other accelerator. Do not use admixtures or combinations of admixtures without prior written approval.

Dosage: Vary the dosage of chemical admixture to account for factors such as air temperature, setting time and cement content to the manufacturer's recommendations.

2.7 CURING COMPOUNDS**General**

Curing compounds: To AS 1160 (1996) and AS 3799 (1998), Type 2.

Sheet material covering: To ASTM C171 (2020), white opaque or clear polyethylene film, or white burlap-polyethylene sheet, or equivalent material.

2.8 OTHER MATERIALS**Tactile ground surface indicators**

Standard: To AS/NZS 1428.4.1 (2009).

3 EXECUTION**3.1 GENERAL****Traffic control**

Traffic restriction: Do not allow traffic or construction plant other than that associated with testing, sawcutting, cleaning or joint sealing on pavement

for minimum 10 days after placing, or when the concrete has reached a compressive strength of at least 20 MPa, and joints have been completely sealed.

3.2 SUBGRADE

Preparation

Conformance: Prepare subgrade to 0222 Earthwork.

Extent: Prepare a uniform subgrade for the full pavement formation, extending at least to the back of kerbs or at least 300 mm beyond each side of the carriageway if kerbs are not proposed.

Reinstatement: Make sure of uniformity for backfilling of any utility trenches.

3.3 SUBBASE

Width

Subbase width: Extend the subbase at its full depth to at least the back of kerbs or other edge stops before their installation.

No integral kerbs: Extend granular unbound subbase at least 300 mm beyond each side of the carriageway.

Tolerance

Subbase finished surface level: +0 mm, -10 mm.

3.4 INSTALLATION

Junctions with existing pavements

Trimming: If new pavement is to be joined to an existing pavement, trim the edge of the existing pavement to create a neat vertical edge for its full depth before placing new pavement material.

Fixed formwork

Type:

- Steel forms.
- Seasoned, dressed timber planks, free of warps, bends or kinks.

Depth: Equal to the edge thickness of the slab and in one piece.

Tolerances on position:

- Level of top of form: -0 mm, +10 mm from pavement surface design level.
- Horizontal tolerance: 10 mm (maximum departure from a plane surface).
- Verticality: 3 mm departure from vertical.

Staking: Stake forms in position using at least 3 steel stakes per form, not more than 1.5 m apart. Lock joints between form sections to prevent movement.

Release agent: Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent.

Re-use: Clean and recoat the forms each time before placing concrete.

Keywords: Form the keyways of keyed construction joints using steel or timber form strips accurately located at the mid-depth of the slab and securely fastened flush against the formwork face.

Reinforcement

Tolerances in fabrication and fixing: To AS 3600 (2018).

Locate reinforcement: Place reinforcement in the top half of the pavement.

Minimum cover to reinforcement: 30 mm.

Splicing mesh: Overlap a minimum of 2 crosswires.

Supports: Provide reinforcement supports as follows:

- Able to withstand construction and traffic loads and maintain the concrete cover, as documented.
- With a protective coating if they are ferrous metal extending to the surface of the concrete.
- Use plastic or concrete supports with galvanized or zinc-coated reinforcement.
- Spacing:
 - . Bars: ≤ 60 diameters.
 - . Mesh: ≤ 600 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: 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: 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.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

Condenser plinths

Requirement: If future split air conditioning systems are required for bedrooms and dining/living areas, provide 1200 x 1000 (wide) x 100 mm (thick) concrete plinths for air conditioning condensers at each isolator location.

Locations where plinths are not required: If possible, mount condensers on the concrete verandah slab.

Plinths located in pathways: Increase pathway width to maintain the required uninterrupted pathway width.

3.5 CONCRETE SUPPLY

Elapsed delivery time

General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with 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)
5 – 24	120

24 – 27	90
27 – 30	60
30 – 35	45

Pre-mixed supply

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to adversely affect placing or compaction.

Testing: Production assessment by concrete supplier to appropriate parts of the AS 1012 series.

Slump test: Take one sample from each batch at the point of discharge from the agitator.

Site mixed supply

Emergencies: If mixing by hand, provide details.

3.6 TESTING**Site tests**

Slip resistance of completed installation: To AS 4663 (2013).

3.7 CONCRETE PLACING AND COMPACTION**Placing**

General: Place concrete uniformly over the width of the slab or lane and so that the face is generally vertical and normal to the direction of placement. Hand spread concrete using shovels, not rakes.

Ponding: Remove any water ponding on the base or subbase before starting placement.

Placing sequence: Commence from one corner (usually the lowest point) and proceed continuously out from that point.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions.

Compaction

Thickness 100 mm or less: Compact by placing, screeding and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.

Thickness more than 100 mm and downturns: Use an immersion vibrator.

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 surface from damage.

Placing in cold weather

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: $\geq 5^{\circ}\text{C}$.

- Formwork and reinforcement before and during placing: $\geq 5^{\circ}\text{C}$.

- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating 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 $\geq 5^{\circ}\text{C}$.

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.

Placed concrete: Prevent from freezing, without using salts or chemicals.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Hot weather placing: Maintain concrete at a temperature $\leq 35^{\circ}\text{C}$.

Formwork and reinforcement: Before and during placing maintain temperature $\leq 35^{\circ}\text{C}$.

Severe weather: If ambient shade temperature more than 38°C, do not mix concrete.

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.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Evaporation rate limit: $\leq 0.50 \text{ kg/m}^2/\text{h}$.

3.8 CONCRETE FINISH**General**

Commencement: Immediately after placement, spreading and compaction of the concrete, start initial finishing procedures to achieve the documented finish.

Final finishing: Do not commence final finishing until all bleed water has evaporated from the surface after initial finishing procedures.

Unformed surfaces

General: Strike off, screed and level slab surfaces to finished levels, to the tolerance class and finish documented.

Formed surfaces

Damage: Do not damage concrete works through premature removal of formwork.

Curing: If forms are stripped when concrete is at an age less than the minimum curing period,

commence curing exposed faces as soon as the stripping is completed, within an hour of exposure.

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, 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.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

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.

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.

Stamped and coloured pattern finish: Provide finishing system.

3.9 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, when the concrete has set sufficiently not to be damaged by the curing process, until the minimum 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 AS 3600 (2018) clause 17.1.5. Cure for at least 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 compounds

Liquid membrane-forming compounds: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least the required curing period after application.

Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

Wet hessian curing

Method: Place wet hessian sheets/bags over concrete surface. Keep hessian wet during the required curing period by regularly sprinkling with water. Protect from wind and traffic.

Impermeable sheet curing

Method: Place impermeable sheets, to ASTM C171 (2020), over concrete surface. Anchor down and tape joints in material to retain concrete moisture. Keep the concrete surface covered for the required curing period.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

3.10 JOINTS

General

Requirement: Construct expansion, contraction and construction joints straight and plumb. Make transverse joints normal to longitudinal joints. Extend transverse expansion and contraction joints continuously from edge to edge of the pavement through interconnected slabs.

Non-dowelled contraction joints

Installation: Construct transverse and longitudinal contraction joints by early power sawing at an appropriate time, tooling or by placing an insert in the fresh concrete.

Construction joints

Planned location: Terminate each day's placing operation at a transverse construction joint located to coincide with a planned contraction or expansion joint.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

3.11 SURFACE SEALERS

General

Application: Apply surface sealer after the curing period and when concrete has dried to allow the sealer to penetrate into the concrete surface.

Curing sealer compound: If using the sealer as a curing compound, apply directly after finishing.

3.12 TACTILE GROUND SURFACE INDICATORS

Preparation

Requirement: Allow concrete to cure at least 7 days. Conform to the manufacturer's requirements and make sure surfaces are clean and free of dust and contaminants.

Installation

General: Drill and clean holes. Install on a dry and flat surface. Conform to the manufacturer's recommendations.

3.13 COMPLETION

Rectification

Reinstating adjacent surfaces: Reinstating surfaces next to new pavements and associated elements. If an existing road pavement has been disturbed, trim back to a straight and undisturbed edge, 250 to 300 mm from and parallel to the new concrete for the full depth of the slab.

Traffic control provisions: Make sure completed work is safe for traffic, reinstate linemarkings where necessary.

Concrete pavement: If pavement does not conform to the tolerances, submit rectification proposal.

Unplanned cracking:

- Maximum 0.4 mm wide crack is acceptable.
- > 1 mm must be assessed, detail a proposal for possible cause and rectification processes.

0276 PAVING – SAND BED

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Consistent in colour and finish.
- Resistant to expected loads in use.
- Within documented level tolerances.
- All surface water directed to drainage outlets.

Conformance: Conform to local authority requirements for levels, grades and paving details (including shape, colour and laying pattern) for paving to footpaths and driveways.

1.2 STANDARDS

General

Residential pavements: To AS 3727.1 (2016).

Slip resistance

Classification: To AS 4586 (2013).

1.3 INTERPRETATION

Definitions

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

- Absolute level tolerance: Maximum deviation from design levels.
- Lippage: Height deviation between adjacent units.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

1.4 TOLERANCES

Completed paving

Level tolerance:

- Absolute: ± 8 mm.
- Relative: 8 mm.

Lippage: Less than 2 mm.

1.5 SUBMISSIONS

Authority approvals

Local authority: Submit authority approvals for paving products, laying patterns, alignment and drainage for footpaths or crossovers.

Products and materials

Clay and concrete paver properties: Submit evidence of conformity to AS/NZS 4455.2 (2010).

Type tests: Submit results, as follows:

- Slip resistance of pavers.
- Accelerated wear test of pavers.

Samples

General: Submit labelled samples of pavers, showing the range of variation in colour and finish.

Tests

Site tests: Submit results, as follows:

- Slip resistance test of completed installations.

1.6 INSPECTION

Notice

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

- Completed trial set-out for paving.
- Completed paving.

2 PRODUCTS

2.1 SAND

Bedding sand

Quality: Free of deleterious material, such as soluble salts which may cause efflorescence.

Grading: To the **Bedding sand grading table** tested to AS 1141.11.1 (2020).

Fines: Do not use single-sized, gap-graded or excessive fine material.

Cement: Do not use cement bound material.

Moisture content: Make sure moisture content is uniform and between 4 to 8%.

Bedding sand grading table

Sieve size (mm)	Percentage passing (by mass) %
9.52	100
4.75	95 – 100
2.36	80 – 100
1.18	50 – 85
0.6	25 – 60
0.3	10 – 30
0.15	5 – 15
0.075	0 – 10

Joint filling sand

General: Well-graded sand, free of deleterious material such as soluble salts which may cause efflorescence.

Moisture content: Use dry sand.

Cement: Do not use cement.

Grading: To the **Joint filling sand grading table** tested to AS 1141.11.1 (2020).

Joint filling sand grading table

Sieve size (mm)	Percentage passing %
2.36	100
1.18	90 – 100
0.6	60 – 90
0.3	30 – 60
0.15	15 – 30
0.075	5 – 10

2.2 GEOTEXTILE MATERIALS

General

Standard: To AS 3705 (2012).

Quality: Free of flaws, stabilised against UV radiation, rot proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.

2.3 CONCRETE AND CLAY PAVERS

General

Standard: To AS/NZS 4455.2 (2010).

Salt attack resistance grade: To AS/NZS 4455.2 (2010) Table 2.7.

Permeable interlocking concrete segmental pavers: To Concrete Masonry Association of Australia CMAA PE01 (2010).

Properties

Requirements: To AS/NZS 4455.2 (2010) Table 2.8.

2.4 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

2.5 EDGE RESTRAINT

Concrete

Standard: To AS 1379 (2007).

Compressive strength: 32 MPa.

Sleepers

Hardwood: Sound hardwood railway sleepers to AS 3818.2 (2010).

Softwood: Sound preservative-treated softwood sleepers.

Preservative treatment: Hazard class H4 to AS/NZS 1604.1 (2021).

3 EXECUTION

3.1 SUBGRADE

Preparation

Subgrade preparation: To *0222 Earthwork*.

Extent: To the rear face of the proposed edge restraints or to the face of existing abutting structures.

Drainage of subgrade

Subgrade drainage: Prepare piped or channelled stormwater and subsoil drainage.

Service trenches: Backfill all drainage trenches to perform similar to the undisturbed ground.

3.2 BASE COURSE

Preparation

Base course: To *0271 Pavement base and subbase*.

Extent: Extend base course below the edge restraint for its full width except at walls or pits.

3.3 EDGE RESTRAINT

Lateral restraint to segmental paving

Perimeter: If not provided by other structures, provide edge restraints to bedding and units.

Drainage: Position edge restraint and pavers so that the tops of the pavers are slightly above the front edge of the edge restraint.

Edge restraint shape: Make sure the edge restraint has a vertical or near vertical side abutting the pavers.

Sleeper edging

General: Fix sleepers in position by spiking with two 13 mm diameter galvanized mild steel rods per sleeper, penetrating at least 400 mm into the subgrade. Drive the rods flush with the upper surface of the sleeper. Arris the upper exposed sleeper edges to produce a 15 mm wide chamfer at 45° to the edges.

Concrete edging or kerb

Construction: Fixed form, extrusion or slip forms to AS 2876 (2000).

Edging or kerb: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level.

Joints: Provide contraction joints 20 mm deep every 5 m.

Timing: Complete concrete edge restraints before bedding course. Allow concrete edge restraints to harden before vibration of the surface course.

Brick

Setting: On a 1:1:6 (cement:lime:sand) mortar haunch.

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

3.4 BEDDING COURSE**General**

Preparation: Remove all loose material from the prepared base.

Geotextile

Position: Place fabric between the base course and the bedding sand and lap 150 mm at joints.

Bedding sand

Spreading: Screed uncompacted sand over prepared base uniformly to achieve a 30 mm thick layer. Maintain sand at a uniform loose density and moisture content.

Bedding course drainage: If water ponding occurs at edge restraint, drain bedding course to existing subsurface drain or drainage pit using geotextile and 20 mm diameter PVC pipe.

Trial section

Moisture content: Prepare a trial section to establish the moisture content limits which will allow paver system compaction to be achieved.

3.5 INSTALLATION**Trial set-out**

General: Prepare a trial paving set-out to each area as follows to:

- Maximise the size of equal margins of cut pavers.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut pavers at margins.

General

Laying: Lay paving on the screeded sand bedding to the documented set-out and pattern.

Joints: 2 to 5 mm in width.

Cut courses: 50 mm minimum plan dimension. On footpaths and other linear elements, use at least two cut courses and maintain symmetry.

Control: Control alignment and laying pattern by stringlines or chalked stringlines every 5 m intervals.

Variable width areas: Include in situ concrete infill strips to make a straight area for paving and take up the variable width. If there is a concrete base, provide paving control joints as follows:

- Located over base control joints.
- 10 mm wide and filled with bitumen impregnated fibreboard.

Laying around obstacles

Public utility access pits and penetrations: Adjust access covers as required before commencing paving. Make sure water drains away from pits with lids and into surface inlet drainage structures.

Concrete surrounds:

- Plan shape: Square or rectangular with a smooth connection with the laying pattern of the pavers.
- Pit position: Centring not required.
- Minimum thickness between the pit and paving: 100 mm.
- Strength grade: N32.
- Colour: Natural.

Precast access chamber: Lay pavers to suit specific dimensions of authority access chambers.

Patterns around obstacles: Lay up both sides of the feature from the main or original laying face.

Compaction of bedding

Compaction: Compact the sand bedding after laying paving units with a vibrating plate compactor and appropriate hand methods, and continue until lipping between adjoining units is eliminated.

Sequence: Compact paving as follows:

- Progressively behind the laying face.
- Complete compaction of laid paving at end of each day.
- Do not compact within 1 m of the laying face except where adjacent to an edge restraint.

Joint filling: Compact all paving units to design levels before starting of joint filling.

Joint filling

Filling: Spread dry sand over the paving units and fill the joints by brooming. Carry out one or more passes with the vibrating plate compactor and refill the joints with sand. Repeat the process until the joints are completely filled.

Timing: Start joint filling immediately after compaction.

3.6 TESTING**Site tests**

Slip resistance of completed installation: To AS 4663 (2013).

3.7 COMPLETION

Protection of the work

Protection: Prevent all vehicular and pedestrian traffic from using the pavement until all compaction and joint filling is completed and all edge restraints are in place.

Spare pavers

General: Supply spare matching pavers of each type for future replacement purposes. Store the spare materials on site.

Quantity: At least 1% of the quantity installed.

Cleaning

General: Leave pavements clean on completion.

Final inspection

General: Before the date for practical completion carry out the following inspections and rectify defects as required:

- Cracking in bound pavements: Maximum width 1.5 mm.
- Subsidence: Offset less than 1.5 m length of the design profile, not more than 5 mm.
- Stepping: Between adjacent elements within the pavement area, not more than 5 mm.
- Chipping and spalling to pavement units: Maximum 10/100 units with chipped or spalled arrises.
- Ponding: Maximum 10 mm deep 15 minutes after rain ceases.
- Paving joints: Refill joints as required.

0277 PAVEMENT ANCILLARIES

1 GENERAL

1.1 INTERPRETATION

Definitions

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

- Absolute level tolerance: Maximum deviation from design levels.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

1.2 TOLERANCES

Channels and kerbs

Absolute level tolerance: ± 10 mm at any point on the finished surface.

Relative level tolerance: 5 mm to the top or face of kerbs, and to the surface of channels.

Plan position deviation: 25 mm.

Exception: Kerb laybacks, grade changes or curves, or at gully pits requiring channel depression.

Linemarking

Longitudinal line lengths: ± 20 mm from the lengths documented in AS 1742.2 (2022).

Longitudinal line widths: ± 10 mm from the widths documented in AS 1742.2 (2022)

Transverse line lengths and widths: ± 10 mm from the lengths and widths documented in AS 1742.2 (2022).

Other markings: ± 50 mm from the dimensions documented or in AS 1742.2 (2022) for arrows, chevrons, painted medians, painted left turn islands and speed markings. Place arrows and speed markings square with the centreline of the traffic lane.

Vehicle barriers

Plan position deviation: 50 mm.

Length: ± 20 mm.

Bollard plumb: H/100.

2 PRODUCTS

2.1 CHANNELS AND KERBS

Concrete

Precast: Proprietary precast units as documented.

In situ: To AS 2876 (2000).

Grade: N20.

2.2 LINEMARKING

Pavement marking paint

Requirement: Conform to the following:

- Solvent-borne paint: To AS 4049.1 (2005).
- Waterborne paint: To AS 4049.3 (2005).
- High performance: To AS 4049.4 (2006).

2.3 VEHICLE BARRIERS

Timber log barriers

Hardwood: To AS 2082 (2007).

Softwood: To AS 2858 (2008) and AS 1720.2 (2006), Grade 5.

Timber preservative for softwood: Minimum hazard class H4 to AS/NZS 1604.1 (2021).

Size: Diameter range 125 to 150 mm for both posts and rails.

Precast concrete wheel stops

Material: Precast concrete units with pre-drilled holes located 300 mm from each end for fixing to ground surface.

Size: 1650 x 150 x 100 mm high.

Plastic/rubber wheel stops

Material: Proprietary plastic or rubber wheel stops with black and yellow chevron markings.

Size: 1650 x 150 x 100 mm high.

Steel tube bollards

Type: Bollards fabricated from heavy steel tube, to AS 1074 (1989).

Minimum nominal size: DN 100.

2.4 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 CHANNELS AND KERBS

General

Precast: Install to manufacturer's instructions.

In situ: Construct channels and/or kerbs in fixed forms, by extrusion or by slip forming to AS 2876 (2000).

Preparation

Requirement: To AS 2876 (2000) Section 8.

Subgrade or subbase material: Shape and compact to form a firm base before placing channels and/or kerbs.

Setting out

General: Set out the work so that all channels and kerbs are placed with tolerances, as documented.

Joints

Requirement: To AS 2876 (2000) clause 11.

Concrete pavement: If channels and/or kerbs are cast adjacent to a concrete pavement, continue the same joint type, as documented for the concrete pavement, across the channels and/or kerbs.

Backfill

Timing: Not earlier than three days after placing channels and/or kerbs, backfill and reinstate the spaces on both sides of the channels and/or kerbs.

Material: Granular, free of organic material, clay and rock in excess of 50 mm diameter.

Compaction: Compact backfill in maximum 150 mm thick layers, to a relative compaction of 95% tested to AS 1289.5.4.1 (2007), for standard compactive effort.

Pavement: Backfill pavement material adjacent to new channels and/or kerbs to the documented requirements of the pavement material.

3.2 LINEMARKING

Preparation

Surface: Clean, dry and free of any deposit which may impair adhesion of the linemarking.

Wet weather: Do not apply linemarking during wet weather or if rain is likely to fall during application or paint drying time.

Provision for traffic: Allow for traffic during application and protect linemarkings until the material has dried sufficiently to carry traffic without being damaged.

Mixing of paint: Before use, mix all paint in its original container to produce a smooth uniform product consistent with the freshly manufactured product.

Removal of existing pavement markings

General: Remove existing linemarking, as documented, from the wearing surface of pavements without causing significant damage to the surface.

Application of linemarking

Requirement: Spray or brush lines, symbols, letters, arrows and chevrons using templates.

Paint thickness: Uniform wet film thickness: 0.35 mm to 0.40 mm.

Linemarking alignment: Straight or with smooth, even curves as documented.

Edges: Form clean, sharp edges. Remove any paint applied beyond the defined edge of the linemarking and leave a neat and smooth marking on the wearing surface of the pavement.

Painting over existing linemarking: Use paint matching the pavement surface.

3.3 VEHICLE BARRIERS

Timber log barriers

Installation: Check out the posts to receive the rails. Set each post 600 mm below the finished surface level and surround with compacted fine crushed rock, gravel or cement stabilised rammed earth. Bolt rails to posts with M12 diameter galvanized bolts and washers, with bolt heads and nuts recessed.

Precast concrete wheel stops

Installation: Drive 12 mm diameter galvanized steel rods a minimum of 600 mm below finished surface level and stop the top of the rod 25 mm below the top of the wheel stop.

Concrete pavement/slab: Bolt the wheel stop to the pavement using galvanized steel masonry anchors, installed to manufacturer's recommendations. Top of bolt to stop 25 mm below the top of the wheel stop.

Completion: Grout fill the holes flush to match the concrete finish.

Steel tube bollards

Installation: Encase buried end of bollard in concrete footing, minimum 600 mm deep x 250 mm

diameter. Finish top of footing minimum 100 mm below finished surface level.

On concrete slabs: Weld on a 10 mm thick base plate drilled for 4 bolts, and bolt to concrete slab using galvanized steel masonry anchors installed to manufacturer's recommendations.

Filling: Fill the tube with 15 MPa concrete.

Open ends: Seal with matching fabricated end caps, spot welded and ground smooth.

3.4 COMPLETION

Cleaning

Completion: Clean progressively and leave adjoining surfaces, pavements and ancillaries clean on completion.

0310 CONCRETE – COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

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

1.2 DESIGN

Requirements

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

- Imposed actions.
- Concrete shrinkage and creep.
- Temperature changes.

1.3 STANDARDS

General

Formwork design and construction: To AS 3610.1 (2018).

Plywood formwork: To AS 6669 (2016).

Composite steel-concrete construction, including profiled steel sheeting and shear connectors: To AS/NZS 2327 (2017).

Reinforced concrete construction: To AS 3600 (2018).

Specification and supply of concrete: To AS 1379 (2007).

Residential ground slabs and footings: To AS 2870 (2011).

Slip resistance

Classification: To AS 4586 (2013).

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.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the defined period at a site.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 (2007) Table 1.2.
- Green concrete: Concrete which has recently set but has not achieved any design strength.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.

- Specimen: A portion of a sample which is submitted for testing.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.5 TOLERANCES

Formwork

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

Plumb of elements ≤ 8 m high: To AS 3610.1 (2018).

Position: Construct formwork so that finished concrete conforms to AS 3600 (2018) clause 17.5 and AS 3610.1 (2018) clause 3.3.

Reinforcement

Fabrication: To AS 3600 (2018) clause 17.2.

Reinforcement position: To AS 3600 (2018) clause 17.5.3.

Formed surfaces

Form face deflections: To AS 3610.1 (2018) Table 3.3.4.1.

Straight elements: To AS 3610.1 (2018) Table 3.3.5.1.

Unformed surfaces

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

Flatness tolerance class table

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

1.6 SUBMISSIONS

Execution details

Reshoring: Submit details of any proposed reshoring.

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

- Changes to the concrete mix.
- Curing and protection methods.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence and times for concrete placement and construction joint locations and relocations. Include any proposed sequential placement of slab segments.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods to suit hot or cold atmospheric conditions during concrete placement.

- 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 (2006) 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 (2018).
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement to AS/NZS 1554.3 (2014).

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

Products and materials

Product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JAS-ANZ accredited third party.
- Report by an Accredited Testing 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.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), and the following:

- 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.

Curing compounds: Submit details of any proposed curing compounds, including the following:

- Dosage rates.
- Certified type-test results by an Accredited Testing Laboratory for water retention to AS 3799 (1998) Appendix B for liquid membrane-forming compounds.
- 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.

Shop drawings

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

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

Requirement: Submit test results, as follows:

- Concrete and grout compressive strength test results to AS 1012.9 (2014).
- Slip resistance test of completed installations.
- Drying shrinkage test results.

1.7 INSPECTION

Notice

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

- Used forms, after cleaning and before re-use.
- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork with all dust and debris removed from forms and reinforcement, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placement and compaction.
- Finishing and curing of concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

2 PRODUCTS

2.1 CONCRETE

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 (2007) clause 1.5.3.
- Special-class: To AS 1379 (2007) clause 1.5.4.

Aggregates

Standard: To AS 2758.1 (2014).

Storage: Store in silos or on a hardstand located away from surface and ground water runoff. Allow for free drainage of rainwater and prevent contamination and intermixing of aggregates.

Cement

Standard: To AS 3972 (2010).

Age: Less than 6 months old.

Storage: Store cement bags in a dry, under cover and above ground environment.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1 (2016).
- Slag: To AS 3582.2 (2016).
- Amorphous silica: To AS/NZS 3582.3 (2016).

Water

Standard: To AS 1379 (2007) 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.

Concrete colour

Standard: To AS 3610.1 (2018).

Chemical admixtures

Standard: To AS 1478.1 (2000), used to manufacturer's recommendations and free from chlorides, or other substance detrimental to concrete or reinforcing steel.

2.2 FORMWORK

General

Form face, linings and release agents: Compatible with documented concrete surface finish and any proposed applied finishes to concrete.

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

Void formers

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

Laboratory testing: Use void formers tested under laboratory conditions for conformance with the following:

- Deflection during placing and compaction of the concrete does not exceed beam or slab span/1000.
- Additional deflection between initial set and 7 days does not exceed span/400.

Test method: Place formers on damp sand and load with a mass of wet concrete at least equal to the mass of the beams or slabs to be supported.

Profiled steel sheeting composite forms

Material: Hot-dipped zinc-coated sheet steel to AS 1397 (2021).

Minimum steel grade: G550.

Zinc coating mass: Minimum Z350.

Accessories: Use materials and corrosion protection compatible with the profiled steel sheeting.

Plywood forms

Material: To AS 6669 (2016).

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 (2018) Section 3.

2.3 REINFORCEMENT

Steel reinforcement

Standard: To AS/NZS 4671 (2019).

Fabrication tolerances: To AS 3600 (2018) clause 17.2.2.

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

Storage: Store reinforcement above the surface of the ground and protect from damage and from deterioration by exposure.

Protective coating

Standard: To AS 3600 (2018) clause 17.2.1.2.

Requirement: 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 to AS/NZS 3750.14 (1997).

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680 (2006), as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanizing 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.

2.4 MISCELLANEOUS

Polymeric film underlay

Vapour barriers and damp-proofing membranes: To AS 2870 (2011) clause 5.3.3.

Curing compounds

Liquid membrane-forming compounds: To AS 3799 (1998).

Surface modifiers

Hardeners, sealants and protectors: If documented, proprietary products conforming to the manufacturer's recommendations.

Slip resistance treatment: If documented, proprietary products conforming to the manufacturer's recommendations.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location

Requirement: 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.

Base preparation

Requirement: Conform to base type, as follows:

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

Installation

Standard: To AS 2870 (2011) clause 5.3.3.

Requirement: 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

Bolt holes

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

Corners

Work above ground: Bevel with a chamfer at re-entrant angles, and a 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

Requirement: In vertical forms 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 form face and linings. Spread the coating uniformly in a thin film and remove any surplus before placing concrete.

Staining: If oil or grease is used, make sure that surfaces to be exposed will not be stained or discoloured.

Unlined timber forms: Thoroughly wet timber before oiling.

Profiled steel sheeting composite formwork

Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs, provide details of proposed fixings.

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.

Void formers

Protection: Keep void formers dry until use, install on a firm level surface and place reinforcement and concrete with minimum delay.

3.3 REINFORCEMENT

General

Fixing: To AS 3600 (2018) clause 17.2.5 and as documented.

Dowels

Fixing: If a dowel has an unpainted half, embed that half 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 (2018) clause 4.10.

Concrete cover for structures for retaining liquids: To AS 3735 (2001) clause 4.4.

Concrete cover for residential ground slabs and footings: To AS 2870 (2011).

Supports

Concrete, metal or plastic supports: Provide 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:

- Bars: \leq 60 bar diameter.
- Mesh: \leq 600 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.

Bending

Restriction: Use only bars with bends as documented. If required to bend or straighten bars on site, do not use heat and use only methods that will not damage the steel and its structural properties, to AS 3600 (2018) clause 17.2.3.2.

Tying

Requirement: 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: If required, tie bundled bars in closest possible contact. Provide tie wire 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 fitments (or helical reinforcement) at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

3.4 CONCRETE SUPPLY

Elapsed delivery time

General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with 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)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

Pre-mixed supply

Addition of water: To AS 1379 (2007) clause 4.2.3.

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to 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 TESTING

General

Test authority: Concrete supplier or an Accredited Testing 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 (2007).

Method of assessment: Project assessment.

Sampling

Method of sampling: To AS 1012.1 (2014).

Sampling locations: To AS 1012.1 (2014) and the following:

- Slump and spread 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 (2007)

Sections 5 and 6 and the following:

- Slump and spread 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 per batch: Columns and load bearing wall elements	Minimum number of samples per day: Other elements
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

3.6 CORES, FIXINGS AND EMBEDDED ITEMS**General**

Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 (2021) Appendix G.

Adjoining elements

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

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 surface finish.

Corrosion protection: In external or exposed locations, galvanize anchor bolts and embedded fixings.

- All threaded products: To AS/NZS 1214 (2016).
- All non-threaded products: To AS/NZS 4680 (2006).

Structural integrity

Position: Fix cores and embedded items to prevent movement during concrete placement. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain documented cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete that provides minimum cover to reinforcement.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131 (2016).
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.7 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 flatness tolerance

Maximum deviation: 6 mm from a 3 m straightedge.

3.8 PLACING AND COMPACTION**Preparation**

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

Placing

Horizontal transport:

- Use suitable conveyors, clean chutes, troughs, hoppers or pipes.
- Minimise jolting and vibration of concrete whilst transporting around site.
- Discharge vertically in a controlled manner into forms or further distribution equipment.

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.

Vertical elements: Limit the free fall of concrete to maximum of 2 m.

Reinforcement: Maintain the documented concrete cover to reinforcement.

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.

Placing in cold weather

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: $\geq 5^{\circ}\text{C}$.
- Forms and reinforcement before and during placing: $\geq 5^{\circ}\text{C}$.
- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating 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 $\geq 5^{\circ}\text{C}$.

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 forms, materials, and equipment coming in contact with the concrete.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Temperature limits: Maintain the following:

- Normal concrete in footings, beams, columns, walls and slabs: $\leq 35^{\circ}\text{C}$.
- For concrete strength grade less than 40 MPa with section thickness ≥ 1 m in all dimensions: $\leq 27^{\circ}\text{C}$.
- For concrete strength grade 40 MPa or greater with section thickness ≥ 600 mm in all dimensions: $\leq 27^{\circ}\text{C}$.
- Forms and reinforcement before and during placing: $\leq 35^{\circ}\text{C}$.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Evaporation rate limit: ≤ 0.50 kg/m²/h.

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.

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.

Joint preparation: Scabble hardened concrete joint surface to a minimum 3 mm amplitude. Remove loose or soft material, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion and isolation joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Expansion joint dowels: Install dowels along the joint, as documented.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

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.

Slab-on-grade control joints

General: Provide control joints, as documented.

Tooled and sawn joints: Form joints within the concrete surface with either a grooving tool or a mechanical circular saw.

Timing: Form joints as early as possible after placement of concrete. Make sure the concrete has hardened sufficiently to prevent dislodging aggregate.

Joint width: 3 to 5 mm wide.

Joint depth: A minimum of $(0.25 - 0.33) \times$ depth of the concrete.

3.10 FORMED SURFACES

General

Surface finish: To AS 3610.1 (2018) Table 3.3.3.1 and as documented.

Damage: Do not damage concrete works through premature removal of formwork.

Curing

Requirement: 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, within an hour of exposure.

Evaluation of formed surfaces

General: If evaluation of formed surface is required, complete the evaluation before surface treatment.

Finishing methods

Requirement: If soffits of horizontal concrete elements or faces of vertical concrete elements are to have a finish other than an off-form finish, provide finishes as documented.

Form removal: If vertical face formwork needs to be removed for finishing methods, while the concrete is green, make sure the concrete has sufficiently set to prevent slump.

Floated finishes:

- Sand floated finish: 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: 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: 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.

3.11 UNFORMED SURFACES

General

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

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.

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.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Sponge finish: After machine floating and steel trowelling, use a damp sponge to wipe the surface to produce an even textured sand finish.

Finishing methods – supplementary finish

Stamped and coloured pattern finish: Provide a proprietary finishing system.

3.12 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, when the concrete has set sufficiently not to be damaged by the curing process, until the minimum 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 AS 3600 (2018) clause 17.1.5 and

the following, unless accelerated curing is adopted:

- . Fully enclosed internal surfaces/Early age strength 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 compounds

Liquid membrane-forming compounds: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least 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 (1998).

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

Wet hessian curing

Method: Place wet hessian sheets/bags over concrete surface. Keep hessian wet during the required curing period by regularly sprinkling with water. Protect from wind and traffic.

Impermeable sheet curing

Method: Place impermeable sheets, to ASTM C171 (2020), over concrete surface. Anchor down and tape joints in material to retain concrete moisture. Keep the concrete surface covered for the required curing period.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

3.13 COMPLETION

Formwork removal

Extent: Remove formwork, other than permanent forms and trapped forms, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete has reached sufficient hardness to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 (2018) where it is more stringent than AS 3610.1 (2018).

- Vertical formwork: To AS 3610.1 (2018) Appendix C Table C2.
- Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.

Removable bolts: Remove tie bolts without damaging the concrete.

Bolt hole filling: Provide material with durability and colour matching the concrete.

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

Curing: 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, within an hour of exposure.

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.

0331 BRICK AND BLOCK CONSTRUCTION

1 GENERAL

1.1 STANDARDS

General

Materials and construction: To AS 3700 (2018).

1.2 TOLERANCES

General

Requirement: To AS 3700 (2018) clause 12.5 and Table 12.1.

1.3 INSPECTION

Notice

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

- Set-out.
- Structural steelwork, including bolts and shelf angles, in position.
- Unit type, colour and texture.
- Bottoms of cavities, after cleaning out.
- Positioning of reinforcement before grouting.
- Control joints, ready for insertion of joint filler.
- Lintels, in position.

2 PRODUCTS

2.1 FIRE PERFORMANCE

Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4 (2014).

2.2 DURABILITY

General

Exposure environment: To AS 3700 (2018) clause 5.3.

Exposure locations: To AS 3700 (2018) clause 5.4.

2.3 MATERIALS

Masonry units

Standard: To AS/NZS 4455.1 (2008) and AS/NZS 4455.3 (2008).

Salt attack resistance grade: To AS 3700 (2018) Table 5.1.

Minimum age of clay bricks: 7 days.

Storage: Store masonry units above the surface of the ground and cover to protect from the weather. Locate away from surface and ground water runoff.

Mortar materials

Mortar class: To AS 3700 (2018) Table 5.1.

Cement: To AS 3972 (2010).

Cement type: GP.

White cement: With not more than 1% iron salts content.

Lime: To AS 1672.1 (1997).

Sand: Fine aggregate with a low clay content, free from efflorescing salts and deleterious matter, selected for colour and grading.

Water: Clean and free from any deleterious matter.

Admixtures: To AS 3700 (2018) clause 11.4.2.4.

Pigment: To EN 12878 (2014), and as follows:

- Integral pigment mix proportion: Not more than 10% by weight of cement.

Masonry cement mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700 (2018)	Clay	Concrete	Calcium silicate	Water thickener
M3	1:0:4	1:0:4	N/A	Yes
M4	1:0:3	N/A	N/A	Yes

Cement (GP/GB) mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700 (2018)	Clay	Concrete	Calcium silicate	Water thickener
M2	1:2:9	N/A	N/A	No
M3	1:1:6	1:1:6	N/A	Optional
M3	1:0:5	1:0:5	1:0:5	Yes
M4	1:0.5:4.5	1:0.5:4.5	N/A	Optional
M4	1:0:4	1:0:4	1:0:4	Yes
M4	1:0-0.25:3	1:0-0.25:3	N/A	Optional

Grout

Standard: To AS 3700 (2018) clause 11.7.

Maximum aggregate size: 12 mm.

Minimum cement content: 300 kg/m³.

Characteristic compressive strength: As documented.

Nominal slump: 200 mm.

2.4 BUILT-IN COMPONENTS

General

Durability class of built-in components: To AS 3700 (2018) Table 5.1.

Steel lintels

Angles and flats: To AS/NZS 3679.1 (2016).

Cold-formed proprietary lintels: Designed to AS/NZS 4600 (2018).

Corrosion protection: To AS 2699.3 (2020).

Cutting: Do not cut after galvanizing.

Reinforcement

Standard: To AS/NZS 4671 (2019).

Corrosion protection: To AS 3700 (2018) clause 5.9.

Minimum cover: To AS 3700 (2018) Table 5.1.

Wall ties

Standard: To AS 2699.1 (2020).

Type: A.

Corrosion protection: To AS 2699.1 (2020).

Duty classification rating:

- Cavities more than 60 mm and less than 200 mm wide: Heavy duty.

Acoustic rated walls: Resilient or plastic ties, as appropriate.

Connectors and accessories

Standard: To AS 2699.2 (2020).

Corrosion protection: To AS 2699.2 (2020).

Flashings and damp-proof courses

Standard: To AS/NZS 2904 (1995).

Slip joints

Standard: To AS 3700 (2018) clause 4.14.

Air vents

Blockwork: Select from the following:

- Concrete framed: Bronze wire mesh in concrete frame, 390 x 190 mm.
- Vent blocks: Purpose-made vent blocks.

Brickwork: Select from the following:

- Concrete framed: Bronze wire mesh in concrete frame, 455 x 160 mm.
- Cut brick: Two cut bricks laid vertically and evenly spaced in a 230 mm wide x two course high opening, backed with bronze wire mesh built in.
- Terracotta: Perforated, 230 x 160 mm.

3 EXECUTION

3.1 GENERAL

Mortar mixing

General: Measure volumes accurately to the documented proportions. Machine mix for at least six minutes. If the initial set of the cement has taken place, discard the mortar. Do not retemper.

Protection

Masonry materials and components: Protect from ground moisture and contamination.

During construction: Cover the top surface of masonry to prevent the entry of rainwater and contaminants.

Bond

Type: Stretcher bond.

Building in

Embedded items: Build in wall ties and accessories as the construction proceeds. If not practicable to obtain the required embedment within the mortar joint in cored or hollow masonry units, fill appropriate cores with grout or mortar.

Steel door frames: Fill the backs of jambs and heads solid with mortar as the work proceeds.

Minimum clearance for timber frame shrinkage

General: In timber framed masonry veneer construction, provide clearances to allow for long-term shrinkage of timber including at windows, doors, thresholds, at the underside of eaves where the masonry and soffit meet and as follows:

- Single storey (slab on ground): 10 mm.
- Two storey (slab to ground floor): 32 mm.
- Additional clearance: Accommodate additional shrinkage of unseasoned floor timbers.

Monolithic structural action

Construction at different rates or times: 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 to obtain monolithic structural action in the completed work.

Header units: Except in stretcher bond facework, provide masonry header units, to AS 3700 (2018) clause 4.11.2 and as follows:

- Spacing: 600 mm maximum.
- Location: Provide header units in the following locations:
 - . At engaged piers.
 - . At engagement of diaphragms with the leaves in diaphragm walls.
 - . At intersections of flanges with shear walls.
 - . At intersections with supporting walls and buttresses.
 - . Between leaves in solid masonry construction.

Mortar joints

General: Set out masonry with joints of uniform width and minimum cutting of masonry units.

Solid and cored units: Lay on a full bed of mortar. Fill perpend solid. Cut mortar flush.

Hollow units: Face-shell bedded. Fill perpend solid. Cut mortar flush.

Joint thickness: 10 mm.

Finish: Conform to the following:

- Externally: Tool to give a dense water-shedding finish.
- Internally: If wall is to be plastered, do not rake more than 10 mm to give a key.

Rate of construction

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

Rods

Set-out: Construct masonry to the following rods:

- 75 mm high units: 7 courses to 600 mm.
- 90 mm high units: 6 courses to 600 mm.
- 190 mm high units: 3 courses to 600 mm.

Temporary support

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

3.2 FACEWORK**Cleaning**

General: To the manufacturer's recommendations and the following:

- Clean progressively as the work proceeds to remove mortar smears, stains and discolouration.
- Do not erode joints if using pressure spraying.

Colour mixing

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

Below ground

Facework: Commence facework at least one full course for blockwork, or two full courses for brickwork, below the adjacent finished surface level.

Double face walls

Selection: Select face units for uniform width and double-face qualities in single-leaf masonry with facework both sides.

Preferred face: Before starting, obtain approval of the preferred wall face, and favour that face should a compromise be unavoidable.

Perpends

General: If other than vertically aligned perpends in alternate courses are proposed, provide details.

Sills and thresholds

General: Solidly bed sills and thresholds and lay them with the top surfaces draining away from the building.

Minimum size of cut unit: Three quarters full width.

3.3 SUBFLOOR WORK**Access openings**

General: In internal walls, provide door-width openings beneath doorways to give access to underfloor areas.

Air vent locations

Minimum subfloor openings and ground clearance: To BCA (2022) F1D8 [BCA (2019) F1.12].

Cavity walls: Provide matching vents in the internal leaves located as near as practicable to the vents in the external leaves.

Location: Below damp-proof course to internal and external walls.

3.4 CAVITY WORK**Cavity clearance**

General: Keep cavities clear at all times.

Cavity fill

General: Fill the cavity with mortar to one course above the adjacent finished (ground) level. Fall the top surface towards the outer leaf.

Cavity width

General: Construct minimum cavity widths in conformance with the following:

- Masonry walls: 40 mm.
- Masonry veneer walls: 40 mm between the masonry leaf and the load bearing frame and 25 mm minimum between the masonry leaf and sheet bracing or services.

Openings

Jamb of external openings: Do not close the cavity.

Wall ties, connectors and accessories

Protection: Install to prevent water passing across the cavity.

3.5 DAMP-PROOF COURSES**Location**

General: Locate damp-proof courses, as follows:

- Timber floors: In the first course below the level of the underside of ground floor timbers in internal walls and inner leaves of cavity walls.
- Cavity walls built off slabs on ground: In the bottom course of the outer leaf, continuous horizontally across the cavity and up the inner face bedded in mortar, turned 30 mm into the inner leaf one course above. Project 10 mm beyond the external slab edge and turn down at 45°.
- Internal walls built off slabs on ground: In the first course above floor level.
- Masonry veneer construction built off slabs on ground: In the bottom course of the outer leaf, continuous horizontally across the cavity. Fasten to the inner frame 75 mm above floor level.
- Walls adjoining infill floor slabs on membranes: In the course above the underside of the slab in internal walls and inner leaves of cavity walls. Project 40 mm and dress down over the membrane turned up against the wall.

Height: Not less than:

- 150 mm above the adjacent finished ground level.
- 75 mm above the finished paved or concrete areas that slope away from the wall.
- 50 mm above the finished paved or concreted areas that slope away from the wall and are protected from the direct effect of the weather.

Installation

General: Lay in long lengths. Sandwich damp-proof courses between mortar.

Joints: Locate away from weepholes.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses and waterproof membranes.

Laps: Lap full width at angles and intersections and at least 150 mm at joints.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

Steps: Step as necessary, but not exceeding two courses per step for brickwork and one course per step for blockwork.

3.6 FLASHINGS

Location

General: Locate flashings, as follows:

- Floors: Full width of outer leaf immediately above slab or shelf angle, continuous across cavity and up the inner face bedded in mortar, turned 30 mm into the inner leaf two courses above for brick and one course above for block. If the slab supports the outer skin and is not rebated, bed the flashing in a suitable sealant.
- Under sills: 30 mm into the outer leaf bed joint one course below the sill, extending up across the cavity and under the sill in the inner leaf or the frame for masonry veneer. Extend at least 150 mm beyond the reveals or each side of the opening.
- Over lintels to openings in cavity walls: Full width of outer leaf immediately above the lintel,

continuous across cavity, turned 30 mm into the inner leaf two courses above for brick and one course above for block or turned up at least 150 mm against the inner frame and fastened to it. Extend at least 150 mm beyond the lintels.

- At abutments with structural frames or supports: Vertically flash in the cavity using 150 mm wide material, wedged and grouted into a groove in the frame opposite the cavity.
- At jambs: Vertically flash jamb, extending 75 mm into the cavity, interleaved with the sill and head flashing at each end. Fix to jambs.
- At roof abutments with cavity walls: Cavity flash immediately above the roof and over-flash the roof apron flashing.

Installation

General: Sandwich flashings between mortar except where on lintels or shelf angles. Bed flashings, sills and copings 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.

Steps: Step as necessary, but not exceeding two courses per step for brickwork and one course per step for blockwork.

Weepholes

Requirement: Locate weepholes to external leaves of cavity walls in the course immediately above flashings, and cavity fill, and at the bottoms of unfilled cavities.

Form: Open perpend.

Maximum spacing: 1200 mm.

3.7 WALL TIES

Location

General: Space wall ties in conformance with AS 3700 (2018) clause 4.10 and at the following locations:

- Not more than 600 mm in each direction.
- Adjacent to horizontal or vertical lateral supports.
- Adjacent to control joints.
- Around openings.

Installation

Embedment: At least 50 mm into mortar. Provide at least 15 mm of mortar cover to any exposed surface.

Fixing of masonry veneer ties:

- To timber frames: Screw fix to outer face of timber frames with fasteners to AS 3566.1 (2002).
- To concrete: Masonry anchors.
- To steel frames: Screw fix to outer face of steel members with fasteners to AS 3566.1 (2002).

3.8 CONTROL JOINTS

General

Location and spacing: Provide control joints to AS 3700 (2018) clause 4.8.

Control joint filling

Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining to masonry. 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 filling with a gun-applied flexible sealant.

Sealant joint depth to width ratio (depth:width): 1:2.

Minimum sealant depth: 6 mm.

Fire-resisting control joints

General: If a control joint is located in an element of construction required to have a fire-resistance level (FRL), construct the control joint with fire-stopping materials which maintain the FRL of the element.

Fire-stopping: To AS 4072.1 (2005).

3.9 BRICKWORK AND BLOCKWORK DUCT RISERS

General

Location: Build a one-piece corrosion-resistant metal tray to the masonry duct risers at roof level to shed water from the duct above roof flashing level.

Installation

General: Cut an opening for the riser. Turn tray edges up 25 mm around the opening, 13 mm clear of the walls. Externally turn the tray up 100 mm under the stepped flashing and down 100 mm over the apron flashing. Lap and solder joints.

Weepholes

General: Provide two weepholes through the masonry duct riser walls on opposite sides immediately above the tray.

3.10 BRICKWORK BED JOINT REINFORCEMENT

Location

General: Locate as follows:

- In two bed joints below and above head and sill flashings to openings.
- In two bed joints below and above 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.

3.11 REINFORCED AND GROUTED BLOCKWORK

Reinforcement

Cover: Maintain cover to vertical and horizontal steel reinforcement using plastic clips or wheels, as appropriate.

Vertical reinforcement: Tie vertical steel reinforcement to the starter bars through cleanout holes in each reinforced hollow masonry unit and fix in position at the top of the wall with plastic clips.

Horizontal: Lay horizontal steel reinforcement in contact with rebated webs. Hold in position using plastic clips if vertical steel is subsequently positioned to wall construction.

Cleaning core holes

General: Provide purpose-made cleanout blocks or machine cut a cleaning hole at the base of each grouted core.

Location: Locate on the side of the wall which is to be rendered or otherwise concealed.

Cleaning: Rod cores to dislodge mortar fins protruding from the blocks and mortar droppings from reinforcement. Remove through the clean-out blocks.

Grouting

Commencement: Do not commence until grout spaces have been cleaned out and the mortar joints have attained sufficient strength to resist blow-outs.

Height of lift: Limit the height of individual lifts in any pour to make sure that the grout can be thoroughly compacted to fill all voids.

Compaction: Compact by vibration or by rodding.

Topping up: On the completion of the last lift, top up the grout after 10 min and within 30 min, and vibrate or rod to mix with the previous pour.

3.12 LINTELS

Location

General: Install one lintel to each wall leaf, as documented.

Installation

General: Do not cut on site. Keep lintels 10 mm clear of heads of frames.

Steel lintels: Pack mortar between any vertical component and supported masonry units. For angles, install the long leg vertically.

Minimum bearing each end:

- Span not more than 1000 mm: 100 mm.
- Span more than 1000 mm and not more than 3000 mm: 150 mm.
- Span more than 3000 mm: To structural drawings.

Propping: Provide temporary props to lintels to prevent deflection or rotation.

- Minimum propping period: 7 days.

3.13 CONNECTORS AND ACCESSORIES**Slip joints**

General: Install 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.

Flexible masonry ties

General: Install stabilising ties at control joints and abutting structural elements, including columns, beams and slab soffits.

3.14 BAGGING**Preparation**

General: Cut joints flush before bagging.

Dry bagging

Application: Apply laying mortar to the surface using a hessian bag or similar. Flush up irregularities, but leave a minimum amount of mortar on the surface.

0341 STRUCTURAL STEELWORK**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Construction category: To AS/NZS 5131 (2016) Appendix C.

Adjoining elements: Provide for the fixing of adjoining building elements that are to be connected to or supported on the structural steel.

1.2 STANDARDS**General**

Materials and design: To AS 4100 (2020).

Materials and design of cold-formed decking, purlins and girts: To AS/NZS 4600 (2018).

Composite steel-concrete construction including profiled steel sheeting and shear connectors: To AS/NZS 2327 (2017).

Fabrication and erection: To AS/NZS 5131 (2016).

1.3 TOLERANCES**General**

Requirement: To AS/NZS 5131 (2016) Section 12 and Appendix F.

Tolerance class: 1.

1.4 SUBMISSIONS**Execution details**

Anchor bolts: If anchor bolts do not meet documented location tolerances, submit proposals for rectification before proceeding.

Bolting connections: For connections not documented, submit proposals.

Bolt tensioning procedure: Submit details of procedure, equipment to be used and calibration of the process.

Site base plate holing: If hand cutting of bolt holes in column base plates are required, submit details.

Purlins and girts: If purlins and girts support components other than roofing or cladding, submit details.

Site modifications: Submit details of proposed on-site modifications or rectifications to any steel member, connection component, mechanical fastener, weld or corrosion protection.

Splices: If variations to documented splice locations or additional splices are proposed, submit details.

Temporary connections or attachments: If not documented, submit details.

Undocumented weld types: Submit proposals for weld type and electrodes.

Welding plan: Submit a welding plan to AS/NZS 5131 (2016) clause 7.2.

Work method statement: Before any erection work commences, submit a work method statement to AS/NZS 5131 (2016) clause 11.2.3.

Fabrication details

Distortions: Submit proposals for the following:

- Preventing or minimising distortion of galvanized components, welded components or welded and galvanized components.
- Restoration to the designed shape.

Identification marks: If members and/or connections will be exposed to view, submit details of proposed marking.

Program: Submit a fabrication program showing the proposed sequence of operations and time required.

Products and materials

Substitution: If alternative sections or connections are proposed, submit details.

Records

Survey: Submit survey of erected structural steel to verify components have been installed as documented.

Drawings: Submit as-built structural drawings, upon completion.

Shop detail documentation

General: Submit shop detail documentation to a scale that best describes the detail, conforming to AS/NZS 5131 (2016) clause 4.4.

Subcontractors

Responsibilities: Submit names and contact details corresponding to the person/organisation assigned responsibility to the items listed in AS/NZS 5131 (2016) Table B3.

1.5 INSPECTION

Notice

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

- Steelwork on-site before erection.
- Anchor bolts in position before casting in.
- Steelwork and column bases erected on site, before grouting, encasing, site protective coating or cladding.
- Tensioning of bolts in categories 8.8/TB, 8.8/TF, 10.9/TB and 10.9/TF.
- Reinforcement and formwork in place before any encasement.
- Completed grouting, encasement, fire protection or site applied protective coating.

2 PRODUCTS

2.1 GENERAL

Materials

Requirement: To AS/NZS 5131 (2016) Section 5.

Storage and handling

Requirement: Pack, support, transport and handle members and components without overstressing, deforming or damaging them or their protective coating.

Damaged items: Rectify or replace. Do not assemble into the structure without approval.

Protection: Wrap or otherwise protect members or components to prevent damage to surface finishes during handling and erection.

Storage: Store off the ground.

Lifting points: Do not allow steel slings to come into direct contact with coated steelwork.

Purchasing and traceability

Purchasing documentation and procedure: To AS/NZS 5131 (2016) clause 4.6.

Level of traceability: To AS/NZS 5131 (2016) clause 5.2.3 and the types defined in AS/NZS 5131 (2016) clause 4.7.

2.2 STRUCTURAL STEEL

Steel members and sections steel grade table

Type of steel	Minimum grade
Hot-rolled sections to AS/NZS 3679.1 (2016) and SA TS 102 (2016)	300
Welded sections to AS/NZS 3679.2 (2016)	300
Hot-rolled plates, floor plates and slabs to AS/NZS 3678 (2016) and SA TS 102 (2016)	250
Hot-rolled flat products to AS/NZS 1594 (2002)	HA250
Hollow sections to AS/NZS 1163 (2016) and SA TS 102 (2016): Circular sections less than 166 mm nominal outside diameter	C250
Hollow sections to AS/NZS 1163 (2016) and SA TS 102 (2016): Sections other than circular sections less than 166 mm nominal outside diameter	C350
Cold-formed purlins and girts to AS 1397 (2021)	G450 or Z350

Certification

Steel: Minimum requirements for test and inspection certificates, to the following:

- Hot-rolled bars and sections: To AS/NZS 3679.1 (2016) clause 11.2.4.
- Welded I sections: To AS/NZS 3679.2 (2016) clause 11.2.4.
- Hot-rolled plates: To AS/NZS 3678 (2016) clause 11.2.4.
- Cold-formed hollow sections: To AS/NZS 1163 (2016) clause 11.2.4.

2.3 MECHANICAL FASTENERS

Standards

Bolts: To AS 1110.1 (2015), AS 1111.1 (2015) and AS/NZS 1252.1 (2016).

Nuts: To AS 1112.1 (2015), AS 1112.2 (2015), AS 1112.3 (2015), AS 1112.4 (2015) and AS/NZS 1252.1 (2016).

Bolting category

Requirement: As documented, to AS 4100 (2020) Table 9.2.1.

Certification

High-strength bolt assemblies: Minimum requirements for test reports, to AS/NZS 1252.1 (2016) clause 6.4.2.

Finish

Bolts, nuts and washers: Hot-dip galvanized to AS/NZS 1214 (2016), corrosion-free, and in serviceable condition.

Anchor bolts

Hexagonal bolts: To AS 1111.1 (2015).

Hexagonal nuts: To AS 1112.3 (2015).

Plain washers: To AS 1237.1 (2002).

Requirement: Provide each anchor bolt with 2 nuts and 2 oversize washers with sufficient thread for the levelling nut and washer to sit below the base plate.

Mechanical and chemical anchors: To AS 5216 (2021), installed to manufacturer's recommendations.

2.4 OTHER MATERIALS**Welding consumables**

Requirement: To the relevant part of the AS/NZS 1554 series.

Studs and shear connectors

Requirement: To AS/NZS 5131 (2016) clause 5.6.

Grout

Requirement: To AS/NZS 5131 (2016) clause 5.8.

3 EXECUTION**3.1 PREPARATION, ASSEMBLY AND FABRICATION****Identification**

Traceability: To AS/NZS 5131 (2016) clause 5.2.3.

Marking: Provide marks or other means of identifying each member compatible with the finish, for setting out, locating, erecting and connecting the steelwork to 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.

Natural beam camber

General: If steel beams have a natural camber, within the straightness tolerance, fabricate the steelwork element with the camber up.

Cutting

Shearing: Do not shear edges of a connection or parts of a member that have been designated as areas of plastic deformation.

Punching: Do not punch fastener holes in locations designated as areas of plastic deformation.

Shaping

Requirement: Where forming, shaping or correcting distorted members, avoid damage and conform to AS/NZS 5131 (2016) clause 6.6.

Holing

Slotted holes: Do not use slotted holes for connections, other than those documented.

Tolerances

Measurement: Check tolerances by measurement after fabrication and application of corrosion protection.

3.2 WELDING**General**

Requirements: To AS/NZS 5131 (2016) Section 7.

Standard: To AS/NZS 1554.1 (2014).

Weld category

Weld categories not documented: Category GP.

Weld type

Weld type not documented: Submit proposals for weld type and electrodes.

Non-destructive weld examination (NDE)

Requirement: To AS/NZS 5131 (2016) clause 13.6.2.

Non-visual NDE: By a third party testing authority.

Repairs: Repair welds revealed as faulty by NDE and repeat the examination.

Site welds

Completion: Weld only when correct alignment and preset or camber have been achieved.

3.3 MECHANICAL FASTENING**Connection contact surfaces**

General: To AS/NZS 5131 (2016) clause 8.4.1.

Bolting categories 8.8/TF and 10.9/TF: Clean, as rolled and free from applied finishes.

Washers

Requirement: Place one washer under the part rotated during tightening process (nut or bolt head).

Lock nuts

General: Provide lock nuts to AS/NZS 5131 (2016) clause 8.2.3 for bolts in moving parts or parts subject to vibration and for vertical bolts in tension.

Method of tensioning TB and TF bolting categories

8.8/TB and 8.8/TF: Use part-turn method or a direct tension indicator device.

10.9/TB and 10.9/TF: Use a direct tension indicator device.

Permanent bolting

Completion: Bolt only when correct alignment and preset or camber has been achieved.

3.4 SURFACE PREPARATION AND TREATMENT**General**

Requirement: Conform to *0344 Steel – hot-dip galvanized coatings* and/or *0345 Steel – protective paint coatings*, as appropriate.

Corrosion protection

Requirement: Conform to the following:

- Paint corrosion protection: To AS 2312.1 (2014).
- Hot-dip galvanized corrosion protection: To AS/NZS 2312.2 (2014) and AS/NZS 4680 (2006).

3.5 FIRE PROTECTION COATINGS

General

Requirement: Apply fire protection to structural steelwork to 0346 Structural fire protection systems.

3.6 ERECTION

General

Execution: Make sure every part of the structure has sufficient design capacity and is stable under construction loads produced by the construction procedure.

Calculations: Verify the adequacy of the structure to sustain any loads and/or procedures, which may be imposed.

Temporary work

General: Provide all necessary temporary bracing or propping.

Temporary connections: Detail required cleats, if not shown on shop detail documentation.

Temporary members: If temporary members are required, fix so as not to weaken or deface permanent steelwork.

Anchor bolts

General: For each group of anchor bolts, provide a template with set-out lines clearly marked for positioning the bolts when casting in.

Beam camber

Requirement: If beam elements have a camber (natural or induced), erect them with the camber up.

Site work

General: Other than work shown on the shop detail documentation as site work, do not fabricate, modify or weld structural steel on-site.

Purlins

Trimming members: Provide to support edges of roof sheeting along hips, valleys and roof penetrations.

Movements

General: Allow for thermal movements during erection.

Grouting at supports

Preparation: Before grouting steelwork 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 constructing supported floors, walls and roofing.

Temperature: Do not grout if the temperature of the base plate or the footing surface exceeds 35°C.

Drifting

Limitation: Use drifting only to bring members into position, without enlarging holes or distorting components.

3.7 REPAIRS

General

Requirement: Repair finishes to restore the full integrity of any coating.

3.8 COMPLETION

Tolerances

Conformance: After completing erection, verify conformance with AS/NZS 5131 Section 12 and Appendix F.

Temporary connections

General: Remove temporary cleats on completion and restore the surface.

0342 LIGHT STEEL FRAMING

1 GENERAL**1.1 RESPONSIBILITIES****Performance**

Requirement: Provide light steel floor, wall, roof and truss framing as follows:

- Suitable for having flooring, linings, cladding and roofing fixed to it.
- Conforming to the documented performance criteria.
- Conforming to the requirements of NASH-1 (2005) or NASH-2 (2014).
- Independently designed and documented.
- Independently certified by a professional engineer for the design and the erected framing.

1.2 STANDARDS**General**

Design, materials and protection: To AS/NZS 4600 (2018).

Residential and Low-rise steel framing: To NASH-1 (2005) (National Association of Steel Housing) and NASH-2 (2014).

1.3 TOLERANCES**General**

Manufacturing, assembly and installation tolerances: To NASH-1 (2005) Appendix D and NASH-2 (2014) Appendix A.

1.4 SUBMISSIONS**Certification**

Erected frame: Submit certification that the erected frame conforms to the documented project requirements.

Design documentation

General: Where the structural documentation defines performance criteria, submit, as follows:

- Design to AS/NZS 4600 (2018) or NASH-1 (2005): Independent design, documentation and certification from a professional engineer.
- To NASH-2 (2014): Certification of conformance to the requirements of NASH-2 (2014).

Reactions: Submit the location and magnitude of reactions that are to be accommodated by the support structure.

Floor and wall frame member sizes: Submit a schedule of proposed member sizes, certified as meeting stated project, and AS/NZS 4600 (2018) or NASH-2 (2014) requirements for span, spacings and loadings.

Shop drawings

General: Submit shop drawings, to a scale that best describes the detail, requirements for the documented configurations and loadings.

Prefabricated roof trusses: Include the following:

- Plan: Truss layout.
- Elevations: Arrangement of members, allowing for the accommodation of in-roof services, and the size and section type of each member.
- Method of assembly and connection details.
- Holding down and bracing: Details demonstrating capability to resist lateral and uplift forces.

Prefabricated wall frames: Include the following:

- Plan: Wall layout.
- Elevation: Arrangement of members, and size and section type of each member.
- Method of assembly, connection, holding down and bracing.

Prefabricated floor frames/cassettes: Include the following:

- Plan: Level of installation, arrangement of members, and size and section type of each member, including prefabricated floor joists.
- Method of assembly, connection, holding down and bracing.

1.5 INSPECTION**Notice**

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

- Steel framing erected on site before lining or cladding.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Transport all components to site and store, if required, so that components or their coating are not damaged or distorted.

Frames and trusses: If required, store on a flat even surface and do not load with other items.

Exposure: Minimise exposure of components to the weather, both during storage, handling and after erection.

2.2 COMPONENTS**Damp-proof course**

Membrane: To the membrane requirements of AS 2870 (2011) or AS/NZS 2904 (1995).

Cold-formed steel framing

General: Cold-formed sections from steel, metallic-coated to AS 1397 (2021).

Corrosion protection: To NASH-2 (2014) Section 8.

Framing members

Cold-formed steel framing for proprietary systems: To NASH-1 (2005) or NASH-2 (2014).

Fascias and barge boards

General: Cold-formed sections from steel, metallic-coated to AS 1397 (2021).

3 EXECUTION

3.1 GENERAL

Frame fabrication

Length: Cut members accurately to length so that they fit firmly against abutting members.

Service holes: If not pre-punched, form holes by drilling or punching, without compromising the structural integrity of the frame, located centrally within the centre third span of the element, conforming to the requirements of NASH-2 (2014).

Swarf: Immediately remove swarf and other debris from cold-formed steel framing.

Fastening

Prefabricated framing: Fasten framing elements using fasteners, as documented, to the fabricator's requirements.

Framing built in-situ: Use fasteners, as documented, from the following types:

- Bolting.
- Self-drilling, self-tapping screws.
- Blind rivets.
- Proprietary clinching system.
- Structural adhesives.
- Welding. On-site welded connections are not permitted.

Compatibility: Compatible with steel frame to prevent galvanic corrosion of dissimilar metals.

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.

Unseasoned or CCA treated timber

General: Do not fix in contact with framing without fully painting the timber and/or the steel.

Earthing

Requirement: To AS/NZS 3000 (2018). 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.

Metal separation: Install lagging to separate non-ferrous service pipes and accessories from the framing.

Grommets: Provide grommets to isolate piping and wiring from cold-formed steel framing.

Site cut holes: Provide plastic bushes or grommets to site cut holes.

3.2 FLOOR FRAMING

General

Protection: If floor framing is for ground floor construction, make sure that it is protected from moisture.

Construction loads: If construction loading exceeds design loading, provide additional support so as to avoid overstressing of members.

3.3 WALL FRAMING

Wall studs

General: Provide studs in single lengths without splices. Place a stud and a stiffened top plate 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.

Heads to openings

Requirement: Provide lintels appropriate to load and span.

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.

Vermin barriers

Brick veneer barrier: Close nail steel wire mesh, with a maximum aperture of 10 mm, to the underside of the bottom plate of external stud walls, extending across the cavity for building into brickwork.

Damp-proof course

Requirement: Provide damp-proof courses under the bottom plate of stud walls built off slabs or masonry dwarf walls, as documented or as follows if not documented otherwise:

- External walls (not masonry veneer): Turn up a minimum of 75 mm on the inside and tack to studs. Project 10 mm beyond the external slab edge or dwarf wall and turn down at 45°.
- Walls of bathrooms, shower rooms and laundries: 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.

Masonry veneer construction: Extend across cavities and build into brickwork.

3.4 ROOF AND CEILING FRAMING

Beam framing

General: Construct framing for flat or pitched roofs where the ceiling follows the roof line, consisting of

prefabricated roof beams, rafters or purlins supporting both ceiling and roof covering.

Additional support

Requirement: Provide additional frame members at the following locations:

- Hanging light fittings.
- Ceiling fans.
- Access panels.
- Any other hanging services or fixtures and fittings.

Water tank or heater in roof space: Provide a support platform to AS/NZS 3500.4 (2021) clause 5.5.1.

Battens

Requirement: Supply and fix battens suitable for span, spacing and proposed roofing material.

Anti-ponding boards

Standard: To AS 4200.2 (2017).

3.5 TRUSSES

Fabrication

Assembly: Factory assemble trusses.

Supports for in roof services

General: If walkways, mechanical plant or other services are to be supported within the roof space, provide support and make sure trusses have been designed to carry the loads.

Water tank and heater: If a water tank or heater is located in the roof space, provide a support platform to AS/NZS 3500.4 (2021) clause 5.5.1 and make sure trusses have been designed to carry the loads.

Marking

General: Permanently mark each truss to show:

- Project identification.
- Manufacturer.
- Tag or number.
- Location.
- Support points.

Installation

Support: Support and fix trusses to the truss fabricator's recommendations.

Vertical movement: Over internal walls not providing support to trusses, provide at least 10 mm vertical clearance and use wall bracing methods which allow for vertical movements, to the truss fabricator's recommendations.

3.6 ROOF TRIM

Fascia, valley and barge boards

Requirement: Fix fascia, valley gutter boards and barge boards in conformance with the manufacturer's recommendations.

3.7 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.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the installer.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier.

0344 STEEL – HOT-DIP GALVANIZED COATINGS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirement: Control atmospheric corrosion to structural steelwork and steel products until the first scheduled maintenance.

1.2 STANDARDS

General

Coating: To AS/NZS 4680 (2006).

Coating on fasteners: To AS/NZS 1214 (2016).

Durability: To AS/NZS 2312.2 (2014).

Metal finishing

Coating mass/thickness minimum: To AS/NZS 4680 (2006).

Threaded fasteners coating mass/thickness minimum: To AS/NZS 1214 (2016)

1.3 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 may lead to dimensional change, distortion or difficulties during galvanizing, identify these and submit details for improvement.

1.4 INSPECTION

Notice

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

- Coating appearance and thickness, at the galvanizing plant.

2 EXECUTION

2.1 GENERAL

Care

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 (2003).

Acid pickling: To AS 1627.5 (2003).

- Inhibitor: Required.

Coating process

General: To AS/NZS 4680 (2006) Section 6.

Threaded fasteners: To AS/NZS 1214 (2016) Section 5.

Post treatment

General: Passivate.

Drilling after completion of hot-dip galvanizing

Repair: Prime drill hole surfaces to AS/NZS 4680 (2006) Section 8 before the surfaces begin to corrode.

Surface finish

Standard: To AS/NZS 4680 (2006) Section 7.

Coating quality: Continuous and as smooth and evenly distributed as possible. Free of blisters, roughness, sharp points, flux residues and any defects that may affect the end use of the article.

Silicon killed steels: Dull grey is acceptable provided a sound and continuous coating is achieved.

Surplus zinc on fastener threads: Remove.

Friction-type bolted connections: Treat coated contact surfaces to achieve the required design slip factor, without removing excessive coating thickness as follows:

- Contact surface preparation: To *GAA Best practice guide for hot dip galvanized bolts and bolted joints (2020)*.
- Slip factor test: To AS 4100 (2020) Appendix J.

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 (2006) Section 8, reject the galvanizing.

Extent and methods: To AS/NZS 4680 (2006) Section 8.

Preparation of galvanized surfaces for paint finishes

Coarse preparation: Remove spikes, and make sure edges are free from lumps and runs.

Light sweep blasting before painting: Required.

- Maximum zinc removal: 10 microns.
- Abrasive grade (range): 150 to 180 microns.
- Abrasive type: Clean ilmenite or garnet.
- Blasting angle to surface: 45° maximum.
- Blast pressure (maximum): 275 kPa.
- Distance of nozzle from surface (range): 350 to 400 mm.
- Nozzle type: 10 to 13 mm orifice diameter venturi type.

2.2 SITE WORK

Site welding

Grinding of edges: Permitted.

Weld areas: Reinstate coating to AS/NZS 4680 (2006) Section 8.

Site coating reinstatement

Rejection: If any item has damaged areas exceeding the limits specified for repair in AS/NZS 4680 (2006) clause 8.1, reject the item.

Extent: Areas damaged by transport, site welding, site flame cutting, site handling, or erection.

Method: To AS/NZS 4680 (2006) Section 8.

0345 STEEL – PROTECTIVE PAINT COATINGS**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide protective paint coatings for the protection of steel products and structural steelwork against interior and exterior atmospheric corrosion, as documented.

Performance

Requirement: Control atmospheric corrosion to structural steelwork and steel products until the first scheduled maintenance.

1.2 STANDARDS**General**

Surface preparation and coating: To AS/NZS 5131 (2016) Section 9 and the recommendations of AS 2312.1 (2014).

1.3 INTERPRETATION**Abbreviations**

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

- DFT: Dry Film Thickness.
- ITP: Inspection and Test Plan.
- MIO: Micaceous Iron Oxide.
- PDS: Product Data Sheet.
- SDS: Safety Data Sheet.

1.4 SUBMISSIONS**Execution details**

Detailing features: If design and fabrication features of the items to be coated may lead to difficulties, identify these and submit details for improvement.

Repair of damaged coating: If the protective coating is damaged, submit a coating repair proposal, based on the coating manufacturer's recommendations for reinstating the corrosion protection function of the system.

Reinstatement: If final coat varies from the submitted sample, submit proposals for reinstatement of the visible final coating system.

Samples

Painting and coating colour: Submit a 400 x 400 mm sample of the finished product for each coating system.

Retention: Retain samples for comparison during application.

Subcontractor

Substrate acceptance: Submit evidence of applicator's acceptance of the coating substrate before starting installation.

Warranties

General: Submit details of the proposed warranty terms, form and period.

1.5 INSPECTION

Notice

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

- Items after fabrication, before commencing surface cleaning and preparation.
- Surfaces after preparation, before application of first coating.
- Coating stages:
 - . After application of primer or seal coats.
 - . After application of each subsequent coat.
- Repair of coating damage: Exposure of corrosion pitting or significant metal loss by blasting process.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Requirement: Handle, store, mix and apply all protective coatings in conformance with the manufacturer's recommendations.

Original containers: Deliver coating products to site in manufacturer's labelled and sealed containers.

Ambient temperature range for storage: 3°C to 30°C, or to manufacturer's recommendations.

Sunlight: Protect coating materials from direct sunlight before mixing or adding the converter (catalyst).

Use-by-date: Use products with limited shelf life before their use-by-date, unless written authorisation from the coating manufacturer's technical services section is provided.

Paint material

Requirement: To AS/NZS 5131 (2016) clause 9.9.3.

Proprietary products

Requirement: Provide all products from the one manufacturer's supply.

Product data sheets (PDS): Keep on site copies of all relevant manufacturer's PDS.

Safety data sheets (SDS): Keep on site copies of all relevant manufacturer's SDS.

Recording: To AS/NZS 5131 (2016) clause 9.9.5.

3 EXECUTION

3.1 GENERAL

Product warnings

Requirement: Conform to the SDS.

Surroundings

Protection: Prevent the release of abrasives, overspray or paint waste debris into the air, ground or to any watercourse. Prevent damage to other assets, services or equipment.

Reinstatement: Repair and/or clean affected surrounding areas.

Working area

General: Perform all painting under cover and/or protected from rain, condensation, dew, excessive wind, overspray or wind-blown dust.

Period: Continue protection where any of these conditions exist until the coating is no longer affected.

3.2 SURFACE PREPARATION

General

Requirement: Conform to AS/NZS 5131 (2016) clauses 9.3, 9.4 and 9.5.

Galvanized, aluminium and zinc primed surfaces

Requirement: Remove grease, oil and other solvent-soluble contaminants to AS 1627.1 (2003). Allow to dry and immediately proceed with priming.

Galvanized and aluminium surfaces: Abrade surfaces to a medium coarse type finish to provide an adhesion key.

Zinc primed surfaces: If present, remove zinc salts from zinc primers.

Treatment of welds

Requirement: Clean welds to remove roughness, using power tools to AS 1627.2 (2002). Remove filings by vacuuming or compressed air.

Temporary welds: Grind flush any temporary welds.

Porous, skip or stitch welds: Not permitted.

Site welding: If possible, avoid site welding. If on site welding is required, prepare and treat the weld to AS/NZS 5131 (2016) clause 9.12.2.

Shop priming

Requirement: Dust off and apply a coat of primer in conformance with the manufacturer's recommendations.

Site coating

General: High pressure wash down all surfaces with clean water. Lightly sand down primer/intermediate coats, which have been shop applied, before site application of next coat.

3.3 COATING APPLICATION

General

Requirement: Conform to the product data sheets.

Painting and coating colour: Verify all project finish colours with the retained samples.

Final surface preparation or coating application

Limits: Do not apply if any of the environmental/climatic/substrate conditions listed in AS/NZS 5131 (2016) clause 9.9.10 exist or if the following conditions are present:

- Ambient air temperature below 5°C or above 40°C.
- Substrate temperature below 10°C or above 45°C.
- The specified surface cleanliness will deteriorate before the full prime coat application can be completed.
- Surface preparation standard has not been achieved.
- Time between final surface preparation and the commencement of coating has exceeded 4 hours.

- Visual tarnishing or black spots develop on the surface of the steel.

Exception: Preliminary blast or other surface preparations may be performed in conditions that are outside the limits, provided the final surface preparation and all coating applications are undertaken under the limit conditions.

Pre-coating: Before the spray application of each coating, stripe coat by brush method all edges, welds, seams, rivets, bolts, boltholes (including slots) and difficult to spray areas. Prime the underlying surfaces of replacement bolts, washers and nuts before installation.

Procedure: Conform to the manufacturer's recommendations.

Subsequent coats: Before applying any subsequent coating layer, make sure the surface condition of the preceding coat conforms to the manufacturer's recommendations and is clean and free from defects.

3.4 PROTECTION

Contamination

Surfaces: Prevent contamination of coated surfaces, which are not yet dry, from blasting dust, abrasive or surface preparation debris and any other foreign matter.

Post application care

General: Protect the coating against physical, chemical, or atmospheric damage until all components are fully cured.

Care: Stack and handle all coated items using fabric slings or padded chains. Use soft packaging, carpet strips or other deformable materials between all coated items.

Water ponding: Stack coated items to prevent water ponding.

3.5 COATING REPAIR

Repair of coating damage

Preparation: Feather back by hand or machine sand all leading edges of intact coating adjacent to the repair, to remove any sharp edge.

Surface contamination: Remove by dusting or blowing down before applying the first coat of paint.

Sequence: Apply the repair coating in the same sequence and manner as the original coating.

Areas damaged without exposing the primer: Wash with a proprietary detergent solution, rinse with clean water and abrade so that edges of sound paint are feathered. Coat the area with the appropriate intermediate and finishing coat materials.

Areas damaged exposing the primer or steel surface: Blast clean to the original standard. Prepare at least 50 mm into the sound coating and to a further feathering zone of approximately 50 mm. Recoat with the documented system to restore the film thickness and integrity over the whole prepared surface including the feathered zone.

Aesthetic reinstatement: If required, repaint to a physical or discernible boundary line.

Defects: If corrosion pitting or areas of significant metal loss and defects are exposed by the blasting process, advise for inspection and have areas passed as being fit for service before proceeding with the coating system.

Timing: Apply the protective coating system within 4 hours of blast cleaning or in any case before visual tarnishing of the steel occurs.

3.6 COMPLETION

General

Joints: On completion, seal all joints and mating surfaces with a compatible polyurethane sealant.

Warranties

Requirement: 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.

0346 STRUCTURAL FIRE PROTECTION SYSTEMS
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1 GENERAL

1.1 STANDARDS

Structural fire protection systems

Materials and components: To NCC (2022) Spec 1 [NCC (2019) Schedule 5].

1.2 SUBMISSIONS

Certification

Certificate of compliance: Submit evidence of compliance with the NCC requirements for suitability of the completed fire protection system for the designated FRL.

Execution details

Substrate cleaning: Give notice of surface conditions which cannot be corrected by normal hand tool cleaning methods.

1.3 INSPECTION

Notice

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

- Substrate preparation.
- System support installation.
- Completed application of protective system coating thickness.

2 PRODUCTS

2.1 SPRAYED FIRE-RESISTING MATERIALS

Material

Requirement: Perlite or vermiculite with a hydraulic binding agent and filler to form plaster.

Standard: To EN 13055 (2016).

Applied decorative and protective surface finishes

Compatibility: Compatible with the sprayed fire-resisting materials, without impairing their performance.

2.2 INTUMESCENT PAINT

General

Requirement: Proprietary system, as documented.

2.3 BOARD FIRE PROTECTION

General

Requirement: Proprietary system, as documented.

2.4 METAL COMPONENTS

General

Atmospheric corrosion category: To 0171 *General requirements*.

Expanded metal lath

Reinforcement mesh: To NCC (2022) S2C7 [NCC (2019) Schedule 5 Annexure to Table 1 clause 1.6].

Keying mesh:

- Aperture: 6 to 20 mm.
- Self-furring expanded metal lath ribs: V-shaped at 100 to 150 mm intervals.

Welded steel wire mesh

Reinforcement mesh: To NCC (2022) S2C7 [NCC (2019) Schedule 5 Annexure to Table 1 clause 1.6].

Keying mesh:

- Wire diameter: 0.7 to 1.6 mm.

Twisted steel wire mesh

Conformance: To AS 2423 (2002).

Reinforcement mesh: To NCC (2022) S2C7 [NCC (2019) Schedule 5 Annexure to Table 1 clause 1.6].

Keying mesh aperture: Nominally 25 to 32 mm.

Fixings

Screws: Deep threaded self-tapping screws, preferably with ribbed heads.

Staples: Steel wire staples.

2.5 ADHESIVES AND SEALANTS

Board adhesives

Adhesive cement: Fixing cement as recommended by the board manufacturer as being part of the tested complete protection system.

Sealants

Fire-resistance rated sealant: Non-hardening sealant, compatible with the materials to be sealed and having a fire-resistance rating equal to that of the building element it seals.

3 EXECUTION

3.1 SPRAYED FIRE-RESISTING PRODUCTS

Applicators

General: Approved by the coating manufacturer to install the coating.

Surface preparation

Requirement: Before coating application, remove materials which may impair adhesion to the substrate, including mill scale, dirt, grime, oil, grease, mould release agents, dust, loose rust, non-compatible primers and paint.

Compatibility: If paint on the steel sections is not compatible with the coating, apply an alkali-resistant sealer compatible with the paint.

Stable gaps and joints wider than 15 mm: Bridge with an appropriate supporting material before applying the coating.

Unstable gaps and joints: Provide a control joint in the spray, with metal lath support on either side of the joint.

Protection of areas not to be coated

Requirement: Prevent damage from spillage, overspray, contamination and fallout.

Sequence

General: Apply coatings after installation of supports, fixings and other attachments and before

installation of items which may obstruct the application.

Support and fixing of reinforcement

Support on walls, columns and beams: To NCC (2022) S2C16, NCC (2022) S2C17 and NCC (2022) S2C18 [NCC (2019) Schedule 5 Annexure to Table 1 clause 7].

Encapsulated substrates: If reinforcement support is not required, wrap and overlap reinforcement at joints and wire tie together.

Thickness

Coating application: To NCC (2022) Spec 1 [NCC (2019) Schedule 5], NCC (2022) Spec 2 [NCC (2019) Schedule 5] and as documented.

Spraying

General: Provide full cohesion in the coating.

Curing

Requirement: Prevent rapid drying, and exposure to wind-driven rain, running water, freezing conditions, structural movement, vibration or impact during curing.

External coatings

Detailing: Provide water shedding slopes to sprayed surfaces and at sprayed terminations provide a weatherseal at the coating-substrate interface with UV stable mastic sealant or weather shields.

Thickness measurements testing

Thickness gauge: If possible, use a direct-reading pin-type thickness gauge with a base plate of 25 mm diameter. Alternatively, use prefixed gauges that do not impair fire performance.

Acceptance criteria for deficient areas:

- Thickness not less than 85% specified thickness: Deficient area not to exceed 1 m², and no other deficient area within 3 m of this deficient area.
- Thickness not less than 75% specified thickness: Deficient area not to exceed 0.2 m², and no other deficient area within 1 m of this deficient area.

Density measurements testing

Acceptance criterion: The manufacturer's stated average dry density $\pm 15\%$.

3.2 INTUMESCENT PAINT

Surface preparation

Requirement: Before coating application, remove materials which may impair adhesion to the substrate, including mill scale, dirt, grime, oil, grease, mould release agents, dust, loose rust, non-compatible primers and paint.

Application

Requirement: To manufacturer's recommendations.

3.3 BOARD FIRE PROTECTION

Fixing

System: Fix proprietary systems in conformance with the recommendations of the manufacturer or supplier to achieve the documented FRL.

Joints

General: Make butt joints true and flush. For single layer construction, provide 6 mm thick cover strip on the rear face of the joint. For multi-layer systems,

stagger the joints in the inner and outer layers at least 100 mm.

Access panels

Sealing: Seal joints to the recommendations of the manufacturer or supplier.

3.4 COMPLETION

Cleaning

General: On completion, remove splatters by washing, scraping or other methods which do not scratch or damage adjacent finished surfaces.

Disposal of products and waste materials

Requirement: Conform to requirements of the local government authority.

Warranties

Requirement: Provide manufacturer's warranties as follows:

- Interlocking performance warranty: Cover materials and workmanship in the terms of the warranty in the form of interlocking performance warranties from the supplier and the installer.
- Form: Against failure of materials and execution under the normal environment and use conditions.

0382 LIGHT TIMBER FRAMING**1 GENERAL****1.1 STANDARDS****General**

Framing: To AS 1684.2 (2021), AS 1684.3 (2021) or AS 1684.4 (2010), as appropriate.

Design: To AS 1720.1 (2010).

1.2 TOLERANCES**Floors**

Maximum deviation from a 3 m straightedge laid in any direction on the floor framing: 5 mm.

Wall 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 straightedge laid in any direction on a surface. 2. Features: Conspicuous horizontal or vertical lines including external corners, parapets, reveals, heads, sills.	

1.3 SUBMISSIONS**Certification**

Requirement: Submit certification by a professional engineer of the design, documentation and erected work to the AS 1684 series and AS 1720.1 (2010). Include the following:

- Reactions: Provide location and magnitude of reactions to be accommodated by the support structure.
- Floor, wall and roof frame member sizes: A schedule of proposed member sizes, certified as meeting stated project requirements for spans, spacings, loadings and deflections.
- Species and stress grade.

Products and materials

Supply: Submit supplier's evidence of conformity (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 evidence of conformity verifying that the erected timber frame conforms to the documented requirements.

Moisture content: Submit records of moisture content.

CCA treated timber: If proposed to be used, submit details.

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 to the requirements of the AS 1684 series and

AS 1720.1 (2010), for the documented configurations and loadings.

Prefabricated roof trusses: Include the following:

- Marking plans.
- Truss plan layout.
- Elevations, with the arrangement of members allowing for the accommodation of in-roof services and the size and section type of each member.
- Camber of all elements.
- The method of assembly, connection, lifting, holding down and bracing.

Prefabricated wall frames: Include the following:

- Wall plan, showing all wall layouts.
- Elevations showing the arrangement of members, and the size and section type of each member.
- The method of assembly, connection, lifting, holding down and bracing.

1.4 INSPECTION**Notice**

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

- Prefabricated units before installation.
- 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.

Marking

Branding: Brand structural timber, under the authority of a recognised product certification scheme to *0185 Timber products, finishes and treatment* as 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 scheme.
- The applicable standard.

Trusses: Permanently mark each truss to show:

- Project identification.
- Manufacturer.
- Tag or number.
- Location.
- Support points.

Preservative treatment

Requirement: To *0185 Timber products, finishes and treatment*, including for termite treatments.

2.2 TIMBER**Certification**

Requirement: Certification, chain of custody and product labelling to *0185 Timber products, finishes and treatment*.

Fascias and barge boards

Hardwood: To AS 2796.1 (1999).

Seasoned cypress pine: To AS 1810 (1995).

Softwood: To AS 4785.1 (2002).

Trusses

Design: To AS 1720.1 (2010).

Nailplated roof trusses: To AS 1720.5 (2015).

Camber: Camber bottom chord upward.

Overhangs: Free from spring or splits.

2.3 STRUCTURAL PLYWOOD**General**

Standard: To AS/NZS 2269.0 (2012).

Bond: Type A to AS/NZS 2754.1 (2016).

Formaldehyde emission class: To AS/NZS 2269.0 (2012).

Veneer

Veneer quality to visible surfaces: CD (minimum) to AS/NZS 2269.0 (2012).

2.4 COMPONENTS**Nailplated joined beams**

Standard: To AS 4446 (1999).

Type: Engineered beam made from stress-graded timber pieces joined together with nailplates.

Mild steel post bases

Embedment: Embed base a minimum of 150 mm into the concrete support.

Location: To timber posts supported off concrete slabs or footings.

Finish: Galvanize after fabrication.

Fasteners

Requirement: Conform to *0181 Adhesives, sealants and fasteners*.

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.

Damp-proof course

Material: To AS/NZS 2904 (1995).

Flashings

Material: To AS/NZS 2904 (1995).

2.5 RECONSTITUTED STRUCTURAL TIMBER PRODUCTS**Wet process fibreboard (including hardboard)**

Standard: To AS/NZS 1859.4 (2018).

Bending strength: To AS/NZS 1859.4 (2018) Section 7.

3 EXECUTION**3.1 FLOOR FRAMING****Bearers and joists**

Levelling: Level bearers and joists by checking or by packing for the full width of the member with dense corrosion-resistant material which is secured in place.

Maximum thickness of packing: 3 mm.

Spring: Lay bearers and joists to allow for straightening under loading.

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 (2021) clause 4.2.2.3 or AS 1684.3 (2021) clause 4.2.2.3 as appropriate.

Herringbone strutting dimensions: Minimum 38 x 38 mm.

Trimmers or blocking dimensions:

- Depth: Joist depth less 25 mm.
- Minimum thickness: 25 mm.

Engineered timber joists 200 mm deep or greater: Provide lateral restraint using blocking or seasoned rim board.

3.2 WALL FRAMING**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.

Grabrails: Provide additional support by fixing 18 mm plywood sheets, flush with the face of studs, to noggings at 450 mm centres.

Vermin barriers

Requirement: Provide vermin barriers as follows:

- Brick veneer barrier: Close nail 10 mm galvanized steel wire mesh to the underside of the bottom plate of external stud walls, extending across the cavity for building into brickwork.
- Stud wall barrier: Metallic-coated steel sheet, 600 mm wide x 0.6 mm thick, fixed to each side of the external stud wall frame at the base. Lap joints 25 mm.

Damp-proof course

Requirement: Provide damp-proof courses under the bottom plate of stud walls built off slabs or masonry dwarf walls, as documented and as follows:

- External walls (not masonry veneer): Turn up at least 75 mm on the inside and tack. Project 10 mm beyond the external slab edge or dwarf wall and turn down at 45°.

- Walls of bathrooms, shower rooms and laundries:
Turn up at least 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 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.

Masonry veneer construction: Extend flashing across cavities and build into brickwork.

3.3 ROOF AND CEILING FRAMING

Wall plates

Fixing: Fix timber wall plates to masonry, with straps, bolts or both.

Fixing plates

Requirement: Provide 35 mm minimum thick timber fixing plates to transfer the design loads where timber joists, rafters or purlins bear on or into steel members. Bolt to the steel member at maximum 500 mm centres and at a maximum of 100 mm from the end of the fixing plate.

Beam framing

Ridge straps: Butt ends of rafters together at ridge, and strap each pair together with 900 mm long steel strap passing over the ridge, triple nail to each rafter.

Additional support

Requirement: Provide additional frame members at the following locations:

- Hanging light fittings.
- Ceiling fans.
- Access panels.
- Any other hanging services or fixtures and fittings.

Water tank or heater in roof space: Provide a support platform to AS/NZS 3500.4 (2021) clause 5.5.1.

Anti-ponding boards

Standard: To AS 4200.2 (2017).

Trusses

Nailplated prefabricated roof trusses: To AS 4440 (2004).

Support: Support trusses on bottom chord at two points only, unless designed for additional support.

Plumb: The lesser of $H/50$ or 50 mm, where H is the height of the truss at point where plumb is being measured.

Vertical movement: Provide minimum vertical clearance of 10 mm plus ceiling batten depth over internal non-load bearing walls. Use bracing methods which allow for the design vertical movements.

3.4 ROOF TRIM

Fascia, valley and barge boards

Requirement: Fix fascia, valley gutter boards and barge boards.

3.5 COMPLETION

Protection

Protection from weather: Provide temporary protection for members until permanent covering is in place.

Tightening

Requirement: Retighten bolts, screws and other fixings so that all joints and anchorages are secure at the date of practical completion.

Cleaning

General: On completion of framing remove debris from any gaps between members and make sure void between bottom chord of trusses and top of any non-supporting internal walls is clear.

0383 DECKING, SHEET AND PANEL FLOORING**1 GENERAL****1.1 STANDARDS****General**

Timber flooring and decking: To AS 1684.2 (2021), AS 1684.3 (2021) or AS 1684.4 (2010), as appropriate.

Slip resistance

Classification: To AS 4586 (2013).

1.2 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.
- Decking: Intermittently-supported external flooring with drainage gaps between boards.
- Flooring - fitted: Flooring fitted between the walls of each room i.e. not platform floors.
- Flooring - intermittently-supported: Flooring which is supported by, and spans across joists or battens.
- Platform flooring: Flooring laid over the whole of the joisted floor structure before the erection of external and internal wall frames.
- Subfloor: The structure that supports the flooring.

1.3 TOLERANCES**Decking**

Maximum vertical deviation for adjacent boards: 3 mm.

Minimum gap between edges of seasoned boards: 4 mm.

Maximum gap between boards:

- Boards ≤ 150 mm wide: 6 mm.
- Boards > 150 mm wide: 10 mm.

Sheet flooring

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

AAC panel flooring

Maximum gap between adjoining panels, excluding control and articulation joints: 5 mm.

1.4 SUBMISSIONS**Certification**

Requirement: Submit evidence of conformity to documented requirements for grading, species and board size. Evidence may be in any of the following forms:

- Supplier's certificate which may be included on an invoice, delivery docket or packet label.
- Report by an independent inspecting authority.

Moisture content: Submit documentation noting moisture content of timber products.

Fire performance

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire-resistance of building elements.**

1.5 INSPECTION**Notice**

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

- Subfloor before laying decking, sheet or panel flooring.
- Completion of installation.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Timber decking: Deliver to site and store on dry ground on level bearers 150 mm high, block stacked, banded and protected against the weather.

Plywood and particleboard sheet flooring: Deliver to site and store on dry ground on level bearers 150 mm high, laid flat and protected against the weather.

AAC panels: Deliver to site and store on dry ground on level bearers 150 mm high and protected against the weather. Conform to manufacturer guidelines for stacking and storage orientation (laid flat/on edge).

2.2 FIRE PERFORMANCE**Fire-resistance of building elements**

Fire-resistance level (FRL) of AAC panels: Tested to AS 1530.4 (2014).

2.3 DECKING**Recycled timber decking**

Standard: To FWPA PN06.1039 (2008).

New timber decking

Standard:

- Preservative-treated softwood to AS 4785.1 (2002) Section 4.
 - . Grade to AS 4785.2 (2002).
- Hardwood to AS 2796.1 (1999) Section 4.
 - . Grade to AS 2796.2 (2006).

Durability:

- Natural durability classification to AS 5604 (2005): Class 2 minimum.
- Preservative treatment to AS/NZS 1604.1 (2021) Table F.1: H3 minimum.
- Identification:
 - . Mark preservative-treated decking timber to AS/NZS 1604.1 (2021).

Arrises: Chamfered or round.

Compressed fibre cement decking

Standard: To AS/NZS 2908.2 (2000).

Category: Minimum 4.

Classification:

- Exterior use: Type A.

- Interior use: Type B.

2.4 SHEET FLOORING

Plywood

Standard: To AS/NZS 2269.0 (2012).

Plywood formaldehyde emission class to AS/NZS 2269.0 (2012): Class E₁.

Surface grade: CD.

Bond: Type A to AS/NZS 2754.1 (2016).

Durability:

- Preservative treatment to AS/NZS 1604.1 (2021) Table F.1:
 - . Indoors above ground: H2 minimum.
 - . Outdoors above ground: H3 minimum.
- Identification: Mark preservative-treated plywood to AS/NZS 1604.1 (2021).

Particleboard

Particleboard flooring: To AS/NZS 1860.1 (2017), Class 1.

Particleboard formaldehyde emission Class to AS/NZS 1860.1 (2017): Class E₁.

Identification: Mark particleboard flooring to AS/NZS 1860.1 (2017).

Product certification scheme

Identification: Identify timber products using branding or certification.

- Branding: Brand plywood and particleboard under the authority of a recognised product certification scheme to *0185 Timber products, finishes and treatment*, as applicable to the product. Locate the brand mark on faces or edges which will be concealed.
- Certification: Provide certification from a recognised product certification scheme to *0185 Timber products, finishes and treatment* as appropriate to the product.

Compressed fibre cement sheet

Standard: To AS/NZS 2908.2 (2000).

Category: Minimum 4.

Classification: Type: B.

2.5 AUTOCLAVED AERATED CONCRETE (AAC) PANELS

General

Requirement: Lightweight concrete floor panels manufactured from a proprietary mixture of sand, lime and cement with a gas-forming additive, and with internal welded steel reinforcing mesh, cured in an autoclave.

Standard: To AS 5146.1 (2015).

Accessories

Requirement: Accessories to the manufacturer's recommendations for the AAC panel system including the following:

- Construction adhesive.
- AAC thin bed adhesive for panel joints.
- MP bugle head and hex head screws. Conform to AS 5146.3 (2018) Table 2.13.3
- Fire-resisting and acoustic rated sealants.

3 EXECUTION

3.1 PREPARATION

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 straightedge laid in any direction with no abrupt variations greater than 1 mm over 250 mm.

Timber decking on steel joists

General: Screw fix seasoned battens to the steel joists so that their top surfaces are aligned.

- Batten size: Minimum 35 mm thick.
- Spacing of fasteners: Less than 600 mm.

3.2 FIXING DECKING

Timber decking

Standard: To AS 1684.2 (2021), AS 1684.3 (2021) or AS 1684.4 (2010) as appropriate.

Installation: Lay in long lengths with the ends of each board firmly butted to the next and firmly in contact with the joists. Stagger the end joints and locate them centrally over joists.

Minimum number of spans across supports: 3.

Nailing:

- General: Make sure the boards are in contact with the joists at the time of nailing, particularly where boards are machine nailed. If nails are to be less than 10 mm from ends of boards, pre-drill nail holes 0 to 1 mm undersize.
- Top nailing: Double nail at each bearing with hot dip galvanized or stainless steel nails driven flush. Offset nails at intermediate fixings or skew nail 10° in opposite directions.

Sealing: Apply one coat of water repellent preservative and one coat of finish coat to top surface of joists and all surfaces of boards before fixing.

Compressed fibre cement decking

General: To manufacturer's recommendations.

Installation: Lay the sheets parallel or at right angles to the joists. Locate end joints centrally over joists. Provide noggings or trimmers joists, cut between and fixed to joists to support the edges of sheets.

Minimum number of spans across support: 2.

Fixing: Pre-drill screw holes with 1 mm clearance over screw diameter and countersink. Fix with corrosion-resistant countersunk screws. Apply sealant to screw hole and screw before fixing and stop screw head with sealant, finished slightly below the surface after fixing.

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.

Composite decking

Installation: To manufacturer's recommendations.

3.3 FIXING SHEET FLOORING**Particleboard flooring**

Installation: To AS 1860.2 (2006).

Plywood flooring

Installation: To AS 1684.2 (2021), AS 1684.3 (2021) or AS 1684.4 (2010), as appropriate.

Compressed fibre cement flooring

General: To manufacturer's recommendations.

Installation: Lay the length of the sheets at right angles to the joists. Stagger the end joints and locate centrally over joists. Apply adhesive to edges of sheets and firmly butt join together.

Minimum number of spans across supports: 2.

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.

Wet area flooring: Stop screw heads with sealant.

3.4 AAC PANEL FLOORING**Standard**

General: To AS 5146.3 (2018).

Subfloor

Requirement: Conform to AS 5146.3 (2018) Table 3.4 for maximum joist spacing.

Cutting

General: Do not cut panels, except in documented locations.

Cut edges: Protect exposed reinforcing with anti-corrosion agent to manufacturer's recommendations.

AAC panel installation

Requirement: Install panels to manufacturer's recommendations and as follows:

- Minimum end bearing length: Greater of 60 mm or span / 80.
- Minimum edge bearing length: 60 mm.
- Apply construction adhesive between the panels and the joists and screw fix the panels to the joists. Conform to AS 5146.3 (2018) Section 6.
- Progressively apply AAC adhesive to joints between adjacent panels.
- Fit panels snugly together to fully bed adhesive.

Control joints

Requirement: Provide minimum 10 mm wide control joints as follows:

- Spaced at maximum 8 m centres in floors up to 100 mm thick.
- Where AAC panels abut adjacent building elements.

Slip joints

General: Provide slip joints to allow for differential movement as documented.

Sealant

Locations: Install fire-resisting and acoustic sealant as documented and as follows:

- At all control joints.
- At services penetrations.

3.5 COMPLETION**Rectification**

General: Correct any defects to joints, remove any excess joint adhesive, and leave the floor panel installation complete, clean and ready for the installation of finishes.

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.

0411 WATERPROOFING – EXTERNAL AND TANKING

1 GENERAL**1.1 RESPONSIBILITIES****Performance**

Requirements: Provide external waterproofing and tanking systems to substrates as follows:

- 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.
- Able to resist water under hydrostatic pressure.

1.2 STANDARDS**Below ground waterproofing**

Membrane design and installation: To BS 8102 (2022).

External waterproofing

Membrane materials: To AS 4654.1 (2012).

Membrane design and installation: To AS 4654.2 (2012).

Stormwater drainage

Standard: To AS/NZS 3500.3 (2021).

1.3 INTERPRETATION**Definitions**

General: For the purposes of this worksection, the definitions given in AS 4654.1 (2012) and AS 4654.2 (2012) and the following apply:

- Bitumen: A viscous material from the distillation of crude oil comprising complex hydrocarbons, which is soluble in carbon disulphide, softens when it is heated, is waterproof and has good powers of adhesion. It is produced as a refined by-product of oil.
 - . APP bitumen: Bitumen modified with atactic (meaning non-crystalline or amorphous) polypropylene wax to form a plastomeric sheet. The membrane is reinforced with fibreglass or non-woven polyester (NWP).
 - . SBS bitumen: Bitumen modified with styrene-butadiene-styrene, a thermoplastic rubber that undergoes a phase inversion at elevated temperature and converts to an elastomeric material. The membrane is reinforced with fibreglass or non-woven polyester (NWP).
- Bond breaker: 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.

- Liquid applied: A water-based formulation which cures to form an elastomeric membrane.
- Polyurethane: Water or solvent-based formulations which moisture cure to form an elastic rubber membrane.
- PVC membrane: Flexible plastic sheet membrane (vinyl).
- 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.
- Substrate: The surface to which a material or product is applied.
- Waterproofing system: Combinations of membranes, flashings, drainage and accessories which form waterproof barriers and which may be:
 - . Loose-laid.
 - . Bonded to substrates.

1.4 SUBMISSIONS**Products and materials**

Manufacturer's data: Submit product data sheets.

Type tests: Submit certificates verifying conformance to AS 4654.1 (2012) Section 2, Tables 2.1 to 2.3.

Records

General: Submit photographic records of application and protection of membranes. Label photographs with date, location and weather during application or curing.

Timing: Record at the following stages:

- After substrate preparation.
- After primer application.
- After membrane installation.
- After protection from traffic provided.

Flood tests: Submit photographic records of flooded areas and adjacent areas noted in **TESTING, Flood test**. Label photographs with date and location.

1.5 INSPECTION**Notice**

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

- Substrate preparation completed.
- Before membranes are covered up or concealed.
- After flood testing.

2 PRODUCTS**2.1 MEMBRANES****Membrane system**

Requirement: Proprietary membrane system suitable for the intended external waterproofing.

Tanking system

Requirement: Proprietary membrane system suitable for the intended below ground tanking.

2.2 ACCESSORIES

Internal roof outlets

General: Proprietary funnel shaped sump cast into the roof slab, set flush with membrane, with a removable grating and provision for sealing the membrane into the base of the outlet.

Bond breakers

Requirement: Compatible with the extensibility 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 the waterproofing system.

Adhesives

Requirement: Waterproof and compatible with the waterproofing system.

Control joint covers

Corners, crossovers, tees and bends: Factory mitred, welded and provided with 50 mm legs.

End closures: Factory folded and sealed to match joint cover profile.

Fixing hobs: Concrete or timber.

2.3 THERMAL INSULATION

Insulation boards

General: Proprietary insulation boards.

2.4 PROTECTION

Protection board

General: Proprietary rigid or semi-rigid protection board.

2.5 SLIP SHEETS

Sheet material

General: A sheet to isolate the membrane system from the supporting substrate or from the topping or mortar bed.

2.6 DRAINAGE CELL PANELS

Walls and planter bases

General: Lightweight, high strength modular drainage cell for below ground or subsoil drainage.

Filter fabric: An open weave geotextile fabric to reduce soil and fines ingress into drainage system.

3 EXECUTION

3.1 PREPARATION

Substrates

General: Prepare substrates as follows:

- Clean and remove any deposit or finish which may impair adhesion of membranes.
- Remove excessive projections.

- Fill voids and hollows in concrete substrates with a concrete mix not stronger than the substrate.
- Fill cracks in substrates wider than 1.5 mm with a filler compatible with the membrane system.
- Remove all traces of a concrete curing compound if used.

Concrete substrates: Cure for more than 28 days.

Moisture content

Requirement: Verify that the moisture content of the substrate is compatible with the water vapour transmission rate of the membrane system by testing to **TESTING, Substrate moisture tests**.

Falls

Requirement: Verify that falls in substrates are greater than 1:100.

Joints and fillets

Internal corners:

- Liquid applied membranes: Provide 15 x 15 mm 45° fillets.
 - Sheet membranes: Provide 40 x 40 mm 45° fillets.
- Fillet material: Cement or plastic.

External corners: Round or arris edges.

Control joints: Prepare all substrate joints to suit the membrane system.

Priming

Compatibility: If required, prime the substrates with compatible primers for adhesion of the membrane system.

3.2 INSTALLATION

Ambient conditions

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

Protection

Damage: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage.

Drains

General: Prevent moisture from tracking under the membranes at drainage locations.

Drains and cages: Provide removable grates or cages to prevent blockage from debris. If the finished surface is above the level of the membrane, provide a slotted extension piece to bring the grate up to the level of the finished surface.

Overflows: Apply a bond breaker to the perimeter of the overflow outlet at its junction with the surface to which the membrane will be fixed. Turn the membranes into the overflow to prevent moisture from tracking behind the membrane.

Sheet membrane joints

Orientation of laps: Lap sheets on the upslope side of the roof fall over sheets on the downslope side.

End laps generally: Stagger end lap joints.

Bituminous sheet membranes:

- Side laps: ≥ 75 mm.
- End laps: ≥ 150 mm.

- Method: Heat welded.

Synthetic rubber membranes:

- Factory-vulcanized laps: ≥ 40 mm.
- Field side laps: ≥ 50 mm.
- Field end laps: ≥ 100 mm.

PVC membranes:

- Factory-welded laps: ≥ 40 mm.
- Field-welded laps:
 - . If used over insulation boards: ≥ 100 mm.
 - . Other instances: ≥ 75 mm.

Movement and control joints

General: Install membranes to accommodate control joints in the substructure.

Bond breakers: Size to allow the membrane to accommodate movement.

Joint backing gutter: Fix a formed metal gutter to one side of the soffit directly below the joint and fall to a suitable disposal or drainage point.

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 (2012) Table A1.
- Anchoring: Secure sheet membranes along the top edge.
- Edge protection: Protect edges of the membrane.

Waterproofing above vertical upward terminations: Waterproof the structure above the termination to prevent moisture entry behind the membrane using cavity flashings, capping, waterproof membranes or waterproof coatings.

Vertical upward terminations:

- Liquid applied membranes: Terminate under an overflashing, or provide an overflashing of liquid applied membrane.
- Sheet membranes: Terminate under an overflashing, or provide a pressure seal overflashing or an overflashing fixed into a cast-in reglet.

Membrane downturns: Provide downturns for sheet membrane systems as follows:

- Roofs or similar structures: Extend minimum 100 mm from the junction of the structure.
- Balconies with a fully bonded membrane: Terminate at the drip groove.

Vertical downward terminations:

- Liquid applied membranes: Extend membrane to the underside of a horizontal return.
- Sheet membranes: Provide a pressure seal overflashing.

Horizontal terminations: Do not provide. Use vertical terminations.

Membrane penetrations

Vertical penetrations: Provide overflashing fixed to the substrate for vertical penetrations including pipes, ducts and vents.

Horizontal penetrations: Provide SBS bitumen flange to seal to membrane to rigid PVC-U conduits and pipes without burning the PVC-U. Do not use high density polyethylene (HDPE), polypropylene (PP) pipes or flexible PVC conduit.

Membrane at balcony doors and windows

Requirement: Install membrane before fixing door or window frames.

Upturn height above external finished floor level: To AS 4654.2 (2012) Table A1.

Hobless and flush thresholds: Install membrane before fixing door or window frames. Provide a continuous grated drain abutting the external face of the door or window sill.

Membrane at parapets

Requirement: Terminate membrane upturns under parapet flashing or capping with at least 75 mm overlap. Do not top fix parapet cappings. Seal heads of fasteners against capping.

Membrane at gutters

Requirement: Terminate membrane over a corrosion-resistant metal angle fixed to the gutter support substrate with the vertical leg of the angle turned down into the gutter at least 35 mm.

Membrane at post supports

Post supports fixed before membrane:

- Fix post support to substrate with countersunk fasteners and seal the perimeter of the base plate to the substrate.
- Lay out membrane sheets to minimise cuts around the post support vertical member.
- Dress the membrane closely around the post support and seal the edge of the penetration to the vertical member.
- Fix an overflashing so that any joint is staggered as much as possible relative to joints in the base membrane, and overlap at least 150 mm beyond the perimeter of the base plate.

Post supports fixed after membrane:

- Fix post support to substrate with countersunk fasteners over a waterproof resilient gasket cut to match the shape of the base plate, and seal the perimeter of the base plate to the membrane.
- Dress the overflashing closely around the post support and seal the edge of the penetration to the vertical member.
- Fix an overflashing and overlap at least 150 mm beyond the perimeter of the base plate.

Membrane to planter boxes

Membrane: Extend root-resistant membrane at least 100 mm vertically above the soil or fill level and secure.

Drainage: Grade the base of the planter to adequately sized drainage outlets and terminate the membrane in the outlets.

Drainage riser: Install a riser with drainage slots that extend from the membrane level to the top of the drainage cell. Extend the riser above the soil fill level and finish with a screw cap to provide access for drain clearing.

Protection board: Provide protection board to the full extent of the membrane including areas between soil level and the underside of flashings and cappings.

Drainage cell: Provide geo-filter fabric wrapped drainage cell to the base of the planter and turn geo-filter fabric up drainage riser at least 100 mm above drainage slots.

Cappings and flashings: Provide capping to the tops of planter walls to protect the membrane. Extend the capping to overlap the top of the protection board on the inside face of the planter wall. Where planter walls abut other walls, provide a flashing over the top of the membrane.

Membrane to below ground structures

Membrane: Externally apply membrane to all walls and return to horizontal surfaces to prevent water tracking around structure at joints and corners.

Reinforcement: Provide reinforcement to the membrane at junctions, corners and over joints to the manufacturer's recommendations.

Protection board: Provide protection board to the full extent of the membrane.

Drainage cell: Provide geo-filter fabric wrapped drainage cell to vertical surfaces of the structure.

Curing of liquid membrane systems

General: To the manufacturer's instructions.

Overlaying finishes on membranes

Compatibility: If a membrane is to be overlaid with another system such as tiles, pavers, ballast, insulation or soil, provide an overlaying system that is compatible with and will not cause damage to the membrane.

Bonded or partially bonded membranes: If the topping or bedding mortar is to be bonded to the membrane, provide sufficient control joints in the topping or bedding mortar to reduce the movement over the membrane.

Slip sheet: If the topping or bedding mortar is structurally sufficient to not require bonding to the substrate, lay a double slip sheet over the membrane to separate it from the topping or bedding mortar.

Paint coatings: If maintenance pathways are indicated by a paving paint, use a paving paint that is compatible with the membrane.

Membrane protection boards:

- Installation: Immediately after the installation of the membrane.
- Fixing: Adhere to the membrane with compatible adhesive or spot torching the membrane as appropriate.

3.3 TESTING

Substrate moisture tests

Moisture content of concrete substrate: Test substrate in-slab relative humidity to ASTM F2170 (2018). Perform three tests for the first 100 m² of subfloor area and an additional test for each additional 100 m².

Moisture content of timber, plywood and particleboard substrate: Test substrate to

AS/NZS 2098.1 (2006) for plywood substrates or to AS/NZS 1080.1 (2012) for timber and particleboard substrates.

Flood test

Application: Perform a flood test before the installation of surface finishes.

Moisture content measurement method: To

Substrate moisture tests.

Set-up:

- Measure the wall/floor junction of adjacent spaces and of the slab soffit below for dryness.
- Record the result for each area.
- Dam the access openings and seal drainage outlets.
- Provide temporary overflows of the same capacity as the outlets.
- Fill space with clean water as follows:
 - . Minimum water level: 25 mm.
 - . Maximum water level: 100 mm.
 - . Minimum dimension below perimeter flashings: 25 mm.
- Test duration: Minimum 24 hours and maximum 72 hours.

Evaluation:

- Visual test: Drain the water. After 2 hours, visually inspect the wall/floor junction of adjacent spaces and of the slab soffit below for water or moisture.
- Moisture meter test: If there is no visual evidence of water, test the same areas for dryness using a moisture meter, and compare the results to the measurements taken before flooding.

Conformance:

- Evidence of water from the visual test: Failure.
- Test results indicating an increase in moisture after flooding: Failure.
- Failure: If required, remedy defects and retest.

Records: Submit records of all flood tests.

3.4 COMPLETION

Reinstatement

Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Warranties

Requirement: 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.

0421 ROOFING – COMBINED**1 GENERAL****1.1 RESPONSIBILITIES****Ambient climatic conditions**

Design rainfall intensity (mm/h): To AS/NZS 3500.3 (2021).

Corrosion resistance

Material: To the manufacturer's recommendations for distance from marine influence.

Roof access

Type: Normal roof maintenance.

1.2 TOLERANCES**Sheet metal roofing**

Supporting members: To AS 1562.1 (2018) clause 4.2.3.

Tile roofing

Roof tiles: Dimensional tolerance to AS 2049 (2002) clause 5.2.

Battens: To AS 2050 (2018) clause 3.2.

1.3 SUBMISSIONS**Fire performance**

Combustibility: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Combustibility**.

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Operation and maintenance manuals

On completion: Submit a manual of recommendations from the roofing manufacturer or supplier for the maintenance of the roofing system including, frequency of inspection and recommended methods of access, inspection, cleaning, repair and replacement.

Products and materials

Type tests: As appropriate for the project, submit evidence of conformity to the following:

- Metal roofing generally: Roof sheeting and fastenings to AS 1562.1 (2018) clause 5.4 for resistance to concentrated loads and to AS 1562.1 (2018) clause 5.5 for resistance to wind pressures.
- Metal roofing in AS/NZS 1170.2 (2021) cyclonic regions: Roof sheeting and fastenings to AS 1562.1 (2018) clause 5.6.
- Plastic sheet roofing: Roofing and fastenings to AS 1562.3 (2006) Section 5 for resistance to wind forces and resistance to impact.
- Tile roofing: Dynamic weather resistance test to AS 4046.9 (2002).

Recycled material content: Submit documentation from the roofing material manufacturer.

Samples

Requirement: Submit samples of the following, showing the range of variation available:

- Trim and accessories with a colour finish.
- Sheet metal roofing:
 - . Sheet metal finishes.
 - . Sealants.
 - . Pre-weathered finish to sheet metal.
- Tile roofing:
 - . Bedding and pointing mortar.
 - . Tiles.

1.4 INSPECTION**Notice**

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

- Roof supports before covering up or concealing.
- Glazing products before they are installed.
- The parts of the roofing, sarking, vapour barrier, insulation and roof plumbing installation before covering up or concealing.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Storage: To the manufacturer's recommendations and as follows:

- Keep clean, dry and unexposed to weather.
- Metal roofing materials: Store away from uncured concrete and masonry, on a level base and not in contact with other materials that cause staining, denting or other surface damage.
- Sheeting: Stack flat and off the ground on at least 3 evenly placed bearers.
- Tile roofing: Store clear of the ground, protected from damage.
- Glazed roofing materials: Protect from building materials and loose debris such as wet plaster, mortar, paint and welding splatter.

Handling metal roofing materials: As follows:

- Use gloves when handling precoated metal roofing material.
- Use soft soled shoes when fixing or working on roofs.
- Protect edges and surfaces from damage. Do not drag sheets across each other or over other materials.

Handling glazed roofing material: To the manufacturer's recommendations.

Storage area conditions: Allocate a safe and trade free area.

Welded safety mesh

Standard: To AS/NZS 4389 (2015).

2.2 FIRE PERFORMANCE**Combustibility**

Glazed roofing: Tested to AS 1530.1 (1994).

Fire hazard properties

Glazing plastics: Conform to the following, tested to AS/NZS 1530.3 (1999).

- Spread-of-Flame Index: ≤ 9 .
- Smoke-Developed Index: ≤ 8 if Spread-of-Flame Index > 5 .

2.3 PROFILED SHEET METAL ROOFING

Standards

Design and materials: To AS 1562.1 (2018).

Fasteners

Requirement: Starter clips, fixing clips and fastenings to the roofing system supplier's recommendations.

Prefinished exposed fasteners: Finish with an oven baked polymer coating to match the roofing material.

Fastenings to timber battens: Fastenings long enough to penetrate the thickness of the batten without piercing the underside.

Profiled fillers

Type: Purpose-made closed cell polyethylene foam profiled to match the roofing profile.

Location: Provide profiled fillers under flashings to the following:

- Ridges.
- Eaves.
- Lapped joints in roof sheeting.

Insulation spacers

Description: Proprietary spacer system to prevent excessive compression of insulation between roof sheeting and framing.

Components

Sealant: 100% neutral cure non-acid based silicone rubber to match roofing.

2.4 ROOF TILING

Terracotta, concrete and composite roof tiling materials

Standard: To AS 2049 (2002).

Ancillaries: Provide accessories compatible with the tiles, necessary to complete the tiling.

Fasteners

Requirement: To AS 2334 (1980) for clout nails and AS 3566.1 (2002) for self-drilling screws, with durability not less than roofing materials.

2.5 GLAZED ROOFING

General

Plastic sheet roofing: To AS 1562.3 (2006).

Plastic sheet materials

Unplasticised polyvinyl chloride (PVC-U) sheet: To AS 4256.2 (2006).

Glass fibre reinforced polyester (GRP) sheet: To AS 4256.3 (2006).

Polycarbonate: To AS 4256.5 (2006).

Sealants: Neutral cure silicone or modified silane (MS) polymer based sealant to the roofing manufacturer's recommendations.

Glazing bars

Requirement: A proprietary extruded aluminium glazing bar including screw on pressure cap and snap-on capping.

Translucent panel systems

Description: Multicell polycarbonate glazing systems comprising polycarbonate panels, associated aluminium or polycarbonate connecting profiles and other framing accessories.

Extruded gaskets and seals

General: Provide seals, as documented.

Materials: Non-cellular (solid) elastomeric seals as follows:

- Rubber products: Neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC): To BS 2571 (1990), E type compounds, colour fastness grade B.

2.6 ROOF PLUMBING

General

Description: Flashings, cappings, gutters, rainheads, outlets, downpipes and accessories necessary to complete the roofing system.

Flashing and capping: Notched to match profile of roofing.

Matching fascia/arge capping: If the selected eaves gutter is a proprietary high front pattern forming part of a combined system of gutter, fascia and barge, provide matching proprietary fascias and barge cappings to roof verges and edges.

Downpipes: Prefinished or painted zincalume.

Standards

Roof drainage: To AS/NZS 3500.3 (2021).

Metal rainwater goods: To AS/NZS 2179.1 (2014).

Flashings and cappings: To AS/NZS 2904 (1995).

2.7 ROOF VENTILATORS

General

Description: A proprietary roof ventilator system including framing, fixing, trim, seals, accessories and flashings.

2.8 ROOF ACCESS

Walkway

Description: A proprietary roof walkway system including fixings.

3 EXECUTION

3.1 GENERAL

Preparation

Substrates or framing: Before fixing roofing, check the alignment of substrates or framing and adjust if required.

Flexible underlay: Check that the underlay or insulation is restrained.

Roofing: Make sure the roofing is clean and free of dust and loose particles.

3.2 INSTALLATION

Protection

General: Keep the roofing and rainwater system free of debris and loose material during construction.

Protection: Protect surfaces and finishes, including the retention of protective coatings during installation.

Thermal movement

Requirement: Allow for thermal movement in the roof installation and the structure, including movement in joints and fastenings.

Metal separation

Requirement: Prevent direct contact between incompatible metals, and between green hardwood or chemically treated timber and aluminium or coated steel, by one of the following methods:

- Applying an anti-corrosion, low moisture transmission coating to contact surfaces.
- Inserting a separation layer.

Wind regions C and D

Fixing of roof sheeting: To the manufacturer's recommendations and as follows:

- Cyclonic fasteners and washers: Galvanized steel EPDM bonded to the manufacturer's recommendations for the appropriate substrate.

3.3 PROFILED SHEET METAL ROOFING

Installation

Standard: To AS 1562.1 (2018).

Fastener type, size, corrosion resistance class, and spacing: To the sheet metal roofing manufacturer's recommendations.

Swarf: Remove swarf and other debris as soon as it is deposited.

Accessories: Provide accessories with the same finish as roofing sheets to complete the roofing installation.

Expansion joints: Provide expansion joints every 35 m in sheet length for roofs with concealed fixings and 24 m in sheet length for roofs with exposed fixings.

Pan type sheets

Removal: Install sheets so that individual sheets can be removed without damage.

Curved corrugated sheet

General: Form by rolling from material recommended for curving or bullnosing. Minimise crimping or creasing across the face of the sheet. Trim off crimped or creased edges and ends.

Ridges and eaves

Sheet ends: Treat as follows:

- Project sheets 50 mm into gutters.
- Close off ribs at bottom of sheets using mechanical means or with purpose-made fillers or end caps.
- Turn pans of sheets up at tops and down into gutters by mechanical means.
- Provide pre-cut notched eaves flashing and birdproofing if required.
- Close off ridges with purpose-made ridge fillers of closed cell polyethylene foam.

Ridge and barge

Capping: Finish off along ridge and verge lines with purpose-made ridge capping or barge rolls.

Sprung curved ridge

General: Lay the roofing sheets in single lengths from eaves to eaves by naturally curving the sheets over the ridge.

Ridge: Seal side laps at the ridge and extend the sealant to the point where the roof pitch equals the recommended pitch of the roofing profile.

End laps

General: If end laps are unavoidable, and the sheet profile is not suitable for interlocking or contact end laps, construct a stepped type lap.

3.4 TILING

Installation

Standard: To AS 2050 (2018).

Setting out: Set out the roof to give an even tile gauge in each course, with full or saw cut tiles at verges.

Bedding and pointing: Bed and point ancillary tiles, including ridges, hips and verges, in coloured mortar to match the tiles.

Tile verge: Finish the verge with cover tiles pointed to the roof tiles. Screw fix to the barge board with round head galvanized screws.

Pointed verge: Bed and point tiles on 100 x 5 mm fibre cement pointing strip.

3.5 GLAZED ROOFING

Plastic sheet roofing

Standard: To AS 1562.3 (2006).

Fixing to timber: 30 mm minimum penetration.

3.6 ROOF PLUMBING

Jointing sheet metal rainwater goods

Butt joints: Make joints over a backing strip of the same material.

Soldered joints: Do not solder aluminium or aluminium/zinc-coated steel.

Sealing: Seal fasteners and mechanically fastened joints. Fill the holes of blind rivets with silicone sealant.

Flashings

Installation: Flash roof junctions, upstands, abutments and projections through the roof. Preform to required shapes if possible. Notch, scribe, flute or dress down as necessary to follow the profile of adjacent surfaces. Mitre angles and lap joints 150 mm in running lengths. Provide matching expansion joints at 6 m maximum intervals.

Upstands: Flash projections above or through the roof with two part flashings, consisting of a base flashing and a cover flashing, with at least 100 mm vertical overlap. Provide for independent movement between the roof and the projection.

Large penetrations in low pitch roofs: Extend the base flashing over the roofing ribs to the ridge to prevent ponding behind the penetrating element.

Wall abutments: Where a roof abuts a wall, provide as follows:

- In masonry walls, planked cladding or concrete: Step in courses to the roof slope. Interleave with damp proof course, if any.
- Raking in masonry: Build into the full width of the outer leaf. Turn up and across the cavity and fix to or build into the inner leaf at least 75 mm above the roofing line.
- Raking in concrete: Turn 25 mm into joints or grooves, wedge at 200 mm centres with compatible material and point up.

Fixing to pipes: Solder or seal with neutral cure silicone rubber and secure with either of the following:

- Clamping ring.
- Proprietary flexible clamping shoe with attached metal surround flashing.

Gutters

Gutter and sump support: Provide framing and lining to support valley gutters, box gutters and sumps. Line the whole area under the gutters and sumps.

Box gutter: Prefabricate box gutters to the required section and shape as follows:

- Form stop ends, downpipe nozzles, bends and returns.
- Dress downpipe nozzles into outlets.
- Hail guards: Install grating over the whole of the box gutter, over all box gutter sumps and over the edges of roofing sheeting entering box gutters.
- Overflows: Provide overflows to prevent back-flooding. Size to pass 100% of the design rainfall. Discharge overflows in visible locations and so water does not enter the building or cause damage to the building.
- Sumps: Minimum 150 mm deep and the full width of the box gutter.

Valley gutters: Profile to suit the valley boarding. Turn back both edges 180 x 6 mm radius. Nail or screw to the valley boarding at the top end to prevent the gutter creeping downwards.

Expansion joints: Provide proprietary elastic expanding adhesive fixed type joints in guttering longer than 30 m.

Gratings: Install removable gratings over rainheads and sumps.

Leaf guard location: All gutter outlets.

External downpipes

General: Prefabricate downpipes to the required section and shape where possible. Connect heads to gutter outlets and, if applicable, connect feet to rainwater drains.

Access cover: Provide a removable watertight access cover at the foot of each downpipe stack.

- Size: Not less than the diameter of the downpipe.

Downpipe support: Provide supports and fixings for downpipes.

Internal downpipes

Access: Provide access openings as follows:

- At each junction and bend.
- At the foot of each stack.

- At every second floor level.

Acoustic insulation: Mineral fibre pipe insulation 50 mm thick, spirally bound on with 1.5 mm wire at 150 mm pitch.

Building in: If pipes are built into masonry or concrete, spiral wrap the pipe (and insulation, if any) with building paper.

3.7 TESTING

Site tests

Standard: To AS/NZS 3500.3 (2021) Section 9.

Internal downpipes: Test each stack hydrostatically in stages, each test to run over two storeys high for two hours. Remedy defects and retest if necessary.

3.8 COMPLETION

Reinstatement

Extent: Repair or replace damage to the roofing and rainwater system. If the work cannot be repaired satisfactorily, replace the whole area affected.

Damage to prepainted finish: Replace panels with scratches in the prepainted finish greater than 2 mm in width visible from the ground.

Fasteners: Make sure weathertight and external panel facings are not distorted.

Cleaning

Roofing and rainwater drainage system: Remove debris, metal swarf, solder, sealants and unused materials.

Exposed metal surfaces: Clean surfaces of substances that interfere with uniform weathering or oxidation.

Roof plumbing: Clean out spoutings, gutters and rainwater pipes after completion of roof installation.

Protection: After completion, remove protective coatings using methods to the manufacturer's recommendations.

Spares

Number: Provide one spare matching tile for every hundred on the roof. Provide spare accessories in the same ratio.

Location: Stack spares within the roof space.

Designated locations: On or next to lines of supporting walls.

Warranties

Requirement: Provide warranties for materials and workmanship in the form of interlocking warranties as follows:

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier/manufacturer.

0431 CLADDING – COMBINED**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide external wall cladding and associated work, as documented.

Corrosion resistance

Material: To the manufacturer's recommendations for distance from marine influence.

1.2 TOLERANCES**Permitted deviations**

Flat sheet and panel cladding: To the manufacturer's recommendations.

Plank cladding: 5 mm from a 1.8 m straightedge or to manufacturer's recommendations.

Profiled metal sheet cladding: To AS 1562.1 (2018) clause 4.2.3.

Structural steelwork for wall cladding: ± 5 mm between bearing planes of adjacent supports.

1.3 SUBMISSIONS**Fire performance**

Combustibility: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Combustibility**.

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire-resistance of building elements**.

Operation and maintenance manuals

General: Submit manufacturer's published use, care and maintenance requirements.

Products and materials

Type tests: As appropriate for the project, submit results of facade testing as follows:

- Water penetration to AS/NZS 4284 (2008).
- Structural testing to AS/NZS 4284 (2008).
- Resistance to wind pressure:
 - . For non-cyclone regions to AS 4040.2 (1992).
 - . For cyclone regions to AS 4040.3 (2018).
- Resistance to impact to AS/NZS 4040.5 (1996).

Samples

Finish: Submit samples of the cladding material showing the range of variation available.

1.4 INSPECTION**Notice**

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

- Framing, pliable membranes and insulation before covering up or concealing.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Store and handle materials to the manufacturer's recommendations and the following:

- Protect materials including edges and surfaces from damage.
- Keep dry and unexposed to weather.
- Do not drag sheets or panels across each other or over other materials.
- AAC panels: Stack on edge, support off the ground and level to avoid sagging and damage to ends, edges and surfaces.
- Composite panels: Store unpacked panels by size in racks and protect from scratching, warping or bending.
- Sheeting: Stack flat and off the ground on at least 3 evenly placed bearers.
- Store metal materials away from uncured concrete and masonry on a level base.
- Do not store metal materials in contact with other materials which may cause staining, denting or other surface damage.
- Use gloves when handling precoated metal cladding material.

Components

Cladding support: Provide components, as documented.

Fasteners and ties: Type, size, corrosion resistance class and spacing to the cladding manufacturer's recommendations.

Flashings: To AS/NZS 2904 (1995).

- Material: Prefinished sheet steel.

2.2 FIRE PERFORMANCE**Combustibility**

Cladding: Tested to AS 1530.1 (1994).

Fire hazard properties

Group number: To AS 5637.1 (2015).

Bonded laminated materials: Tested to AS/NZS 1530.3 (1999). Fire hazard indices, as follows:

- Spread-of-Flame Index: 0.
- Smoke-Developed Index: ≤ 3 .

Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4 (2014).

Fire-stops

Requirement: Where fire-stops and smoke flashings are placed between inner faces of the cladding and building elements (such as beam, slab or column faces), install and seal to meet fire test requirements.

2.3 AERATED AUTOCLAVED CONCRETE (AAC) PANELS**General**

Requirement: Proprietary AAC panels.

Standard: To AS 5146.1 (2015).

Joint adhesive: Proprietary adhesive to the manufacturer's recommendations.

Sealant: Flexible sealant to the manufacturer's recommendations.

2.4 COMPOSITE PANELS

General

Requirement: Proprietary non-combustible composite panels.

Panel joints and control joints: Integral.

Flexible sealant: Non-staining to the manufacturer's recommendations.

2.5 FIBRE CEMENT (FC) PLANKS

General

Requirement: Proprietary single faced fibre cement building planks.

Standard: To AS/NZS 2908.2 (2000) and the following:

- Type A Category 3.

Corners: Preformed metal joining pieces.

2.6 FIBRE CEMENT (FC) SHEETS

General

Requirement: Proprietary single faced fibre cement sheets.

Standard: To AS/NZS 2908.2 (2000) and the following:

- Type A Category 3.

Finish: Smooth and even, free of imperfections such as chips.

Sealant and bond breaking tape: To the manufacturer's recommendations.

Eaves and soffit lining

Sheets: Single faced fibre cement.

Minimum sheet thickness: 6 mm.

Joints: PVC-U extrusion.

2.7 PROFILED SHEET METAL

General

Requirement: Proprietary profiled sheet metal cladding.

Design and installation: To AS 1562.1 (2018).

3 EXECUTION

3.1 GENERAL

Preparation

Substrates or framing: Before fixing cladding, check the alignment of substrates or framing and adjust if required.

Flexible underlay: Check that the underlay or insulation is restrained.

Cladding: Make sure the cladding is clean and free of dust and loose particles.

Installation

Requirement: Install cladding as follows:

- Fix sheeting firmly against framing to the manufacturer's recommendations.

- Plumb, level, straight and to documented tolerances.

- Fixed or anchored to the building structure in conformance with the wind action loading recommendations.

- Isolated from any building loads, including loads caused by structural deflection or shortening.

- Allow for thermal movement.

Cladding layout: Cut/fabricate and install cladding to suit the layout as documented.

Protection: Protect surfaces and finishes, including the retention of protective coatings during installation.

Wind regions C and D

Cyclonic fasteners and washers: Galvanized steel EPDM bonded to the manufacturer's recommendations for the appropriate substrate.

External suspended soffits

General: Support external suspended soffits on rigid members capable of carrying the loads from imposed actions. Install members to minimise any eccentricity, and carry the positive and negative loads from wind actions through to the supporting structure.

Proprietary systems or products

Requirement: Use panels and components from a single proprietary system and install to the manufacturer's recommendations.

Accessories and trim

Requirement: Provide accessories and trim required to complete the installation, or as documented.

Corner flashing for profiled and seamed metal sheets: Finish off at corners with purpose-made folded flashing strips.

Metal separation

Requirement: Prevent direct contact between incompatible metals, and between green hardwood or chemically treated timber and aluminium or coated steel, by either of the following methods:

- Apply an anti-corrosion, low moisture transmission coating to contact surfaces.
- Insert a separation layer.

Incompatible metal fixings: Do not use.

Horizontal cladding

Horizontal cladding surface:

- Minimum slope: 1:15.
- Staining: Slope away from visible vertical facade areas to prevent staining.

Defective and damaged parts

Defective components: Do not install component parts which are defective, including warped, bowed, dented, chipped, scratched, abraded or broken members.

Damaged parts: Remove and replace damaged parts during installation.

3.2 AAC PANEL CLADDING

Installation

Standard: To AS 5146.3 (2018).

Joint adhesive: Apply to vertical and horizontal joints. Remove excess adhesive from the face after panels are butted together.

Sealant: Caulk control joints, gaps between panels and infill or penetration framing with flexible sealant.

Vertical joints: Finish flush.

Cracking: For render finishes, minimise cracking at joints to the manufacturer's recommendations.

3.3 COMPOSITE PANEL CLADDING

General

Fabrication: Factory fabricate panels and elements wherever possible.

Installation: To the manufacturer's recommendations.

Joints

Requirement: Rigidly secure joints other than movement joints. Fabricate joints to the manufacturer's recommendations or as documented.

Arrangement: Set out in even panels with joints coinciding with framing or as documented.

Control joints: To coincide with structural movement joints and as documented.

Fixing

Requirement: Mechanically fix panels to supporting frame and to the manufacturer's recommendations.

3.4 FC SHEET CLADDING

Joints

Control joints:

- Locate between the panel and fixing system and the supporting structure, as documented.
- Sheet edges: Square cut.
- Sealant: Do not apply finish coating over joint sealants.

Arrangement: Set out in even panels with joints coinciding with framing or as documented.

Fixing

General: Corrosion-resistant nails or screws to the manufacturer's recommendations.

Eaves and soffit lining: Fix at 150 mm centres to soffit bearers at a maximum of 450 mm centres.

3.5 PROFILED SHEET METAL CLADDING

General

Installation: To AS 1562.1 (2018).

Ground clearance: Maintain documented clearance.

Cutting sheets: Wherever possible, factory cut to length. Do not use an abrasion disc.

Accessories: Provide material with the same finish as cladding sheets.

Swarf: Remove swarf and other debris as soon as it is deposited.

3.6 COMPLETION

Fasteners

Requirement: Adjust for weathertightness without distortion of external panel face.

Reinstatement

Extent: Repair or replace damage to the cladding. If the work cannot be repaired satisfactorily, replace the whole area affected.

Damage to prepainted finish: Replace panels with scratches in the prepainted finish.

Cleaning

Requirement: Remove excess debris, metal swarf, solder, sealants and unused materials.

Exposed metal surfaces: Clean surfaces of substances that interfere with uniform weathering or oxidation.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Panels: Clean surfaces with soft, clean cloths and clean water to the manufacturer's recommendations.

Warranties

Requirement: Cover materials and workmanship 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.

0451 WINDOWS AND GLAZED DOORS

1 GENERAL**1.1 RESPONSIBILITIES****Performance**

Product design: Provide windows with sashes capable of being opened to satisfy the maintenance requirements, as documented.

1.2 STANDARDS**General**

Selection and installation: To AS 2047 (2014).

Glazing

Glass type and thickness: To AS 1288 (2021), if no glass type or thickness is nominated.

Materials and installation: To AS 1288 (2021).

Quality requirements for cut-to-size and processed glass: To AS/NZS 4667 (2000).

Windows and glazed doors in Northern areas

Selection and installation: To AS 2047 (2014) for the following:

- Serviceability design wind pressure: To AS 2047 (2014) Table 2.1, as appropriate for the project site conditions.
- Ultimate strength test pressure: To AS 2047 (2014) Table 2.5, as appropriate for the project site conditions.

1.3 SUBMISSIONS**Certification**

Conformance: Submit evidence that window and door assemblies conform to AS 2047 (2014).

Sealant compatibility: Submit statements from all parties to the installation certifying the compatibility of sealants and glazing systems to all substrates.

Opacified glass: Submit a report, from the manufacturer, certifying that the proposed method of opacifying the glass will not be detrimental to the glass or affect the glass product warranty.

Toughened glass: For each batch of glass, submit certification from the manufacturer of heat soaking.

Protection of openable windows: Submit a certificate of on-site fall prevention testing.

Operation and maintenance manual

Window and door assemblies: Submit the window and glazed door manufacturer's published instructions for operation, care and maintenance.

Hardware: Submit the manufacturer's published recommendations for use, care and maintenance.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS/NZS 2208 (1996) Appendix A.

Type tests: Submit results, as follows:

- Acoustic performance of windows and doors.
- Protection of openable windows.
- Wind-borne debris impact for windows, doors and screens to AS/NZS 1170.2 (2021) clause 2.5.8.

Samples

Window and door framing: Submit the following:

- Colour samples of prefinished production materials showing the limits of the range of variation in the documented colour.
- Joints made by proposed techniques.
- Sections for frames, sashes, louvres and slats.

Glazing: Submit samples of glazing materials, each at least 200 x 200 mm, showing the visual properties and range of variation, if any, for each of the following:

- Tinted or coloured glass or glazing plastics.
- Surface modified or surface coated glass.
- Patterned or obscured glass or glazing plastics.
- Ceramic-coated glass.
- Wired glass.
- Mirror glass.

Hardware and accessories: Submit samples of the following:

- Window manufacturer's standard hardware and accessories including locks, latches, handles, catches, sash operators, anchor brackets and attachments, masonry anchors and weatherseals (pile or extruded).
- Generic hardware: Submit samples of generic hardware not documented as proprietary items.

Labelling: Label each sample, with the series code reference and date of manufacture.

Shop drawings

General: Submit shop drawings, to a scale that best describes the detail, showing the following:

- Full size sections of members.
- Hardware, fittings and accessories including fixing details.
- Junctions and trim to adjoining surfaces.
- Layout (sectional plan and elevation) of the window assembly.
- Lubrication requirements.
- Methods of assembly.
- Methods of installation, including fixing, caulking and flashing.
- Provision for vertical and horizontal expansion.
- Method of glazing, including the following:
 - . Rebate depth.
 - . Edge restraint.
 - . Clearances and tolerances.
 - . Glazing gaskets and sealant beads.

Subcontractors

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

1.4 INSPECTION**Notice**

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

- Openings prepared to receive windows.
- Commencement of window installation.

2 PRODUCTS

2.1 GENERAL

Acoustic performance

Windows and doors: Rating to AS/NZS ISO 717.1 (2004), as documented.

Protection of openable windows

Fall prevention: To BCA (2022) D3D29 [BCA (2019) D2.24].

Testing: To AS 5203 (2016).

Marking

Window assemblies: To AS 2047 (2014) Section 8.

2.2 FRAMES

Aluminium frames

Standard: To AS 2047 (2014) clause 3.1.

Construction: Assembled from aluminium sections, including accessories such as pile strips, fixing ties or brackets and cavity flashings, with provision for fixing documented hardware and seals.

Subsill: If the frame includes a subsill, provide a self-draining section.

Steel frames

Standard: To AS 2047 (2014) clause 3.4.

Construction: Continuously welded from metallic-coated steel sheet sections, including accessories such as buffers, fixing ties or brackets, and cavity flashing. Provision for fixing documented hardware, seals and electronic security assemblies, and prefinished with a protective coating.

Metallic-coating class to AS 1397 (2021) interior: ZF100.

Finish: Grind the welds smooth, cold galvanize the welded joints and shop prime.

Timber frames

Standard: To AS 2047 (2014) clause 3.2.

Hardwood: To AS 2796.1 (1999):

- Grade: Select.

Softwood: To AS 4785.1 (2002):

- Grade: Select.

Construction: Assembled from timber sections, with provision for fixing documented hardware including rebates for seals, where documented.

PVC-U frames

Standard: To AS 2047 (2014) clause 3.3.

2.3 GLASS AND GLAZING

Performance

Glass: 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.

Heat soaking

Requirement: Heat soak the following:

- Toughened glass.

- Heat strengthened glass with a surface compression greater than 52 MPa tested to ASTM C1279 (2013).

Standard: To EN 14179-1 (2016).

Marking: To EN 14179-1 (2016) or certified by the manufacturer to AS 1288 (2021) clause 3.8.2.

Safety glazing materials

Standard: To AS/NZS 2208 (1996).

Type: Grade A to AS 1288 (2021).

- Certification: Required.

- Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Marking: To AS 1288 (2021) clause 5.23.

Heat strengthened glass

Requirement: Heat strengthened annealed glass that requires extra strength and thermal resistance.

Standard: To ASTM C1048 (2018).

Ceramic-coated glass

General: Heat strengthened or toughened glass with a coloured ceramic coating fused to and made an integral part of the surface to ASTM C1048 (2018), Condition B.

Opacified glass

Description: Glass with an opacifier permanently bonded to the inner face.

Insulating glass units (IGUs)

Manufacture, testing and installation: To AS 4666 (2012).

Glass thickness selection: To AS 1288 (2021).

Noise reducing glazed assemblies

Identification: Label each panel with a legible non-permanent mark, self-destroying when removed, stating and certifying the R_w rating, and identifying the testing authority. Remove when directed.

2.4 GLAZING MATERIALS

General

Requirement: Putty, glazing compounds, sealants, gaskets, glazing tapes, spacing strips, spacing tapes, spacers, setting blocks and compression wedges appropriate for the conditions of application and required performance.

Jointing materials

Requirement: Provide jointing and pointing materials to manufacturer's recommendations that 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

Sealing compound (polyurethane, polysulfide, acrylic): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compound (silicone): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compound (butyl): To ASTM C1311 (2022).

Primer

Compatibility: Apply the manufacturer's 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 that do not absorb water.

Bond breaking: Provide backing rods, and other back-up materials for sealants, that do not adhere to the sealant.

2.5 SCREENS**Fixed screens**

General: Provide fixed screens fitted to the window frames with a clipping device that permits removal for cleaning.

Hinged screens

General: Hinged at the top to give access to opening sash.

Retractable screens

General: Provide a proprietary retractable screen, comprising aluminium frame and fibreglass mesh, fitted between the guide channels incorporated in the frame, and a retraction system including tension spring, nylon bearings, positive self-locking device and plastic sealing strip at sill.

Sliding screens

General: Provide a matching aluminium head guide, sill runner, and frame stile sections for screens not part of the window frame.

Hardware: Nylon slide runners and finger pull handle. Provide pile strip closers against sash where necessary to close gaps.

Aluminium framed screens

General: Provide aluminium extruded or folded box frame sections with mesh fixing channel, mitred, staked and screwed at corners. Provide an extended frame section where necessary to adapt to window opening gear.

Mesh: Bead the mesh into the frame channel with a continuous resilient gasket, so that the mesh is taut and free of distortion.

2.6 SECURITY WINDOW GRILLES**General**

Requirement: Proprietary metal security grilles, or operable screen and frames, fixed to the building structure with tamper resistant fastenings.

Security window grilles: To AS 5039 (2008).

Screen infill material: Type III to AS 5039 (2008).

Cyclone debris screen

Location: Provide to all glazed windows and doors in Northern areas.

Requirement: Powder coat finished stainless steel screw clamped 0.9 mm strand type 304 stainless steel wire mesh screens.

2.7 ALUMINIUM FRAME FINISHES**Powder coatings**

Service condition category: To AS 3715 (2002).

Coating performance: To AAMA 2604 (2021) and AAMA 2605 (2020) as appropriate.

Anodised

Standard: To AS 1231 (2000).

Thickness:

- Internal: 15 microns.
- External: 20 microns.

2.8 OTHER MATERIAL FRAME FINISHES**Finish**

Standard: To AS 2047 (2014) clause 3.4.1.4.

2.9 ANCILLARY COMPONENTS AND FITTINGS**Trim**

General: Provide trim, shadow gaps and architraves, as documented.

Extruded gaskets and seals

General: Provide seals, as documented.

Materials: Non-cellular (solid) elastomeric seals as follows:

- Rubber products: Neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC): E type compounds, colour fastness grade B.

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 (1995).

Nylon brush seals

General: Dense nylon bristles locked into holding strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door or frame to the manufacturer's recommendations.

Pile weatherstrips

Standard: To AAMA 701/702 (2011).

Materials: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised, fixed to the frame to the manufacturer's recommendations.

Finned type: A pile weatherseal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

Weather bars

General: Provide corrosion-resistant weather bars or threshold plates for hinged external doors, located under the centres of closed doors or to manufacturer's recommendations.

2.10 HARDWARE**Hardware documented generically**

General: Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use, compatible with

associated hardware, and fabricated with fixed parts firmly joined.

Locks and latches

Standard: To AS 4145.3 (2001).

Window catches: Provide 2 catches per sash to manually latched awning or hopper sashes over 1000 mm wide.

Sliding patio doors and windows: Key-lockable patio bolts to all doors and windows.

Sash balances

Requirement: Match the spring strength of the balances to the sash weight they support.

Sash operators

Requirement: Provide sash operators, as documented.

Window restrictors

Requirement: Provide window restrictors that limit the window opening.

- Opening limit: < 110 mm and > 125 mm.

2.11 KEYING

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

Pin tumbler locks: Nickel alloy, not brass.

Lever locks: Malleable cast iron or mild steel.

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 arised.

3.2 INSTALLATION

General

Requirement: Install windows and glazed doors frames as follows:

- Plumb, level, straight and true within building tolerances.
- Fixed or anchored to the building structure in conformance with the wind action loading requirements.
- Isolated from any building loads, including loads caused by structural deflection or shortening.
- Allow for thermal movement.

Glazing

Requirement: 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.

- Watertight and airtight for external glass.

Temporary marking: Use a method which does not harm the glass. Remove marking on completion.

Toughened glass: Do not cut, drill, edge-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.

Heat absorbing glass: In locations exposed to direct sunlight, provide wheel cut edges free from damage or blemishes, with minimum feather.

Preglazing

Window assemblies and glazed doors: Supply inclusive of glazing, shop preglazed.

Site glazing

External timber framed glazing: Glaze with putty.

Weatherproofing

Flashing and weatherings: Install flashings, weather bars, threshold plates, drips, storm moulds, joint sealant and pointing to prevent water penetrating the building between the window frame and the building structure under the prevailing service conditions, including normal structural movement of the building.

Fixing

Fasteners and fastener spacing: Conform to the recommendations of the manufacturer.

Packing: Pack behind fixing points with durable full width packing.

Fasteners: Conceal fasteners.

Prepared masonry openings: If fixing of timber windows to prepared anchorages needs fastening from the frame face, sink the fastener heads below the surface and fill the sinking flush with a material compatible with the surface finish.

Joints

General: Make accurately fitted tight joints so that fasteners or fixing devices such as pins, screws, adhesives and pressure indentations are not visible on exposed surfaces.

Sealants:

- If priming is recommended, prime surfaces in contact with jointing materials.
- If frames are powder coated apply a neutral cure sealant.

Operation

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

Protection

Removal: Remove temporary protection measures from the following:

- Contact mating surfaces before joining up.
- Exposed 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. Install proprietary seals to manufacturer's recommendations and adjust correctly.

Trim

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

Insect screens

Installation: Provide insect mesh screens to all operable windows and sliding doors.

Security screens

Installation: To AS 5040 (2003) by a Police Licensed security installer.

Cyclone debris screen

Mounting: Top hung (windows) and side hung (doors), fully framed, mitred and staked to protect from side impact and insects.

- Hinge: Minimum three 70 mm fixed pin hinges for each screen.
- Hinge position: 170 to 180 mm from outer edge of screen at 500 mm centres.

Screen (surround) frame: 70 x 20 mm.

Base frame:

- Fixing: Screw fixed to the building structure, through cladding into wall framing, with 10g tamper resistant screws at 100 mm from the corners and 300 mm centres.
- Drainage points: Minimum two 20 x 5 mm (elongated) holes to prevent water pooling.
- Wire surface clearance: Provide projection so that wire clearance from glazing is not less than the rate of instantaneous deflection measured during testing, 105 mm optimum.

Screen configuration: Align with window configuration.

- Maximum panel dimension: 1200 x 1500 mm.

Gravity self-centring hook for window screens: Provide hook to hang screen from rafter or eaves when in the fully open position.

- Hook material: 6 mm galvanized steel rod.

Screen finish:

- Mesh: Black powder coat.
- Frame: Powder coat.

Marking: Provide the manufacturer's name in 3 mm high letters on the internal face of the frame, using one of the following methods:

- Embossing the frame.
- Adhesive, transparent acrylic, untearable polyester film label.

3.3 HARDWARE

Fasteners

Materials: Use materials compatible with the item being fixed and of sufficient strength, size and quality to perform their function.

- Concealed fasteners: Provide a corrosion-resistant finish.

- Exposed fasteners: Match exposed fasteners to the material being fixed.

Support: Provide appropriate back support (for example lock stiles, blocking, wall noggings and backing plates) for hardware fasteners.

- 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 pop rivets.

Proprietary window systems

Requirement: Provide the standard hardware and internal fixing points for personnel safety harness attachment, if required by and conforming to the governing regulations.

Operation

General: Make sure working parts are accurately fitted to smooth close bearings, without binding or sticking, free from rattle or excessive play, lubricated where appropriate.

Opening force performance: To AS 1428.1 (2021).

Supply

Delivery: Deliver window hardware items, ready for installation, in individual complete sets for each window set, as follows:

- Clearly labelled with the intended location.
- In a separate dust and moisture proof package.
- Including the necessary templates, fixings and fixing instructions.

3.4 COMPLETION

Hardware

Adjustment: Leave the hardware with working parts in working order, and clean, undamaged, properly adjusted, and lubricated where appropriate.

Keys

Contractor's keys: Immediately before the date for practical completion, replace cylinders to which the contractor has had key access during construction with new cylinders that exclude the contractor's keys.

Keys: For locks keyed to differ and locks keyed alike, verify quantities against key records, and deliver to the contract administrator at practical completion.

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.

Repair of finish

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

Cleaning

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 out.

Warranties

Window and door assemblies: Provide the manufacturer's published product warranties.

Hardware: Provide the manufacturer's published product warranties.

0453 DOORS AND ACCESS PANELS

1 GENERAL

1.1 STANDARDS

General

Timber and composite doors: To AS 2688 (2017).

1.2 SUBMISSIONS

Operation and maintenance manuals

Recommendations: Submit the manufacturer's published recommendations for service use.

Products and materials

Type tests: Submit results, as follows:

- Fire-resisting and smoke doorsets.
- Acoustic performance of doorsets.

Samples

General: Submit 2 samples as follows:

- Colour range from prefinished production material, including anodised or organic coated extrusions and sheet. Following the colour selection, submit 5 sets of samples showing the colour range.
- Door manufacturer's standard hardware items.
- Finishes to prepared surfaces, including timber stains or veneers.
- Joints using proposed techniques.
- Proposed sections for frames, louvres and slats.

1.3 INSPECTION

Notice

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

- Door frames in place before building in to masonry.

2 PRODUCTS

2.1 FRAMES

External doors

Requirement: Double rebated with weather gaskets and seals.

Aluminium frames

Construction: Assembled from aluminium sections, including accessories such as buffers, pile strips, strike plates, fixing ties or brackets and cavity flashings, with provision for fixing documented hardware and seals.

Threshold: If the frame includes a threshold member, provide a self- draining section with slip- resistant surface.

Steel frames

Construction: 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, seals and electronic security assemblies, and prefinished with a protective coating.

Base metal thickness (minimum):

- General: 1.1 mm.
- Fire-resisting doorsets: 1.5 mm.
- Security doorsets: 1.6 mm.

Metallic-coating class to AS 1397 (2021) interior: ZF100.

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.

Timber frames

Hardwood: To AS 2796.1 (1999):

- Grade: Select.

Softwood: To AS 4785.1 (2002):

- Grade: Select.

Joints:

- Morticed head and through tenons.
- Trenched head:
 - . Bare faced tenons on jambs.
 - . Full let-in jambs.

Construction: Assembled from timber sections, with provision for fixing documented hardware including rebates for door seals, where documented.

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 (1998).
- Wet process fibreboard (including hardboard): To AS/NZS 1859.4 (2018).
- Dry process fibreboard (including medium density fibreboard): To AS/NZS 1859.2 (2017).
- Particleboard: To AS 1859.1 (2017).
- Plywood and blockboard for interior use: To AS/NZS 2270 (2006).
- Plywood and blockboard for exterior use: To AS/NZS 2271 (2004).
- Seasoned cypress pine: To AS 1810 (1995).
- Timber – hardwood: To AS 2796.1 (1999).
- Timber – softwood: To AS 4785.1 (2002).

Identification

Panel doors: Provide panels branded under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment*, as applicable to the product. Locate the brand on faces or edges which will be concealed in the works.

Joinery doors

General: Provide joinery doors, as documented.

Flush panel doors

General: Provide flush panel doors of balanced construction, as documented.

Medium density fibreboard doors: Single thickness of moisture resistant general purpose medium density fibreboard with the same surface finish to both sides, for internal use.

Construction

General: To AS 2688 (2017).

Adhesives:

- Internal: To AS/NZS 2270 (2006).
- External: To AS/NZS 2271 (2004).

Door thickness:

- General: 35 mm.
- External doors and doors over 900 mm wide: 40 mm.

Door width: 870 mm, unless documented otherwise.

Cut-outs: If openings are required in flush panel 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.

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.

Louvre grilles: Construct by inserting the louvre blades into a louvre frame, and fix the frame into the door.

Double doors

Square edged doors: Bevel 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 where documented. Form rebates to suit standard rebated hardware.

2.3 DOORSETS

Marking and labelling

Fire-resisting doorsets: To AS 1905.1 (2015), Section 6.

Doors and doorsets: To AS 2688 (2017), clause 2.5.

Acoustic performance

Doorsets: Rating to AS/NZS ISO 717.1 (2004), as documented.

Automatic door assemblies

Standard: To AS 5007 (2007).

Control systems: To *0455 Door hardware*.

Cavity sliding doors

General: Proprietary product comprising steel and timber frame construction with rigid steel top, base and rear supporting members and incorporating the overhead door track, ball race type wheel carriages, guides, stops, split jamb linings and removable pelmet.

Duct access panels

General: Proprietary products comprising metal-faced doors side-hung to steel door frames, including hardware and accessories such as hinges and lock and installation lugs.

Fire-resisting doorsets

Standard: To AS 1905.1 (2015) and BCA (2022) Spec 12 [BCA (2019) Spec C3.4].

Floor access panels

Frame: Weld from 50 x 50 x 6 mm angle, with two 40 mm cogged fixing lugs each side and shop prime.

Covers: 6.5 mm checker floorplate, on 40 x 40 x 6 mm angle welded frame with 32 x 6 mm diagonal stiffening flats. Cut, radius and grind off 100 x 25 mm lifting slots in each end of covers.

Security screen doorsets

Standard: To AS 5039 (2008).

Screen infill material: Type III to AS 5039 (2008).

Mesh type: Type 304 stainless steel mesh with minimum 0.9 mm diameter wires.

Screen construction: Provide screens conforming to the following:

- Framing: Extruded aluminium frame.
- Mesh attachment: Fix mesh to frame with screw-clamps and anti-tamper screws. Provide screw-clamps which transfers forces around the frame so that the mesh remains intact after heavy impact.
- Finish: Powder coated. Colour of screen frame to match adjoining door frame colour.

Screen arrangement: Hinged or sliding conforming to the following:

- Allow cleaning of any fixed lights from the outside.
- Held open position: Allow for mechanisms for holding in position.
- Make sure screens are compatible with door/window system and does not interfere with its operation.

Operation and latching: From the inside with a keyless one touch locking system.

Smoke doorsets

Construction: Solid core doors not less than 35 mm thick.

Standard: To AS 6905 (2007) and BCA (2022) Spec 12 [BCA (2019) Spec C3.4]. Tested to AS 1530.7 (2007).

2.4 ANCILLARY MATERIALS**Trim**

General: Provide trim, shadow gaps and architraves, as documented.

Extruded gaskets and seals

General: Provide seals, as documented.

Materials: Non-cellular (solid) elastomeric seals as follows:

- Rubber products: Neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC): E type compounds, colour fastness grade B.

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 (1995).

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 holding strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door or frame to the manufacturer's recommendations.

Pile weatherstrips

General: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised, fixed to the door or frame to the manufacturer's recommendations.

Standard: To AAMA 701/702 (2011).

Weather bars

General: Provide corrosion-resistant weather bars or threshold plates under hinged external doors, located under the centres of closed doors or to manufacturer's recommendations.

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.
 - 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.

Aluminium frames

Building into masonry: Screw galvanized steel brackets twice to jambs and build in.

Fixing to masonry openings: Use proprietary expansion anchors and screw twice through jambs at each fixing.

Fixing to stud frame openings: Screw once to studs at each fixing.

Steel frames

Building into masonry: Attach galvanized steel rods to jambs, build in and grout up.

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.

Fixing to stud frame openings: Attach galvanized steel brackets to jambs and screw twice to studs at each fixing.

Timber frames

Building into masonry: Screw galvanized steel brackets twice to jambs and build in.

Fixing to masonry openings: Use proprietary expansion anchors and screw twice through jambs at each fixing.

Fixing to stud frame openings: Back screw twice to jambs at each fixing.

Fixing to thresholds: Dowel external door frames to thresholds other than timber with 10 mm diameter brass dowels, 100 mm long.

Heads of fasteners: Conceal if possible, otherwise sink the head below the surface and fill the sinking flush with a material compatible with the surface finish.

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. Install proprietary seals to manufacturer's recommendations and adjust correctly.

Weatherproofing

Flashings and weatherings: Install flashings, weather bars, threshold plates, 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.

Tolerances

Installation: To AS 2688 (2017) Section 7.

3.3 DOORSETS

General

Installation: To AS 2688 (2017) Section 7.

Security screen doors

Installation: To AS 5040 (2003) by a Police Licensed security installer.

Door type and location: Provide hinged and sliding security screen doors to the external face of entry door to each dwelling as follows:

- Hinged security screen doors: To the external face of each entry door to the dwelling, excluding store room.
- Sliding security screen: To glazed sliding doors.

3.4 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.

Opening force performance: To AS 1428.1 (2021).

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.

0454 OVERHEAD DOORS**1 GENERAL****1.1 STANDARDS****General**

Garage doors and other large access doors: To AS/NZS 4505 (2012).

Fire-resistant roller shutters: To AS 1905.2 (2005).

Design wind pressure: To AS/NZS 1170.2 (2021).

1.2 SUBMISSIONS**Operation and maintenance manual**

General: Submit the manufacturer's published instructions for operation, care and maintenance.

Products and materials

Manufacturer's data: Submit the manufacturer's product data sheets.

Type tests: Submit the following:

- Fire-resistance level: Verification from an Accredited Testing Laboratory of fire-resistance level.
- Acoustic performance: Verification from an Accredited Testing Laboratory of weighted sound reduction index (R_w).
- Wind-borne debris impact: Verification from an Accredited Testing Laboratory of wind-borne debris impact rating.

1.3 INSPECTION**Notice**

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

- Tracks and guides installed before doors or shutters are hung.

2 PRODUCTS**2.1 GENERAL****Door assembly**

Requirement: Proprietary system complete with the manufacturer's standard operating system, hardware, and accessories.

Marking and labelling

Garage doors and other large access doors: To AS/NZS 4505 (2012) Section 8.

Fire-resistant roller shutters: To AS 1905.2 (2005) Section 6.

2.2 SECTIONAL OVERHEAD DOORS**Panels**

Requirement: Materials and finishes, as documented.

Bottom panel: Adapted for sloping floors or threshold and fitted with a compressible PVC or neoprene seal strip.

Side tracks

Material: Roll formed galvanized steel.

Reinforcing: If required to carry door loads without distortion, reinforce horizontal track sections with a galvanized rolled steel channel.

Counterbalancing

General: Counterbalance the door by an adjustable torsion spring system connected to the door by cables of galvanized steel multi-strand wire rope, or by an equivalent system.

2.3 RIGID OVERHEAD DOORS**Panels**

Requirement: Materials and finishes, as documented.

Rigid door frame: Braced frame capable of resisting the structural design actions without distortion when the door is in both vertical and horizontal positions.

2.4 OPERATION**General**

Operation method: As documented.

Manual operation

General: Install so that the force required to operate the door manually does not exceed 220 N.

Manual method: Provide a manual door operating system incorporating the following, as documented:

- Hand stick (for high openings): By a boat hook type pole supplied with the installation.
- Chain: By pulling on a chain passing over a sprocket on the drum, with reduction gears where necessary.
- Crank handle: By a removable crank handle inserted into a gearbox mounted above the opening.
- Lockable handle: From inside and outside, attached to the door panel.

Motorised operation

General: Provide a motorised door operating system incorporating the following, as documented:

- An electric motor with limit switches, and of adequate capacity to operate the specified door smoothly and without strain.
- Overload cutout.
- Automatic safety system to stop and reverse door if obstructed while closing, or stop door if obstructed while opening.
- Photocell or IR beam safety device.
- Integrated light fixture, automatically switched on when opener is activated, and switched off by timer.
- Manual release handle to disengage door from drive mechanism in the event of a power failure.
- Operation by battery-powered radio remote controller, supplied as part of the system.
- Additional operation by push-button or key switch, located 1500 mm above floor level.

Wicket door: If a wicket is fitted to the shutter, provide a limit switch device to prevent motor operation until wicket and the frame are hinged clear of the curtain.

Accessories

General: Incorporate the following accessories, as documented:

- Light fixture.
- Radio remote transmitter.
- Push-button or key switch.
- Internet connectivity.
- Obstruction detection – for motor reversal.
- Reversing starters.
- Warning systems – speakers, flashing lights or traffic lights.
- Wall controls.
- Uninterrupted Power Supply (UPS).
- Switches and timers.

3 EXECUTION**3.1 INSTALLATION****General**

Requirement: Install overhead doors in conformance with the manufacturer's recommendations and as documented.

Preparation

Substrate: Before start of installation, check the alignment of substrates or framing and adjust if required.

Frames, guides and tracks

Requirement: Install frames, guides and tracks as follows:

- Plumb, level, straight, true, and within tolerances and clearances recommended by the manufacturer.
- Fixed or anchored to the building structure using mechanical fixings suitable for the substrate and the imposed loads.
- Isolated from any building loads, including loads caused by structural deflection or shortening.

3.2 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.

Safety: Make sure all safety features are operating.

Remote control devices: Make sure devices are programmed and operating.

Protection

Temporary coating: On or before the date for practical completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used for protection.

Warranties

General: Submit the manufacturer's published product warranties.

0455 DOOR HARDWARE**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

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.

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.

Handing: Before supply, verify on site, the correct handing of hardware items.

1.2 SUBMISSIONS**Execution details**

Door-by-door schedule: Submit a door-by-door hardware schedule.

- Information sources: This worksection and the contract drawings.

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.

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.

Operation and 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:

- Approval of a hardware sample.
- Acceptance of an equivalent to a specified proprietary item.
- A contract variation to a door hardware requirement.

Key coding system: 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.

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.

Subcontractors

Automatic door operators: Submit names and contact details of proposed manufacturer and installer.

Pressure floor mat: Submit names and contact details of proposed manufacturer and installer.

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, accessories fixings and fixing instructions.

Hardware specified generically: Hardware of the required 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.

Storage and handling

General: Store and handle to protect materials from damage, to the manufacturer's recommendations.

2.2 LOCKS AND LATCHES**General**

External hinged doors: Provide single cylinder with release snib deadlocks.

External sliding doors: Provide standard secure door lock.

Internal doors: Provide lever passage sets to all internal swing doors.

Standard

General: To AS 4145.2 (2008).

Padlocks

Standard: To AS 4145.4 (2002).

Lock and latch classification

Rating systems: To AS 4145.1 (2008) Section 3.

Performance requirements: To AS 4145.2 (2008) Section 3.

2.3 HINGES**Butt hinge materials**

Doors fitted with closers: Provide low friction ball bearing hinges.

Fire-resisting doors: To AS 1905.1 (2015).

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 allow door removal.

Timber 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: 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 (L x W x T) (mm)	Door leaf weight (kg)	Number of hinges
2040 x 400 x 35	≤ 19	2
2040 x 600 x 35	≤ 29	2
2040 x 720 x 35	≤ 35	3
2040 x 820 x 35	≤ 39	3
2040 x 920 x 35	≤ 44	3
2040 x 1020 x 35	≤ 49	4
2040 x 720 x 40	≤ 37	3
2040 x 820 x 40	≤ 42	3
2040 x 920 x 40	≤ 48	3
2040 x 1020 x 40	≤ 52	4
2040 x 720 x 50	≤ 45	3
2040 x 820 x 50	≤ 50	3
2040 x 920 x 50	≤ 57	3
2040 x 1020 x 50	≤ 68	4
2400 x 720 x 40	≤ 50	4
2400 x 820 x 40	≤ 52	4
2400 x 920 x 40	≤ 55	4
2400 x 1020 x 40	≤ 60	4
2400 x 1220 x 50	≤ 72	5
2040 x 920 x 70	≤ 88	Pivot hinges

Aluminium doors

Application: Aluminium hinges for aluminium doors, or for doors of other materials in aluminium frames of a weight of 40 kg or less.

Hinges for aluminium doors table

Nominal hinge size	Door leaf weight (kg)	Knuckles (minimum)	Screws/hinge leaf (minimum)

(L x W x T) (mm)			
100 x 70 x 3	≤ 30	3	3
100 x 80 x 3.5	≤ 50	5	4
130 x 50 x 3.4	≤ 75	Interfold	3

Length (L) is the dimension along the knuckles, not including hinge tips, if any, and width (W) is the dimension across both hinge leaves when opened flat.

2.4 DOOR HANGING SYSTEMS

General

Requirement: Provide sliding door tracks and guides, as documented.

2.5 ANCILLARIES

Bolts

General: Barrel bolts, flush bolts and tower bolts with keepers, including lock plates, staples, ferrules or floor sockets.

Extruded gaskets and seals

General: Provide seals, as documented.

Materials: Non-cellular (solid) elastomeric seals as follows:

- Rubber products: Neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC): E type compounds, colour fastness grade B.

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.

Nylon brush seals

General: Dense nylon bristles locked into holding strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door or frame to the manufacturer's recommendations.

Pile weatherstrips

General: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised, fixed to the door or frame to the manufacturer's recommendations.

Standard: To AAMA 701/702 (2011).

Rebated doors

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

Strike plates

General: Use strike plates supplied with the locks or latches. Do not provide universal strike plates.

Weather bars

General: Provide corrosion-resistant weather bars or threshold plates under hinged external doors, located under the centres of closed doors or to manufacturer's recommendations.

Door buffers and stops

Internal doors: Floor or wall mounted door buffers or stops.

2.6 DOOR CONTROLLERS

Standard

General: To AS 4145.5 (2011).

Performance

Requirement: Door controllers, pivots, floor or overhead door closers, and automatic door operators, suitable for the door type, size, weight, sliding action and swings required and the operating conditions, including wind and air conditioning pressure.

Automatic door operators

General: Complete automatic door operators for opening and closing doors, including door hanging (hinges, pivots or sliding gear) and electrical connection to distribution board.

Installation: Provide necessary recesses and core-holes, grout in components where required, and repair any damage. Provide cover plates for access to units in door heads, frames or transoms.

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 that turns on for not less than 2 minutes before switching 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.

Pressure floor mats: Automatic door activating system consisting of a mat which when deflected by foot pressure operates a switch which activates the door or doors.

Closers

Hinged and pivot doors:

- Fire-resisting doors: Closers tested and certified for use as components of fire-resisting door assemblies:
 - . Standard: To AS 1905.1 (2015).

2.7 ELECTRONIC CONTROL DEVICES

General

Requirement: Electric strikes, electric locks, drop bolts and/or similar devices to suit door construction and hardware.

Electromagnetic hold-open devices: To AS 1905.1 (2015) and AS 1670.1 (2018).

Glass doors: Tumbler, drop bolts or magnetic holders.

Double leaf doors (solid frame): Electric strike or lock on the inactive leaf, connected to the door frame by concealed flexible wiring.

Activation

Activation device: Keypads, card readers or other activation devices located next to entry points.

External: 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.

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.

Delivery of keys

Number of keys: 3 sets of keys per dwelling.

Group keying

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.

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: 900 mm to 1100 mm.

Locks

Cylinders: Fix vertically and with consistent key alignment.

Door buffers and stops

Fixing: Fix on the floor or wall, as appropriate, to prevent the door or door furniture striking the wall or other surfaces.

Fasteners

Materials: Provide materials compatible with the item being fixed, and of sufficient strength, size and quality to perform their function.

- Concealed fasteners: Provide a corrosion-resistant finish to concealed fasteners.
- Exposed fasteners: Match exposed fasteners to the material being fixed.

Security: Locate exposed fasteners 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 fasteners.

- 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 pop rivets.

Floor springs

General: Form a recess in the floor slab for the floor spring box, securely fix 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. Do not weld hinges to frames.

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.

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. Install proprietary seals to manufacturer's recommendations and adjust correctly.

Security doors

Hinges: 3 hinges with anti-tamper or steel fixed pin hinges.

- Fixing to door frame: Welded to the frame or provide hinges concealed when the door is closed.

Locksets and furniture: Provide as follows:

- Latch set with lever handles.
- Minimum 37 x 6 mm thick aluminium push bar, installed at 800 mm above the finished floor level.
- A triple action cylinder deadbolt mortice fitting lock with 2 keys.
- Restraining chain.

Closers: Provide heavy duty pneumatic door closers.

Keying: Locks keyed alike where multiple doors are fitted.

Seals: Mohair door seal to the bottom of the doors.

Marking: Mark the manufacturer's name to the top of the door, on the inside face.

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.

Opening force performance: To AS 1428.1 (2021).

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.

Warranties

Requirement: Cover materials and workmanship in the form of interlocking warranties from the manufacturer and the installer.

Automatic door operators: Provide interlocking warranties from the manufacturer and installer covering materials and workmanship.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the manufacturer and installer.

0457 EXTERNAL SCREENS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirement: Conform to the following:

- Plumb, level, straight and true within the building tolerances of the structural system.
- Undamaged and free of surface defects or distortions.
- Fixed or fastened to the building structure.
- Able to resist wind and other actions without vibration or permanent distortion.

1.2 STANDARDS

General

Aluminium framed sunscreens, awnings and shutters:

- Stress analysis of members: To AS/NZS 1664.1 (1997) or AS/NZS 1664.2 (1997).

Horizontal screen loadings: To AS/NZS 1170.1 (2002).

Electrically operated external louvres and blinds:

- Drive motors: To AS/NZS 60335.2.97 (2017).

Access for maintenance: To AS 1657 (2018).

1.3 INTERPRETATION

Abbreviations

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

- BMS: Building Management System.
- PVC-U: Unplasticised polyvinylchloride.

1.4 SUBMISSIONS

Certification

Sealant compatibility: Submit statements from all parties to the installation that certify the compatibility of sealants with screen components, finishes and all substrates.

Fire performance

Combustibility: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Combustibility.**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

Operation and maintenance manuals

Requirement: At completion, submit the screen manufacturer's recommendations for operation, care and maintenance.

Samples

General: Submit samples of the following:

- Sections proposed for frame members, louvres, accessories, cover panels and trim.
- Joints made, using proposed techniques.

- Colour samples of prefinished production material (e.g. anodised or thermoset powder coated extrusions or sheet, glazing, infill panel material or fabric), each at least 200 x 200 mm, showing the limits of the range of variation in the selected colour, if any, for each component of the screens specified.
- Accessory and hardware items documented descriptively or by performance (i.e. not proprietary items). Include handles, operators, controls, switches, sensors, motors, fixing clips, anchor brackets and attachments, fixings, gaskets and weatherseals.

Labelling: Label each sample, giving the brand and product name, manufacturer's code reference, date of manufacture and intended building location.

Shop drawings

General: Submit shop drawings to a scale that best describes the detail, calculations and specifications conveying the following information:

- Layout of the screen assembly (sectional plans, vertical sections, and elevations of each building face where screens are to be installed).
- Full size sections of typical members including mullions, transoms, subheads, sills, subsills, louvres, infill panel material or fabric, beads, bearings, linkages, exposed fixings, sealant beads, glazing gaskets, splice plates, trays and cover strips, with notes specifying the proposed materials.
- Lubrication requirements for adjustable or operable screens.
- Method of assembly, including isometric or axonometric and exploded views of typical framing junctions, showing panel to panel joints (for modular systems).
- Method of installation, including the following:
 - . Location and magnitude of reactions to be accommodated by the support structure.
 - . Type and location of fasteners and other attachments to be cast or otherwise built into the building structure.
 - . Erection tolerances.
 - . Accurate locations and full size details of machined slots, keyholes and other penetrations in frame extrusions for lifting and installing the units.
 - . Junctions and trim to adjoining surfaces.
 - . Caulking and flashing.
 - . Locations of visible heads of fasteners.
- Provision for differential vertical or horizontal movements, including the following:
 - . Thermal expansion and contraction.
 - . Frame deflections.
- Details of motor and operating mechanism enclosures.
- Method of draining the assembly, including details showing the following:
 - . Pressure equalised drained joints.
 - . Location, number and size of weepholes.

- Connection points to rainwater or stormwater systems.
- Hardware, fittings and accessories including window cleaning restraints and visible heads of fasteners.
- Infill panel stiffening.
- Location and power requirements of motors, sensors and controls.
- Wiring diagrams of control systems BMS interface details.
- Scale drawings and descriptions of prototype external screens.

Subcontractors

General: Submit names and contact details of the proposed manufacturers and, if the manufacturer is not the installer, the installers recommended by the manufacturers.

Warranties

Requirement: Submit warranties as documented.

1.5 INSPECTION

Notice

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

- Commencement of installation of screen assemblies.
- Completion of installation.

2 PRODUCTS

2.1 GENERAL

Marking

Requirement: Before the separate parts of the screens are delivered to the site, provide suitable and sufficient marks or other means for identifying each part, and for showing its correct location and orientation, when installed.

2.2 FIRE PERFORMANCE

Combustibility

Cladding: Tested to AS 1530.1 (1994).

Fire hazard properties

Bonded laminated materials: Tested to AS/NZS 1530.3 (1999). Fire hazard indices, as follows:

- Spread-of-Flame Index: 0.
- Smoke-Developed Index: ≤ 3 .

Awning, sunshade, canopy, blind or shading hood: Tested to AS/NZS 1530.3 (1999). Fire hazard indices, as follows:

- Spread-of-Flame Index: ≤ 9 .
- Smoke-Developed Index: ≤ 8 , if Spread-of-Flame Index is > 5 .

2.3 MATERIALS GENERALLY

Structural steel

Design and materials: To AS 4100 (2020).

Welding: To the AS/NZS 1554 series.

Galvanizing: To AS/NZS 4680 (2006).

Wire rope cables

Materials: Stainless steel Type 316 or galvanized steel.

Fabric

Supply: Supply fabric by a single manufacturer as part of a single batch.

Inspection: Check each roll of material for flatness, faults in the fabric and the coatings, by visual inspection in directional sunlight at a distance of 4 m and by passing the membrane over a uniformly illuminated surface.

Stitching: Use UV stabilised polyester thread with a minimum tensile strength of 180 N. Use lock type stitching with a twin needle machine.

Perimeter reinforcing: Reinforce the perimeter of each fabric panel with UV stabilised polyester rope, coated with PVC-U and incorporating pockets for the tension cables.

2.4 METAL FINISHES**Anodising**

Standard: To AS 1231 (2000).

Thickness: ≥ 15 microns to 20 microns.

Hot-dip galvanizing

Minimum coating mass/thickness: To AS/NZS 4680 (2006).

Powder coating

Application to aluminium and aluminium alloy substrates for architectural applications: To AS 3715 (2002) and as appropriate AAMA 2603 (2021), AAMA 2604 (2021) and AAMA 2605 (2020).

Application to metal substrates other than aluminium for architectural applications: To AS 4506 (2005).

2.5 FIXED PANEL TYPE SCREENS**General**

Requirement: Provide infill panel materials mounted in a metal perimeter frame or subframe as follows:

- To withstand imposed actions and wind actions for the location without failure or permanent distortion, and without panel flutter.
- To shed water without pooling.

Expansion joints

Requirement: Allow for expansion and contraction in continuous sections at spacings not exceeding the manufacturer's recommendations, or 6 m, whichever is the lesser.

Fixing: Provide a fixing system appropriate to the panel material that will retain the panel without distortion or dislocation.

Framing materials

Requirement: Frames fabricated from solid or hollow metal sections.

Fixing: Provide fastener brackets or arms mounted on the face of the building, and brace as necessary with stays, including tensile elements such as wire cables and turnbuckles.

2.6 LOUVRE TYPE SCREENS**General**

Requirement: Provide louvre screen assemblies able to withstand the ultimate design wind pressure for that location without failure or permanent distortion of members, and without blade flutter.

Expansion joints

Requirement: Allow for expansion and contraction in continuous sections (e.g. continuous louvres, interlocking mullions) at spacings not exceeding those recommended by the manufacturer, or 6 m, whichever is the lesser.

Fixed metal louvres

Requirement: Metal louvre blades mounted in a metal perimeter frame or subframe, or on carrier frames, installed horizontally or vertically.

Blades: Rolled or extruded metal, or extruded metal blades swaged together with cross bars to form self-supporting panels.

Adjustable louvres

Requirement: Adjustable louvre system including louvre blades clipped or fixed into blade holders pivoted to stiles or coupling mullions, linked together in banks, installed horizontally or vertically.

Operation: Provide an operating system, incorporating a locking or latching device for each bank of louvres.

Pergolas

Supports: Support wide horizontal louvre assemblies on posts mounted on terraces and balconies to form pergolas. Maintain the integrity of waterproofing membranes when fixing posts or brackets to terraces and balconies.

2.7 EXTERNAL SHUTTERS**Aluminium framed shutters**

Requirement: Provide aluminium extruded or folded box frame sections, mitred, staked and screwed at corners, and shutter blades.

Fixed shutter blades

Requirement: Fix shutter blades to the frames with concealed fixings.

Adjustable shutter blades

Requirement: Provide adjustable shutter blades to the frames, complete with operating bar or mechanism that rotates individual blades to the same angle and constrains them in the required position.

Hinged shutters

Requirement: Hinge shutters at the top or side, as documented. Provide a latch or lock on the frame opposite the hinge side.

Sliding shutters

Requirement: Provide matching aluminium head guide, sill runner, and frame stile sections.

Hardware: Nylon slide runners and finger pull handle. Provide pile weatherstripping against sash where necessary to close gaps.

Bushfire shutters

Requirement: To AS 3959 (2018) clause 3.7.

3 EXECUTION

3.1 FABRICATION

Aluminium fabrication and construction

Standard: To AS/NZS 1664.1 (1997) or AS/NZS 1664.2 (1997).

Fasteners

Requirement: Provide fasteners of sufficient strength and quality to perform their required function.

Joints

Requirement: Make accurately fitted tight joints so that neither fasteners nor fixing devices create pressure indentations that are visible on exposed faces. Where heads of fasteners are unavoidably visible, finish them to match the adjacent surface.

Protection

Corrosion protection: Provide protection against corrosion that may be caused in metals by products or processes normally employed on a building site or by normal atmospheric or other ambient conditions and by-products including rainwater, drinking and drinking water, airborne salt and airborne pollution.

Durability: Provide materials resistant to exposure to weather and UV radiation so that their colour, surface finish, flexibility and water resistance are maintained.

Temporary measures: Do not use adhesive tape, film or paper, or applied coatings liable to bond to the substrate, when exposed to sunlight or weather, as temporary measures to protect screen components during the course of the works. If temporary measures are used, remove all traces, particularly from contact mating surfaces before joining up.

Operation

Requirement: Provide moving parts which operate freely and smoothly, without vibration, rattling, binding or sticking, and at correct tensions or operating forces. Lubricate if appropriate.

3.2 WELDING

General

Quality: Provide finished welds descaled and free of surface and internal cracks, slag inclusion and porosity. Provide continuous welding unless permanently concealed.

Restrictions: Do not weld as follows:

- On site.
- On finished surfaces.
- Next to a finished surface or glass, unless the adjacent surface is protected from damage.

3.3 EMBEDDED FIXINGS

General

Fixing: Fix screens to the building structure by one of the following methods, and as documented:

- Fasteners cast into the concrete of the building structure. Do not displace reinforcement, when locating embedded items.

- Chemical fixings, expanding bolt sockets.
- Bolting or welding to brackets or structural framing.

Standard for embedment

For concrete: To AS 3600 (2018).

For masonry: To AS 3700 (2018).

Fixing brackets

Requirement: Provide fasteners and other methods of attachment of the screens to the structure with the following characteristics:

- Three-way adjustment to accommodate fabrication and construction tolerances.
- Provision for building movements while fixing the screens in their correct positions.
- Adequacy for structural design actions.

Protection

Cast-in items: Prevent the entry of concrete slurry into bolt holes, channels, and other openings for the fasteners. Fill the openings using an easily removed water repellent material before casting in.

Placement

Tolerance:

- Maximum deviation from correct position: 13 mm.

Fastener channels embedded parallel or perpendicular to the edge of a concrete structural member:

- Minimum length of embedded anchor: 200 mm.
- Minimum distance from the concrete edge to the nearest part of the anchor: 100 mm.

3.4 INSTALLATION

Installation tolerance

Alignment:

- Maximum deviation of any member from its true alignment (plumb, level, or line of slope): 1:1000, up to a maximum of 10 mm in a continuous run of members in one direction.
- Maximum misalignment between adjoining members: 1 mm.

Position:

- Maximum deviation of any part from its true position: 10 mm

Reference lines and marks

Requirement: Provide on each floor, in agreed locations, accurate perimeter offset reference lines, plumb with corresponding lines on other floors, and height benchmarks.

Wire rope cables

Requirement: Preload cables by cyclic loading to achieve a uniform modulus of elasticity and a linear stress/strain relationship within the working range. Use a swaging system to achieve a breaking strength of terminals not lower than the minimum design strength of the cable system.

Cleaning

Requirement: During erection, promptly remove foreign matter from the screens without damage to finishes. Do not use abrasive cleaners or acid.

3.5 COMPLETION

Cleaning

Method: Clean all visible surfaces with soft clean cloths and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty from the manufacturer.

0461 GLAZING

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Thermal qualities: U-Value and Solar heat gain coefficient (SHGC) as documented.

1.2 STANDARDS

Glazing

Glass type and thickness: To AS 1288 (2021), if no glass type or thickness is nominated.

Materials and installation: To AS 1288 (2021).

Quality requirements for cut-to-size and processed glass: To AS/NZS 4667 (2000).

1.3 SUBMISSIONS

Certification

Design: Submit an engineer's certificate confirming conformance to AS 1288 (2021).

Installation: Submit certification from the fabricator that the method of glazing, the selection of sealant systems and conditions next to the glass conform to the following:

- Compatible with the edge seal of insulating glass units (IGUs) and self-cleaning glass.
- Will not be detrimental to the long-term structural performance, weathering capabilities and visual qualities of the glass.

Glazier's data: Submit the glazing subcontractor's statement certifying the following:

- A satisfactory thermal safety assessment.
- The assembled frame provides the required glazing clearances and tolerances, and maximum and minimum joint configurations, based on the bow, warp and kink characteristics of the required glass types, and is ready for glazing.

Execution details

Site glazing: If site glazing is intended, submit proposals.

Operation and maintenance manuals

Requirement: Submit manufacturers' published recommendations for in-service use.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS/NZS 2208 (1996) Appendix A.

Samples

General: Submit samples of glazing materials, each at least 200 x 200 mm, showing specified visual properties and the range of variation, if any, for each of the following:

- Tinted or coloured glass or glazing plastics.
- Surface modified or surface coated glass.
- Patterned or obscured glass or glazing plastics.
- Ceramic-coated glass.
- Wired glass.

- Insulating glass units.
- Mirror glass.

Shop drawings

Requirement: Submit shop drawings showing the following:

- Method of glazing
- Rebate depth.
- Edge restraint.
- Clearances and tolerances.
- Glazing gaskets and sealant beads.

1.4 INSPECTION**Notice**

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

- Glass products before they are installed.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Storage: Store glass and glazing materials in a clean, dry area and unaffected by weather, to the manufacturer's recommendations. Protect from building materials and loose debris such as wet plaster, mortar, paint and welding splatter.

Handling: Handle glass to the manufacturer's recommendations.

2.2 GLASS AND GLAZING**Performance**

Glass: 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.

Heat soaking

Requirement: Heat soak the following:

- Toughened glass.
- Heat strengthened glass with a surface compression greater than 52 MPa tested to ASTM C1279 (2013).

Standard: To EN 14179-1 (2016).

Marking: To EN 14179-1 (2016) or certified by the manufacturer to AS 1288 (2021) clause 3.8.2.

Safety glazing materials

Standard: To AS/NZS 2208 (1996).

Type: Grade A to AS 1288 (2021).

Certification: Required.

- Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Marking: To AS 1288 (2021) clause 5.23.

Heat strengthened glass

Requirement: Heat strengthened annealed glass that requires extra strength and thermal resistance.

Standard: To ASTM C1048 (2018).

Insulating glass units (IGUs)

Manufacture, testing and installation: To AS 4666 (2012).

Glass thickness selection: To AS 1288 (2021).

Noise reducing glazed assemblies

Identification: Label each panel with a legible non-permanent mark, self-destroying when removed, stating and certifying the R_w rating, and identifying the testing authority. Remove when directed.

2.3 GLAZING MATERIALS**General**

Requirement: Putty, glazing compounds, sealants, gaskets, glazing tapes, spacing strips, spacing tapes, spacers, setting blocks, shims and compression wedges appropriate for the conditions of application and required performance.

Primer

Compatibility: Apply the manufacturer's recommended primer to the surfaces in contact with sealant materials.

2.4 ANCILLARY COMPONENTS AND FITTINGS**Extruded gaskets and seals**

General: Provide seals, as documented.

Materials: Non-cellular (solid) elastomeric seals as follows:

- Rubber products: Neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC): E type compounds, colour fastness grade B.

Pile weatherstrips

Standard: To AAMA 701/702 (2011).

Material: Polypropylene or equivalent pile and backing, low friction silicone treated, ultraviolet stabilised.

Finned type: A pile weatherseal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

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 arised.

3.2 INSTALLATION**Glazing**

Requirement: 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.
- Watertight and airtight for external glazing.

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.

Heat absorbing glass: In locations exposed to direct sunlight, provide wheel cut edges free from damage or blemishes, with minimum feather.

Preglazing

Window assemblies and glazed doors: Supply inclusive of glazing, shop preglazed.

Curtain walls: Supply inclusive of glazing, shop preglazed.

Site glazing

Minimum dimensional requirements: Edge clearance, edge cover, front clearance and back clearance to AS 1288 (2021).

External timber framed glazing: Glaze with putty.

3.3 COMPLETION

Replacement

Requirement: After replacing damaged glass, leave the work clean, polished, free from defects, and in good condition.

Cleaning

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 out.

Warranties

Glazing subcontractor's warranty: Provide an undertaking conditional only on compliance with the manufacturers' recommendations for maintenance, to repair or replace glass and glazing materials that become defective or prove unsuitable for the nominated application; during the warranty period.

Glass manufacturer's warranty: Provide an undertaking, conditional only on compliance with the manufacturer's recommendation for installation and maintenance, to supply replacement glass units to the site for replacement of defective units defined as follows:

- IGU units: Units in which the hermetic seal has failed as evidenced by intrusion of foreign matter, or internal condensation at temperature above 2°C.
- Coated glass units (including coated super insulating glass units): Units in which the metallic coating shows evidence of manufacturing defects, including but not necessarily limited to cracking or peeling, as determined in conformance with ASTM C1048 (2018).

Toughened glass warranty: Provide a manufacturer's warranty that toughened glass supplied for use in curtain walls has been subjected to a heat soaking process that has converted at least 95% of the nickel sulfide content to the stable beta-phase.

0467 GLASS COMPONENTS

1 GENERAL

1.1 STANDARDS

General

Materials and installation: To AS 1288 (2021).

Quality requirements for cut-to-size and processed glass: To AS/NZS 4667 (2000).

1.2 SUBMISSIONS

Certification

Barrier design: Submit a professional engineer's certificate confirming conformance with AS/NZS 1170.1 (2002) clause 3.6.

Sealant compatibility: Submit statements from all parties to the installation certifying the compatibility of sealants and glazing systems to all substrates.

Glazing: Submit 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.

Toughened glass: For each batch of glass, submit certification from the manufacturer of heat soaking.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS/NZS 2208 (1996) Appendix A.

Shop drawings

Requirement: Submit shop drawings showing the following:

- Method of glazing.
- Rebate depth.
- Edge restraint.
- Clearances and tolerances.
- Glazing gaskets and sealant beads.
- Pocket fixing details for frameless glass barriers.

Warranties

Shower screens: Submit manufacturer's and installer's warranty on completion.

Barriers: Submit manufacturer's and installer's warranty on completion.

1.3 INSPECTION

Notice

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

- Glass components before they are installed.

2 PRODUCTS

2.1 GLASS

Performance

Glass: Free from defects which detract from appearance or interfere with performance under normal conditions of use.

Heat soaking

Requirement: Heat soak the following:

- Toughened glass.
- Heat strengthened glass with a surface compression greater than 52 MPa tested to ASTM C1279 (2013).

Standard: To EN 14179-1 (2016).

Marking: To EN 14179-1 (2016) or certified by the manufacturer to AS 1288 (2021) clause 3.8.2.

Safety glazing materials

Standard: To AS/NZS 2208 (1996).

Type: Grade A to AS 1288 (2021).

Certification: Required.

- Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Marking: To AS 1288 (2021) clause 5.23.

2.2 GLAZING MATERIALS

General

Requirement: Putty, glazing compounds, sealants, gaskets, glazing tapes, spacing strips, spacing tapes, spacers, setting blocks, shims and compression wedges appropriate for the conditions of application and required performance.

Jointing materials

Requirement: Provide recommended jointing and pointing materials that 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

Sealing compound (polyurethane, polysulfide, acrylic): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compound (silicone): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compound (butyl): To ASTM C1311 (2022).

Primer

Compatibility: Apply the manufacturer's 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 that do not absorb water.

Bond breaking: Provide backing rods, and other back-up materials for sealants, that do not adhere to the sealant.

2.3 MIRRORS

Reflective surface

Type: Silver layer deposited on the glass or glazing plastic.

Protective coatings: Copper free coating, at least 5 µm thick, and 2 coats of mirror backing and edge sealing paint having a total dry film thickness of at least 50 µm.

Venetian silvered mirror (one way vision glass): 15 mm wide silvered strips alternating with 3 mm wide clear strips.

Safety glass mirrors

Type: Grade A safety glass to AS 1288 (2021).

Safety compliance: To AS/NZS 2208 (1996).

Solid backed annealed glass mirrors

Type: Annealed glass mirror with backing.

Backing: 9 mm waterproof plywood.

2.4 SHOWER SCREENS

Shower screen systems

Type: Proprietary system comprising frames of extruded aluminium, stainless steel, or PVC-U, assembled around safety glass to form fixed panels and sliding, hinged or pivoted doors.

Glass: To AS 1288 (2021) clause 5.8.

2.5 GLASS BARRIERS

Glass barrier systems

Glass in barriers: To AS 1288 (2021) Section 7.

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 arised.

3.2 INSTALLATION

Glazing

Requirement: 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.
- Watertight and airtight for external glass.

Temporary marking: Use a method which does not harm the glass. Remove marking on completion.

Toughened glass: Do not cut, drill, edge-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.

Heat absorbing glass: In locations exposed to direct sunlight, provide wheel cut edges free from damage or blemishes, with minimum feather.

3.3 FIXING MIRRORS

General

Adhesive fixing: Clean surfaces to be bonded. Apply non-acidic silicone adhesive to the manufacturer's recommendations. Secure the mirror to the substrate with double sided adhesive tape until the adhesive cures.

Screw fixing: Fix direct to wall plugs with dome-headed chromium-plated screws in each corner and at 900 mm maximum centres around perimeter. Provide polyethylene sleeves and washers to prevent contact between screw and glass. Do not over-tension the screws.

Frame fixing: Proprietary aluminium frames to mirror perimeter, corners mitred. If unbacked, bed glass edges in a continuous resilient gasket. Attach the frame to the substrate with concealed screw fixings. Seal the frame to the substrate with paintable sealant which will not react with the mirror coating. Do not allow the sealant to contact the mirror back.

Bead fixing: Rebated timber beads to mirror perimeter, corners mitred. If unbacked, bed glass edges in a continuous resilient gasket. Screw fix the beads to the substrate.

Clip fixing: Fix direct to wall plugs with chromium-plated fixed clip and spring clip fixings at 900 mm maximum centres around perimeter. If unbacked, provide polyethylene or cork washers to prevent contact between clips and mirror back.

3.4 GLAZED SHOWER SCREENS

Water shedding

Requirement: Provide an assembly which sheds water to the inside without retaining it on the frame surfaces. Seal the edge of the frame to adjoining surfaces with a resilient strip.

Sliding assemblies

Hanging: Hang the sliding sash on stainless steel or nylon sheaves on overhead channel track formed in the frame head, and fit nylon or equivalent bottom guides.

Hardware: Pull handles on both sides of sash, or of leading sash in multiple sash arrangements.

Fixing

Proprietary shower screens: To the manufacturer's recommendations.

3.5 GLASS BARRIERS

Installation

General: Install proprietary glass barrier systems to the manufacturer's recommendations.

3.6 COMPLETION

Warranties

Shower screens: Manufacturer's warranty:

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the manufacturer.

Barriers: Manufacturer's and installer's warranty:

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the manufacturer and the installer.

0471 THERMAL INSULATION AND PLIABLE MEMBRANES

1 GENERAL**1.1 INTERPRETATION****Definitions**

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

- Batts: Flexible insulation supplied as factory cut pieces and composed of mineral wool (glass and rock fibre) or polyester fibre.
- Bio-soluble: A product that dissolves in bodily fluids and is quickly cleared from the lungs.
- Blankets: Flexible insulation supplied as factory cut rolls and composed of mineral wool (glass and rock fibre) or polyester fibre, and may be combined with reflective facings.
- Fire hazard properties: To NCC (2022) Schedule 1 [NCC (2019) Schedule 3].
- Pliable building membrane: To AS/NZS 4200.1 (2017) and equivalent to sarking-type materials as defined in the NCC.
- Thermal insulation terminology: To AS/NZS 4859.1 (2018).
- Vapour permeable (breathable) membrane: A flexible membrane material, normally used for secondary waterproofing that allows for the transmission of water vapour.

1.2 SUBMISSIONS**Fire performance**

Combustibility: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Combustibility**.

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Products and materials

Thermal insulation properties: Submit evidence of conformity to AS/NZS 4859.1 (2018) and AS/NZS 4859.2 (2018).

1.3 INSPECTION**Notice**

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

- Insulation or pliable membrane materials after installation and before concealment.

2 PRODUCTS**2.1 FIRE PERFORMANCE****Combustibility**

Insulation: Tested to AS 1530.1 (1994).

Fire hazard properties

Insulation materials: Tested to AS/NZS 1530.3 (1999). Fire hazard indices as follows:

- Spread-of-Flame Index: ≤ 9 .
- Smoke-Developed Index: ≤ 8 if Spread-of-Flame Index > 5 .

Materials with reflective facing: Tested to AS/NZS 1530.3 (1999) and the recommendations of Appendix A6.

Pliable membranes: Flammability Index ≤ 5 tested to AS 1530.2 (1993).

Exposed insulation/linings: Group number to AS 5637.1 (2015).

2.2 MATERIALS**Thermal insulation**

Standard: To AS/NZS 4859.1 (2018).

Wet process fibreboard (softboard): To AS/NZS 1859.4 (2018).

Mineral wool insulation: Bio-soluble and not listed as a hazardous material in the Safe Work Australia *Hazardous Chemical Information System* (HCIS).

Pliable building membranes

Standard: To AS/NZS 4200.1 (2017).

Vapour control membranes:

- Vapour barrier:
 - . Vapour control classification: Class 1 or Class 2, as documented.
- Vapour permeable (breathable) membrane:
 - . Vapour control classification: Class 3 or Class 4, as documented.

Water control (sarking) membrane (other than walls and gables):

- Water control classification: Water barrier.

2.3 COMPONENTS**Fasteners and supports**

General: Metallic-coated steel.

Mesh support to roof insulation

Welded safety mesh: To AS/NZS 4389 (2015).

Thermal break strips

Product type: Proprietary item.

R-Value ($\text{m}^2 \cdot \text{K/W}$): ≥ 0.2 .

3 EXECUTION**3.1 GENERAL****Thermal insulation**

Requirement: To AS 3999 (2015) and BCA (2022) J4D3 [BCA (2019) J1.2].

Installation: Firmly butt together with no gaps except as follows:

- Access openings and vents: Do not obstruct.
- Light fittings: To AS/NZS 3000 (2018) clause 4.5.
- Electrical cables: To AS 3999 (2015) clause 2.6.

Glass wool and rock wool insulation: Conform to the *ICANZ Industry code of practice for the safe use of glass wool and rock wool insulation (2003)*.

Pliable building membrane

Installation: To AS 4200.2 (2017) and BCA (2022) J4D3 [BCA (2019) J1.2].

3.2 FLOORS

Under suspended framed floors

Fibre batts: Fit tightly between framing members. If other support is not provided, staple nylon twine to the framing and stretch tight.

Rigid cellular insulation boards:

- Installation: Fix to the underside of timber strip flooring. Butt tightly to joists.
- Fixing: Adhesive or mechanical fasteners.

Over suspended framed floors

Rigid cellular insulation boards:

- Installation: Over sheet flooring and between battens supporting a final flooring finish.

Below concrete slab on ground

Preparation: Sand blinding or working slab.

Rigid cellular insulation boards:

- Laying pattern: Stretcher bond, with edges tightly butted.
- Damp-proof membrane: Lay over insulation.

Over concrete slab on ground

Substrate preparation: Prepare substrate as follows:

- Clean and remove any deposit or finish which may impair adhesion or location of insulation.
- Remove excessive projections.
- Voids and hollows > 10 mm with abrupt edges: Fill with a cement:sand mix not stronger than the substrate or weaker than the bedding.

Rigid cellular insulation boards:

- Laying pattern: Stretcher bond, with edges tightly butted.
- Fixing: Adhesive fix directly to the concrete floor slab.

Under suspended concrete slab

Fibre batts:

- Fixing: Mechanical fasteners and support mesh or nylon twine.

Rigid cellular insulation boards:

- Fixing: Adhesive or mechanical fasteners.
- Joints: Apply reinforced foil tape to all joints.

3.3 WALLS

Framed walls

Fibre batts: Friction fit between framing members. If other support is not provided, staple nylon twine to the framing and stretch tight.

Thermal break strips: Provide to steel framing with lightweight external cladding:

- Screw fixing: Button head screws at 1 m centres.
- Adhesive fixing: Wallboard adhesive walnuts at 1 m centres.

Masonry veneer cavity walls

Rigid cellular insulation boards:

- Installation: Fix boards horizontally with the tongue to the top edge, pushed over prefixed wall ties and held firmly against the wall frame. Keep boards clean, dry and free from mortar and grout. Do not bridge the cavity.
- Fixing: Hex head screws at 450 mm centres.

Flashings: Install flashings before installing insulation. Prevent entry of water behind the insulation boards.

Full masonry cavity walls – external face of internal leaf

Rigid cellular insulation boards:

- Installation: Fix boards horizontally with the tongue to the top edge and firmly against the inner masonry skin. Keep boards clean, dry and free from mortar and grout. Do not bridge the cavity.
- Fixing: Proprietary plastic clips on pre-installed wall ties.

Flashings: Install flashings before installing insulation. Prevent entry of water behind the insulation boards.

Full masonry cavity walls – internal face of internal leaf

Substrate preparation: Conform to the following:

- Clean and remove any deposit or finish which may impair adhesion or location of insulation.
- Remove excessive projections and fill voids and hollows with plaster.
- Maximum surface deviation from a 2400 mm straightedge: 6 mm.

Substrate correction: Skim plaster.

Rigid cellular insulation boards:

- Installation: Fix boards horizontally with staggered vertical joints, all close butted and without crushing.
- Fixing: Proprietary adhesive compatible with the insulation. Apply sufficient pressure to evenly distribute adhesive.

Vapour permeable (breathable) membrane

Requirement: Provide a vapour permeable membrane behind external facing material that does not provide permanent weatherproofing or that may be subject to condensation forming on the internal face, including the following:

- Boards or planks fixed vertically or diagonally.
- Boards or planks fixed in exposed locations where wind driven rain can penetrate the joints.
- Unpainted or unsealed cladding.
- Masonry veneer.

Installation: Run the vapour permeable membrane horizontally on the outer face of external wall framing, over the flashing, from the bottom plate up. Pull taut over the framing and fix to framing members. Seal across the wall cavity at the top.

Horizontal laps: At least 150 mm wide, lapped to make sure water is shed to the outer face of the membrane.

End or vertical overlaps laps: At least 150 mm wide made over framing.

Openings: Run the vapour permeable membrane over the openings and leave covered until windows and doors are installed. Cut the membrane on a 45° diagonal from each corner of the opening, fold the flaps inside and fix to the inside frame of the opening. If the membrane is used to provide a continuous airtight layer, seal all joints with pressure sensitive adhesive tape.

Fixing: Install as follows:

- Timber frames: Metallic-coated clouts, 20 mm long 6 to 8 mm staples or punched multi-point metallic-coated steel brads.
- Steel or aluminium frames: Hex head screws, with either 20 mm diameter washers or through hardboard strips.
- Plywood: Alternatives:
 - . Metallic-coated clouts, 20 mm long 6 to 8 mm staples or punched multi-point metallic-coated steel brads at minimum 300 mm centres.
 - . Water based contact adhesive with a 50% adhesive cover.

3.4 CEILINGS

Cathedral ceilings

Rigid cellular insulation boards:

- Installation: Lay boards with their long edges at right angles to the rafters and with the tongue pointing up the slope. Start laying at eaves and progress towards the ridge. Cut boards and tightly fit to abutments and penetrations.
- Fixing: Secure temporarily by occasional nailing to the rafters. Fix permanently by nailing counter battens to the rafters.
- Sealing: Seal gaps with polyurethane foam.

Framed ceilings

Fibre batts: Fit tightly between framing members. If support is not otherwise provided, staple nylon twine to the framing and stretch tight.

Suspended ceilings

Fibre batts and blankets: Lay batts/blankets over the ceiling system close butted to each other and to the suspension rods.

3.5 ROOFS

General

Requirement: Provide insulation to the whole of the roof area including skylight shaft walls, except the following:

- Eaves, overhangs, skylights, vents and openings.
- Roofs to outbuildings, garages, and semi-enclosed spaces such as verandahs, porches and carports.

Mesh support to roof insulation

Requirement: Provide support to the following:

- Water control (sarking), vapour barrier or reflective thermal insulation membranes laid over roof framing members that are spaced at more than 900 mm centres.

- Blanket type thermal insulation laid over roof framing members as sound insulation to metal roofing.

Installing welded safety mesh: To AS/NZS 4389 (2015).

Metal roofs

Fibre batts: Fit tightly between framing members.

Fibre blanket for sound insulation: Install over the roof framing, reflective thermal insulation (if any), and mesh support, so that the blanket is in continuous contact with the underside of the metal roofing sheets.

Combined fibre blanket and reflective insulation: Lay facing reflective insulation face downwards over safety mesh.

Thermal break strips: Provide to steel framing supporting metal sheet roofing.

- Screw fixing: Button head screws at 1 m centres.
- Adhesive fixing: Wallboard adhesive walnuts at 1 m centres.

Waterproof membrane roofs

Preparation: Make sure membrane is clean and free of loose material. Lay separation layer over membrane with edges lapped 300 mm and turned up at upstands and penetrations.

Rigid cellular insulation boards: Lay boards in brick pattern with shiplap edges pushed together firmly, cut neatly around penetrations and extend up upstands.

Pliable building membranes

Vapour barrier: Lay over the roof framing with sufficient sag to allow the bulk insulation to achieve its full thickness. Overlap all edges 150 mm and seal all joints with pressure sensitive adhesive tape.

Water control (sarking) membrane: Provide sarking under tile roofing.

3.6 COMPLETION

Warranties

Requirement: Provide warranties for materials and workmanship warranties in the form of interlocking warranties as follows:

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the supplier/manufacturer.

0511 LINING**1 GENERAL****1.1 RESPONSIBILITIES****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 TOLERANCES**Permitted deviations**

Bearing surface of finished framing:

- Gypsum lining: To AS/NZS 2589 (2017) clause 4.2.2.
- Other lining: 4 mm from a 1.8 m straightedge.

1.3 SUBMISSIONS**Fire performance**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Samples

Prefinished panels: Minimum 300 x 600 (wide) mm panel for each finish with associated trim.

Shop drawings

General: Submit shop drawings to a scale that best describes the detail, showing the following:

- Decorative panels: Panel set-out, large scale panel fixing details, attachment devices and other components.

1.4 INSPECTION**Notice**

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

- Substrate or framing before installation of linings.
- Finished surface of installation before applying:
 - . Sealer.
 - . Finish coatings or decorative papers.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Store 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.

Certification

Timber based products: Label panels under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment*, as applicable to the product. Locate the label on faces or edges that will be concealed in the works.

2.2 FIRE PERFORMANCE**Fire hazard properties**

Group number: To AS 5637.1 (2015).

2.3 PLASTERBOARD**General**

Standard: To AS/NZS 2588 (2018).

Minimum thickness: Conform to the following:

- Generally: 10 mm.
- Improved impact resistance: 13 mm, where required by the principal.

2.4 FIBRE CEMENT**General**

Standard: To AS/NZS 2908.2 (2000).

Wall and ceiling linings: Type B category 2.

Minimum thickness: Conform to the following:

- Wall:
 - . Generally: 9 mm.
 - . Improved impact resistance: 12 mm, where required by the principal.
- Ceiling: 6 mm.

2.5 PLYWOOD AND BLOCKBOARD**General**

General interior use: To AS/NZS 2270 (2006).

Areas requiring moisture resistance: To AS/NZS 2271 (2004).

Visible surfaces with a clear finish: Veneer quality A.

Other visible surfaces: Veneer quality B.

Back/face veneer: Veneer quality C or D.

Presealed plywood: Plywood pre-sealed both sides and edges with a machine applied sealer.

2.6 PARTICLEBOARD**General**

Standard: To AS 1859.1 (2017).

2.7 WET PROCESS FIBREBOARD**General**

Hardboard, medium board and softboard: To AS/NZS 1859.4 (2018).

General purpose board

Location: Interior use generally.

Tempered (MR) board

Location: For areas with humid conditions or subject to occasional wetting.

Veneered general purpose board

Location: Timber veneer faced to one or both sides for decorative ceiling and wall lining.

Softboard

Location: Pinboards and insulation boards for roofing/ceiling, walls, partitions and doors.

2.8 DRY PROCESS FIBREBOARD (INCLUDING MEDIUM DENSITY FIBREBOARD)**General**

Standard: To AS/NZS 1859.2 (2017).

Melamine overlaid medium density fibreboard: Medium density fibreboard (STD MDF) overlaid on both sides with low pressure melamine.

2.9 METAL**General**

Atmospheric corrosivity categories C1 or C2:

Coated steel to AS 1397 (2021):

- Coating class interior: Z275.
- Coating class exterior: Z450.

Atmospheric corrosivity categories C3 or C4:

Stainless steel Type 304 or Type 316 to ASTM A240/A240M (2022).

2.10 ADHESIVES, SEALANTS AND FASTENERS**Adhesives**

For wallboards: Gunnable synthetic rubber/resin based mastic contact adhesive formulated for bonding flooring and wallboards to a variety of substrates.

Sealants

Fire-resisting sealant: Non-hardening sealant, compatible with the materials to be sealed and having a fire-resistance rating equal to that of the building element it seals.

Acoustic sealant: Non-hardening sealant compatible with the materials to be sealed.

Fasteners

Steel nails: Hot-dip galvanized.

3 EXECUTION**3.1 CONSTRUCTION GENERALLY****Conditions**

Requirement: Do not start lining work until the building or installation area is enclosed and weathertight, and all wet trades have been completed.

Preparation

Requirement: Before fixing linings, check and adjust the alignment of substrates or framing, if necessary.

Substrate: Make sure substrates are plumb, level, in true alignment and to the lining manufacturer's recommendations.

Timber, steel framing and battened masonry: To AS/NZS 2589 (2017) clause 4.2.

Pre-conditioning

General: Acclimatise timber panels in the in-service conditions for 2 to 3 weeks before installing.

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 rated 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**Installation**

Gypsum plasterboard and fibre reinforced gypsum lining: To AS/NZS 2589 (2017).

Level of finish and jointing: To AS/NZS 2589 (2017) clause 3.1.

- Generally: Level 4 minimum.
- Concealed surfaces: Level 3.

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.
- If required for penetrations for services, including mechanical grilles and lighting fixtures.
- If required to support fixtures.

Multiple sheet layers

Application: Fire-resisting and acoustic rated walls.

Joints: Fill and flush up all joints and fasteners in each layer and caulk up perimeters and penetrations before installing following 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.

3.3 FIBRE CEMENT

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.

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.
- If required for penetrations for services, including mechanical grilles and lighting fixtures.
- If required to support fixtures.

Fixing

Timber framed construction: Nail only or combine with adhesive, to manufacturer's recommendations.

Steel framed construction: Screw only or combine with adhesive, to manufacturer's recommendations.

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.

Masonry wall construction: Conform to the following:

- Direct fixing: Adhesive fix to the masonry except where lining forms a substrate for tiled finish.
- Furring channels: Fix using screw and/or adhesive.

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-resisting and acoustic rated walls.

Joints: Fill and flush up all joints and fasteners in each layer and caulk up perimeters and penetrations before installing following layers. Stagger all sheet joints by minimum 200 mm.

Joints

Joint width:

- Butt joints: 1 to 2 mm.
- Exposed 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.

- 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 TIMBER PANEL LINING

General

Installation: Set out in even panels with joints coinciding with framing members. Fit and fix panels and trim plumb, level and in true alignment of face and grain.

Fixing:

- Plywood and hardboard: Wallboard adhesive or pin fixed to timber frame, screw fixed to steel frame. Punch pin heads just below surface.
- Laminated plastic: Wallboard adhesive.

Plywood

Expansion joints: Provide a 2 to 3 mm gap at edges of linings and as follows:

- 2 to 3 mm gap at each panel joint, or
- 6 to 9 mm every 3.6 m, or
- 8 to 12 mm every 4.8 m.

Areas with an expected high level of internal moisture: Provide a gap of 4 to 6 mm every 1.2 m.

3.5 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.

3.6 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.

Warranties

Requirement: Warrant against defective materials and installation.

0522 PARTITIONS - FRAMED AND LINED

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Strength and stability: To remain stable, and without rattle and signs of deflection or permanent deformation under normal conditions of use, including the slamming of doors.

Serviceability: To support imposed dead loads, seismic loads, wind loads, including designated eccentric loads and not to deflect in excess of the following, where H is the height of the partition:

- The lesser of H/240 or 30 mm for partitions subjected to wind loads and lined with flexible material.
- The lesser of H/360 or 20 mm for partitions subjected to wind loads and lined with brittle materials.
- H/500 for eccentric loads.

1.2 TOLERANCES

Framed and lined partitions

Finished framing: To AS/NZS 2589 (2017) clause 4.2.2.

1.3 SUBMISSIONS

Certification

Installed partitions: Submit a certificate from an independent testing authority as evidence that the partition system installed conforms to the documented weighted sound reduction index (R_w).

Fire performance

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire-resistance of building elements.**

Products and materials

Manufacturer's data: Submit manufacturer's standard product literature for each system type.

Type tests: Submit results as follows:

- Impact resistance.
- Pressure resistance.
- Surface indentation resistance.
- Weighted sound reduction index (R_w): To AS/NZS ISO 717.1 (2004).

1.4 INSPECTION

Notice

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

- Set-out before installation.
- Partition framing before installation of linings and finishes.
- Completion of installation.

2 PRODUCTS

2.1 FIRE PERFORMANCE

Fire hazard properties

Group number: To AS 5637.1 (2015).

Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4 (2014).

2.2 TESTING

General

Impact resistance, lightweight partitions: To withstand impact without permanent deformation, damage, failure of fastenings.

- Test method: Use the apparatus and procedure of the sand-bag test of ASTM E695 (2003).

Pressure resistance: To withstand a uniformly distributed load normal to the plane of the partition without permanent deformation or damage or excessive deflection.

- Test method: ASTM E72 (2015).

2.3 FRAMING

Light steel framing

Requirement: Proprietary framing system of metallic-coated folded steel strip lipped studs and channel section top and bottom tracks and noggings.

Sections and members: To AS/NZS 4600 (2018).

Light timber framing

Timber species: Radiata pine.

Seasoning: Required.

Stress grade: F5 to AS/NZS 1748.1 (2011).

2.4 LININGS

Plasterboard

Standard: To AS/NZS 2588 (2018).

Fibre cement

Standard: To AS/NZS 2908.2 (2000).

Wall and ceiling linings: Type B category 2.

Minimum thickness: 4.5 mm.

Accessories

General: Accessories necessary to complete the installation including the following:

- Corner beads.
- Stop beads.
- Shadowlines.
- Control joints.
- Sheet metal and MDF partition end caps.

Adhesives

General: Adhesives of types appropriate to their purpose and substrates, applied to transmit the loads imposed without causing discolouration of finished surfaces.

Sealants

General: Sealant types appropriate for the partition's documented acoustic rating and fire-resistance level, and compatible with partition materials and building substrate.

2.5 AUTOCLAVED AERATED CONCRETE (AAC) PANELS

General

Requirement: Lightweight concrete partition panels manufactured from a proprietary mixture of sand, lime and cement with a gas-forming additive, and with internal welded steel reinforcing mesh, cured in an autoclave.

Standard: To AS 5146.1 (2015).

Accessories

Requirement: Accessories to the manufacturer's recommendations for the AAC panel system including the following:

- Base angle.
- Deflection head track.
- Steel top hat.
- Mortar.
- Fire-resisting and acoustic rated sealant.
- Panel joint adhesive.
- AAC thin bed adhesive for panel joints.

2.6 PLENUM BAFFLES

General

Requirement: Plenum baffles that maintain the documented fire-resistance level and acoustic performance of the partitions.

Types

Bulk insulation: Layers of bulk insulation batts compressed between the top of the partition and the slab soffit.

Impregnated vinyl: Lead impregnated vinyl sheeting hung as a curtain from the slab soffit.

Plasterboard: Plasterboard sheets bonded together (if more than one layer).

3 EXECUTION

3.1 GENERAL

Preparation

Substrate: Prepare the substrate to receive the partitions.

Carpet: Fix bottom tracks over polyethylene film. Prevent carpet threads from pulling if drilling or installing fasteners.

Protection

General: Protect existing work from damage during the installation and rectify any damage. Provide temporary coverings if required.

Set-out

General: Set out the partition grid on the centreline of framing members, and to coincide with the ceiling grid and other major building grid, as applicable.

3.2 INSTALLATION

Partition erection

General: Install partitions plumb, level, on their correct alignment, and firmly fixed.

Building movements:

- Provide clearances or deflection heads so that partitions are not damaged by structural building movements including long-term slab deflection.
- If fire-resistance levels or acoustic ratings are required, provide a resilient foam or mastic seal with properties equal to those required for the partition.

Suspended slabs: Provide deflection heads.

Structural floor control joints

General: Do not run or fix partitions framing across control joints.

Acoustic rated partitions

General: Isolate the frames from floors, ceilings and vertical abutments with beads of non-hardening sealant compatible with the materials to be sealed.

Trim

General: Provide trim such as beads, mouldings, stops and skirtings to make neat junctions between lining components, finishes and adjacent surfaces.

Sealing fire-resisting and acoustic rated partitions

General: 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.

3.3 LIGHT STEEL FRAMES

Tracks

General: Conform to the following:

- Fix bottom tracks to floor substrate.
- Fix top wall tracks to suspended ceiling grid or as documented.
- Fix deflection head tracks to the structural soffit above.

Fixing to masonry: Provide masonry anchors of expansion or chemical grout type. Do not use explosive-driven fastenings.

Fixing to metal deck roofs: Provide for vertical uplift movement, as documented.

Fixing to suspended ceilings: Provide intermediate support and bracing at maximum 1500 mm centres and at all load concentrations, doorways and jamb studs.

Seismic movement: If required, do not butt wall tracks or deflection heads against each other. Provide 10 mm clearance between tracks, or as documented.

Track fixing: Fix top and bottom tracks at 600 mm maximum centres generally, and 100 mm from ends. Splice plates at ends to maintain continuity and alignment.

Stud framing

General: Provide studs in single lengths without splices. Rotate intermediate studs into tracks for friction fixing. Screw fix jamb studs, corner studs and wall intersection studs to tracks.

Fixing: Fix noggings at 1350 mm maximum centres vertically and as required for skirtings and wet area lining. Make sure that faces of noggings and studs are accurately aligned.

Lintels: Install a stiffened top plate lintel for spans of 1800 mm or greater.

Curved partitions

Stud spacing: Conform to the sheeting manufacturer's recommendations for curved partitions.

Jams

General: Install boxed double studs at jams and heads to all openings.

Additional frame support

General: Provide frame support for fixing the following:

- Floor and wall mounted fixed joinery units, furniture and equipment.
- All wet area fittings and fixtures.
- All grabrails and handrails.

Timber nogging: Provide 240 x 40 mm timber nogging with proprietary stud fixing brackets for wall-hung sanitary fittings.

Stud stiffening: Provide stud stiffening to support wall-hung joinery units and equipment with:

- Full height close fitting timber inserts.
- Boxed steel lipped studs.

Stud service holes

General: Use factory pre-cut flared holes, or provide site cut holes punched or drilled on the centreline of the member and fit proprietary plastic bushes or grommets. Splice additional stiffening to studs if site cut service holes exceed 1/3 the depth of the member.

Metal separation

General: Isolate non-ferrous service pipes and accessories from the metal framing.

Earthing

Permanent earthing: Required.

Temporary earthing: Provide temporary earthing during erection until the permanent earthing is installed.

Cavity walls

General: If bridging is nominated, provide to the manufacturer's recommendations.

Staggered stud framed walls

General: Provide studs staggered at 300 mm centres set in oversized top and bottom plates so that each face has stud fixings at 600 mm centres.

3.4 LIGHT TIMBER FRAMES

Moisture content

General: Do not install framing that does not meet the following values tested to AS/NZS 1080.1 (2012):

- Air conditioned buildings: 8 to 10%.
- Intermittently heated buildings: 10 to 12.5%.
- Unheated buildings: 12 to 15%.

Framing

General: Construct wall frames to AS 1684.4 (2010) Section 6, as appropriate for internal walls.

Double faced walls: Provide gauged timbers in studs, noggings and plates.

3.5 AUTOCLAVED AERATED CONCRETE (AAC) PANELS**Support framing**

General: Install deflection head track and base angle to building structure, with mechanical fasteners at maximum 600 mm centres.

Cutting

General: Cut panels as required for recommended clearance between top of panel and structural soffit, and where panels abut columns and adjacent construction.

Cut edges: Protect exposed reinforcing with anti-corrosion agent to manufacturer's recommendations.

AAC panel installation

General: Install panels to manufacturer's recommendations and as follows:

- Minimum 35 mm into the deflection head track.
- Secure into the base angle.
- Progressively apply panel adhesive to vertical joints between adjacent panels.
- Fit panels snugly together to fully bed adhesive.

Standard: To AS 5146.3 (2018).

Control joints

General: Provide minimum 10 mm wide control joints as follows:

- Spaced at maximum 6 m centres in continuous partition runs.
- Where AAC panels abut adjacent building elements.

Sealant

Locations: Install fire-resisting and acoustic sealant as documented and as follows:

- At both sides of deflection head track at junction with structural soffit.
- At all control joints.
- At services penetrations.

3.6 PLASTERBOARD**Installation**

Gypsum plasterboard and fibre reinforced gypsum lining: To AS/NZS 2589 (2017).

Level of finish and jointing to AS/NZS 2589 (2017) clause 3.1:

- Generally: Level 4 minimum.
- Concealed surfaces: Level 3.

Multiple sheet layers

Application: Fire-resisting and acoustic rated partitions.

Joints:

- Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before installing following layers.

- Stagger all sheet joints: Minimum 200 mm.

Joints and joint treatment

General: Install joint accessories as documented, in conformance with manufacturer's recommendations. Install plumb, level and true to line.

Flush joints: Use joint reinforcing tape bedded in joint compound with recessed edge sheets and finish flush.

Butt joints: Make joints over framing members or provide back blocking.

External corner joints: Bed purpose fabricated perforated metallic-coated steel corner beads in joint compound.

Ceiling junctions: Install purpose fabricated perforated metallic-coated steel shadowline to top of partition.

Sheet metal partition end caps: Provide purpose fabricated perforated metallic-coated steel end caps, sized for partition thickness and bedded in joint compound.

MDF end caps: Provide recessed edge sheets and finish flush using joint reinforcing tape and joint compound.

Dry joints: Provide square edged sheet and finish with a PVC-U joining section.

Control joints: Provide purpose-made perforated metallic-coated control joint beads at not more than 12 m centres in partitions and to coincide with structural control joints. Bed in joint compound.

Wet areas: Provide additional supports, flashings, trim and sealants as required.

Joints in tiled areas: Bed reinforcing tape in joint compound. Do not apply a topping coat.

3.7 FIBRE CEMENT**Installation**

General: Install as follows:

- Run sheets across the framing members.
- In flush jointed applications, stagger end joints in a brick pattern and locate joints on framing members, away from the corners of large openings.
- Provide supports at edges and joints.
- Do not fix to top and bottom plates or noggings.

Timber framing: Nail only or combined with adhesive.

Steel framing: Screw only or combined with adhesive.

Tiled and wet 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. Do not use adhesive fixing alone.

Multiple sheet layers

Application: Fire-resisting and acoustic rated partitions.

Joints:

- Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before installing following layers.
- Stagger all sheet joints: Minimum 200 mm.

Joints and joint treatment

General: Install joint accessories as documented, in conformance with manufacturer's recommendations. Install plumb, level and true to line.

Flush joints: Use joint reinforcing tape bedded in joint compound with recessed edge sheets and finish flush.

External corner joints: Bed purpose fabricated perforated metallic corner beads in joint compound.

Ceiling junctions: Install purpose fabricated perforated metallic-coated steel shadowline to top of partition.

Sheet metal partition end caps: Provide purpose fabricated perforated metallic-coated steel end caps, sized for partition thickness and bedded in joint compound.

MDF end caps: Provide recessed edge sheets and finish flush using joint reinforcing tape and joint compound.

Dry joints: Use 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.
- 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 reinforcing tape in joint compound. Do not apply a topping coat.

- Control joints: At maximum 4.2 m centres and spaced 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.

3.8 PLENUM BAFFLES

Baffles

General: Install plenum baffles tightly butted to building structure, service ducts, pipes and conduits and to the top of the partition or to the top of the suspended ceiling directly above the line of the partition. Seal joints, penetrations and intersections and maintain the required performance.

Bulk insulation: Install individual layers to fill space between building structure and the top of the partition or the top of the suspended ceiling.

Flexible sheet insulation: Fix to soffit through a continuous furring channel, hang to meet the top of the partition and extend horizontally 900 mm over the suspended ceiling.

Fire-resisting partitions

General: If a suspended ceiling of equivalent fire-resistance is not provided, either extend the partitions to the underside of the structural soffit, or provide plenum baffles of equivalent fire-resistance level.

Acoustic rated partitions

General: If a suspended ceiling of equivalent sound insulation rating is not provided, either extend the partitions to the underside of the structural soffit, or provide acoustic rated plenum baffles. The ceiling and baffle to provide a combined rating equivalent to the partition rating.

3.9 COMPLETION

Rectification

General: Correct any defects to joints, remove any excess joint compound, and leave the partition installation complete, clean and ready for the application of finishes.

Warranties

Requirement: Warrant against defective materials and installation.

0531 SUSPENDED CEILINGS – COMBINED**1 GENERAL****1.1 STANDARDS****General**

Suspended ceilings: To AS/NZS 2785 (2020).

1.2 TOLERANCES**Suspension system**

Flatness, twist, winding and bow: 1.5 mm deviation from a 1.5 m straightedge placed in any position.

Deflection: To AS/NZS 2785 (2020) Table 2.4.5.

Setting out and levelling: To AS/NZS 2785 (2020) Appendix D.

Sheeted or flush ceiling suspension system

Suspension system bearing surface for flush lined ceiling: To AS/NZS 2589 (2017) Table 4.2.2.

Deflection: To AS/NZS 2589 (2017) Table 3.5.1.2.

1.3 SUBMISSIONS**Fire performance**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire-resistance of building elements.**

Operation and maintenance manuals

General: On completion, submit manufacturer's recommendations for the care and maintenance of the ceiling, and operating instructions for demounting, if applicable.

Products and materials

Type tests: Submit results as follows:

- Weighted suspended ceiling normalized level difference: To AS/NZS ISO 717.1 (2004).
- Weighted sound absorption coefficient: To AS ISO 11654 (2002), as tested to AS ISO 354 (2006).
- Weighted sound reduction index: To AS/NZS ISO 717.1 (2004).

1.4 INSPECTION**Notice**

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

- The suspension system before the installation of lining.
- The ceiling assembly before the installation of fittings and site painting, if applicable.
- The completed ceiling.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Store suspended ceiling components in a dry and secure area, and to the manufacturer's recommendations.

2.2 FIRE PERFORMANCE**Fire hazard properties**

Group number: To AS 5637.1 (2015).

Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4 (2014).

2.3 SUSPENSION SYSTEM**Ceiling suspension system**

Consistency: Provide ceiling systems as complete proprietary systems, fabricated by one manufacturer.

Materials

Coated steel: To AS 1397 (2021).

Aluminium: To AS/NZS 1866 (1997).

Protective coatings for steel components: To AS/NZS 2785 (2020) Appendix F.

Protection against atmospheric corrosion: To AS 2312.1 (2014) and AS/NZS 2312.2 (2014).

2.4 LININGS**Plasterboard and fibre cement sheeting**

Requirement: To *0511 Lining*.

Sealants

Fire-resisting sealant: Non-hardening sealant compatible with the materials to be sealed and having a fire-resistance rating equal to that of the building element it seals.

Acoustic sealant: Non-hardening sealant compatible with the ceiling materials and rated to R_w 65.

2.5 TRIM**General**

Trim: Provide trim consistent with the materials and finishes of the ceiling system.

Accessories

General: Provide accessories as part of the proprietary ceiling system necessary to complete the installation.

3 EXECUTION**3.1 GENERAL****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 structural control joints. Do not bridge structural control joints.

Prefinishes

General: Repair damaged prefinishes by recoating.

3.2 SUSPENSION SYSTEM**Suspension system**

General: Fix suspension system to the structural soffit.

Support members: Install 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.
- Allow for access for maintenance of services.

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.

Grid members: If required, notch grid members at the junction with the perimeter trim to make sure the ceiling units lay flat on the perimeter trim.

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.
- If services obstruct the ceiling supports, provide bridging and suspension on each side of the services.
- Do not support services terminals on ceiling units.

Bracing

General: Provide bracing to prevent lateral movement and to resist the imposed horizontal seismic force.

Bulkheads

General: Integrate bulkheads with the ceiling structure and brace to prevent lateral movement. If the ceiling is terminated at a bulkhead, provide for seismic requirements.

External suspended soffits

General: Support external suspended soffits on rigid members capable of carrying the loads from imposed actions. Install members to minimise any eccentricity, and carry the positive and negative loads from wind actions through to the supporting structure.

Fasteners

General: Provide concealed fasteners. If material supporting hangers is less than 3 mm thick, do not use screw fasteners.

3.3 PLASTERBOARD**Installation**

Gypsum plasterboard and fibre-reinforced gypsum plaster: To AS/NZS 2589 (2017).

Level of finish and jointing: To AS/NZS 2589 (2017) clause 3.1.

Suspended flush ceilings: Fix using screws or screws and adhesive to ceiling members or support frame.

Multiple sheet layers

Application: Fire-resisting and acoustic rated ceilings.

Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before installing following 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 and movement joints: Align lining control joints with structural movement joints and as follows:

- Ceilings:
 - . Internal: At maximum 12 m centres.
 - . External: At maximum 6 m centres.
- Control joint beads: Purpose-made metallic-coated.
- Seismic joint: Purpose-made flexible joint and cover.
- Location: Position joints to intersect light fixtures, vents or air diffusers, as required.

Wet areas: Install additional supports, trim and sealants, as required.

3.4 FIBRE CEMENT

Installation

General: 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.

Suspended flush ceilings: Fix using screws or screws and adhesive to ceiling members or support frame.

Multiple sheet layers

Application: Fire-resisting and acoustic rated ceilings.

Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before installing following layers. Stagger all sheet joints by minimum 200 mm.

Joints

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.

Non-set joints: Provide square edge joint with metal or socket strip backing.

Control and movement joints: Align lining control joints with structural movement joints, in accordance with the manufacturer's recommendations and as follows:

- Control joint beads: Purpose-made metallic-coated.
- Seismic joint: Purpose-made flexible joint and cover.
- Support: Provide framing parallel to the joint on each side. Do not fix the lining to abutting building surfaces.
- Location: Position joints to intersect light fixtures, vents or air diffusers, as required.

Wet areas: Install additional supports, trim and sealants, as required.

3.5 ACCESS PANELS

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.

3.6 TRIM

General

Trim: Install trim at junctions with other building elements and surfaces, including walls, beams and

penetrations, consistent with the materials and finishes of the ceiling system.

Accessories

General: Install accessories as part of the proprietary ceiling system necessary to complete the installation.

Plasterboard cornices

Fixing: Mitre at corners and adhesive fix with cornice cement. Pin in place at cornice edges until adhesive sets, remove pins and fill holes.

Fibrous plaster cornices and roses

Fixing: Pin or prop in place and fix with wet gypsum plaster and scrim straps over framing members.

Fire-resisting walls

Requirement: Seal to soffit with sealant with an equivalent fire-resistance level before fixing decorative cornices, if any.

3.7 COMPLETION

General

Exposed surfaces: Touch up shop applied finishes and restore damaged or marked areas.

Cleaning: Clean completed surfaces

Debris and unused material: Remove from site.

Spares

General: Provide spare matching ceiling components, as follows, and store the spare materials on site where directed:

- Supporting system: One spare supporting member (hanger or framework member) for every 100 members or part thereof of the same type installed in the ceiling.
- Accessories: One spare of each type for every 50 units or part thereof installed in the ceiling.

Warranties

Requirement: Provide warranties for materials and workmanship in the form of interlocking warranties from the supplier and the installer.

Form: Against failure of materials and execution under normal environment and conditions of use.

0551 JOINERY**1 GENERAL****1.1 TOLERANCES****General**

Requirement: Fabricate and install joinery items to substrates undamaged, plumb, level, straight and free of distortion.

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

1.2 SUBMISSIONS**Operation and maintenance manuals**

General: Submit manufacturer's published recommendations for service use.

Products and materials

Manufacturer's data: Submit manufacturer's product data.

Proprietary items: Submit the manufacturer's standard drawings and details showing:

- Methods of construction.
- Assembly and fixing, with dimensions and tolerances.

Samples

General: Submit samples as follows:

- Boards: Two of each type, complete with finish and edge stripping.
- 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.
- Timber veneer: Provide three variants, two samples of each variant showing maximum expected variation.
- Fabric: Two swatches of each type.
- Stainless steel items: Two of each type.
- Timber bench cupboard door: One sample, complete with hardware.
- Drawer front: One sample, complete with hardware.

- Timber stair, balustrade and handrail: One finished sample.

Clear finished timber: Submit samples as follows:

- Initial submission:
 - . Veneered board: Three samples each 600 x 600 mm for each species.
 - . Solid timber: Three samples each 40 x 19 x 600 mm for each species.
- Control sample: The approved selection from the initial submission.
- Finished sample: Cut the control sample in half and apply the finish to half the remaining area.

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.
- Stone benchtop layout including joint arrangement and penetrations.
- Locations of sanitary fixtures, stoves, ovens, 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.

Subcontractors

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

1.3 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.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.
- Completion of installation.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

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. Store in an adequately ventilated space away from heat and direct sunlight. 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 (1999).

Hardwood for furniture: To AS 2796.3 (1999).

Seasoned cypress pine: To AS 1810 (1995).

Softwood for trim: To AS 4785.1 (2002).

Softwood for furniture: To AS 4785.3 (2002).

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 finished sizes apply.

Plywood

Interior use generally: To AS/NZS 2270 (2006).

Interior use, exposed to moisture: To AS/NZS 2271 (2004).

Visible surface with a clear finish: Veneer quality A.

Other visible surfaces: Veneer quality B.

Wet process fibreboard (including hardboard)

Standard: To AS/NZS 1859.4 (2018).

Particleboard

Standard: To AS 1859.1 (2017).

Melamine overlaid particleboard: Particleboard overlaid on both sides with low pressure melamine.

Dry process fibreboard (including medium density fibreboard)

Standard: To AS/NZS 1859.2 (2017).

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 (2017).

Certification

Timber based products: Label panels under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment*, as 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 (2006) and AS/NZS 2271 (2004).

Reconstituted wood-based panel formaldehyde emission class: To the AS/NZS 1859 series.

High-pressure decorative laminate (HPDL) sheets

Standard: To AS/NZS 2924.1 (1998).

Minimum thickness: Conform to the following:

- 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, including to studs: 3.0 mm.
- For edge strips: 0.4 mm.

Splashbacks

Ceramic tiles: Glazed ceramic tiles to AS 13006 (2020).

Glass: 6 mm toughened colourback safety glass to AS/NZS 2208 (1996).

Edging

Cupboards and drawers: 2 mm ABS.

2.3 VENEERS

Timber veneer

Requirement: Provide veneers slip matched and flitch batched and falling within the visual range of the approved samples.

Veneer quality: To AS/NZS 2270 (2006).

Minimum grade:

- Select grade, veneer quality A, for visible surfaces to have clear finish or to have no coated finish.
- General purpose grade, veneer quality B, for other visible surfaces.

Vinyl veneer

Type: Proprietary unbacked vinyl fabric factory-bonded to the designated surface.

2.4 JOINERY ASSEMBLIES

General

Standard: To AS 4386 (2018).

Plinths

Material:

- Exterior general purpose plywood.
- High moisture resistant particleboard.
- High moisture resistant medium density fibreboard.

Thickness: 16 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.

Fasteners: Conceal with finish.

Installation: Scribe to floor and secure to wall to provide level platform for carcasses.

Carcasses

Material:

- Overlaid high moisture resistant particleboard.
- Overlaid high moisture resistant medium density fibreboard.

Thickness: 16 mm.

Joints:

- 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.

Fasteners: Conceal with finish.

Installation: Secure to walls at not more than 600 mm centres.

Drawer fronts and doors

Material:

- 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 or 900 mm maximum width.

Drawer fronts: Rout for drawer bottoms.

Drawer backs and sides

Material: PVC film wrapped particleboard.

Thickness: 12 mm.

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.

Drawer and door hardware

Hinge types: Concealed metal hinges with the following features:

- Nickel plated.
- Adjustable for height, side and depth location of door.
- Integrated soft and self-closing action.
- Hold open function.

Piano hinges: Chrome plated steel, extending full height of doors.

Slides: Metal runners and plastic rollers with the following features:

- 30 kg loading capacity.
- Integrated soft and self-closing action.
- Closure retention.
- White thermoset powder coating or nickel plated.

2.5 WORKING SURFACES

Laminated benchtops

Finish: High-pressure decorative laminated sheet.

Balance underside: Extend laminate to the undersides of benchtops.

Installation: Scribe to walls. Fix to carcass at least twice per 600 mm length of benchtop.

Joint sealing: Fill joint with sealant matching finish and clamp with proprietary mechanical connectors.

Stone benchtops

General: Provide 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.

Material: Re-constituted stone.

Minimum thickness: 20 mm.

2.6 OTHER MATERIALS

Tactile ground surface indicators

Tactile ground surface indicators to stairs: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 JOINERY

General

Joints: Provide materials in single lengths where 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.

Fixing to substrate: Fix joinery units to substrates as follows:

- Floor mounted units: 600 mm centres maximum.
- Wall mounted units: To each nogging and/or stud stiffener.

Fasteners: Screws with washers into timber or steel framing, or masonry anchors.

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 or substrate 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.

Glass splashbacks

Adhesive: 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 TIMBER STAIRS**Set-out**

General: Set out stair rod to give uniform risers and uniform treads respectively in each flight.

Fabrication

Closed strings: Trench for treads and risers.

Cut strings: Profile for treads and risers. Mitre riser ends.

Treads: Arris nosings to a pencil round. Return nosings at cut strings. Groove for riser tongue in closed rise stair. Set rise 19 mm back from nosing.

Nosing strip: To BCA (2022) D3D14 [BCA (2019) D2.13] and BCA (2022) D3D15 [BCA (2019) D2.14].

Top tread: Flush with finished floor, otherwise to match stair treads. Provide similar tread section as nosing to floor edges around stairwell.

Risers: Tongue to tread. Mitre to string in cut string stairs.

Installation

General: Glue joints in internal work. In closed rise stairs, wedge treads and risers to strings. Plant 2 glue blocks behind each tread to riser junction. Trim floors to carry ends of stairs and around stair well.

Stair bolts (to open rise close string stairs): Provide 8 mm diameter mild steel stair bolts, one at each end and one at centre of flight, transversely between strings. Draw strings tight against ends of treads.

Fascia: Provide fascia of depth sufficient to overlap 19 mm below ceiling, fixed to floor joists hard up under nosing.

Trim: Provide beads and mouldings as necessary, including a scotia or similar planted under the tread nosing against the risers and cut strings, a bead between wall strings and wall, and a bead behind the fascia over the ceiling finish.

Soffit lining: Fix to 38 x 38 mm nailing battens notched and nailed to the underside of treads and risers of closed riser stairs at the centre of flights and at each side.

3.3 TIMBER BALUSTRADES**General**

Requirement: Provide balustrading to stair and landing, consisting of newels, handrail, balusters, and associated mouldings.

Newels

General: Halve and bolt to strings. Turn tops to detail.

Handrails

Installation: Install handrails on edge, stubbing tenon to newels.

Bullnose arrises: 13 mm radius.

Balusters

Installation: Stub tenon to handrail at top and to tread or floor at bottom.

Spacing: At 100 mm centres.

3.4 TRIM**General**

Requirement: Provide trim such as architraves, beads, mouldings, stops and skirtings to make neat junctions to openings and between lining components, finishes and adjacent surfaces. Provide paint finish to skirtings.

Fixing

To masonry walls: Screw with wall plugs at 600 mm centres maximum.

To stud walls: Nail to plate or framing at 600 mm centres maximum.

3.5 COMPLETION**Protection**

Timber treads: Provide full timber or plywood casing.

Cleaning

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.

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary protective coatings.

0552 METALWORK - FABRICATED

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Undamaged, plumb, level and straight or as documented.
- Free of surface defects or distortions or as documented.

1.2 STANDARDS

General

Access for maintenance: To AS 1657 (2018).

Structural design actions: To AS/NZS 1170.1 (2002).

1.3 TOLERANCES

General

Requirement: ± 2 mm from design dimensions.

1.4 SUBMISSIONS

Operation and maintenance manuals

General: Submit manufacturer's published recommendations for service use.

Products and materials

Proprietary items: Submit the manufacturer's standard drawings and details showing:

- Methods of construction.
- Assembly and fixing, with dimensions and tolerances.

Stainless steel: For each batch of stainless steel supplied to the works, submit a certificate of conformance or test certificate, as documented.

Stainless steel welding: Before fabrication commences, submit evidence of qualification of the welding procedure by testing to AS/NZS 1554.6 (2012) clause 4.7 or evidence of prequalification to AS/NZS 1554.6 (2012) clause 4.12.

Shop drawings

General: Submit shop drawings to a scale that best describes the detail, showing the following information:

- Overall and detail dimensions.
- 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.

Subcontractors

General: Submit names and contact details of proposed suppliers, fabricators 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.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Requirement: Store and handle fabricated metalwork, as follows:

- Deliver to site in unbroken wrapping or packing.
- Store on a level base, away from uncured concrete and masonry and areas of wet plaster.
- Do not store in contact with other materials that may cause staining, denting or other surface damage.
- Use gloves when handling precoated finishes.
- Keep storage time to minimum by delivering items only when required for installation.

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.

2.2 MATERIALS

Metals and components

Performance: Provide metals and components in quantity, lengths and cross-sections of strength and stiffness suited to their required function and as documented.

Stainless steel

Plate, sheet and strip: To ASTM A240/A240M (2022).

Bar: To ASTM A276/A276M (2017).

Tube: To ASTM A554 (2021).

Aluminium

Plate sheet and strip: To AS/NZS 1734 (1997)

Bar, rod and wire: To AS/NZS 1865 (1997).

Tube: To AS/NZS 1867 (1997).

Aluminium alloys, compositions and designations: To AS 2848.1 (1998).

Steel

Steel plate: To AS/NZS 3678 (2016).

Hot rolled bars and sections: AS/NZS 3679.1 (2016).

Welded sections: To AS/NZS 3679.2 (2016).

Fasteners

Performance: Provide fasteners to resist galvanic corrosion in materials of structural and mechanical

strengths and corrosion resistance at least equal to that of the lowest resistant metal in the connection.

Materials: Provide fasteners as follows:

- To copper and copper alloys: Copper or copper- alloy fixing devices only.
- To aluminium and aluminium alloys: Aluminium alloy or non- magnetic stainless steel fixing devices only.
- To stainless steel: Appropriate stainless steel materials only.

2.3 OTHER MATERIALS

Tactile ground surface indicators

Tactile ground surface indicators to stairs: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Aluminium structures

Standard: To AS/NZS 1664.1 (1997) or AS/NZS 1664.2 (1997).

Metals

Incompatible metals: Separate using concealed layers of suitable materials in appropriate thicknesses.

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 deforming the cross-section and the material thickness.

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.

Joints

General: Fit joints to an accuracy appropriate to the class of work. Finish visible joints made by cutting, drilling, 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 or as documented.

Splicing

General: Provide structural members in single lengths.

3.2 WELDING AND BRAZING

Welding

Quality: Provide finished welds which are free of surface and internal cracks, welding slag, and porosity.

Corners and edges: Grind smooth sharp, marred, or roughened corners and edges.

Rough surfaces: Deburr and grind smooth.

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/NZS 1554.1 (2014) Section 6, AS/NZS 1554.6 (2012) Section 6 or AS/NZS 1665 (2004) Section 6, as appropriate.

Brazing

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

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

3.3 STAINLESS STEEL FABRICATION

Welding stainless steel

Qualification of welders: To AS 1796 (2022).

Riveting

General: Use 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 FIXED STEEL LADDERS

Assembly

Materials, design and construction: To AS 1657 (2018).

Fixing: Fix ladder stiles securely to the building structure at tops and bottoms of flights, and at intermediate points.

3.5 RETRACTABLE CEILING ACCESS STAIR

General

Retractable access stair: A proprietary system, pre-assembled and fixed in place, comprising the following:

- Retractable ladder.
- Infill frame and ceiling panel.
- Handrails, if required.

3.6 STEEL PLATFORMS AND WALKWAYS

General

Steel platforms and walkways: Rooftop mesh platform system for mounting of equipment, comprising the following:

- Frame: Proprietary or structural engineer designed, in aluminium or galvanised structural steel.
- Deck: Slip-resistant, expanded galvanised steel or aluminium mesh.
- Roof connectors: Proprietary or to structural engineer's details.
- Associated access stairs, handrails and balustrades, including toe boards.

3.7 BALUSTRADES

Fabrication

Method: Welding.

Joints: Produce smooth unbroken surfaces at joints. Scribe the joints between posts and rails. Make end-to-end joints over an internal sleeve.

Bends: Make changes of direction in rails by evenly curved pipe bends.

Free ends: Seal the free ends of pipes with fabricated or purpose-made end caps.

Fixing to structure

General: Provide fabricated predrilled or purpose-made brackets or post bases, and attach the piping to the building structure with fixings, including bolts into masonry anchors, and coach screws or bolts into timber, of metal compatible with the piping.

Galvanizing

General: If possible, complete fabrication before galvanizing; otherwise apply a zinc-rich primer to affected joint surfaces.

Other protective coatings

General: Apply other protective coatings as documented and to the manufacturer's recommendations.

3.8 PROPRIETARY BALUSTRADES

General

Balustrades: A proprietary system, pre-assembled and fixed in place, comprising the following:

- Posts, rails and balusters.
- Infill frame and panels.
- Handrails, if required.

3.9 CORNER GUARDS

Guards

General: Where projecting corners of the structure require protection from mechanical damage, provide metal corner guards as follows:

- Consisting of rolled angle sections or sections fabricated from metal sheet bent to the radius or angle of the corner.
- Fitting close to adjoining surface finishes.
- Solidly grouted up at the back as necessary to eliminate voids.
- Securely fixed by a method which does not cause distortion in the guard surface, and consists of either concealed built in lugs, or flush countersunk head fixings into appropriate anchors.

3.10 COMPLETION

Cleaning

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of coatings used as temporary protection.

0572 MISCELLANEOUS FIXTURES AND APPLIANCES

1 GENERAL**1.1 SUBMISSIONS****Operation and maintenance manuals**

General: Submit the manufacturers' data as follows:

- Recommendations for demounting and relocation.
- Recommendations for service use, care and maintenance.
- List of manufacturers and suppliers for replacement parts.

Products and materials

Manufacturer's drawings: Submit the manufacturer's standard drawings and details showing methods of construction, assembly and fixing, with dimensions and tolerances, connection method for all removable components.

Subcontractors

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

2 PRODUCTS**2.1 GENERAL****Waste bins**

Type: Prefinished proprietary products manufactured from metals or plastics in standard sizes and colours.

2.2 APPLIANCES**Cooking appliances**

Oven: Stainless steel, electric, fan-forced, under bench or wall oven, as documented.

- Dimension: Minimum 600 mm wide.

Cooktop: Provide one of the following:

- Gas cooktop: Where reticulated gas is available, provide minimum 4 burners, stainless steel, gas cooktop.
- Electric cooktop: Where reticulated gas is not available, provide minimum 4 zone, ceramic glass, electric cooktop.

Rangehoods: Provide fixed or retractable rangehood, flued to the outside, and with removable filters.

Exhaust fans

Kitchen, bathroom and laundry: 250 mm diameter.

2.3 EXTERNAL FIXTURES**Clothes drying facilities**

Single dwellings: Provide individual clothesline for each dwelling.

- Type: Height adjustable fold down wall mounted clothes hoist.

Grouped and multiple dwellings: Provide a wall or post mounted fold down framed clothesline or wall

mounted extendable clothesline to private external areas.

Letterboxes

Type: Proprietary metal letter box with corrosion-resistant, weatherproof body, weather protected letter slot, lockable hinged door, house or unit number, and accessories necessary for correct installation.

Standard: To AS 4253 (2019).

3 EXECUTION**3.1 GENERAL****Letterboxes**

Requirement: Where Australia Post provides a postal service, provide letterboxes conforming to the requirements of Australia Post, and as follows:

- Dwellings with street frontage: One numbered and lockable letterbox each.
- Other dwellings: Banks of letterboxes.

Keys: Upon completion, provide 2 sets of keys per letterbox.

3.2 COMPLETION**Warranties**

Requirement:

- Manufacturer's warranty against defects in workmanship.
- Installer's warranty against defects in installation.

0573 FIRE EXTINGUISHERS AND BLANKETS**1 GENERAL****1.1 SUBMISSIONS****Products and materials**

Requirement: Submit evidence of suitability for use, to NCC (2022) A5G1 [BCA (2019) A5.0], for all fire protection products.

2 PRODUCTS**2.1 EXTINGUISHERS****Portable fire extinguishers**

General: To AS/NZS 1841.1 (2007).

Type:

- Water: To AS/NZS 1841.2 (2007).
- Wet chemical: To AS/NZS 1841.3 (2007).
- Foam: To AS/NZS 1841.4 (2007).
- Powder: To AS/NZS 1841.5 (2007).
- Carbon dioxide: To AS/NZS 1841.6 (2007).
- Non-rechargeable: To AS/NZS 1841.8 (2007).

Selection, location and distribution: To AS 2444 (2001).

2.2 BLANKETS**Fire blankets**

General: To AS/NZS 3504 (2006).

Selection and location: To AS 2444 (2001).

3 EXECUTION**3.1 INSTALLATION****Fire fighting equipment**

Standard: Installation to AS 2444 (2001).

Signage: Provide signs to **STATUTORY SIGNS** in *0581 Signage*.

3.2 COMPLETION**Routine service**

Portable fire extinguishers: To AS 1851 (2012) Section 10.

Fire blankets: To AS 1851 (2012) Section 11.

0574 WINDOW COVERINGS**1 GENERAL****1.1 SUBMISSIONS****Fire performance**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

1.2 INSPECTION**Notice**

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

- Building locations or substrates prepared to receive window coverings before installation.

2 PRODUCTS**2.1 FIRE PERFORMANCE****Fire hazard properties**

Windows coverings: Tested to AS/NZS 1530.3 (1999).

2.2 MATERIALS**Fabrics**

Uncoated woven and knitted fabrics: To AS 2663.1 (1997).

- Performance classification (minimum): 2.

Coated woven and knitted fabrics: To AS 2663.2 (1999).

- Performance classification (minimum): 2.

Holland blind fabrics: To AS 2663.3 (1999).

2.3 COVERING TYPES**Holland blinds**

Requirement: Complete proprietary systems, as documented, fabricated by one manufacturer.

3 EXECUTION**3.1 INSTALLATION****General**

Requirement: Install window coverings using the manufacturer's fabricated mounting brackets, clips or tracks and other hardware. Install coverings plumb, level and true to line.

Fixing: Match exposed mounting hardware with colour and finish of adjacent track and/or wall architrave finish.

Adjustment: Adjust all operating hardware for smooth operation free from binding, and to provide even, accurate alignment of window covering in open and closed positions.

Safety: Install child safety devices on all control cords. Install all control cords in conformance with *Competition and Consumer (Corded Internal Window Coverings) Safety Standard (2014)*.

Clearance

General: Provide 5 mm horizontal clearance at each side of blinds for recessed applications.

3.2 COMPLETION**Warranties**

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the manufacturer and the installer.

- Form: Against failure of materials and execution under normal environment and conditions of use.
- Period: As offered by the manufacturer and the installer.

0581 SIGNAGE**1 GENERAL****1.1 RESPONSIBILITIES****Performance**

Requirement: Provide signage as follows:

- Appropriately secured.
- Located within a clear line of vision.
- With characters and symbols contrasting with the background.
- With clean, well-defined edges or arrises, and free from blemishes.

1.2 STANDARDS**Signs**

Safety signs - design and use: To AS 1319 (1994).

Signs and graphics for disability access: To AS 1428.1 (2021) and AS 1428.2 (1992).

Tactile wayfinding signs: To AS 1428.4.2 (2018).

2 PRODUCTS**2.1 MATERIALS****Standards**

Aluminium:

- Plate for engraving: Alloy and temper designation 6063-0 to AS 2848.1 (1998).
- For casting: To AS 1874 (2000).
- Finishes:
 - . Anodising: To AS 1231 (2000).
 - . Powder coating: To AS 3715 (2002) and AAMA 2604 (2021).

Stainless steel:

- External: Type 316. Mirror electropolish surface finish.
- Internal: Type 304. No. 4 brushed (general purpose polished) surface finish.

Plastics:

- PVC-U sheet: Semi-rigid sheet.
- Rigid cellular polystyrene: To AS 1366.3 (1992), class VH for cut-out shapes.

Brass and bronze: Plate, sheet and strip: To AS 1566 (1997).

- Finish: Patinated.

Glass type and thickness: To AS 1288 (2021).

Photoluminescent exit signs: To BCA (2022) E4D8(a)(ii) [BCA (2019) E4.8(b)].

Adhesive

General: Proprietary solvent based contact adhesive compatible with the substrate and signage material.

2.2 STATUTORY SIGNS

Termite protection

Conformance: BCA (2022) B1D4(i)(ii)
[BCA (2019) B1.4(i)(ii)] and AS 3660.1 (2014)
Appendix A.

Required fire door and required smoke door

Conformance: BCA (2022) D3D28
[BCA (2019) D2.23].

Non-required stair, ramp or escalator

Conformance: BCA (2022) Spec 14
[BCA (2019) Spec D1.12].

Exit signs, Class 2 or 3 buildings and Class 4 parts, in lieu of illuminated exit signs

Conformance: BCA (2022) E4D5
[BCA (2019) E4.5], BCA (2022) E4D6
[BCA (2019) E4.6] and BCA (2022) E4D7
[BCA (2019) E4.7].

Braille and tactile exit signage

Conformance: BCA (2022) E4D5
[BCA (2019) E4.5], BCA (2022) D4D7
[BCA (2019) D3.6] and BCA (2022) Spec 15
[BCA (2019) Spec D3.6].

Fire hose reels and fire hydrants

Conformance: AS 2441 (2005) clause 10.4.4 and
AS 2419.1 (2021) clause 11.3.5.

Fire hose reel – Location sign

Conformance: AS 2441 (2005) clause 4.1.

Fire brigade booster assembly cabinet – Location sign

Conformance: AS 2419.1 (2021) clause 11.3.1 and
AS 2118.6 (2012) clause 2.2.3.

Fire brigade booster assembly – Notice of pressure

Conformance: AS 2419.1 (2021) clause 11.3.4.

Boosters in series with pumps

Conformance: AS 2419.1 (2021) clause 11.3.7.1.

Portable fire extinguishers – Cabinet

Conformance: AS 2444 (2001) clause 3.6.

Portable fire extinguishers – Location signs

Conformance: AS 2444 (2001) clause 3.3.

Fire blankets

Conformance: AS 2444 (2001) clauses 6.3, 6.4 and
Figure 6.1.

Regulatory car park signs – Low clearance

Conformance: AS/NZS 2890.1 (2004) clause 4.3.4.

Regulatory car park signs – Stop and Give Way

Conformance: AS/NZS 2890.1 (2004) clause 4.3.4.

Regulatory car park signs – Speed limit

Conformance: AS/NZS 2890.1 (2004) clause 4.3.4.

Regulatory car park signs – Hump warning

Conformance: AS/NZS 2890.1 (2004) clause 4.3.4.

Regulatory car park signs – Steep grade warning

Conformance: AS/NZS 2890.1 (2004) clause 4.3.4.

Regulatory car park signs – Accessible parking facilities

Conformance: AS/NZS 2890.6 (2009) clause 3.1.

Unisex accessible sanitary facilities

Conformance: AS 1428.1 (2021) clause 5.1 and
BCA (2022) D4D7 [BCA (2019) D3.6].

Ambulant sanitary facilities

Conformance: AS 1428.1 (2021) clause 5.1 and
BCA (2022) D4D7 [BCA (2019) D3.6].

Non-accessible sanitary facilities

Conformance: AS 1428.1 (2021) clause 5.1 and
BCA (2022) D4D7 [BCA (2019) D3.6].

Non-accessible pedestrian entrance

Conformance: AS 1428.1 (2021) clause 5.1 and
BCA (2022) D4D7 [BCA (2019) D3.6].

Hearing augmentation

Conformance: AS 1428.1 (2021) clause 5.2.2,
BCA (2022) D4D8 [BCA (2019) D3.7] and
BCA (2022) Spec 15 [BCA (2019) Spec D3.6].

Main switchboard – Main entry

Conformance: AS/NZS 3000 (2018) clause
2.10.2.4.

Main switchboard – Room or enclosure

Conformance: AS/NZS 3000 (2018) clause
2.10.2.4.

3 EXECUTION

3.1 WORKMANSHIP

Production

General: Form signage and graphic items accurately with clean, well-defined edges or arises, free from blemishes.

Engraving to two-layer plastic laminate: Engrave lettering to expose the lower laminate.

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.

Laser cut lettering: Individual vinyl letters with self-adhesive backing.

Printed lettering: Lettering and graphic images screen/digitally printed on:

- Film with self-adhesive backing.

- Acrylic sheet.

- Aluminium plate.

- Stainless steel plate.

Fabricated: Three dimensional, formed as follows:

- Laser cutting from solid material and hand finished as necessary.

- Moulding: Individual plastic hollow three dimensional characters and shapes formed by:

- Injection moulding.

- Vacuum forming.

- Built-up individual shapes by fabricating the faces and edges from separate pieces neatly and securely joined.

3.2 INSTALLATION

General

Requirement: Install signage and graphic items level and plumb, securely mounted, with concealed corrosion and theft-resistant fixings.

Self-adhesive signs

Requirement: Fix free of bubbles and creases.

Aluminium and stainless steel signs

Pin fixing: Epoxy fix to substrate.

Illuminated signs

Electrical fittings: Provide a junction box for power connection, and the necessary lamps with proper mountings, protection, and accessories including wiring transformers and insulators.

3.3 COMPLETION

Cleaning

General: Remove protective coverings, replace damaged signage and leave the work clean, polished, free from defects, and in good condition.

Warranties

Requirement: Warrant against defective materials and incorrect installation.

0611 RENDERING AND PLASTERING

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- 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 INTERPRETATION

Abbreviations

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

- CRF: Cement render – finish.
- 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 (rendering and plastering): The final coat of a coating system.
- Finishing treatment (plastering): The treatment applied to a finish coat which may include processes and results.
- Plaster: A mixture of binders, aggregate and water which is applied to substrates in a plastic state and dries and cures 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.

1.3 TOLERANCES

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
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 ±10% over the length of the arris.

1.4 SUBMISSIONS

Samples

Sample panels: If sample panels are required, prepare complete with beads and other embedded items as follows:

- Size: 1200 x 2400 mm.

1.5 INSPECTION

Notice

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

- Sample panels ready for inspection.
- Substrates immediately before applying base coats.
- Finish treatments before decoration.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Store materials in a dry, well-ventilated and secure storage area, unaffected by weather.

2.2 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.

Metal 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 to AS 1397 (2021): For beads or lath in cement plaster: To the **Corrosion resistance and durability table**.

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% tested to AS 1141.12 (2015), and free from efflorescing salts.

Sand grading for base coat plaster table

Sieve size (mm)	Percent passing	
	Minimum	Maximum
4.75	100	100
2.36	90	100
1.18	60	90
0.6	35	70
0.3	10	30
0.15	0	5
0.075	0	3

Plaster for autoclaved aerated concrete

General: Proprietary product manufactured for use with the wall system.

Bonding products

General: Proprietary products manufactured for bonding cement-based plaster to solid substrates.

Cement

Standard: To AS 3972 (2010).

Type: GP.

Colouring products

General: Provide proprietary products manufactured for colouring cement plaster.

Integral pigment proportion: 5% maximum weight of cement.

Cornice cement

General: Provide a proprietary product manufactured for use with the cornice.

Cornices

Cast plaster: Proprietary item.

Corrosion resistance and durability

Compliance: To the **Corrosion resistance and durability table** or provide proprietary products with metallic and/or organic coatings of equivalent corrosion resistance and as follows:

- Galvanize: To AS/NZS 4680 (2006).

Corrosion resistance and durability table

Atmospheric corrosivity category to AS 4312 (2019)	Metal lath, beads and embedded items	Minimum cement content (mix type) above damp-proof course
C1 and C2	Galvanize after fabrication 300 g/m ² Stainless steel Type 316	CRW
	Powder coated aluminium	CRM
C3	Stainless steel Type 316 Powder coated aluminium	CRM
C4	Stainless steel Type 316 Powder coated aluminium	CRS

Note: For categories C5 and CX seek specialist advice.

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 (1997).

Lime putty

General: Prepare lime putty as follows:

- Stand dry hydrate of lime to AS 1672.1 (1997) and water for 24 hours or more without drying out.
- Stand quicklime and water for 14 days or more without drying out.

Mixes

General: Select a mix proportion to suit the conditions of application.

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	Cement render base coats	1 1	1 2	6 9
Second coat - External	CRF	Cement render base coats	1 1	1 2	5 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	- -	1.5 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.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 2 mm of the laitance and expose the aggregate before applying a bonding treatment.

Painted surfaces: Remove paint and hack the surface at close intervals.

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.

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: ≥ 3 mm and < 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.

- Masonry and concrete substrates: If mechanical key cannot be attained by scabbling and bonding, fix metal lath.

- Metal and other non-porous substrates: Fix 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: Join up on internal corners only. 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:

- Abutments with metal door frames.
- Abutments with other finishes.
- Junctions between different substrates.

Cornices

General: Accurately cut and mitre corners. Match and align ornament. Do not make butt joints in the length of a cornice unless required, or if full lengths are not available.

Installation: Butter edges, mitres and joins for the full length of the cornice with adhesive.

Mechanical fixing: If cornice projects across a ceiling 400 mm or more, provide additional mechanical fixing as follows:

- Fixing centres: ≤ 600 mm.

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
Dense concrete ceilings	9 max	3 max
Brickwork and blockwork	12 min	3 max
Lightweight concrete and blocks	12 min	3 max
Metal lath measured from the face of the lath.	18 min	3 max

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 FINISHES

Finishing treatments

Plain even surfaces: Work the hardening plaster as follows:

- Bag: Rub the finish coat when set firm with a hessian bag or similar.
- 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.
- Steel trowel: Steel trowel finish coat to a smooth dense surface which is not glass-like and is free from shrinkage cracks and crazing.
- Wood or plastic float: Float the finish coat on application to an even surface with a wood or plastic float.

Ornamental patterned surfaces: Work the hardening plaster with a trowel or other tool for the documented type.

Sprayed textured surfaces: Spray plaster onto a substrate using a purpose-designed machine.

Stippled textured surfaces: Work the hardening plaster with a stiff brush.

Rough thrown surfaces: Throw plaster onto a substrate or pebbles onto a plastic plaster base for the documented type.

Specialist plaster finishes

Polymer modified render:

- Basecoat render: Proprietary polymer modified cementitious render supplied as a complete plastering system.
- Finish coats: Proprietary trowelled on coloured and textured polymer modified finish coats.

Polished plaster: In situ applied plaster system incorporating selected stone dust in a proprietary matrix producing a smooth polished surface with visual patterning.

Glass bead coatings: Glass beads bound in a proprietary matrix.

3.4 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.

0612 CEMENTITIOUS TOPPINGS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Consistent in level, finish, colour and texture.
- Free of discontinuities.
- Resistant to environmental degradation within the manufacturer's stated life span.
- Accommodating movement in the substrate between control joints.
- If floating, without edge curl.
- If bonded, without drummy areas.
- Without obvious shrinkage cracks.

1.2 STANDARDS

Slip resistance

Classification: To AS 4586 (2013).

1.3 TOLERANCES

General

Thickness: Deviation from the documented thickness:

- Thickness < 15 mm: ±2 mm.
- Thickness ≥ 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.

1.4 SUBMISSIONS

Products and materials

Manufacturer's data: Submit manufacturer's product data for the following:

- Admixtures.
- Bonding products.
- Colouring products.
- Curing products.
- Sealant products.
- Slip-resistant products.
- Surface treatment products.

Samples

General: If required, submit samples of the following products:

- Colouring products.
- Control joint products.
- Surface treatment products.

1.5 INSPECTION

Notice

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

- Substrates ready for laying of toppings.

2 PRODUCTS

2.1 MATERIALS

Admixtures

Standard: To AS 1478.1 (2000).

Aggregates

Standard: To AS 2758.1 (2014).

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.

Separating layer

General: Provide a bond breaker to separate the topping from the substrate, as documented.

Cement

Standard: To AS 3972 (2010).

- 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 (2007).

Unreinforced topping: Normal-class.

Reinforced topping table

Exposure location	Strength grade	Cover to reinforcement (mm)
Internal and external greater than 50 km inland and non-industrial and non-tropical	N25	20
External greater than 50 km inland and tropical and External near coastal (> 1 km < 50 km)	N32	30
External coastal less than 1 km but not in the splash zone	N40	35

Reinforcement

Standard: To AS/NZS 4671 (2019).

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.

Water

General: Clean and free from any deleterious matter.

Mixes

General: Provide pre-mixed concrete for toppings as follows, or alternatively 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 Skirtings: 13	1	2	1
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: $\geq 300 \mu\text{m}$.

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.

2.2 CONTROL JOINTS**Control joint materials**

Control joint strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

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 35A.

Backing rod: Compressible closed cell polyethylene foam with a bond breaking surface.

3 EXECUTION**3.1 PREPARATION****Substrates**

General: Prepare substrates as follows:

- Clean and remove any deposit which may impair adhesion of monolithic or bonded toppings.
- Remove excessive projections and fill voids and hollows with a mix not stronger than the substrate or weaker than the topping.

Substrates for bonded toppings

Hardened concrete: Roughen by scabbling to remove 2 mm of the laitance and expose the aggregate.

Bond product: 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**Installation**

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.

Unbonded toppings: Lay separating layer.

Toppings over 50 mm thick:

- Lay in two layers of equal thickness.
- Place a layer of reinforcement between the topping layers. Lap reinforcement 200 mm and tie. Do not create four way laps.

Temperature control

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.

3.3 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.

Steel trowel finish: After machine floating finish as follows:

- Produce a smooth surface relatively free from defects using power tools.
- When the surface has hardened sufficiently, use steel hand trowels 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 from trowel marks and defects.

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.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

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.

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.

Stamped and coloured pattern finish: Provide a proprietary finishing system.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

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 stair treads and landings

Slip resistance treatment: Form two grooves and fill with a silicon carbide two-part resin.

Dimensions: 10 mm deep, 15 mm wide, length width of tread less 100 mm.

Position:

- First groove: Centre 35 mm from tread nose.
- Second groove: Centre 60 mm from step nose.

Surface treatment

General: Apply the surface treatment after floating and before the topping surface has set.

3.4 CONTROL OF MOVEMENT

General

Requirement: Provide control joints as documented and as follows:

- 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 topping-finished areas into bays.
 - . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- 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 pre moulded strip.
- Install a control joint proprietary product, as documented.

3.5 JOINT ACCESSORIES

Floor finish dividers

General: Provide a corrosion-resistant metal dividing strip suitably fixed to the substrate, at junctions with differing floor finishes, 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.

Weather bars

General: Provide corrosion-resistant weather bars or threshold plates under hinged external doors, located under the centres of closed doors or to manufacturer's recommendations.

3.6 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.

Protection

General: Protect finished work from damage during building operations.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty from the installer.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the installer.

0621 WATERPROOFING – WET AREAS

1 GENERAL**1.1 RESPONSIBILITIES****Performance**

Requirements:

- Graded to floor wastes, to dispose of water without ponding.
- Able to prevent moisture entering the substrate or adjacent areas.

1.2 STANDARDS**Waterproofing wet areas**

Standard: To AS 3740 (2021).

1.3 INTERPRETATION**Definitions**

General: For the purposes of this worksection, the definitions given in AS 3740 (2021) and the following apply:

- Membranes (waterproof): Impervious barriers to liquid water which may be:
 - . Installed below floor finishes.
 - . Installed behind the wall sheeting or render.
 - . Installed to the face of the wall sheeting or render.
 - . Applied in liquid or gel form and air cured to form a seamless film.
 - . Applied in sheet form with joints lapped and sealed.
- Waterproofing system: Combinations of membranes, flashings, drainage and accessories which form waterproof barriers and which may be:
 - . Loose-laid.
 - . Bonded to substrates.
- Wet area: An area within a building supplied with a floor waste.

1.4 SUBMISSIONS**Products and materials**

Manufacturer's data: Submit product data sheets.

Type tests: Submit certificates verifying conformance to AS/NZS 4858 (2004) Table 8.1.

Records

General: Submit photographic records of application and protection of membranes. Label photographs with date and location.

Timing: Record at the following stages:

- After substrate preparation.
- After primer application.
- After membrane installation.
- After protection from traffic provided.

Liquid applied membranes:

- Record wet film thickness once every 10 m² and compare to the manufacturer's requirements.

- On completion of every 100 m² of each coat, compare the amount of membrane used with the manufacturer's application rate and record the result.

Membrane continuity tests: Submit reports:

- Flood test, including photographic records of flooded areas and adjacent areas. Label photographs with date and location.
- Electronic leak detection test.
- Seam probe test.

Samples

Requirement: Submit 300 x 300 mm samples of each type of membrane.

Shop drawings

Requirement: Submit shop drawings showing the following:

- Junctions with vertical surfaces and upstands.
- Junctions at perimeters.
- Drainage details.
- Control joints.
- Flashings.
- Penetrations.
- Corners.
- Terminations and connections.
- Membrane layers.

Tests

Site tests: Submit results, as follows:

- Substrate moisture content test.
- Membrane continuity tests, including records of retesting after rectification:
 - . Flood tests.
 - . Electronic leak detection tests.
 - . Seam probe tests.

1.5 INSPECTION

Notice

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

- Substrates prepared and ready for installation of the wet area waterproofing systems.
- Secondary layers prepared and ready for subsequent layers.
- Membranes after installation and before concealment.
- After flood testing, if applicable.

2 PRODUCTS

2.1 MEMBRANES

Standards

Standard: To AS/NZS 4858 (2004).

Membrane system

Requirement: Proprietary membrane system suitable for the intended internal wet area waterproofing.

Total VOC limits

Requirement: Conform to the following maximum TVOC content:

- Waterproof membrane: 250 g/L.

2.2 ACCESSORIES

Waterstop angles

Material: Rigid, corrosion-resistant angles compatible with the waterproof membrane system.

Bond breakers

Requirement: Compatible with the extensibility class of the membrane to be used.

Material: Purpose-made bond breaker tapes 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 or water resistant, flexible, mould-resistant and compatible with the waterproofing system and to the manufacturer's recommendations.

Adhesives

Requirement: Waterproof and compatible with the waterproofing system.

3 EXECUTION

3.1 PREPARATION

Substrates

General: Prepare substrates as follows:

- Clean and remove 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, make sure support members are in full lengths without splicing.
- If floors are 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 nor weaker than the bedding.
 - . Fill depressions less than 10 mm with a latex modified cementitious product with feathering eliminated by scabbling the edges.
 - . Fill cracks in substrates wider than 1.5 mm with a filler compatible with the membrane system.

Concrete substrates: Cure for more than 28 days.

External corners: Round or arris edges.

Moisture content

Requirement: Verify that the moisture content of the substrate is compatible with the water vapour transmission rate of the membrane system by testing to the recommendations of AS 3740 (2021) Appendix F.

Falls

Membrane applied to substrate: Make sure the fall in the substrate conforms to the fall documented for the finish.

Sheet substrate fastening

Requirement: Provide fasteners compatible with the substrate. Mechanically fasten to the supporting structure.

Waterstop angles

Requirement: Provide waterstop angles at door thresholds and shower enclosures to support the waterproof membrane at junctions between waterproofed and non-waterproofed areas.

Sizing: Size the vertical leg of the waterstop angle to conform to the requirements of AS 3740 (2021).

Corners: Cut the horizontal leg and bend the vertical leg at corners instead of forming vertical joints between separate lengths of angle.

Fixing: Fix waterstop angles to the substrate with compatible sealant or adhesive and corrosion-resistant countersunk or wafer head screws.

Priming

Compatibility: If required, prime the substrates with compatible primers for adhesion of the membrane system.

Bond breakers

Requirement: After the priming of surfaces, provide bond breakers at wall/floor 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.
- Width: Conform to AS 3740 (2021) Table 4.10.

3.2 INSTALLATION**Ambient conditions**

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

Protection

Damage: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage and an overlaying finish is installed.

Extent of waterproofing

Requirement: Conform to AS 3740 (2021) and BCA (2022) F2D2 [BCA (2019) F1.7]. Provide waterproofing, including to the following areas:

- Floors in bathrooms and other wet areas: To full extent of floor area.
- Walls in bathrooms:
 - . All tiled wall surfaces.
 - . Minimum 150 mm above finished floor level.
- Walls in shower areas: Minimum 1800 mm above finished floor level.
- Wall/floor and wall/wall junctions and joints.
- Penetrations.

Sheet membrane joints

Bituminous sheet membranes:

- Side laps: ≥ 75 mm.
- End laps: ≥ 150 mm.

Synthetic rubber membranes:

- Factory-vulcanized laps: ≥ 40 mm.
- Field side laps: ≥ 50 mm.
- Field end laps: ≥ 100 mm.

PVC membranes:

- Factory-welded laps: ≥ 40 mm.
- Field-welded laps: ≥ 75 mm.

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 waterstop angles.

Vertical flashings: Provide vertical corner flashings continuous across wall/wall junctions to at least 1800 mm above finished floor level of the shower or base of the bath or tray, or 50 mm above the shower rose, whichever is the higher.

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.

Vertical sheet flashings:

- Return legs at least 50 mm on each wall.
- Do not penetrate flashing with wall lining fasteners.

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 embed it in the first coat of membrane with one half of the tape on each side of the corner or joint. Apply a second coat of membrane to seal the fabric.

Drainage connections

Floor wastes: Provide floor wastes of sufficient height to accommodate the thickness of floor finishes and bedding at the outlet position. Position leak control flange to drain at membrane level. Turn membrane down 50 mm minimum into the floor waste leak control flanges, and adhere to form a waterproof connection.

Preformed drainage channels:

- With continuous leak control flanges: Provide a continuous waterproof connection between the membrane and the channel.
- Without leak control flanges: Provide continuous waterproofing under the channel and terminate

the membrane at a floor waste with a recessed leak control flange.

Vertical membrane terminations

Upstands:

- Shower areas: Minimum 150 mm above the highest finished tile level of the floor within the shower area.
- Shower areas with ceiling mounted shower rose: To the full height of the wall.
- Bath without an integral upstand edge without showers over: Minimum 150 mm above the shower rose connection.
- Bath with an integral upstand edge, bath with a shower over or bath adjoining an unenclosed shower: Minimum 150 mm above the bath edge.

Anchoring: Secure sheet membranes along the top edge.

Edge protection: Protect edges of the membrane.

Showers

Framed shower screens:

- Install a waterstop angle directly below where the base of the shower screen sill will be installed.
- Size the angle so that the vertical leg finishes at least 5 mm above the level of the tiles.
- Support and adhere the membrane over the waterstop angle and extend the membrane at least 50 mm into the adjacent area.

Frameless shower screens:

- Install a waterstop angle directly below where the base of the shower screen will be installed.
- Support and adhere the membrane over the waterstop angle and extend the membrane at least 50 mm in to the adjacent area.
- Install a capping angle over the membrane and vertical leg of the waterstop angle to protect the exposed membrane.
- Install the shower screen over the capping angle.

Framed or frameless shower screens with trench drain located below screen:

- Install a waterstop angle where the outer edge of the trench drain to the perimeter of the shower will be installed.
- Size the angle so that the vertical leg finishes at the underside of the tiles.
- Support and adhere the membrane over the waterstop angle and terminate the membrane at floor wastes as documented in **Drainage connections**.

- Install the trench drain with the shower screen located vertically above it.

Unenclosed showers

Requirement: Extend membrane at least 1500 mm into the room from the shower rose outlet, on the walls and floor.

Baths

Baths with integral upstands:

- Recess bath edges into walls or batten off wall lining sufficiently to allow water resistant wall finishes to overlap the integral upstands.

- Maintain the structural integrity of walls that are rebated.

Baths without integral upstands or with showers over:

- Form a rebate in the wall to receive the bath edge.
 - . Rendered masonry walls: Form or chase in the render.
 - . Framed and lined walls: Form in the wall lining with a corrosion-resistant lipped channel.
- Waterproof the wall above and below the rebate, including the rebate, and the floor area under the bath.

- Seal the edge of the bath into the rebate.

Plinth-mounted insert baths and spas:

- Line framed enclosures for insert baths.
- Form an upstand on the inside edge of the enclosure opening to receive the bath with an angle or compressible foam rod.
- Waterproof walls abutting the enclosure, the top of the plinth and the interior and exterior of the enclosure.
- After tiling the walls, top of the plinth and exterior of the enclosure, install the bath with its downturn edge lip outside the upstand formed on the edge of the opening and seal the lip to the tiles.
- Minimum dimension from wall or free edge of the plinth to insert bath: 100 mm.

Taps and spouts

Requirement: Waterproof penetrations for taps and spouts with preformed flange systems or a sealant.

Provision for servicing: Install taps so tap washers or ceramic discs can be serviced without damaging the waterproofing or seal.

Wall recesses

Requirement: Support all faces of the recess and line with the same sheet material as the adjacent wall. Fall base of recess towards the shower area. Flash all junctions and waterproof all surfaces.

Curing of liquid membrane systems

General: To the manufacturer's instructions.

Curing: Allow membrane to fully cure before tiling.

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 (2021).

Bonded or partially bonded membranes: If the topping or bedding mortar is 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 TESTING

Substrate tests

Moisture content: Test substrate for suitability for the installation of membranes to AS 3740 (2021) Appendix F.

- Maximum relative humidity of concrete or cementitious screeds: To AS 3740 (2021) Appendix F2.4.

- Moisture content of timber and plywood substrates: To AS 3740 (2021) Appendix F2.3.

Membrane continuity tests

Flood test: To AS 3740 (2021) Appendix C2.

Electronic leak detection test: To AS 3740 (2021) Appendix C3.

Seam probe test: To AS 3740 (2021) Appendix C4.

3.4 COMPLETION

Reinstatement

Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Warranties

Requirement: 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.

0631 CERAMIC TILING

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- 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.
- Direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

1.2 STANDARDS

Tiling

General: Conform to the recommendations of those parts of AS 3958.1 (2007) referenced in this worksection.

Slip resistance

Classification: To AS 4586 (2013).

1.3 TOLERANCES

Completed tiling

Requirement: To the recommendations of AS 3958.1 (2007) clause 5.4.6.

1.4 SUBMISSIONS

Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the tiling, including procedures for maintaining the slip-resistance classification stating the expected life of the slip-resistance classification.

Products and materials

Product conformity: Submit the following:

- Tiles: Evidence of conformity to AS 13006 (2020).
- Tile adhesive: Evidence of conformity to AS ISO 13007.1 (2020).
- Acoustic underlay: Evidence of weighted normalised impact sound pressure level to AS ISO 717.2 (2004) as measured for the complete tiling system.

Type tests: Submit results, as follows:

- Slip resistance to AS 4586 (2013).
- Accelerated wear test.

Evidence of delivery: Submit delivery docket as evidence of delivery of specified tiles.

Samples

General: Submit labelled samples of tiles, including fittings, accessories, grout and sealants, showing the range of variation in colour and finish.

Tests

Site tests: Submit results, as follows:

- Slip resistance test of completed installation.
- Impact sound insulation rating.

1.5 INSPECTION

Notice

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

- Substrate immediately before tiling.
- Trial set-outs before execution.
- Control joints before sealing and grouting.
- Grout and sealant colours before application.

2 PRODUCTS

2.1 UNDERLAY

Fibre cement underlay

Standard: To AS/NZS 2908.2 (2000), Type B, category 2 minimum.

Thickness: 6 mm minimum.

Acoustic underlay

General: Provide a proprietary product recommended by the manufacturer as compatible with the tiling system.

2.2 TILES AND ACCESSORIES

Tiles

Standard: To AS 13006 (2020).

Coves, nosings and skirtings: Provide matching stop-end and internal and external angle tiles moulded for that purpose.

Exposed edges: Provide 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 or use proprietary trim.

Accessories

General: Provide tile accessories which match the composition, colour and finish of the surrounding tiles.

Tile trims: Provide proprietary trim for wall tiles and floor tiles, as documented.

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

2.3 ADHESIVES

General

Standard: To AS ISO 13007.1 (2020).

Type

General: Provide adhesives compatible with the materials and surfaces to be adhered, and as documented.

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.

2.4 MORTAR

Materials

Cement type to AS 3972 (2010): GP.

- White cement: Iron salts content $\leq 1\%$.
- Off-white cement: Iron salts content $\leq 2.5\%$.

Lime: To AS 1672.1 (1997).

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.

Terracotta tiles: Use proprietary polymer modified mortar.

Mixing: To AS 3958.1 (2007) clause 2.15.

Water

General: Clean and free from any deleterious matter.

2.5 GROUT

Type

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

Terracotta tiles: Use proprietary polymer modified grout.

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.

Epoxy grout: As documented.

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.

2.6 CONTROL JOINTS

Control joint materials

Control joint strip: A proprietary control joint consisting of a neoprene core sandwiched between metal plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: One-part self-levelling non-hardening mould resistant, silicone or polyurethane sealant applied over a backing rod. Finish flush with the finished surface.

- Floors: Trafficable, Shore hardness greater than 35A.

Backing rod: Compressible closed cell polyethylene foam with a bond breaking surface.

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.
- Concrete blockwork: 28 days.
- Toppings on slabs and rendering on brick or blockwork: A further 21 days.
- Rendered swimming pool shell: A further 21 days minimum.

3.2 PREPARATION

Standard

Preparation: To the recommendations of AS 3958.1 (2007) 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: Make sure substrates are as follows:

- Clean and free 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.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

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.

3.3 FIXING UNDERLAY

Installation

Requirement: Lay in staggered (brick) pattern, perpendicular to the direction of the subfloor, with joints in the underlay not coinciding with joints in the subfloor. Fix with fasteners and fastener spacing to the manufacturers recommendations. If panels are not tongue and grooved, make sure edges are fully supported.

Membranes: If sheet flooring is the substrate for a wet area membrane, fix with stainless steel countersunk head screws.

3.4 TILING GENERALLY

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.

Bath ventilation

General: If required, ventilate the space below fully enclosed baths with at least 2 vermin proof ventilating tiles.

3.5 SETTING OUT

Tile layout

Requirement: Set out tiles as documented, allowing for control joints, or as follows if desired layout is undocumented:

- General tiling: 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. Align floor and wall tile joints, where possible.
- Feature tiling: Provide trial set out for large or complex areas and patterns.

Tile joints

Joint widths: Set out tiles to give uniform joint widths within the following limits:

- Floors:
 - . Dry pressed tiles: 3 mm.
 - . Extruded tiles: 6 mm.
 - . Vitrified: 3 to 5 mm.
 - . Quarry tiles: 6 to 12 mm.
 - . Chemical resistant epoxy jointed tiling: 5 to 6 mm.
- Large and/or irregular floor tiles: 6 to 12 mm.
- Mounted mosaics: To match mounting pattern.
- 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.

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 make sure 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**

Requirement: 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: Conform to falls as documented and the following:

- Falls to floor wastes: 1:80 minimum.
- Continuous fall of floor plane to floor waste: 1:50 maximum.

Change of finish: Maintain finished floor level across changes of floor finish including carpet.

3.7 BEDDING**Standard**

Adhesive: To AS 3958.1 (2007) clause 5.6.

Cement mortar: To AS 3958.1 (2007) clause 5.5.

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.

Terracotta tiles: Use pre-sealed tiles or apply a breathable sealer and lay dry. If a final sealed finish is selected, use a compatible laying sealer.

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, tested with a 3 m straightedge. 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, tested with a 3 m straightedge, 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 walls and floors: > 90%.

- Wet areas and benchtops: 100%.

Pattern of distribution of adhesive: To the recommendations of AS 3958.1 (2007) 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 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.

3.8 CONTROL OF MOVEMENT**General**

Requirement: Provide control joints carried through the tile and the bedding to the recommendations of AS 3958.1 (2007) 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 internal corners.
- 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.

3.9 GROUTED AND SEALANT JOINTS**Grouted joints**

General: Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary and remove any tiles spacers 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.

Mosaic tiles

Grouting mosaics: If paper faced mosaics are to be bedded in cement mortar, pre-grout the sheeted mosaics from the back before fixing. After fixing, rub grout into the surface of the joints to fill any voids left from pre-grouting. Clean off surplus grout. When grout has set, wash down. If necessary, use a proprietary cement remover.

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.
- Around fixtures interrupting the tile surface, for example pipes, brackets, bolts and nibs.
- 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.

3.10 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. If changes of floor finish occur at doorways, make the junction directly below the closed door. Grout up underneath to provide continuous support.

Stepping: Less than 3 mm.

Wall trims

General: Provide where documented. Install flush with adjacent tile surfaces and to manufacturer's recommendations.

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.

Weather bars

General: Provide corrosion resistant metal weather bars or threshold plates under hinged external doors, located under the centres of closed doors or to manufacturer's recommendations.

3.11 TESTING

Site tests

Slip resistance of completed installation: To AS 4663 (2013).

Impact sound insulation rating of completed installation: To AS ISO 717.2 (2004).

3.12 COMPLETION

Cleaning

General: Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

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.

0651 RESILIENT FINISHES**1 GENERAL****1.1 STANDARDS****General**

Installation: To AS 1884 (2021).

Slip resistance

Classification: To AS 4586 (2013).

1.2 SUBMISSIONS**Fire performance**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

Operation and maintenance manuals

General: Submit manufacturer's instructions for care and maintenance for each type of finish.

Products and materials

Manufacturer's data: Submit the manufacturer's product data sheets for each type of finish, and the manufacturer's recommendations for its application including the following, as appropriate:

- Thickness and width of sheet, or size of tile.
- Adhesive and jointing method.
- Resistance to wear, indentation, chemicals, light and fire.
- Flexibility and bending strength.

Type tests: Submit results, as follows:

- Slip resistance to AS 4586 (2013).

Subcontractors

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

Substrate acceptance: Submit evidence of installer's acceptance of the flooring substrate before starting installation.

Tests

Site tests: Submit results, as follows:

- Slip resistance test of completed installation.
- 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.

1.3 INSPECTION**Notice**

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

- Substrate immediately before fixing resilient finishes or underlay.
- Completed installation.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Store and handle to the manufacturer's recommendations.

2.2 FIRE PERFORMANCE**Fire hazard properties**

Critical radiant flux: Tested to AS ISO 9239.1 (2003).

2.3 UNDERLAYS**Cementitious**

General: Polymer modified cementitious smoothing and self-levelling compound.

Thickness: 3 mm minimum.

Fibre cement underlay

Standard: To AS/NZS 2908.2 (2000), Type B, category 2 minimum.

Thickness: 5 mm minimum.

Wet process fibreboard (hardboard) underlay

Standard: To AS/NZS 1859.4 (2018).

Classification: General purpose medium board, manufactured specifically as flooring underlay.

Thickness: 5.5 mm.

2.4 MOISTURE BARRIER**General**

Description: Water-based moisture barrier to the resilient finish and adhesive manufacturer's recommendations, if required.

2.5 ADHESIVES**General**

Requirement: To the resilient finishes manufacturer's recommendations.

2.6 SHEETS AND TILES**Polyvinyl chloride (PVC)**

Resilient floor covering, homogeneous: To EN ISO 10581 (2020).

Resilient floor covering, heterogeneous: To EN ISO 10582 (2018).

Resilient floor covering, jute or polyester felt backing: To EN 650 (2012).

Resilient floor covering, with foam layer: To EN 651 (2011).

Resilient floor covering, with particle based enhanced slip resistance: To EN 13845 (2017).

Resilient floor covering, semi-flexible polyvinyl chloride tiles: To EN ISO 10595 (2012).

Vinyl planks

Type: Loose laid wood design vinyl planks.

Total thickness: Minimum 4 mm.

Wear layer thickness: Minimum 0.55 mm.

Surface treatment: PUR treatment.

2.7 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 SUBCONTRACTORS

General

Requirement: Use specialist installers recommended by the material manufacturers.

3.2 PREPARATION

Substrates

General: To AS 1884 (2021) Section 3.

Substrate tolerance table

Property	Length of straightedge laid in any direction	Max. deviation under the straightedge
Planeness	2000 mm	4 mm
Abrupt deviation tolerance	150 mm	0.5 mm

Concrete substrates

Requirement: Do not start installation of the resilient finishes until the concrete substrate conforms to AS 1884 (2021) clause 3.1 and the adhesive and resilient finish manufacturers' recommendations.

Substrate rectification: Conform to the following:

- Surface treatments: Mechanically remove any incompatible surface treatments, including the following:
 - . Sealers and hardeners.
 - . Curing compounds.
 - . Waterproofing additives.
 - . Surface coatings and contamination.
- Surface quality: Remove projections and fill voids and hollows with a smoothing and self-levelling compound compatible with the adhesive. Allow filling or levelling compound to dry to manufacturer's recommendations.

Moisture content rectification: Provide a moisture barrier to the flooring manufacturer's recommendation.

Cleaning: Remove loose materials or dust.

Timber, plywood, particleboard and fibre cement sheet substrates

Requirement: Do not start installation of the resilient finishes until the timber, plywood, particleboard and fibre cement substrate conforms to AS 1884 (2021) clause 3.6.

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.

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

Conditioning of floor covering and subfloor: To AS 1884 (2021) clause 4.1 and manufacturer's recommendations.

Acclimatisation

Before installation: Remove flooring from the packaging and store not more than 5 boxes high in the laying area for at least 24 hours.

3.3 INSTALLATION

General

Requirement: To AS 1884 (2021) Section 5 and the manufacturer's recommendations.

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.

Tile set-out

General: Set out tiles from centre of room. If possible, cut tiles at margins only to give a cut dimension of at least 100 mm x full tile width. Match edges and align patterns. Arrange the tiles so that any variation in appearance is minimised.

Edges

General: Make sure edges are firm, unchipped and machine-cut accurately to size and square to the face, and that edges are square to each other before installation.

Joints

Non-welded: Butt edges together to form tight neat joints showing no visible open seams.

Doorways: Where changes of floor finish occur at doorways, locate the joint on the centreline of the door leaf in the closed position.

Expansion joints

General: To the manufacturer's recommendations for joint widths, and area and length limitations.

Junctions

General: Scribe neatly up to returns, edges, fixtures and fittings. Finish flush with adjoining surfaces.

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.

Vinyl planks

Installation: Install using pressure sensitive adhesive to the manufacturer's recommendations. Set out planks from centre of room. Align patterns, texture and grain in one direction.

3.4 SHEETING

Welded joints

Thermal 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 with a damp cloth.

Epoxy jointing: Join seams with epoxy adhesive.

3.5 VINYL STAIR FINISH

General

Preformed: Provide purpose-made vinyl stair finish combining riser, nosing and tread in the one element. Lay each step consecutively with the joint at the bottom of each riser.

Formed in situ: Fit the sheet vinyl to each tread, and to the riser above, in one piece, coved in the angle. Accurately scribe, cut and fit to stair nosings and perimeters.

3.6 JOINTS AND ACCESSORIES

Accessories

General: Provide purpose-made matching moulded accessories for nosings, coves, skirtings, edge cover strips and finishes at junctions, margins, and angles, if available. Otherwise, form accessories from the sheet material. Provide solid backing for radiused coves and nosings.

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.

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.

Control joint materials – sheet flooring

Proprietary slide plate divider strip: Provide interlocking metal plates grouted into pockets formed in the concrete joint edges to finish flush with the flooring surface.

Vinyl skirting

Feather edge: Moulded PVC skirting section.

Flat skirting: Flat PVC skirting section.

Fixing: Scribe as necessary. Mitre corners. Fix to walls with contact adhesive.

Minimum height: 100 mm.

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 floor finish manufacturer's recommendations for sheeting material and thickness.

3.7 COMPLETION

Protection

Finished floor surface: Keep traffic off floors for a minimum of 24 hours after laying or until bonding has set, whichever period is the longer. Avoid contact with water for minimum 7 days after laying.

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.

Spare materials

General: Supply spare matching resilient finishes and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

Quantity: At least 1% of the quantity installed.

0652 CARPETS**1 GENERAL****1.1 STANDARDS****Slip resistance**

Classification: To AS 4586 (2013).

1.2 TOLERANCES**General**

Requirement: To AS/NZS 1385 (2007).

1.3 SUBMISSIONS**Fire performance**

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

Operation and maintenance manuals

Contents: Submit maintenance manuals with the following:

- A technical specification of the carpet installation.
- The manufacturer's recommendations for use, care and maintenance of the carpet to AS/NZS 3733 (2018).
- The names and address of the supplier and manufacturer of each component.

Products and materials

Manufacturer's documentation: Submit copies of the following data:

- Product data sheets.

Slip resistance classification: Submit evidence of conformity to documented requirements.

Samples

General: Submit labelled production run samples demonstrating the range of colour, pattern, texture and pile yarn available in each documented carpet type.

Sample size: Submit the following:

- Carpet: Manufacturer's standard swatch.
- Tiles: 4 x tile size.
- Edge strip, trim, extrusions, and stair and landing nosings: Submit a 300 mm length of each type.
- Underlay: Submit one labelled sample at least 600 x 600 mm.
- Stitched seam: Submit one sample, minimum 1000 mm length.

Penetrations: Submit one production carpet sample with a penetration access cut as documented in **EXECUTION, INSTALLATION - CARPET.**

Sample installation: Lay a sample area of each type of carpet with underlay, minimum 10 m², including accessories, and 3000 mm of typical seam.

Subcontractors

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

Substrate acceptance: Submit evidence of installer's acceptance of the substrate before starting installation.

Tests

Moisture content and alkalinity of subfloor/substrate: Submit test report as evidence of conformity to **PREPARATION, Substrate.**

Warranties

General: Submit the manufacturer's product warranties.

1.4 INSPECTION**Notice**

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

- Substrate immediately before fixing underlay.
- Completed carpet after cleaning and before covering for protection.

2 PRODUCTS**2.1 GENERAL****Storage and handling**

Requirement: Store on a flat, clean, dry, well ventilated and secure storage area, elevated above the subfloor and unaffected by weather.

2.2 FIRE PERFORMANCE**Fire hazard properties**

Critical radiant flux: Tested to AS ISO 9239.1 (2003).

2.3 CARPET**Carpet**

Minimum grade: Residential Medium Duty under the Australian Carpet Classification Scheme.

Total VOC emission tested to ISO 10580 (2010): < 0.5 mg/m²/h.

Batching

Requirement: Carpet from one manufacturing batch and dye lot.

Antimicrobial treatment

Requirement: Non-metallic, colourless, odourless, positively charged polymer applied during manufacturing to form a molecularly bonded surface to resist bacteria and mould growth.

Insect resistance

Requirement: Carpets and underlays comprising materials either inherently resistant to insect attack or treated against insect attack by moth and carpet beetle, by application of insect resist agents (IRA) to the yarn during wet processing at the manufacturing stage.

Insect resist treatment of wool: Application Level 4 to the recommendations of Woolmark Specification CP-4 (2016).

Stain and soil resistance

Requirement: Carpet with one or more of the following:

- Fluoro-treatments: Fluorochemical soil and liquid repelling chemical treatment applied during manufacturing.
- Stain blockers: Colourless acid-based dye stainblocker applied to dyed fibres.

2.4 CARPET TILES

General

Type: Non-stick, non-curling tiles capable of being taken up without damage and then re-laid in different positions.

Marking: On the back, showing manufacturer's instructions or directional arrow for laying.

Tolerances

Requirement: Conform to the following:

- Dimensional tolerance: 0.2%.
- Squareness: Maximum difference of 2 mm between lengths of diagonals.

Sustainable carpet tile backing

Re-usable backing: Proprietary vinyl backing to carpet tiles capable of separation and recycling in new carpet tiles.

2.5 UNDERLAYS

Application

Performance: To AS 2455.1 (2019) clause 1.5.2.

Cementitious

General: Polymer modified cementitious smoothing and self-levelling compound.

Thickness: 3 mm minimum.

Fibre cement hard underlay

Standard: To AS/NZS 2908.2 (2000).

Thickness: 5 mm minimum.

Dry process fibreboard (MDF) hard underlay

Standard: To AS/NZS 1859.2 (2017).

Classification: Moisture resistant Medium density fibreboard (MR MDF).

Thickness: 5.5 mm.

Wet process fibreboard (hardboard) underlay

Standard: To AS/NZS 1859.4 (2018).

Classification: General purpose medium board, manufactured specifically as flooring underlay.

Thickness: 5.5 mm.

Soft underlay

Standard: To AS 4288 (2003).

2.6 OTHER MATERIALS

Adhesives

General: Compatible with the floor covering material, and suitable for bonding it to the subfloor to AS 2455.1 (2019) clause 1.5.3.

Friction compound: Suitable for holding carpet tiles in position without permanent sticking.

Hot-melt adhesive tapes

General: Commercial grade glass fibre and cotton thermoplastic adhesive-coated tape 60 mm wide on a 90 mm wide metal foil base and backed with silicone-coated release paper.

Preformed carpet grippers

General: Architectural plywood carpet grippers with 3 rows of corrosion-resistant angled pins of length appropriate to the carpet type to AS 2455.1 (2019) clause 1.5.4.

Size (minimum): 33 mm wide x 7 mm thick.

Location: At edges, except where edge strips are used. Provide double grippers to edges where recommended by the manufacturer.

Edge strips

Type: Heavy duty edge strip appropriate to the floor covering type (tackless or adhesive fixed), capable where necessary of accommodating different levels of adjacent floor finishes.

Form: Metal moulding or extrusion, with vinyl inserts.

Location: At exposed edges of the carpet, and at junctions with differing floor finishes or finishes of a different thickness. Where edge strips occur at doorways, locate the junctions directly below the closed door.

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 PREPARATION

General

Pre-installation requirements: To AS 2455.1 (2019) Section 2.

- Carpet tiles: Pre-laying requirements including access panel floors to AS 2455.2 (2019) clause 4.

Working environment: Do not start work before the building is enclosed, wet work is complete and dry, overhead work is complete and good lighting is available.

Protection: Protect adjoining surfaces.

Substrate

General: Conform to the following:

- To AS 2455.1 (2019) or AS 2455.2 (2019), as appropriate.
- Clean and free of any deposit or finish which may impair adhesion or location and functioning of control joints.
- Free of any imperfections, including ridges, indentations and projections which may adversely affect the installed carpet.

Concrete substrate rectification: Remove projections, grind as necessary and fill voids and hollows with a levelling compound compatible with the adhesive to achieve the required tolerance.

Timber substrate rectification: Remove projections. If conformance with the **Substrate tolerance table** cannot be achieved, fix a hard underlay in brick pattern. Make sure joints do not coincide with substrate joints.

Moisture content: Do not start installation unless:

- Concrete: The moisture content of the concrete has been tested to AS 2455.1 (2019) Appendix B and the values in AS 2455.1 (2019) Appendix B

and AS 2455.2 (2019) Appendix B as appropriate have been obtained.

- Timber, plywood or particleboard substrates: The moisture content of the substrate has been tested to AS/NZS 1080.1 (2012) for timber and particleboard or AS/NZS 2098.1 (2006) for plywood and values are obtained as follows:
 - . Air conditioned buildings: 8 to 10%.
 - . Intermittently heated buildings: 10 to 12.5%.
 - . Unheated buildings: 12 to 15%.

Alkalinity: Do not start installation unless:

- Concrete: The alkalinity of the concrete has been tested to AS 2455.1 (2019) Appendix B and the values in AS 2455.1 (2019) Appendix B and AS 2455.2 (2019) Appendix B as appropriate have been obtained.

Fixtures: Remove door stops and other fixtures, and refix in position undamaged on completion of the installation. Make sure fixings penetrate substrate and are stable.

Substrate tolerance table

Property	Length of straightedge laid in any direction	Max. deviation under the straightedge
Flatness Class B	3 m	6 mm
Smoothness	150 mm	1 mm
Planar	2000 mm	4 mm

3.2 INSTALLATION - CARPET

General

Requirement: To AS 2455.1 (2019) Section 3 and the manufacturer's recommendations.

Batching

Requirement: In a single area and for each documented type, quality, or colour, use carpet from one manufacturing batch and dye lot.

Setting out

Joints in underlay: Make sure joints in underlay do not coincide with carpet joints. Do not carry underlay over carpet grippers or edge strips.

Partition layout: Confirm that permanent partitions have been installed before starting carpet laying.

Seaming methods

Woven carpet: Machine or hand sew. Do not provide glued taped seams unless selvages are woven to suit and recommended by manufacturer.

Tufted carpet: Seam with hot-melt adhesive tape.

Seam sealing: Apply appropriate seam sealer to each cut edge.

Cutting laid carpet

Method: If penetrations through laid carpet are necessary for electrical, telephone or other outlets, cut the carpet either by cross cutting or by cutting rectangular or circular openings.

Cutting holes in concrete floors: Protect the carpet and remove concrete particles and dust on completion. Replace the cut carpet over the opening without any signs of fraying or other damage, and fix with a peel-up adhesive, or resew.

3.3 INSTALLATION - CARPET TILES

General

Installation: To AS 2455.2 (2019) and the manufacturer's recommendations.

3.4 STAIRS AND LANDINGS

Installation

General: To AS 2455.1 (2019) clause 3.10.

Concrete stairs

Fixing: Adhesive method.

Laying method: Apply the floor covering continuously to the treads and risers.

Timber stairs

Closed risers:

- Fixing: Tackless method, with a gripper strip in each angle between treads and risers.
- Laying: Apply the floor covering continuously to the treads and risers.

Open risers:

- Fixing: Adhesive.
- Laying: Wrap the carpet around the tread and neatly butt join beneath the nosing if a separate nosing is required, or if not, in the centre of the underside of the tread.

3.5 COMPLETION

Cleaning

Requirement: Progressively clean the work. Remove waste, excess materials and adhesive.

Final cleaning: When the installation is complete, clean the carpet as necessary to remove extraneous matter, marks and soiling and to lift the pile where appropriate.

Protection

Requirement: Provide fabric drop sheets. Do not use plastic sheeting. If wheeled traffic is to follow carpet installation, protect with hardboard sheets butted and fixed with adhesive tape.

0671 PAINTING**1 GENERAL****1.1 RESPONSIBILITIES****Performance****Requirement:**

- 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.

1.2 STANDARDS**Painting**

General: To the recommendations of those parts of AS/NZS 2311 (2017) referenced in this worksection.

1.3 INTERPRETATION**Definitions**

General: For the purposes of this worksection, the definitions given in AS/NZS 2310 (2002) and the following apply:

- Gloss: The optical property of a surface, characterised by its ability to reflect light specularly.
- 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, surfaces with the following specular gloss reading is defined as follows:
 - . Full gloss: Over 85 gloss units.
 - . Gloss: Over 50 and up to 85 gloss units.
 - . Semi-gloss (satin): Over 20 and up to 50 gloss units.
 - . Low gloss (low sheen): Over 5 and up to 20 gloss units.
 - . Flat finish (matt): Up to 5 gloss units.
- Opacity: The ability of a paint or textured and membrane coating to obliterate the colour difference of a substrate.
- Paint or coating system: A product in liquid form, which when applied to a surface, forms a dry film having protective, decorative or other specific technical properties.
- Primer, prime coat: The first coat of a painting system that helps bind subsequent coats to the substrate and which may inhibit its deterioration.
- Sealer: A product used to seal substrates to prevent the following:
 - . Materials from bleeding through to the surface.
 - . Reaction of the substrate with incompatible top coats.
 - . Undue absorption of the following coat into the substrate.

- Substrate: The surface to which a material or product is applied.
- Undercoat: An intermediate coat formulated to prepare a primed surface or other prepared surface for the finishing coat.

1.4 SUBMISSIONS**Products and materials**

General: Submit the following at least 3 weeks before the paint is required:

- Paint brand name and product range quality statement.

Samples

Clear finish coatings: Submit labelled samples of timber or timber veneer matching those to be used in the works as follows:

- Label for identification and prepare, putty, stain, seal and coat, as documented.
- Size: Minimum 500 x 500 mm.

Opaque coatings: Submit labelled samples of each coating system, on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

Wet samples

General: Submit two clearly labelled, 500 mL samples of each type of coating required to be tested.

Subcontractors

Specialist applicators: Submit name and contact details of proposed specialist applicators.

1.5 INSPECTION**Notice**

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

- Opaque finishing stages:
 - . Completion of surface preparation.
 - . After application of final coat.
- Clear finishing stages:
 - . Before surface preparation of timber.
 - . Completion of surface preparation.
 - . After application of final coat.

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 PAINTING MATERIALS

Standards

Paint types: To AS/NZS 2311 (2017) Table 4.2 and the following:

- Metal primer - general purpose for iron and steel: To AS/NZS 3750.19 (2008).
- Metal primer - latex for metallic zinc surfaces: To AS 3730.15 (2006).
- Metal primer - solvent borne for ferrous metallic surfaces: To AS 3730.21 (2006).
- Metal primer - zinc-rich organic for iron and steel: To AS/NZS 3750.9 (2009).

Combinations

General: Do not combine products from different manufacturers in a paint system.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the topcoat.

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 *Poisons Standard (SUSMP) (2022)* Part 2 Section 7.

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.

Clear finishes: Complete clear timber finishes before commencing opaque paint finishes in the same area.

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.

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.

Difficult to remove fixtures: Where removal is impractical or difficult, apply surface protection before substrate preparation and painting.

Substrate preparation – generally

General: Prepare substrates to receive the documented paint system.

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.

Clear timber finish systems: Prepare the surface so that its attributes will show through the clear finish without blemishes, using methods including the following:

- Removal of bruises.
- Removal of discolourations, including staining by oil, grease and nailheads.
- Bleaching where necessary to match the timber colour sample.
- Puttying.
- Fine sanding, with the last abrasive no coarser than 220 grit, so that there are no scratches across the grain.

Treated surfaces: If surfaces have been treated with preservatives or fire retardants, make sure the paint system is compatible with the treatment and does not adversely affect its performance.

Exposed steel in coastal areas

Requirement: Before painting, including before applying primers and sealers, clean exposed surfaces to the recommendations of AS 2312.1 (2014) Section 4.

Unpainted surfaces

Standard: To AS/NZS 2311 (2017) Section 3.

Cleaning external surfaces

Sound external surfaces other than timber: Remove dirt, grease, loose and foreign matter, efflorescence and mould by water blasting or steam cleaning without damaging the surface. Remove remaining loose material with hand tools. Use sanding blocks to preserve the arrises of masonry and stone details.

Efflorescence: Eliminate the source of salt and water before cleaning. Allow surface to dry for 15 to 30 days before repainting.

New masonry: Allow 30 days for the masonry to cure and pH level to stabilise before painting.

3.2 PAINTING SYSTEMS

General

Number of coats: Except where one or two coat systems are documented, each paint system consists of at least 3 coats.

New unpainted interior surfaces

Standard: To AS/NZS 2311 (2017) Table 5.1.

New unpainted exterior surfaces

Standard: To AS/NZS 2311 (2017) Table 5.2.

Specialised painting systems

Standard: To AS/NZS 2311 (2017) clause 5.2. Provide the following final coats:

- High build textured or membrane finishes for concrete and masonry: Paint reference number B38 using products conforming to the AS/NZS 4548 series.

- Two-pack gloss pigmented polyurethane: Paint reference number B44.
- Two-pack epoxy: Paint reference number B29.
- Two-pack water based epoxy: Paint reference number B29A.

Exposed steel in coastal areas

Standard: To AS 2312.1 (2014) Table 6.3 for the appropriate durability.

3.3 APPLICATION

Exposed steel in coastal areas

Requirement: Immediately before application of each subsequent paint coat, clean painting surface to remove any soluble salts and contamination which are likely to affect the performance of subsequent paint coatings.

Paint application: To the recommendations of AS 2312.1 (2014) Section 5 and the paint manufacturer.

Paint coating systems: To the recommendations of AS 2312.1 (2014) Section 6.

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 (2017) 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 timber 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:

- External fascia boards.
- Timber door and window frames.
- Bottoms of external doors.
- Associated trim and glazing beads.
- Timber board cladding.

Spraying

General: If the paint application is by spraying, use conventional or airless equipment which conforms to the following:

- Satisfactorily atomises paint being applied.
- Does not require paint to be thinned beyond the maximum amount recommended by the manufacturer.

- Does not introduce oil, water or other contaminants into the applied paint.

Paint with known health hazards: Provide personal protection, masking, ventilating and screening facilities to AS/NZS 4114 (2020).

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 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 (2009).

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.

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.

Wet paint warning

Notices: Place in a conspicuous location and do not remove until the paint is dry.

3.4 COMPLETION

General

Protection and masking: Remove masking and protection coverings before paint has dried.

Cleaning: On completion of painting, remove splatters from adjacent finished surfaces by washing, scraping or other methods which do not scratch or damage the surface.

Reinstatement: Repair, replace or refinish any damage, including works of other trades. Touch up new damaged paintwork or misses only with the paint batch used in the original application.

Fixtures: Refix removed and undamaged fixtures in the original locations. 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.

0673 POWDER COATINGS**1 GENERAL****1.1 STANDARDS****General**

Application to aluminium and aluminium alloy substrates for architectural applications: To AS 3715 (2002) and AAMA 2603 (2021), AAMA 2604 (2021) and AAMA 2605 (2020) as appropriate.

Application to metal substrates other than aluminium for architectural applications: To AS 4506 (2005).

1.2 INTERPRETATION**Definitions**

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

- Powder coating: The process of preparing, applying, fusing and curing a thermoset powder coating material to a substrate:
 - . Thermoset powder coating: A mixture of finely ground particles of pigment and resin sprayed on to a prepared substrate. Charged powder particles adhere to electrically grounded surfaces until heated and fused into a smooth coating in a curing oven.
 - . Polyester powder coating: Uses an enhanced polyester resin.
 - . Fluoropolymer powder coating: Uses PTFE (poly tetra fluoro ethylene) for aluminium substrates.
- Substrate: The surface to which a material or product is applied.

1.3 SUBMISSIONS**Products and materials**

Coating manufacturer: Submit the following details at least 3 weeks before fabrication:

- Recommended coating system for the nominated service condition.
- Brand name.
- Storage and handling recommendations.
- Product data sheets.
- Maintenance recommendations.

Samples

Powder coating samples: Submit samples of each coating system on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

Subcontractors

Specialist applicators: Submit name and contact details of proposed specialist applicators as registered by the coating manufacturer.

Warranties

General: Submit the coating manufacturer's warranties.

2 EXECUTION**2.1 PREPARATION****Substrate pre-treatment**

Powder coating to aluminium: To AS 3715 (2002) Appendix G.

Powder coating to metals, other than aluminium: To AS 4506 (2005) Appendix I.

2.2 COATING PROPERTIES**Coating performance**

Powder coating to aluminium: To AS 3715 (2002), AAMA 2604 (2021) or AAMA 2605 (2020).

Powder coating to metals other than aluminium: To AS 4506 (2005) Section 2.

2.3 COMPLETION**Cleaning**

Aluminium architectural applications: Clean completed assembly to AS 3715 (2002) Appendix C.

Metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 (2005) Appendix D.

0702 MECHANICAL**1 MECHANICAL SYSTEMS****1.1 STANDARDS****General**

Mechanical ventilation and air conditioning: To AS 1668.1 (2015) and AS 1668.2 (2012).

Microbial control: To AS/NZS 3666.1 (2011), AS/NZS 3666.2 (2011) and the recommendations of SA/SNZ HB 32 (1995).

Plumbing, drainage and water supply: To AS/NZS 3500.0 (2021), AS/NZS 3500.1 (2021), AS/NZS 3500.2 (2021), AS/NZS 3500.3 (2021) and AS/NZS 3500.4 (2021) and the PCA (2022) [PCA (2019)].

Refrigeration systems: To AS/NZS 5149.1 (2016), AS/NZS 5149.2 (2016), AS/NZS 5149.3 (2016) and AS/NZS 5149.4 (2016).

Residential heating and cooling systems: To AS/NZS 5141 (2018).

1.2 SUBMISSIONS**Baseline data**

Requirement: Submit baseline data to **BASELINE DATA** in *0171 General requirements*.

Certification

Completion: Submit certificate as verification that the design and installation conforms to all contractual and statutory requirements.

Shop drawings

Requirement: Show the following on the drawings:

- Areas to be air conditioned and ventilated.
- Air conditioning zones and sensor location.
- Drawing of the proposed duct, pipe and equipment layout. Show proposed zoning and methods of heating.
- Proposed plant locations.
- Details of fire provisions.
- Proposed ventilation systems.

1.3 ADHESIVES AND SEALANTS**Requirements**

Requirement: Provide only materials that:

- Have a Smoke-Developed Index less than 3 and a Spread-of-Flame Index of 0 tested to AS/NZS 1530.3 (1999).
- Are suitable for application by gun, spray, brush, hand or other means recommended by the manufacturer.
- Are recommended by the adhesive or sealant manufacturer for the application and surfaces to which they are applied and which bond without the application of primers.
- After curing, have high elastomeric properties under the operating conditions to which it is exposed including temperatures, air velocities, contaminants in the air and vibration.

- If exposed to sunlight, are resistant to ultraviolet light and ozone.
- Remain flexible and maintain their sealing and adhesion performance for the design life of the component to which they are applied.
- Do not support mould or other microbial growth.
- Are resistant to oils, refrigerants and water.
- Are non-toxic.
- Do not emit volatile organic compounds.

2 PACKAGED AIR CONDITIONING**2.1 AIR CONDITIONING DESIGN****Standards**

Ducted air conditioners: To AS/NZS 3823.1.2 (2012).

Non-ducted air conditioners: To AS/NZS 3823.1.1 (2012).

Equipment

Performance: Supply equipment as follows:

- Made by a manufacturer with a demonstrated ability to provide spare parts and service promptly to the site.
- Operational within the documented range of outdoor design conditions under the calculated loads without excessive head pressure, unstable operation or icing.
- Labelled to AS/NZS 3823.2 (2013): Minimum 5 star energy rating.

Refrigerant: Provide refrigerant listed as Safety Group A1 or A2L in AS/NZS ISO 817 (2016) and having an Ozone Depletion Potential of 0 and Global Warming Potential less than 700.

Reverse cycle units: Provide effective outdoor coil defrost facility that prevents room temperature dropping more than 2°C during defrost.

Split systems: Supply indoor and outdoor condensing units designed and rated by the manufacturer to operate together.

- Capacity: Minimum 3.5 kW.

Equipment enclosures: Provide enclosures, materials and finishes that are corrosion-resistant, assembled and reinforced to prevent flexing and drumming.

External equipment enclosures: Weatherproof.

Enclosure insulation: Insulate enclosures to prevent external surface condensation under all operating conditions. Fix insulation to panels with waterproof adhesive applied to at least 50% of the panel area.

Supply fan: Centrifugal with multi-speed or variable speed motor, or single speed motor with belt drive and adjustable pulley.

Condenser fans: Low speed propeller or axial.

Filter performance: Provide dry media filters with performance to one of the following:

- AS 1324.1 (2001): ≥ G4.
- ASHRAE 52.2 (2017): ≥ MERV 6.
- EN 779 (2012): ≥ G4.

- ISO 16890-1 (2016): \geq Coarse 90%.

Drain trays: Aluminium, stainless steel or plastic to collect all moisture inside indoor and outdoor units.

Coils: Copper tube with aluminium plate fins.

Controls

General: Provide the following functions:

- Temperature control for each zone located to accurately sense zone temperature.
- Fan speed selection for multi and variable speed fans.
- Day/night zone changeover if scheduled.
- Time switch for each system with \geq 6 temperature programs per day, separate programs for each day of the week, manual set point over ride and Vacation temperature set back.

2.2 UNIT INSTALLATION

General

Requirement: Supply all necessary components, including but not limited to:

- Means of attachment to the structure.
- Anti-vibration mounting.
- Appropriate flexible connections.
- Trim and weather sealing around openings.
- Electrical connections.
- Drainage connections.
- Field connection of refrigerant lines in split systems.

Alignment: Install units level, plumb and to manufacturer's recommendations.

Fixing: Bolt units in place with minimum 4 anchors or suspension rods.

Vibration isolation

General: Provide to each assembly at least four mountings, located to give uniform deflection under the applied load.

Isolation efficiency: \geq 95%.

Suspended units:

- Suspended from lightweight structures: Metal spring or rubber-in-shear isolation mountings with at least 25 mm static deflection. Provide each mounting with a levelling screw and locknut.
- Suspended from heavyweight structure: Double deflection neoprene or rubber in shear mountings static deflection greater than or equal to 15 mm.

Floor mounted units: Mount on neoprene waffle pads.

Cleaning

General: Clean interior of ductwork progressively during installation.

2.3 DUCTWORK

Standard

Flexible duct: To AS 4254.1 (2021).

Rigid ductwork: To AS 4254.2 (2012).

Materials

Ductwork fittings: Provide fittings, including fittings between flexible duct, fabricated from sheet metal.

Insulation fire hazard properties: To AS 4254.1 (2021) and AS 4254.2 (2012).

Flexible duct

Layout: Install flexible duct as straight as possible with minimum number of bends. Maximise bend radius but not less than required by AS 4254.1 (2021) clause 2.5.3(i).

Cutting to length: Make sure the inner core is fully extended before cutting. Cut to this length. Do not leave excess lengths of flexible duct for possible future relocation of air terminal devices.

Joints: Securely fix flexible duct to rigid spigots and sleeves using draw bands. Provide spigots with a bead.

Draw bands: Stainless steel or non-metallic with a tensile strength of \geq 670 N.

Sealing: Seal the joint between the flexible duct and rigid duct using one of the following methods:

- Duct tape as detailed in AS 4254.1 (2021).
- Mastic sealant placed between the flexible duct core and rigid duct. Do not apply mastic sealant as a fillet.

Maximum length of flexible duct sections: 6 m including the length of any rigid duct or sleeves used to join lengths of flexible duct.

Substitution: If rigid duct is shown on the drawings do not substitute flexible duct.

Constriction: If flexible duct is compressed or deformed by a building element or other component, conform to the following:

- Extent of constriction: Smallest dimension perpendicular to air flow not less than 80% of the original duct diameter.
- Length of constriction: Less than 300 mm.
- Number of constrictions: Not more than 2 in an individual run of flexible duct in not more than 20% of flexible duct runs in an air handling system.

Safety trays

General: If leaks or condensation from equipment could cause nuisance or damage to the building or its contents, provide a galvanized steel safety tray under the equipment.

2.4 AIR GRILLES

General

Supply air: Provide supply air grilles, diffusers, registers or unducted room air conditioners to evenly distribute supply air within the space. Provide at least one air grille, diffuser, register or unducted room air conditioner in each room or space served.

Return air: Provide return air grilles to the air conditioning plant in an energy efficient manner.

Proprietary air grilles: Conform to the following:

- Free from distortion, bends, surface defects, irregular joints, exposed fastenings and operation vibration.
- With flange corners neatly mitred, butted and buffed, with no joint gaps.

Material: Steel or aluminium.

Finish to exposed surfaces: Powder coated to the nominated colour.

Installation

Mounting: Provide a matching escutcheon to close gaps between the air grille and its surrounds. Provide air grilles with flanges to cover penetrations and irregularities in surrounds.

Appearance: Install square.

Fixing accessibility: Provide fasteners which allow removal of the air grille without damage to surrounds or air grille.

Gaskets: Provide foam type gaskets under air grille flanges or flanged supports.

Plenum and cushion head boxes: Provide side entry plenum or cushion head boxes to air grilles connected to flexible ductwork.

2.5 REFRIGERATION PIPEWORK

General

Pipes: To AS 1571 (2020).

Deemed to comply: Split system manufacturer's standard pre-charged piping kit standard.

2.6 CONDENSATE DRAINS

General

Requirement: Provide trapped, at least DN 20 condensate drains to AS/NZS 3666.1 (2011) from each indoor coil and safety tray. Provide drains from each reverse cycle outdoor coil unless casing freely drains to a roof or other location where condensate will not cause damage or pond.

2.7 COMPLETION

Commissioning

Requirement: Commission mechanical services when:

- The respective systems or parts of systems are at a stage of static completion.
- The building work on which commissioning depends is complete.

Adjustments: Make the adjustments necessary to achieve the documented performance under continuous operating service conditions, including balancing, setting the controls, checking the operation of overload and safety devices, and correcting malfunctions.

Automatic controls: Test controls hardware and software for correct operation.

Sensors for automatic controls:

- Calibration: Calibrate sensors to within the documented accuracy of the sensor.
- Set points: Adjust sensors to documented values.

Safety controls: Test each safety control and facility by simulating the unsafe condition that the control is intended to protect against. Make sure that monitoring and safety measures are in place for the test to protect personnel from injury and the building and equipment from damage.

Cleaning

General: Clean filters, outdoor coils, grilles and diffusers before the date for practical completion.

Operating and maintenance instructions

Requirement: Provide written operating and maintenance instructions containing the following:

- Contractor's contact details for service calls.
- Manufacturers' maintenance and operation literature.
- Manufacturers' warranty certificates if the manufacturers' warranty period is greater than the defects liability period.
- Description of day to day operation.
- Setting of time switches.
- Schedule of recommended maintenance.

Record drawing: Provide a drawing of the system as installed.

2.8 MAINTENANCE

General

Requirement: Provide all labour and material necessary to maintain the mechanical installation including, but not limited, to filter media, belts, refrigerants, lubricants and all items commonly referred to as consumable.

Maintenance period: The greater of 12 months from the date of completion of commissioning of the systems and the duration of the Defects Liability Period.

Corrective maintenance: Attend site and undertake corrective maintenance within 24 hours of receipt of verbal or written advice.

Preventative maintenance: Provide preventative maintenance recommended by the equipment manufacturer.

Minimum level of maintenance: To the operation and maintenance manual and the manufacturer's recommendations.

Frequency of maintenance: Carry out the actions, at no lower frequency than the intervals recommended in AIRAH DA19 (2019) for Maintenance Level A.

Service records: Record maintenance undertaken in the schedules in the operation and maintenance manuals. Minimum level of maintenance: To the operation and maintenance manual and the manufacturer's recommendations.

Frequency of maintenance: Carry out the actions, at no lower frequency than the intervals recommended in AIRAH DA19 (2019) for Maintenance Level A.

Service records: Record maintenance undertaken in the schedules in the operation and maintenance manuals.

3 FANS

3.1 DESIGN

Fan efficiency

Requirement: Provide fans with efficiencies to BCA (2022) J6D5 [BCA (2019) J5.4].

Centrifugal fans

Requirement: Select fans so the air flow can be increased at least 10% above the rate documented, as follows:

- Against the corresponding increased system resistance as installed.
- Without unstable operation.
- Without motor change.
- By speed change alone.

Axial flow fans

Requirement: Select fans so the air flow can be increased at least 10% above the rate documented, as follows:

- Against the corresponding increased system resistance as installed.
- Without unstable operation.
- Without motor change.
- By pitch angle change alone.

Fans with multi-speed motors

Requirement: Conform to the following:

- Two speed fans: Provide fans selected to perform duties documented.
- Fans with 3 or more speeds and single phase fans with adjustable speed control: Provide fans selected to achieve the duty documented at a speed not more than 80% of highest speed.

3.2 CENTRIFUGAL FANS – IN-LINE

General

Requirement: Non-overloading power characteristics.

Casings

Casing types: Rectangular or circular with spigot or flanges for duct mounting, with construction as follows:

- Steel: Metallic-coated steel sheet, spot welded. Brush and prime spot welds with zinc-rich organic primer to AS/NZS 3750.9 (2009).
- Non-metallic: Moulded glass reinforced plastic (GRP) or impact resistant plastic with integral support foot.

Access to impellers up to 350 mm diameter: Provide fan manufacturer's standard fast clamps both sides of the fan to permit removal of the impeller-motor assembly or fan as a whole.

Impellers

Requirement: Backward inclined or forward curved style.

Construction: Metallic-coated steel, extruded aluminium or polypropylene.

Balance: Balance impellers statically and dynamically.

Electrical

Motors: Direct mounted to impellers with minimum thermal class 155 (F) insulation to IEC 60085 (2007).

Bearings: Sealed for life bearings with a minimum rating fatigue life of 40 000 hours at 40°C ambient.

Overload protection: Provide manual reset current overload protection to AS/NZS 60335.2.80 (2016).

Electrical connection: Terminal box external to fan casing and wired to fan motor.

3.3 AXIAL FLOW FANS

General

Requirement: Non-overloading power characteristics.

Casing

Type: Tubular, flanged at each end, constructed from mild steel, fully welded, hot-dip galvanized after fabrication.

Impellers

Requirement: Aerofoil section blades constructed from cast aluminium alloy or glass reinforced plastic.

3.4 ROOF MOUNTED FANS

Types

General: Centrifugal, mixed flow, aerofoil axial or propeller.

Axial flow and propeller: Conform to **AXIAL FLOW FANS**.

Mixed flow fans:

- Impeller: Mixed flow with rotating parts vibration isolated from the unit casings by suitable resilient mountings.
- Arrangement: Position the motor above the impeller to allow servicing from above the roof.

Housing

Requirement: House fans in compact bases fitted with weathering skirts and a hinged or removable weatherproof cowl with bird screen.

Material: UV stabilised ABS, polypropylene, polyethylene, glass-fibre reinforced polyester or steel, hot-dip galvanized (HDG) after manufacture.

Vertical discharge

Requirement: Weatherproof metallic-coated steel, plastic or aluminium backdraft dampers where the weather may enter when units are stopped.

Backdraft damper closure: Counterweighted or electrically driven.

Motors

Bearings: Sealed for life or grease-packed, fitted with lubrication lines extending through roof cowls. Provide bearings with a minimum rating fatigue life of 40 000 hours. Provide access to grease relief ports.

Minimum degree of protection: IP55.

3.5 WINDOW/WALL FANS

General

Housing: Provide the following:

- Isolating mountings.
- Discharge cowls with birdmesh guards.
- Backdraft shutters constructed from lightweight nylon or aluminium blades, arranged to gravity close when fans are not operating.

3.6 INSTALLATION

Duct connections

Flexible connections: Provide flexible connections to prevent transmission of vibration to ductwork. If under negative pressure, make sure that flexible

connection does not reduce fan inlet area by providing a spacer piece at least one fan diameter long between the flexible connection and the fan inlet.

0802 HYDRAULIC

1 HYDRAULIC SYSTEMS

1.1 STANDARDS

General

Plumbing and drainage: To AS/NZS 3500.0 (2021), AS/NZS 3500.1 (2021), AS/NZS 3500.2 (2021), AS/NZS 3500.3 (2021), AS/NZS 3500.4 (2021) and the PCA (2022) [PCA (2019)].

Copper pipe and fittings-installation and commissioning: To AS 4809 (2017).

Gas: To AS/NZS 5601.1 (2013).

Microbial control: To AS/NZS 3666.1 (2011), AS/NZS 3666.2 (2011) and the recommendations of SA/SNZ HB 32 (1995).

1.2 INTERPRETATION

Abbreviations

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

- LPG: Liquefied petroleum gas.

1.3 SUBMISSIONS

Records

Certificate of compliance: Within 5 working days of completing the plumbing works, including gas, lodge a Certificate of compliance with the Department of Mines, Industry Regulation and Safety or Plumbers Licensing Board. Include all required documentation.

1.4 INSPECTION

Notice

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

- Excavated surfaces.
- Concealed or underground services.

1.5 PRODUCTS

Authorised products

Requirement: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

Water efficiency

Requirement: Provide products with documented water efficiency but not less than that in the PCA (2022) [PCA (2019)].

Labelling

Water efficiency labelling: Provide products conforming to and labelled to the Water Efficiency Labelling Scheme (WELS) or the Waterwise Products Program.

Bushfire-prone areas

Site with Bushfire Attack Level (BAL) 12.5, 19, 29, 40 or FZ to AS 3959 (2018): If external and above ground, provide metal pipes and fittings to AS 3959 (2018).

1.6 INSTALLATION

Connections to mains

General: Excavate to locate and expose the connection points and connect to the Network Utility Operator and gas Network Operator mains. On completion, backfill and compact the excavation and reinstate surfaces and elements which have been disturbed such as roads, pavements, kerbs, footpaths and nature strips to *0223 Service trenching*.

Connections: Connect to Network Utility Operator mains.

Metering: Provide metering, valves and fittings to Network Utility Operator requirements.

Service trenching

Requirement: To *0223 Service trenching*.

Accessories

General: Provide the accessories and fittings necessary for the proper functioning of the systems, including taps, valves, outlets, pressure and temperature control devices, strainers, gauges and pumps.

Isolating valves: In addition to valves required to meet statutory requirements, provide valves to allow safe isolation of parts of the system, with minimum inconvenience to the building occupants, in event of leaks or maintenance.

Movement compensation

Compensation: Arrange piping crossing building expansion joints so that moment in the joint does not cause damage.

1.7 PIPING

Finishes

Exposed piping: Finish exposed piping, including fittings and supports, as follows:

- In internal locations such as toilet and kitchen areas: Chrome plate copper piping to AS 1192 (2004) service condition 2, bright.
- Externally and steel piping and iron fittings internally: Paint.
- In concealed but accessible spaces (including cupboards and non-habitable enclosed spaces): Leave copper and plastic unpainted except for identification marking. Prime steel piping and iron fittings.

Valves: Finish valves to match connected piping.

1.8 COMMISSIONING

General

Requirement: Provide commissioning as documented. Conform to *0171 General requirements* and SA TS 5342 (2021).

2 SANITARY FIXTURES

2.1 PRODUCTS

Toilet suites

Rating: Minimum 4 stars WELS rated dual flush.

Shower heads

Rating: Minimum 3 stars WELS rated.

Baths

Type: Bath with soap holder, waste outlet, bar grate and plug.

- Dwellings with 3 or more bedrooms: Minimum 1675 mm length.
- Other dwellings: Minimum 1500 mm length.

Basins

Type: White, vitreous china vanity basin with overflow.

Properties: Size, configuration and tap hole configuration, as documented.

Towel rails

Type: Chrome plated brass or stainless steel rail, as documented.

Robe hooks

Type: Chrome plated brass or stainless steel rail, as documented.

Toilet roll holders

Type: Chrome plated brass or stainless steel single roll holder, as documented.

Soap dish

Type: Chrome plated brass or stainless steel dish, as documented.

Laundry tub and cabinet

Standard: To AS/NZS 1229 (2002) Section 5.

Type: Provide one of the following:

- Tub and cabinet with lockable side entry for concealed washing machine taps.
- Tub integrated into joinery.

Tub material: Type 304 stainless steel.

Bowl capacity: Minimum 42 litres.

Internal tap fittings

Rating: Minimum 4 stars WELS rated.

Type: All fittings other than bath outlets and showers to be chrome plated lever handled mixer tap (hot and cold) with 150 mm swivel arm with aerator outlet.

Kitchen sink

Type: Sink with drainer on each side and single tap hole. Bowl type as documented.

Size: As documented.

3 WATER HEATERS

3.1 GENERAL

Water heaters

Requirement: Provide water heaters compatible with low flow fixtures and fittings.

Location: Locate water heaters where they can be maintained or replaced without damaging adjacent structures, fixtures or finishes.

Isolating valves: Provide isolation valves to water heaters.

3.2 ELECTRIC STORAGE WATER HEATERS

Description

General: Proprietary automatic electrically heated water heater including connections, controls and fittings.

Standards

General: To AS/NZS 4692.1 (2005).

Energy performance: To AS/NZS 4692.2 (2005).

Tariff

General: Install so that the heating system qualifies for the tariff concession or subsidy offered by the electricity distributor.

3.3 GAS STORAGE WATER HEATERS**Description**

General: Proprietary automatic gas-fired water heater including connections, controls and fittings.

Standards

Heater design and construction: To AS/NZS 5263.1.2 (2020) and AS/NZS 4552.2 (2010). If a flue damper is available for the water heater supplied, provide one.

Energy performance: To AS/NZS 4552.2 (2010).

3.4 SOLAR WATER HEATERS**Description**

General: Proprietary automatic water heater comprising solar collector and storage container and including connections, controls and fittings.

Standards

General: To AS/NZS 2712 (2007).

3.5 HEAT PUMP WATER HEATERS**Description**

General: Proprietary automatic water heater comprising self-contained reverse cycle heating system and storage container, including connections, controls and fittings.

Standards

General: To AS/NZS 2712 (2007).

Safety: To AS/NZS 60335.2.40 (2019).

Performance evaluation: To AS/NZS 5125.1 (2014).

3.6 INSTANTANEOUS WATER HEATERS**Gas instantaneous heaters**

Standard: To AS/NZS 5601.1 (2013).

Energy rating: Minimum 6 stars.

Power supply: Provide gas and electrical supply with isolation at the heater.

Free air flow: Make sure air flow around and above the heater is not obstructed and discharge air does not short-circuit to the air intake.

Electric instantaneous heaters

Standard: To AS/NZS 60335.2.35 (2013).

3.7 INSTALLATION**General**

Standard: Install to AS/NZS 3500.4 (2021).

Gas water heaters

Standard: Install to AS/NZS 5601.1 (2013).

Solar water heaters

Collectors: Install collectors:

- Facing $\pm 20^\circ$ of north.
- Inclined at the angle for the nearest location listed in AS/NZS 3500.4 (2021) Table G.1.

- In a location not subject to shading at any time of year especially in winter when the sun is low.

Adjustment: If installing at other angles and/or subject to shading, increase the size of the collectors to that required to give the performance of an unshaded collector oriented as specified above.

Heat pump water heaters

General: Make sure that free air flow around and above the heater is not obstructed and that discharge air does not short-circuit to the air intake.

Manifolds

General: If multiple heaters are installed in banks use the manufacturer's standard manifold arrangement to provide equal flow through each heater in the bank.

3.8 COMMISSIONING**General**

Requirement: Commission to the manufacturer's recommendations.

4 TANKS**4.1 STANDARDS****General**

Metal tanks and rainwater goods: To AS/NZS 2179.1 (2014).

Products in contact with drinking water: Tested to AS/NZS 4020 (2018).

4.2 SUBMISSIONS**Warranties**

Manufacturer's warranty: Submit the tank manufacturer's warranty. Include a copy of the warranty in the operation and maintenance manual.

4.3 PRODUCTS**Accessibility**

Interior: Arrange tanks so the interior is accessible for inspection and cleaning. Arrange internal features to permit effective cleaning.

Support

Requirement: Provide structural support to withstand the weight of the tank when full without deformation or excessive settling.

4.4 BLADDER TANKS**General**

Type: Proprietary plastic bladder type.

Material: Reinforced polymer conforming to AS 2070 (1999), resistant to puncture and microbial attack.

Bedding: Provide adequate bedding to support the weight of the bladder when full.

4.5 METALLIC-COATED STEEL TANKS**Construction**

Materials: Conform to the following:

- Top and sides: Metallic-coated steel with polymer film to AS 2070 (1999) on the inside and pre-painted on the outside.

- Base: Metallic-coated steel with polymer film to AS 2070 (1999) on inside and prepainted on the outside.
- Plinth: Provide a plinth under the whole area of the tank designed to support the load of the tank when full.

4.6 ROTATIONALLY MOULDED TANKS

General

Standard: To AS/NZS 4766 (2020).

4.7 ABOVE GROUND TANK INSTALLATION

General

Restraint: Restrain the tank to prevent movement, when empty, caused by wind and other loads.

Base: Provide a level base with gaps not exceeding 10 mm, free of sharp projections and projecting beyond the edge of the tank at all points.

Foundations

Requirement: Provide foundations for the tanks that are flat, level with irregularities measured laterally or diagonally less than 2 mm in any 1 m but no more than 6 mm in any 3 m.

Intermittent supports: Continuous across the width of the tank and spaced to manufacturer's recommendations.

Rotationally moulded tanks

Support:

- Tanks ≤ 1000 litres: Trim and compact the ground and place a level bed of sand at least 50 mm thick.
- Tanks > 1000 litres: Designed by a professional engineer.

Coated steel tanks

Support: Fully support the tank on a self-draining timber or concrete base.

Corrosion protection:

- Prevent contact with dissimilar metals.
- Arrange so that no part of the tank is below ground level and so that adjacent ground surfaces fall away from the tank.
- Do not use sharp objects inside the tank. After drilling or cutting ferrous metal, remove swarf with a magnet.
- Recoat or seal new openings to restore original corrosion resistance.

Bladder tanks

Support: Locate on a level base free from sharp objects. Install with manufacturer's supporting frame.

Relief: Provide over-pressurising relief and air vent.

4.8 COMPLETION

Cleaning

Cleaning: Wash and flush tanks to remove manufacturing and other contaminants.

5 STORMWATER – BUILDINGS

5.1 GENERAL

Standards

General: To AS/NZS 3500.3 (2021).

5.2 STORMWATER DRAINS

Cleaning

General: During construction, use temporary covers to openings and keep the system free of debris.

Laying

Installation: Lay in straight lines between changes in direction or grade with sockets pointing up hill. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous, cap open ends to prevent entry of foreign matter.

Downpipe connections

Termination: Select from the following:

- Termination over pit: Stop downpipe 100 mm above the ground level and discharged into grated pit. Do not connect directly into stormwater pipes.
- Direct connection: Bring downpipes out from the building at a suitable angle and level so the downpipe enters the underground drain at the finished level of the surrounding area. Turn up branch pipelines with bends to meet the downpipe, finishing horizontally 50 mm (nominal) above finished ground or pavement level. Seal joints between downpipes and drains.

5.3 SUBSOIL DRAINS

General

Requirement: Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under floors and pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Trench width: Minimum 450 mm.

Trench floor: Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material.

Pipe depth: Provide the following minimum clear depths, measured to the crown of the pipe, below the following elements:

- Formation level of the pavement, kerb or channel: 100 mm.
- Average gradient of the bottom of footings: 100 mm.
- Finished surface of unpaved ground: 450 mm.

Joining

General: At junctions of subsoil pipes, provide tees, couplings or adaptors to AS 2439.1 (2007).

Pipe underlay

General: Bed piping on a continuous underlay of bedding material, minimum 75 mm and maximum 150 mm thick after compaction. Lay the pipe with one line of perforations at the bottom.

Chases: If required, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

Pipe surrounds

General: Place the material in the pipe surround in layers, of a maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements, slabs and channels.
- To within 150 mm of the finished surface of unpaved or landscaped areas.

Geotextile

Requirement: Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene amide or vinylidene chloride and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

Marking: To AS 3705 (2012).

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation, do not expose the filter fabric to sunlight for more than 14 days.

Filter socks

General: Provide permeable polyester socks, capable of retaining particles 0.25 mm and greater. Securely fit or join the sock at each joint.

5.4 PITS

Finish to in situ exposed surfaces

General: Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms.

Location: At junctions, changes of gradient and changes of direction of stormwater drains.

Metal access covers and grates

Standard: To AS 3996 (2019).

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface.
- In landscaped areas: 25 mm above finished surface.
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

5.5 TESTING

Pre-completion tests

General: Before backfilling or concealing, carry out the following tests to AS/NZS 3500.3 (2021) Section 9:

- Downpipes within buildings: Air or water pressure test.
- Site stormwater drains and main internal drains: Air or water pressure test.
- Rising mains from pumped discharge: Water pressure test.

Leaks: If leaks are found, rectify and re-test.

5.6 COMPLETION

Cleaning

General: Clean and flush the whole installation.

6 WASTEWATER

6.1 GENERAL

Standards

General: To AS/NZS 3500.2 (2021).

Waterless composting toilets: To AS/NZS 1546.2 (2008).

On-site domestic wastewater treatment units: To AS 1546.3 (2017).

Cleaning

General: During construction, use temporary covers to openings and keep the system free of debris.

6.2 PRODUCTS

Material selection

Environmental conditions: Provide materials capable of withstanding the operational environmental conditions. Select and install to manufacturers' recommendations.

Dissimilar materials: Connect dissimilar materials using adapters to Network Utility Operator requirements and manufacturer's recommendations.

Rubber banded sleeves: Do not provide.

6.3 FLOOR WASTES

General

Requirement: Provide each floor waste with a trap constructed of the material specified for the sanitary plumbing system. Fit off each riser with a minimum 80 mm diameter, chromium plated brass grating finished flush with the surrounding floor finish. If the floor surfaces are vinyl, provide gratings and outlets designed to permit the vinyl to be turned down into the outlet and the grating clamped down onto the surface.

Waterproofing: Make sure all penetrations through floors and finishes up to the edge of grates are fully waterproof.

Priming: Provide priming of floor wastes. If floor wastes cannot be primed via fixture, provide priming valves to maintain the water seal to AS/NZS 3500.2 (2021).

6.4 SANITARY PLUMBING

Order of work

Requirement: Start drain laying at the downstream end of the drainage system (at the connection point to site infrastructure), not the upstream end. Confirm invert levels with building elements before starting to lay drains.

Expansion joints

Location: Provide expansion joints where pipes cross seismic or movement joints in the building, and from the building to below ground outside the building.

Inspection openings

Location: Provide inspection openings at each upstream end of branch and main drains, change of direction, entry to stacks and to AS/NZS 3500.2 (2021). Provide inspection openings complete with access riser brought up to finished floor levels. If access risers are located in tiled floor areas or surfaces with similar finishes, provide slip-resistant inspection covers with neoprene gas tight sealing rings.

Size: Provide inspection openings that allow full access to the waste pipe.

Vertical stacks: Provide a removable access gate opening of size equal to the diameter of the pipe approximately 600 mm above finished floor level. If the stack is concealed behind a wall or duct, provide a hinged access panel in the wall or duct with finish to match the surface in which it is installed.

Tundishes

Location: Provide suitably sized, trapped tundishes to collect condensate wastes from mechanical equipment, as documented. Connect tundishes to nearest waste or floor drain. Connect tundish waste to floor wastes, wastes or drains and provide traps and vents where necessary.

Charging: If tundishes are not provided with a constant discharge from equipment and are connected directly to the sanitary plumbing system or drainage system, provide a trap seal primer valve to make sure that the trap of the tundish is charged at all times.

Vent pipes

Requirement: Provide upstream and downstream vents to AS/NZS 3500.2 (2021).

Location: Locate vents at least 6 m from any air intake or grille and at least 3 m from exhaust discharges.

Staying to roof: If fixings for stays penetrate the roof covering, seal the penetrations and make watertight.

Terminations: Provide vent cowls of the same material as the vent pipe.

Wet area floors

General: Where drainage connections pass through wet area floors, terminate 4 mm below the substrate surface.

6.5 SEWAGE TREATMENT**Septic tanks and interceptor tanks**

Requirement: Provide septic tanks and associated fittings to AS/NZS 1546.1 (2008) and the *Code of Practice for Product Approval of Onsite Wastewater Systems* (2013).

Effluent disposal: To AS/NZS 1547 (2012).

Tank requirements and size: 1 x 1200 mm diameter and 1 x 1500 mm diameter concrete septic tanks.

Lid type: Trafficable.

Installation of apparatus for sewage treatment: To the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 (WA)*.

Drains from floor level to septic tanks: Run in 100 mm sewer pipe.

I/O junctions: Bury connectors and junction boxes.

Compliance and approval: To the Health Department and local government authority's requirements.

Leach drains

Length and type: To *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 (WA)* and local government authority's requirements.

Installation: Construct with brickwork, concrete segments, or lightweight polypropylene modular tank system (for underground water storage).

6.6 COMPLETION**Cleaning**

General: On completion clean and flush the whole installation.

7 COLD AND HEATED WATER**7.1 GENERAL****Standards**

General: To AS/NZS 3500.1 (2021) and AS/NZS 3500.4 (2021).

Copper pipe: To AS 4809 (2017).

Heated water temperature

Standard: To AS/NZS 3500.4 (2021).

Maximum temperature at ablution outlets: 50°C.

Maximum recommended temperature at kitchen sinks and laundry tubs: 60°C.

7.2 PRODUCTS**Backflow prevention devices**

Standard: To AS/NZS 2845.1 (2022) and AS 2845.2 (2010).

Pressure drop: Select for lowest pressure drop compatible with the required functions.

Thermostatic mixing valves

Standard: To AS 4032.1 (2005).

Requirement: Provide thermostatic mixing valves that automatically control the temperature at the mixed outlet to a preselected temperature and suitable for the number of outlets served by the individual valve.

Controls: Include the following:

- A temperature sensitive automatic control that maintains temperature at the preselected setting and rapidly shuts down the flow if either the supply system fails, or if the normal discharge water temperature is exceeded.
- Hot water flush facility.

Wall box: If documented, house the thermostatic mixing valve in a stainless steel recessed wall box with a hinged door and keyed lock.

Water meters

Standard: To AS 3565.4 (2007).

Installation: To the requirements of the Network Utility Operator.

Sub water meters: Provide sub water meters as documented.

7.3 PIPING

Piping

Requirement: Install piping in straight lines and to uniform grades. Arrange and support the piping so that it remains free from vibration and water hammer, while permitting thermal movement. Keep the number of joints to a minimum. Prevent direct contact between incompatible metals.

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

Concealment: If practicable, conceal piping and fittings requiring maintenance or servicing so that they are accessible within non-habitable enclosed spaces such as roof spaces, subfloor spaces and ducts. Keep pipelines in subfloor spaces at least 150 mm above ground and make sure access can be provided throughout for inspection. Provide at least 25 mm clearance between adjacent pipelines (measured from the piping insulation where applicable).

Building penetrations: If piping or conduit penetrates building elements, provide metal or PVC-U sleeves formed from oversized pipe sections.

Cover plates: If exposed piping emerges from wall, floor or ceiling finishes, provide cover plates of non-ferrous metal, finished to match the piping, or of stainless steel.

Pipe support materials: The same as the piping, or galvanized or non-ferrous metals, with bonded PVC-U or glass fibre woven tape sleeves where needed to separate dissimilar metals.

Stand pipes

Requirement: Provide external stand pipes complete with 12 mm brass hose cocks, as follows.

- One at front and one at rear fixed against the building.
- One for each private balcony.
- One for each private courtyard.

Hose tap connection: Provide threaded connection (not welded) to cold water service.

- Fix hose tap to wall 600 mm above the finished ground level with backflow prevention devices to AS/NZS 3500.1 (2021).

7.4 BACKFLOW PREVENTION

Location

Requirement: Provide backflow prevention devices in the following locations:

- On main incoming domestic cold water supplies, downstream of meters.
- On all mechanical plant, upstream of the plant.
- On all irrigation systems.
- In other locations required by the Network Utility Operator and AS/NZS 3500.1 (2021).

Installation

Location: Arrange to be readily accessible and easily removal.

External valve locations: Protect from damage and vandalism.

Arrangement: Provide each backflow prevention device with the following:

- Provide unions if \leq DN50, flanges for larger sizes.
- Isolating valves upstream and downstream of each backflow prevention devices.
- Dual check valves to AS/NZS 3500.1 (2021).
- Line strainer upstream of each backflow prevention device.
- Tundish and drain with connection to waste drain to AS/NZS 3500.1 (2021).

Registration: Register valves to Network Utility Operator requirements.

7.5 COMMISSIONING

General

Strainers: Remove, clean and replace strainer baskets.

Cleaning and disinfection: To AS/NZS 3500.1 (2021) Appendix G.

Cold water systems: Test and commission to AS/NZS 3500.1 (2021) Section 17.

Heated water systems: Test and commission to AS/NZS 3500.4 (2021) Section 9 and AS/NZS 3666.1 (2011) Section 3.

Non-drinking water services: To AS/NZS 3500.1 (2021) Section 9.

Testable backflow prevention devices: Test and commission to AS/NZS 2845.3 (2020) by a licensed plumber with backflow device accreditation. Tag and certify to the requirements of the Network Utility Operator.

Thermostatic mixing valves: To AS 4032.1 (2005).

7.6 COMPLETION

Charging

Completion: On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in full operational condition.

Thermostatic mixing valves

Field testing and maintenance: To AS 4032.3 (2022).

8 FUEL GAS

8.1 STANDARDS

Reticulated gas systems

General: To AS/NZS 5601.1 (2013).

Gas equipment

Standard: To AS 3645 (2017) and AS/NZS 5263.0 (2017).

Industrial and commercial gas-fired appliances

General: To AS 3814 (2018).

Steel mains and services

Maximum operating pressure not more than 1050 kPa: To AS/NZS 4645.2 (2018).

Flue cowls

General: To AS 4566 (2005).

8.2 PIPING**Concealment**

General: If practicable, install piping so that it is concealed within service ducts or non-habitable enclosed spaces and does not appear on external walls. Otherwise, provide metal piping mounted on metal brackets and provide metal cover plates at penetrations.

Connection to gas Network Operator mains

Connection: Arrange for connection and connect to gas Network Operator mains. Conform to gas Network Operator requirements.

Buried pipes

Warning tape: During backfilling, lay plastic warning tape 300 mm above and for the full length of buried gas pipes.

- Type: Minimum 100 mm wide, with GAS PIPE UNDER marked continuously.

8.3 LPG STORAGE SYSTEMS**Tank LPG storage**

Tank colour: White.

Certificate holders: Provide a galvanized steel pipe, one end fitted with a brass plug, one end threaded and fitted with a threaded brass cap. Weld to the tank support member.

Cylinder LPG storage

Fittings: Supply cylinders with regulators which have AGA approval.

Hoods

General: Provide a weatherproof protective steel cover to the valve and regulators of 450 L capacity cylinders, together with hinge pins, padlock and key.

Function: For storage of current storage system approval and test certificates.

Marking: Mark the threaded cap with the phrase LPG CERTIFICATES.

Notices and signs

General: Required.

8.4 MANUALS**Operation and maintenance manuals**

Requirement: Prepare manuals to include recommendations for the operation, care and maintenance of gas appliances, storage tanks, valves, regulators and their associated fittings.

8.5 COMMISSIONING**General**

Requirement: On completion of installation and testing, turn on isolating and control valves, and purge and charge the system.

Purging: Conform to the recommendations of AS/NZS 5601.1 (2013) Appendix D.

Appliances: Commission appliances. Conform to the recommendations of AS/NZS 5601.1 (2013) Appendix O.

8.6 COMPLETION**Charging**

Requirement: Immediately before the date for practical completion, fully charge the system with gas.

LPG systems: Fill gas storage containers and replace gas used in testing.

9 RAINWATER STORAGE SYSTEMS**9.1 STANDARDS****General**

Metal rainwater goods: To AS/NZS 2179.1 (2014).

Design, installation, maintenance and repairs: To the recommendations of SA HB 230 (2008).

9.2 RAINWATER TANKS**Rainwater tanks**

Accessories: Provide accessories needed to complete the installation and constructed from corrosion resistant material compatible with the tank material. Include the following:

- Inlet and outlet connections.
- Floating outlet to draw water from the upper part of the tank.
- Tight fitting lids or insect proof screens at all openings.
- Flap valves at every opening to the tank.
- Calmed inlet to the tank to prevent stirring sediment.
- Flywire screened overflow siphon to skim surface contaminants.
- Vermin proof, childproof access opening.
- Easily cleanable filter before the entry to the tank with maximum 1 mm mesh size.

First flush diverter

General: Provide a first flush diverter. Arrange to drain completely.

Sizing: Select for at least 20 L/100 m² rainwater catchment area.

Construction: Corrosion resistant and compatible with the rainwater plumbing and tank.

Discharge: Discharge waste water from the first flush diverter either:

- If permitted by the local authority, onto grassed areas away from tank and building footings.
- To the stormwater installation.

Installation

Requirement: Provide structural support to withstand the mass of the tank when full without deformation or excessive settling. Support connecting piping independently of the tank. Provide a 300 mm long section of reinforced flexible hose to prevent piping exerting a load on the tank. Pipe overflow to discharge away from the tank. Prevent the entry of sunlight to the interior of the tank.

Above ground tanks: Restrain the tank to prevent movement, when empty, caused by wind and other

loads. Provide a level base with gaps not exceeding 10 mm, free of sharp projections and projecting beyond the edge of the tank at all points.

Interior access: Arrange tanks so the interior is accessible for inspection and cleaning. Arrange internal features to permit effective cleaning.

Rotationally moulded tanks: Trim and compact the ground and place a level bed of sand at least 50 mm thick.

Coated steel tanks: Fully support the tank on a self-draining timber or concrete base. Prevent contact with dissimilar metals. Arrange so that no part of the tank is below ground level and so that adjacent ground surfaces fall away from the tank. Do not use sharp objects inside the tank. Remove swarf with a magnet if drilling or cutting.

Bladder tanks: Locate on level base free from sharp objects. Install with manufacturer's supporting frame. Provide over-pressurising relief and air vent.

Cleaning: Flush the rainwater system. Wash and flush tanks to remove manufacturing and other contaminants.

9.3 CLEANING

General

Requirement: Flush the rainwater system. Wash and flush tanks to remove manufacturing and other contaminants.

9.4 COMMISSIONING

General

Testing and commissioning: To AS/NZS 3500.1 (2021) Section 9.

10 GREYWATER SYSTEMS

10.1 STANDARDS

General

Requirement: To AS/NZS 3500.1 (2021).

Sanitary plumbing and sanitary drainage: To AS/NZS 3500.2 (2021).

Design and installation: To the recommendations of SA HB 326 (2008).

10.2 GREYWATER TREATMENT SYSTEMS

Greywater diversion devices

WaterMark: Required.

Access: Locate to facilitate access for inspection and maintenance.

Tanks

General: Provide an appropriately sized surge tanks.

Overflow: Pipe to sewer.

Arrangement: Prevent the entry of sunlight to the interior of the tank.

Backflow prevention

Standard: To AS/NZS 3500.1 (2021) and the requirements of the Network Utility Operator.

10.3 CLEANING

General

Requirement: Flush the greywater system. Wash and flush tanks to remove manufacturing and other contaminants.

10.4 COMMISSIONING

General

Testing and commissioning: To AS/NZS 3500.1 (2021) Section 9.

0902 ELECTRICAL

1 ELECTRICAL SYSTEMS**1.1 STANDARDS****Electrical services**

Requirement: To AS/NZS 3000 (2018), unless otherwise documented.

Electrical installations

Electrical design: To AS/NZS 3000 (2018).

Selection of cables: To AS/NZS 3008.1.1 (2017).

Degrees of protection (IP code): To AS 60529 (2004).

Electromagnetic compatibility (EMC): To the AS/NZS 61000 series.

Communications systems: To AS/CA S008 (2020), AS/CA S009 (2020), AS/NZS 11801.1 (2019) and AS/NZS 14763.2 (2020).

1.2 INTERPRETATION**Abbreviations**

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

- WAER: *WA Electrical Regulations*.
- RCD: Residual Current Device.

Definition

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

- Telephony: Speech and low band frequencies (= 100 kHz).

1.3 SUBMISSIONS**Baseline data**

Requirement: Submit baseline data to **BASELINE DATA** in *0171 General requirements*.

Certification

General: Submit the following:

- Certification of conformance with AS/NZS 3000 (2018), for electrical services.
- Telecommunications cabling: Submit certification for the product and installation.

Completion: Submit certificate as verification that the design and installation conforms to all contractual and statutory requirements.

Products and materials

Data: Submit technical data for all items of plant and equipment, including the following:

- Assumptions.
- Calculations.
- Model name, designation and number.
- Capacity of all system elements.
- Country of origin and manufacture.
- Materials used in the construction.
- Size, including required clearances for installation.
- Certification of compliance with the applicable code or standard.

- Technical data schedules corresponding to the equipment schedules in the contract documents. If there is a discrepancy between the two, substantiate the change.

- Manufacturers' technical literature.

- Type test reports.

- Single line diagram(s), including fault levels at switchboards, cable size and type.

- Switchboard layouts.

Lighting: Submit technical data on the following:

- Luminaires.

- Lamps.

- Ballasts.

- Power factor correction equipment.

- Lighting control systems.

- All accessories.

Telecommunications cabling: Submit technical data including the following:

- System design parameters: Performance.

- Voice and/or data transfer rate.

- Cable type and characteristics.

- Segregation requirements for EMI/EMR.

- Maximum length of cables.

- Cross-connect type and characteristics.

- Cross-connect block.

- Patch cords.

- Fibre optic terminations.

- Patch panel module.

- Cable management for racks.

- Rack.

- Fly leads.

Emergency evacuation lighting: Submit technical data for each type of luminaire and exit sign including the following:

- Maximum luminaire spacing for a given mounting height.

- Luminaire classification to AS/NZS 2293.3 (2018).

- Central battery and charger performance test reports, including discharge and charging characteristics.

Records

Cable management: Before the date for practical completion, submit log books for each distribution frame with details of cable terminations and provisions for recording cable, line and jumper information.

Samples

Lighting: Submit samples of all luminaires and accessories complete with lamp, control gear and three core flex and plug.

Emergency evacuation lighting: Submit samples of all luminaires and exit signs.

Shop drawings

Lighting: Submit shop drawings for the following:

- Lighting columns.

- Lighting column mounting bases.

- Non-proprietary luminaires.
- Non-standard fixing brackets.

Telecommunications cabling: Submit the following:

- Layouts of equipment racks.
- Cross-connect layout.
- Cabling diagram for complete system.
- Cable management system.

1.4 INSPECTION

General

Requirement: Conform to *0171 General requirements*.

1.5 COMMISSIONING

General

Requirement: Provide commissioning as documented. Conform to *0171 General requirements* and SA TS 5342 (2021).

2 LOW VOLTAGE POWER SYSTEMS

2.1 PERFORMANCE

Network supply

General: Liaise with the electricity distributor and provide network connection, as documented.

Program: Schedule the works and statutory inspections to suit the construction program.

Prospective fault current: Determine, from the electricity distributor, the prospective fault current and fault protection requirements.

Supply system: 400 V, 3-phase, 4-wire, 50 Hz, multiple earth neutral (MEN) system.

Distribution system

General: Provide power distribution system elements, as documented.

2.2 SURGE PROTECTION DEVICES (SPD)

General

Requirement: Provide all mode metal oxide varistor based series connected SPD to protect equipment in racks and cabinets, if required.

Standard: To AS 4262.1 (1995) and AS 4262.2 (1999).

Surge rating (I_{max}): ≥ 20 kA (8/20 μ s) phase to neutral and 10 kA neutral to earth.

Voltage protection level (U_p):

- < 600 V at 3 kA.
- 700 V at 500 A.

Visual indicator: Provide visual indication of SPD status.

Enclosure and installation: House SPD in an electrical switchboard or panel and protect with a suitable rated circuit breaker equal to or less than the load current rating of the SPD.

2.3 CONNECTION OF MAINS POWER SUPPLY

Network cable and point of attachment

Connection to network supply: Run aerial network operator's service cable to the private pole or as documented, to the WAER (2019).

Point of attachment for service cable: Provide private pole or as documented, to the WAER (2019).

Pole mounted point of attachment: Provide 12 mm galvanized round steel hook assembly welded to a steel private pole for supporting and connecting aerial network cable at the site boundary to the WAER (2019).

Power run-in

Supply to dwelling for multiple dwellings projects: Provide cabling to switchboard and underground run-in power from the main switchboard to each dwelling.

Maximum cable span:

- Standard service bracket: 30 m.
- Long span raiser bracket: 30 m.

Consumers mains

Requirement: Provide consumers mains, associated services and all necessary fault and overload current protection equipment to AS/NZS 3000 (2018) Section 3 and the WAER (2019).

Protected consumers mains: Provide short circuit and overload protection, where required by the electricity distributor.

Private poles

General: Conform to WAER (2019) and the electricity distributor's requirements for the following:

- Weld on 12 mm round steel hooks.
- Construction, height and position of power pole.
- Points of attachment of aerial distribution such as brackets and anchor blocks.

Private pole location: As documented.

Pole: 125 (internal diameter) x 4.8 mm (thick) galvanized steel.

Pole footing: 450 x 450 x 1200 mm (deep) mass concrete.

Pole height: 6 m above finished ground level with bottom end protruding minimum 100 mm through the bottom of the footing.

Metering

Retail: Provide metering to the requirements of the WAER (2019) and as documented.

Private: Provide energy measurement to BCA (2022) J9D3 [BCA (2019) J8.3], if required.

Photovoltaic metering: Provide energy measurement to BCA (2022) J9D3 [Not in NCC 2019], if required.

Private poles: If required, mount pole on concrete bases to the WAER (2019) and install electrical mains at the centre of the pole and in underground conduits.

- Electrical mains: Provide in underground conduits from the private pole or service pillar to meter panels.

Electrical/gas meter box: Standard metal single or combined cabinet.

Meter installation: Install to the electricity distributor's requirements, including for meter type.

2.4 WIRING SYSTEMS

General

Wiring and site cable reticulation systems: Appropriate to the installation conditions and the function of the load. Include the following:

- Underground services.
- Above-ground services.
- In-building services.

Type: Re-wireable system.

Neutral conductors: Same size as the corresponding active conductors. Rate the neutral conductor size for the maximum harmonic currents.

2.5 POWER CABLES

Standards

Polymeric insulated cables: To AS/NZS 5000.1 (2005).

Aerial cables:

- Copper conductors: To AS 1746 (1991).
- Aluminium conductors: To AS 3607 (1989) or AS 1531 (1991).

Cable

Requirement: Select multi-stranded copper cables.

Default insulation: V-75.

Default sheathing: 4V-75.

Minimum size: Conform to the following:

- Lighting subcircuits: 1.5 mm².
- Power subcircuits: 2.5 mm².
- Submains: 6 mm².

Voltage drop: Select final subcircuit cables within the voltage drop parameters dictated by the route length and load.

Fault loop impedance: Provide final subcircuit cables to satisfy the requirements for automatic disconnection under short-circuit and earth fault/touch voltage conditions.

Underground residential distribution (URD) systems: Cables to AS/NZS 4026 (2008).

Distribution cables: To AS/NZS 4961 (2003).

Colours

Conductor colours: For fixed wiring cables, provide coloured conductor insulation or at least 150 mm of close-fitting coloured sleeving at the termination points of each conductor.

Active conductors in single phase circuits: Red.

Active conductors in polyphase circuits:

- A phase: Red.
- B phase: White.
- C phase: Blue.

Neutral conductors: Black.

Earthing conductors: Green-yellow.

Sheath: White.

Cable installation

Classifications: To AS/NZS 3013 (2005).

Handling cables: Report damage to cable insulation, serving or sheathing.

Stress: Do not use installation methods that exceed the cable's pulling tension. Use cable rollers for cable installed on tray/ladders or in underground enclosures.

Straight-through joints: Unless unavoidable due to length or difficult installation conditions, run cables without intermediate straight-through joints.

Cable joints: Locate in accessible positions in junction boxes and/or in pits.

Individual wiring of extra-low voltage circuits: Tie together at regular intervals.

Rewirability: Provide conduits as necessary to allow wiring replacement without structural work or the removal of cladding, lining, plaster or cement render.

Tagging

General: Identify multicore cables and trefoil groups at each end with stamped non-ferrous tags clipped around each cable or trefoil group.

Marking

General: Identify the origin of all wiring by legible indelible marking.

Submains and final subcircuits

Installation: Provide the following:

- Cables with diameter less than 13 mm: Run in conduit, cable ducts or support on cable trays or ladders.
- Single core cables of 3-phase circuits: Install unenclosed single core cables of diameter greater than 13 mm laid on cable tray in trefoil (RWB) or quadrofoil (RWBN) groups.
- Cables for lighting systems: Run in conduit, cable ducts, suspend on catenary systems or support on cable trays or ladders.
- Accessible concealed spaces: Install thermoplastic insulated and sheathed cables.
- Inaccessible concealed spaces: Install cable in PVC-U conduit.
- Roof spaces: Install cable below heat insulation and sarking. If not protected from high ambient roof space temperatures by thermal insulation, derate the cables, to AS/NZS 3008.1.1 (2017) Table 27, for an assumed ambient temperature of 55°C.
- Accessible ceiling voids: Support and enclose cables on ceiling surfaces or ceiling suspension systems.
- Plastered or rendered masonry: Install cable in PVC-U conduit.
- Double sided face brick partition: Install cable in PVC-U conduit installed within the brick wall by slotting bricks or using any pathways provided in the brick.

- Stud framed walls with bulk insulation: Install cables in PVC-U conduit.
- Stud framed walls without bulk insulation: Thermoplastic insulated and sheathed cables allowing rewirability. Bush all knock-outs in steel framing to prevent cable damage. Earth metal stud frames to the electrical earthing system.
- Horizontal cable trays or ladders: Fix cables using proprietary nylon cable ties or straps, cable saddles or clips at 2000 mm intervals.
- Vertical cable risers: Fix cables using proprietary nylon cable ties or straps, cable saddles or clips at 1000 mm intervals.
- Plant rooms: Install cable in heavy duty PVC-U conduit or on tray, cable ladder or in duct.

2.6 EARTHING

Earthing systems

Protective earthing system with a multiple earth neutral (MEN) connection: To AS/NZS 3000 (2018) Section 5.

Earth electrodes

General: Provide electrodes to AS/NZS 3000 (2018) clause 5.3.6.

Bonding

General: Provide equipotential bonding to AS/NZS 3000 (2018) clause 5.6.

Earth and bonding clamps

General: Provide proprietary earthing and bonding clamps.

Standard: To AS 1882 (2002).

2.7 ELECTRICAL ACCESSORIES

General

Style: Provide accessories of the same style and from the same manufacturer.

Socket outlets - generally

Standards:

- General: To AS/NZS 3112 (2017).
- Industrial: To AS/NZS 3123 (2005).

Socket outlet properties: Provide sockets conforming to the following:

- Type: Integral switched socket outlet.
- Material: High impact plastic.
- Size: Standard single gang.
- Current rating: 10 A.
- Pin arrangement: Mount outlets with the earth pins at the 6 o'clock position.

Plastic switched socket outlets

Colour: White electrical.

Mounting configuration: Horizontal.

Ironclad socket outlets

Type: Integral switched socket outlet.

Material: Diecast metal or cast iron.

Colour: Grey.

Weatherproof socket outlets

Colour: Grey.

Combined RCD switched socket outlets

Type: Integral RCD unit with double switched socket outlet.

Colour: White electrical.

RCD trip current: Conform to the following:

- General light and power: 30 mA Type II to AS/NZS 3190 (2016).

Multi-switch socket outlets on grid mounted panels

Type: Separate switch and socket outlets grid mounted on propriety or custom designed panels.

Material: High impact plastic.

Colour: White electrical.

Panel finishes: To suit work requirements.

Plugs – 230 volt

Requirement: Insulated type to AS/NZS 3112 (2017) with integral pins.

230 volt combination switch and permanently connected cord outlet

Type: Three terminal flush mounted switch and flex-lock insert assembly.

Colour: White electrical.

Neon indicator: Provide neon indicator.

Flex-lock assembly: Match and securely grip the size and type of flexible cable used.

Mounting configuration: Horizontal.

Permanently connected equipment

General: Provide final subcircuit to permanently connected equipment.

Isolating switch: Locate adjacent to equipment.

Mounting:

- Internal installations: Flush mount.
- External installations: Weatherproof surface mounted.

Coordination: Coordinate with equipment supplier.

Wall/ceiling mounted equipment: Conceal final cable connection to equipment.

Isolating switches

Standard: To AS 3133 (2020).

Emergency stop switches

Standard: To AS/NZS IEC 60947.5.5 (2015).

Type: Mushroom head with latch and twist releaser.

3-phase outlets

Standard: To AS/NZS 3123 (2005).

Type: Surface mounted Integral switched socket outlet with flap lid on the outlet.

Material: High impact plastic.

IP rating: IP56.

Size: To suit current rating and pin configuration nominated in the project documents.

Colour: Grey.

Current rating: 5 pin, 20 A, 400 V a.c.

Switch mechanism: Rotating type.

Pin arrangement: Five round pins mounted with earth pins at the 6 o'clock position, neutral pins in the centre and the red, white and blue phases in a

clockwise sequence when viewed from the front of the outlet.

Plug: Provide a matching plug top for each outlet.

Air conditioning

Provisions for air conditioning: If air conditioning is required, provide for a wall mounted future split system to the areas required. Allow for an external waterproofed power isolator mounted 500 mm above the condenser plinth.

Power isolators: Install on a separate circuit, with a circuit breaker mounted in the load centre or meter box to AS/NZS 3000 (2018).

Installation

General: Install accessories and conceal cabling in walls in conformance with the following:

- Rendered masonry partition: Flush wall box, with conduit chased into wall.
- Double sided face brick partition: Vertically mounted flush wall box, with conduit concealed in cut bricks.
- Face brick external cavity wall: Flush wall box, with thermoplastic insulated cables in conduit run in cavity and tied against inner brick surface, or thermoplastic sheathed cables run in cavity.
- Stud partition: Flush plate secured to proprietary support bracket or wall box.
- Fire walls: Flush wall box, with conduit built into wall. Provide additional fire protection around wall boxes, where necessary to maintain fire-resistance rating.

Location: Confirm final location of all outlets and equipment on site, before installation.

Spacing from adjacent horizontal surface: ≥ 75 mm to the centre of accessory socket.

Default mounting heights to centre of accessory plate:

- Outlets: Minimum 300 mm.
- Switches and controls: 900 to 1100 mm and horizontally aligned with the door handle.

Accessories: Flush mounted, except in plant rooms.

Common face plates: Mount adjacent flush mounted accessories under a common faceplate.

Restricted location: Do not install wall boxes across junctions of wall finishes.

Surface mounting: Proprietary mounting blocks.

Installation of ceiling mounted accessories

Connections for appliances: Flush mounted outlets on the ceiling next to support brackets.

Mounting: Mount appliances independent of ceiling tiles and suspended ceiling suspension system. Fix directly to concrete slab or to roof structure above ceiling.

Connections for fixed equipment: Provide concealed permanent connections.

Fixing: For equipment and appliances heavier than 30 kg, provide support through the suspended ceiling to the building structure. Brace appliances that have excessive bending moments, are heavy or vibrate, to prevent horizontal movement.

2.8 CEILING FANS - NORTHERN AREAS

Internal ceiling sweep fans

Type: White fans with 1400 mm diameter metal blades and sealed bearings.

Mounting: Flush.

Controls: Supplied by the manufacturer with variable speed, summer/winter switch and off control.

- Mounting height: 1500 mm above finished floor level.

External ceiling sweep fans

Type: Brown or black fans with 1400 mm diameter metal blades and sealed bearings.

Design and installation: To AS/NZS 3000 (2018) clause 1.5.14.

Mounting: Flush.

Switches and socket outlets: With an Ingress Protection (IP) Rating, to AS/NZS 3000 (2018), if installed in a location where water ingress is possible, including where exposed to cyclonic conditions.

Controls: Supplied by the manufacturer with variable speed, summer/winter switch and off control.

- Mounting height: 1500 mm above finished floor level.

3 POWER GENERATION – PHOTOVOLTAIC

3.1 SYSTEM DESCRIPTION

System components

Requirement: Incorporate the following:

- Photovoltaic array.
- Regulator.
- Battery system.
- Inverter.
- Connection to low voltage power system.

Warranties

Requirements: Provide manufacturer's and installer's warranties, covering the following:

- Components except panels: Minimum 5 years.
- Panels: Minimum 10 years.

3.2 STANDARDS

General

Requirement: For the purpose of this worksection, the following standards relating to stand-alone systems are also applicable to network connected systems:

- Stand-alone power systems: To AS/NZS 4509.1 (2009) and AS/NZS 4509.2 (2010).
- Grid connected systems: To AS/NZS 4777.1 (2016) and AS/NZS 4777.2 (2020).
- IEC 61836 (2016).

3.3 PHOTOVOLTAIC MODULE

General

Selection: To AS/NZS 4509.2 (2010) and AS/NZS 5033 (2021).

Array

Encapsulation: Required.

Toughened glass: Required.

Protection rating: \geq IPX6.

Integral bypass diode protection: Required.

Cells

Type: Crystalline.

Standard: To IEC 61215-1-1 (2021).

Efficiency: \geq 12%.

3.4 REGULATOR

General

Selection: To AS/NZS 4509.2 (2010).

Function: Charge cycle control including:

- Low battery voltage disconnect.
- Pulse width modulation.
- \geq 3 step series regulation.

Display: LCD display of:

- Battery voltage.
- Charge current.
- Ampere hours in and out.
- Load current.

Alarms: Visible and audible low and high battery voltage alarms.

Transient protection: Required.

3.5 BATTERY SYSTEM

General

Selection: To meet the documented performance.

Blocking diodes: Required.

Service life: \geq 10 years.

Standards

General: To AS 2676, AS 4086.1 (1993) and AS/NZS 5139 (2019).

3.6 INVERTER

General

Selection: To meet the documented performance.

Waveform: True Sine wave.

Waveform quality: To the AS/NZS 4777 series.

Voltage regulation: \pm 8%.

Harmonic distortion of output current: $<$ 4%.

Frequency regulation: \pm 1%.

Efficiency: \geq 90% at 10% load.

Protection: Overload, short-circuit and transient required.

Automatic no-load shutdown: Required.

Display:

- Output power.
- Grid stability.

Standards

General: To AS/NZS 4777.2 (2020).

Synchronisation

Requirement: Self-commutation modules which automatically synchronise the inverter supply frequency and phase angle to the low voltage network or other embedded generator system.

3.7 CONTROL SYSTEM

Control panel

General: Provide photovoltaic system control panels, switchgear and controlgear assemblies.

3.8 PHOTOVOLTAIC METERING

General

Requirement: Provide bi-directional metering equipment to meter the photovoltaic energy that is exported back to the grid to the requirements of the electricity distributor and the electricity retailer.

3.9 COMMISSIONING

General

Requirement: Pre-commission, test and commission to AS/NZS 4509.1 (2009), and AS/NZS 5033 (2021) and the manufacturer's recommendations. Obtain test reports from manufacturers or suppliers verifying the performance of safety and control functions of each system.

4 SWITCHBOARDS – PROPRIETARY

4.1 GENERAL

Performance

Supply system: Switchboards to suit 400 V, 3-phase, 4-wire, 50 Hz, multiple earth neutral (MEN) supply system.

4.2 DESIGN

Switchboards for electric vehicle charging equipment

Requirement: Conform to BCA (2022) J9D4 [Not in NCC 2019].

4.3 STANDARDS

General

General: To AS/NZS 3000 (2018).

Main switchboards and distribution switchboards: To AS/NZS 61439.1 (2016), AS/NZS 61439.2 (2016), and the recommendations of SA/SNZ TR 61439.0 (2016).

Distribution switchboards intended for use by unskilled/ordinary persons: To AS/NZS 61439.2 (2016), AS/NZS 61439.3 (2016), and the recommendations of SA/SNZ TR 61439.0 (2016).

4.4 PRODUCTS

Switchboard connection

Type: Front connected.

Enclosure

Default material: Metallic-coated sheet steel.

Separation

Default: Form 1 to AS/NZS 61439.2 (2016).

Metering

Retail: To the requirements of the electricity retailer and the electricity distributor.

Private: Provide energy measurement to BCA (2022) J9D3 [BCA (2019) J8.3], if required.

Photovoltaic metering: Provide energy measurement to BCA (2022) J9D3 [Not in NCC 2019], if required.

Main switchboard main switches

Spare capacity: Provide at least 25% spare capacity in the ratings main switch/isolators.

Busbars

General: Incorporate proprietary insulated busbar systems for the interconnection of isolators, circuit breakers and other circuit protective devices.

Busbar fault rating: Rated to meet the prospective fault current for 1 second or a minimum rating of $\geq 18\text{kA/second}$, whichever is the greater.

Spare capacity

Default spare poles: $\geq 20\%$.

Main switchboard incoming busbar: $\geq 25\%$.

Earthing

General: Make provision for the connection of the communications earth terminal (CET) at switchboard earth bar to AS/CA S009 (2020).

Doors

General: Provide lockable doors with a circuit card holder unless enclosed in cupboards or in an area which is not readily accessible to the public.

Keying: Key alike for multiple doors, 2 keys per assembly.

IP rating

Default rating: IP42 minimum.

Weatherproof: IP56 minimum.

Finishes

External and interior: To the manufacturer's standard colour and finish.

Supporting structure

Assemblies:

- Wall mounted: $\leq 2\text{ m}^2$.
- Floor mounted: $> 2\text{ m}^2$.

Ventilation

General: Required to maintain design operating temperatures at full load.

Cable entries

General: Neatly adapt one or more cable entry plates, if fitted, to accept incoming cable enclosure. Provide the minimum number of entry plates to leave spare capacity for future cable entries. Do not run cables into the top of weatherproof assemblies.

Single core cables rated $> 300\text{ A}$: Pass separately through non-ferrous gland plates. Do not provide ferrous metal saddles. Minimise eddy currents.

Cable enclosures

Requirement: Continue cable enclosures to or into assemblies and fit cable entry plates so that the IP

rating of the assembly and the fire-resistance level of the cable are maintained.

Cable supports

Requirement: Support or tie mains and submains cables within 200 mm of terminations. Provide cable supports suitable for stresses resulting from short-circuit conditions.

5 SWITCHBOARD COMPONENTS**5.1 DESIGN****Statutory authority's equipment**

General: Liaise with the electricity distributor about the installation and coordinate with their protective and control equipment.

5.2 REQUIREMENTS**General**

Selection: To AS/NZS 3000 (2018) clause 1.7 and Section 2.

Rated duty: Uninterrupted.

Rated making capacity (peak): $\geq 2.1 \times$ fault level (r.m.s.) at assembly incoming terminals.

Utilization category: To AS/NZS 60947.1 (2021) clause 5.4 and the recommendations of Annex A.

- Circuits consisting of motors or other highly inductive loads: At least AC-23.
- Other circuits: At least AC-22.

Coordination: Select and adjust protective devices to discriminate under overload, fault current, and earth fault conditions.

Enclosure: IP4X minimum.

5.3 SWITCH-ISOLATOR**General**

Standard: To AS/NZS 60947.1 (2021) and AS 60947.3 (2018).

Poles: 3.

Operation: Independent manual operation including positive ON/OFF indicator.

Shrouding: Effective over range of switch positions.

Fault make/fault break switch-isolators

Rated breaking capacity: To AS 60947.3 (2018) Table 3.

Rated short-time withstand current: As defined in AS/NZS 60947.1 (2021) clause 5.3.6.1 and the manufacturer's recommendation for the prospective fault current conditions.

Rated short-circuit making capacity: As defined in AS/NZS 60947.1 (2021) clause 5.3.6.2, to conform to the manufacturer's recommendation for the prospective fault current conditions.

Rated short-circuit breaking capacity: To AS/NZS 60947.1 (2021) clause 5.3.6.3 and the manufacturer's recommendation for the prospective fault current conditions.

Load make/load break switch-isolators

Rated making and breaking capacity: As defined in AS/NZS 60947.1 (2021) clause 5.3.5 to conform to AS 60947.3 (2018) Table 3 and the manufacturer's

recommendations for the prospective fault current conditions.

5.4 OVERLOAD AND FAULT PROTECTION GENERALLY

General

Requirement: Provide overload and fault protection devices, including full discrimination and cascade protection, and grade with the electricity distributor's incoming supply protection system and the downstream site protection devices.

5.5 MOULDED CASE AND MINIATURE CIRCUIT BREAKERS

General

Moulded case breakers: To AS/NZS 60947.1 (2021) and AS/NZS IEC 60947.2 (2015).

Miniature circuit breakers: Interrupting capacity classification to AS/NZS 60898.1 (2004) or AS/NZS 3111 (2009).

- For general building services: Type C.
- For motor protection: Type D.

Operation: Independent manual operation including positive ON/OFF indicator.

Trip type: Conform to the following:

- Moulded case breakers: Adjustable thermal, fixed magnetic.
- Miniature circuit breakers: Fixed thermal and fixed magnetic.

Mounting: Mount circuit breakers so that the ON/OFF and current rating indications are clearly visible with covers or escutcheons in position. Align operating toggles of each circuit breaker in the same plane.

Clip tray chassis: For miniature overcurrent circuit breakers, provide clip tray assemblies capable of accepting single, double or triple circuit breakers and related busbars. Provide moulded clip-on pole fillers for unused portions.

Interchangeable trip units: Connect trip units so that trip units are not live when circuit breaker contacts are open.

Fault current limiting circuit breakers: Select breaker frame sizes from one manufacturer's tested range of breakers to give cascade and discrimination protection within the switchboard and downstream switchboards as required.

5.6 RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS (RCBO)

General

Residual current operated with overcurrent protection type: To AS/NZS 61009.1 (2015).

Type: Type I.

Default tripping current: 10 mA.

5.7 PROTECTION OF POWER AND LIGHTING CIRCUITS

General

Requirement: Conform to the following:

- Provide RCD/MCBs on every circuit.

- Individually protect lighting circuits and power (GPOs) circuits by combined Residual Current Device compliant with Department of Communities <40 ms trip time and Miniature Circuit breakers (RCD/MCBs).

- Where 15A socket outlets are documented, install on a separate RCBO circuit.

- Where ceiling sweep fans are documented, install on a separate RCBO circuit.

- Where external lighting circuits are documented, install on separate RCBO circuits.

Labelling

General: Provide labels for equipment within assemblies. Locate so that it is clear which equipment is referred to, and so that lettering is not obscured by equipment or wiring.

6 LIGHTING

6.1 STANDARDS

General

Energy efficiency for ballasts and lamps: To AS/NZS 4783.2 (2002).

Minimum energy performance standards (MEPS)

General: To AS 4782.2 (2019), AS/NZS 4783.2 (2002) and AS 4934.2 (2021).

Self-ballasted lamps: To AS 4847.2 (2019).

6.2 PROPRIETARY LUMINAIRES

General

Requirement: Provide proprietary luminaires complete with lamps, luminaire control equipment, lighting control equipment, and accessories. Provide lamps of the same type from the same brand and country of manufacture.

Self-ballasted lamps: To AS/NZS 60968 (2001).

Luminaires

Standard: To AS/NZS 60598.1 (2017).

Luminaire type: Provide the following, as documented:

- Oyster light fittings: 32W, 350 mm diameter (nominal) fluorescent fittings and acrylic diffuser.
- LED recessed downlights: Insulation contact (IC) rated 15W fittings spaced at maximum 1.5 m spacing.
- Fluorescent tube fittings: Twin 18W T8 fluorescent tube, battens and clear prismatic diffuser or vandal resistant cover.

Luminaire colour rendering: Cool white.

Non-specified luminaires: Provide a bayonet cap batten holder and lamp at each lighting point location where no luminaire is documented.

6.3 FLUORESCENT LAMPS

Standards

Fluorescent lamps: To AS/NZS 4782.1 (2020) and AS 4782.2 (2019).

Compact fluorescent lamps: To AS/NZS 4847.1 (2010) and AS 4847.2 (2019).

Properties

CCT: 4000 K.

Colour rendering: Group 1B to AS/NZS 1680.1 (2006).

Linear and circular lamp type: T8 (26 mm diameter) or T5 (16 mm diameter), linear lamps, triphosphor, TL84.

Compact fluorescent lamps types: Four-pin, non-integrated type.

6.4 FLUORESCENT LAMP BALLASTS**Linear and circular lamp types**

General: Provide electronic fluorescent lamp ballasts for fluorescent lamp lighting systems selected for compatibility with the lamp and control method.

Electronic fluorescent lamp ballasts: Conform to the following:

- To AS/NZS 61347.2.3 (2016) and AS/NZS 60929 (2020).
- Current total harmonic distortion: < 15%.
- Soft start.
- Number of ballasts: Provide separate ballasts for each lamp or integral dual ballasts as an alternative for dual lamp fittings.

Ballast performance measurement – fluorescent lamps: To AS/NZS 4783.1 (2001).

CFL lamp types

General: Provide electronic fluorescent lamp ballasts for CFL lighting systems selected for compatibility with the lamp and control method.

Electronic fluorescent lamp ballasts: Conform to the following:

- To AS/NZS 61347.2.3 (2016) and AS/NZS 60929 (2020).
- Current total harmonic distortion: < 15%.
- Number of ballasts: Provide separate ballasts for each lamp or integral dual ballasts as an alternative for dual lamp fittings.

Ballast performance measurement – fluorescent lamps: To AS/NZS 4783.1 (2001).

Fluorescent lamp power factor correction

General: Provide power factor correction on all luminaires to a minimum power factor of 0.9 lagging.

6.5 ELV VOLTAGE TRANSFORMERS OR ELV SWITCH POWER SUPPLIES**General**

Requirement: Provide separate ELV transformers for each ELV lamp.

Standard: To AS/NZS 4879.1 (2008), AS/NZS 4879.2 (2010) and AS/NZS 61558.1 (2018).

6.6 LIGHT-EMITTING DIODE (LED) LUMINAIRES**General**

Requirement: Provide light-emitting diode (LED) luminaires.

Light-emitting diode luminaires

Colour: CRI > 80.

CCT: 3000 K.

6.7 CONTROL GEAR ENCLOSURE**General**

Requirement: Provide controlgear support enclosure within the body of the luminaire, except where remotely mounted controlgear is documented or required by the manufacturer.

Enclosures and controlgear mounting assemblies: Provide heat dissipation facilities to dissipate heat from the luminaire.

Controlgear enclosure: Form a barrier against direct contact with live parts of the controlgear and the area of the luminaire containing the lamp and lamp support holders.

Separate controlgear enclosures: If separate controlgear enclosures external to the luminaire are required, conform to the above requirements.

Fixing: Screw fixed.

6.8 WIRING**External flexible cords**

Recessed luminaires: Provide flexible cord in conformance with the following:

- Length: ≥ 1.5 m.
- Cross-sectional area: 0.75 mm^2 .
- Type: 3-core V75 (minimum) PVC/PVC, connected to a 10 A 3-pin moulded plug to AS/NZS 3112 (2017) or multi-pin plug.

6.9 LIGHTING CONTROL**General**

Requirement: Provide the following:

- Lighting switches.
- Electronic lighting switches.
- Dimmers.
- Automatic control systems.

Digital control system

General: Provide a proprietary, microprocessor-based system to control lighting under automatic and user interface control, if required.

Motion sensor controls

Requirement: Provide to external light fittings at the front and rear of dwellings.

6.10 ACCESSORIES**Run-on timer switches**

General: Provide run-on timer switches, if required.

Delay: Adjustable to 20 minutes.

6.11 SUPPORTS**General**

Requirement: Install luminaires on proprietary supports, including battens, trim, noggings, roses and packing material.

Suspended luminaires

Rods: Steel pipe suspension rods fitted with gimbal joints.

Chains: Electroplated welded link chain.

Levelling wire: Stainless steel.

Levelling: Adjust the suspension system length so that the lighting system is level and even.

Horizontal tolerance: ± 3 mm between luminaires within the same area.

Surface mounted luminaires

General: Fit packing pieces to level luminaires and prevent distortion of luminaire bodies. Provide packing strips to align end to end luminaires.

Fixing: Conform to the following:

- Generally: Provide 2 fixings at each end of fluorescent luminaires.
- Luminaires less than 150 mm: A single fixing at each end in conjunction with 1.6 mm backing plates may be used.
- Provide battens and support for the fitting.
- Do not direct fix into plasterboard.

Recessed luminaires

General: Install recessed luminaires in trimmed openings in the suspended ceiling.

6.12 COMMISSIONING

General

Requirement: Before the date for practical completion carry out the following:

- Verify the operation of all luminaires.
- Adjust aiming and controls for all luminaires under night time conditions.
- Replace lamps which have been in service for a period greater than 50% of the lamp life as published by the lamp manufacturer.

Digital control system: Commission to the manufacturer's recommendations and to the documented control requirements.

7 INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) SYSTEMS

7.1 SYSTEM DESCRIPTION

System components

Requirement: Provide the following as appropriate:

- Network connection.
- Campus distributor.
- Campus cabling.
- Building distributor.
- Backbone cabling.
- Floor distributors.
- Consolidation points.
- Telecommunications outlets.
- Patching.

System performance

Application class: To AS/NZS 11801.1 (2019) clause 6.3.1 Class E.

Balanced system: To AS/NZS 11801.1 (2019) clause 8.2.1 (data/voice) Category 6A U/FTP.

Fibre system class: To AS/NZS 11801.1 (2019) clause 8.3.

System warranty: 15 years minimum.

Surge protection devices (SPD)

General: Provide surge protection devices to protect equipment in racks and cabinets to LOW VOLTAGE SYSTEMS, **SURGE PROTECTION DEVICES (SPD)**.

7.2 STANDARDS

General

Authorities: To the requirements of the Australian Communications and Media Authority (ACMA).

Cabling products: To AS/CA S008 (2020), AS/NZS 11801.1 (2019) and AS 11801.2 (2019).

Communications cable systems: To AS/CA S009 (2020), AS/NZS 11801.1 (2019), AS/NZS 3084 (2017) and AS/NZS 14763.2 (2020).

Communications cable systems for small office/home office: To AS/CA S009 (2020), AS 11801.2 (2019), AS 11801.4 (2019) and AS/NZS 14763.2 (2020).

Cable management and documentation: To AS 3085.1 (2022).

7.3 NETWORK CONNECTION

External network

Requirement: Conform to the Australian Government's policy document *Telecommunications in new developments (2020)*.

Communication carriers: Liaise with each external communications carrier and determine the services and site access requirements for each network carrier's connection.

NBN installation

Requirement: To the *NBN Guideline (2021)*.

New buildings: To the *NBN Guideline (2021)* clause 3.6.

Location type: Open enclosures to the *NBN Guideline (2021)* clause 4.4.3.

7.4 BUILDING ENTRANCE FACILITIES

Campus distributor (CD)

Standard: To AS/NZS 11801.1 (2019) and AS 11801.2 (2019).

Network termination device

Requirement: Provide network termination device for the termination of external carrier cables and facilities. Provide separate frames as required for each external communications' carrier and for copper and optical fibre cables.

Degree of protection for external BD/CDs: To AS 60529 (2004).

7.5 DISTRIBUTORS

General

Requirement: Provide the Building Distributors (BD) and Floor Distributors (FD) for voice and data to AS/NZS 11801.1 (2019) and as documented for the termination of campus and building backbone cable systems and the horizontal cable distribution systems.

Equipment requirements: Provide cable termination racks, patch panels, equipment mounting racks for servers and routers complete with power outlets as documented.

Copper cable termination distributors

General: Provide Krone insulation displacement termination frames for the termination of copper backbone and horizontal cable services.

Certification: Provide vendor certification (including the warranty period) for the integrated voice/data copper cabling systems.

Equipment racks

Dimension and type: Conform to the following:

- Equipment racks: 19 inch wide industrial type, or 600 mm or 800 mm wide RUs:
 - . ≤ 18 RU: Wall mounted, 600 mm depth.
 - . > 18 RU: Floor mounted, 800 mm or 1000 mm depth.
- Patch panels – Copper CAT 6A cables: 800 mm wide and 800 mm deep.
- Patch panels – Optical fibre cables: 800 mm wide and 800 mm deep.
- Server racks: 600 mm wide and 1000 mm deep.

Access location: Front, sides or rear.

Cable tray: Locate within outer cabinet void.

Doors: Provide transparent safety glass, lockable doors.

Power provision: Minimum 1 socket outlet for every 3 rack units on vertical rail.

Cable management: Provide as follows:

- 1 module for every 2 patch panels.
- 1 module for each fibre termination panel.
- Location: Vertically, on both sides of the panel.

Provisions for active equipment: 25% minimum, 1 fixed shelf for every 4 RU of active equipment space.

Ventilation: Fan assisted.

Earthing: CES earth bar required.

Fixing: Conform to the following:

- Floor mounted: Firmly fix to floor, bolt together multiple racks using standard kit accessories.
- Floor/Wall mounted: Firmly fix to floor and wall.

Cross connect patch panels (copper cables)

General: Provide cross connect patch panels.

Terminations: Terminate directly to the modular connector.

Fixed terminations:

- Rear terminals: Connect to 45° IDC punch down type.
- Front terminals: Connect to RJ45 modular connector.

Patch cords: Terminate cord ends with appropriate registered jacks.

Optical fibre termination panels

Requirement: Provide rack mounted termination frames for the termination of optical fibre backbone and horizontal cable services.

Certification: Provide vendor certification, including the warranty period, for the optical fibre cabling systems.

Break out trays: Provide fibre optic cable break out trays at each group of fibre optic cable terminations.

Loom cables: Neatly loom cables and lay stripped cables into the break out tray.

Secure cables: Make sure that cables are secured by the sheath and that there is no stress on the fibre optic cores.

Cross connect patch panels (optical fibre cables)

Requirement: Provide optical fibre cross connect patch panels as documented for both single and multicore optical fibre cables.

Cable management

Record book: Provide a record book at each cross-connect.

Location: Secure log books in each distribution frame records holder.

Identification, labelling, and record documentation: To AS 3085.1 (2022).

7.6 CABLES

Copper

Standard: To AS/CA S008 (2020), AS/CA S009 (2020), AS/NZS 11801.1 (2019), AS 11801.2 (2019) and AS/NZS 14763.2 (2020).

Campus and building voice backbone cables: Multicore CAT 3 UTP cable as documented or to suit the voice outlet density at each building or floor distributor, with 30% spare capacity allowance.

Horizontal cabling voice and data: CAT 6A U/FTP cabling to each floor outlet.

Balanced system cables: Unshielded or shielded twisted pairs.

Cable end length: Provide a 5 m cable loop at each end of the cable.

Optical fibre

Standard: To IEC 60793-2-10 (2019).

Campus and building backbone cables:

- Default multimode type: 6 core multi-mode OM3 50/125 µm.
- Default single mode type: single core 9/125 µm.

Length: Provide not less than 1000 mm spare at each end.

Component type: SC.

Safe practices: To AS/NZS 2967 (2014).

External

Standard: Water penetration resistance to IEC 60794-1-2 (2021).

7.7 TELECOMMUNICATIONS OUTLETS

General

Outlets: Provide RJ45 8 way modular jacks, mounted on 6-way faceplate. Provide for up to three modular voice or data outlets on the each faceplate with three spaces for identification inserts.

Pinouts: T568A to AS/NZS 11801.1 (2019) and AS 11801.2 (2019).

7.8 FLY LEADS**General**

Type: Stranded.

Length: 1200 mm.

Quantity: Provide fly leads to 50% of outlets installed.

7.9 PATCH CORDS**General**

Type: Stranded.

Length: 900 mm.

Quantity: 100% of outlets installed.

Termination: Registered jacks.

7.10 WIRELESS ACCESS POINT (WAP)**General**

Requirement: Provide WAPs documented, cabled to patch panels in the nearest FD.

Compatibility: ISO/IEC/IEEE 8802-11 (2018) and IEEE 802.11 (2020).

LAN port: 100 Mbps.

Modes: Wireless access point, point-to-point bridge, point-to-multi-point wireless bridge, wireless client and wireless repeater.

Power over ethernet: Required.

Location: Install in ceiling voids distributed around the site buildings and determine the number and location by a site survey using the wireless network to confirm full site coverage.

7.11 ENGINEERING SERVICES**General**

Requirement: Provide cabling systems, as documented.

7.12 CABLE INSTALLATION**Installation**

Requirement: To the manufacturers' recommendations.

Crossover: Install cables neatly and without crossovers between cables.

Loom size: Loom cables into groups not exceeding 50 cables, and hold looms in place using reusable cable ties at least 20 mm wide. Do not exert compressive force on the cables when installing cable straps.

Cable separation

Separation for safety: To AS/CA S009 (2020), and by at least 150 mm.

Fluorescent luminaires: Maintain a clearance of more than 300 mm.

External cables

Requirement: To CA C524 (2013).

7.13 TELECOMMUNICATIONS OUTLET INSTALLATION**Installation**

Mounting: Flush mount.

Style, material and colour of plates: To match adjacent power and switch plates.

Horizontal cabling termination: Terminate Category 6A cabling to the rear of the outlet modular jack with insulation displacement connections forming a gas tight joint. Arrange cable pairs at each jack conforming to AS/NZS 11801.1 (2019) Figure 9.

7.14 EARTHING SYSTEM**General**

Standard: To AS/CA S009 (2020) Section 20.

Communication earth system (CES)

Requirement: Provide a communications earth terminal (CET) adjacent to each electrical switchboard. Connect the CET to the local protective earth (PE) system at the switchboard.

Distributor: Provide an earth bar within each distributor and connect to the local CET.

Interconnections: Verify that there are no interconnections between the lightning protective earthing system and the telecommunications earthing system.

7.15 TESTING**General**

Requirement: Carry out 100% channel tests.

Cable tests

Telecommunications cabling installation copper cables: To IEC 61935.1 (2019).

Telecommunications cabling installation fibre optic cables: To AS/NZS 14763.3 (2017).

Site tests

Standard: To AS/NZS 11801.1 (2019) Annex A. Include the following:

- Basic Link and Channel transmission tests including the following:
 - . Wire map.
 - . Length.
 - . Attenuation.
 - . NEXT.
 - . ACR.
 - . Propagation delay.
 - . Delay skew.
 - . Power sum NEXT.
 - . Power sum ACR.
 - . ELFEXT.
 - . Power sum ELFEXT.
 - . Return loss.
- Optical fibre cable: Carry out Basic link transmission tests including the following:
 - . Length.
 - . Attenuation.

8 TELEVISION DISTRIBUTION SYSTEMS**8.1 SYSTEM DESCRIPTION****System components**

Requirement: Provide a system suitable for the reception and distribution of analog and digital television, video, radio and sound signals.

Network connection: Where documented, arrange with the network operator(s) for the connection of their cable or satellite network. Conform to the network operators' requirements.

Designer: Network operator's Approved Design Partner.

Survey: Confirm location and height of Free-to-air (FTA) antenna by on-site measurements.

Performance requirements

General: To AS/NZS 1367 (2016).

Capacity: Provide the distribution system with the installed capacity to accommodate 30% additional outlets.

Single dwelling installations with separate television distribution systems

General: Provide a television distribution system for each dwelling as follows:

- FTA TV antenna and mounting brackets.
- R6 coaxial 75 ohm cable system.
- Wall outlet sockets, as documented.
- A distribution splitter where multiple outlets are required.

Masthead amplifier: Provide wideband amplifier where TV signal is below the satisfactory performance levels.

Multiple dwelling installations requiring an MATV distribution system

General: Provide an MATV distribution system as follows:

- FTA TV Antenna and mounting brackets.
- Coaxial 75 ohm cable system.
- Masthead and distribution amplifiers.
- Wall outlet sockets, as documented.

Capacity of MATV distribution system: To accommodate 30% additional outlets.

8.2 STANDARDS

General

Electromagnetic compatibility: To AS/NZS 1367 (2016) Section 3.

8.3 SYSTEM COMPONENTS AND PERFORMANCE

Signal sources

Free-to-air (FTA) antennae system: Provide a digital compatible FTA antennae system terminating at the premises cabling interface conforming to AS 1417 (2015).

Mast installation: Carry site survey to determine the height and location of the antenna(e).

- Structure and installation: Conform to AS 1417 (2015).

Network operator: Provide for the connection of the network operator's system terminating at the premises cabling interface.

Local signal source: Provide television input sockets at the premises cabling head-end for the distribution of in-house television channels.

Service entry

General: Provide service entry facilities to suit signal sources, head end equipment and distribution systems.

Head end equipment

General: Provide head end equipment to suit signal sources, distribution systems and documented performance.

Surge protection devices (SPD)

General: Provide surge protection devices to protect final equipment in racks and cabinets to LOW VOLTAGE POWER SYSTEMS, **SURGE PROTECTION DEVICES (SPD)**.

Distribution system

General: Provide a MATV cabling distribution network from the head end equipment for Free-to-air to each network distribution tap.

FTA distribution taps: Provide FTA distribution taps.

Network distribution taps: For systems designed for more than one network operator provide individual distribution taps for each network operator. Co-locate the taps with FTA taps in groups to facilitate selected connection or changes to outlet feeders.

Location: Group all equipment as documented.

Coaxial cables

General: R6, 75 ohm, quad coaxial cable.

Trunk cables: Use RG11, 75 ohm, quad coaxial cables for trunk cables between head end equipment and taps or where high losses are experienced when using R6 cables.

Outlets

Quantity: Provide as follows:

- Smaller dwellings (with single family room): One outlet to each dwelling unit from the distribution tap(s).
- Larger dwellings (with family room and lounge room): Two outlets to each dwelling unit (1 to lounge and 1 to family room) from the distribution tap(s).

Distribution outlets: "F" type coaxial cable termination sockets.

Multiple services: Where required, provide separate sockets for each source and service.

Mounting height: 200 mm above floor.

Service cabinets

Requirement: As required for the housing of television distribution equipment at documented locations.

Construction: Aluminium, weatherproofed to suit the documented location, with dustproof door seals and fitted with keyed alike locks, as documented.

Colour: As documented.

Power outlets: 10 amp, 240 volt GPOs of sufficient quantity to power the equipment mounted in the cabinet.

8.4 COMMISSIONING

General

Standard: To AS/NZS 1367 (2016).

Requirement: Commission to the manufacturer's recommendations.

Extent: Test 100% of the system to demonstrate compliance with all documented requirements.

Setup: Use locally generated test signals to provide static conditions for level measurements.

Carrier-to-noise measurements: Required.

9 EMERGENCY EVACUATION LIGHTING

9.1 SYSTEM DESCRIPTION

General

Requirement: Provide single point monitored emergency lighting and exit signs, as documented.

9.2 SINGLE POINT SYSTEM LUMINAIRES

General

Requirement: Provide single point luminaires complete with lamps, luminaire control equipment, lighting control equipment, batteries and accessories. Provide lamps of the same type from the same brand and country of manufacture.

Visual indicator lights: Provide a red indicator, readily visible when the luminaire is in its operating location, which indicates that the battery is being charged.

Inverter system: Provide protection of the inverter system against damage in the event of failure, removal or replacement of the lamp, while in normal operation.

Local test switches: Provide a momentary action test switch, accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp.

Common test switches: Provide a common test switch on the local distribution board which disconnects main supply to the luminaires and tests for discharge performance and automatically reverts to normal operating mode after testing.

Monitored system

Data connection: Provide internal monitoring facilities and provision for the connection of data cabling to a central monitoring computer.

Batteries

Type: Lead-acid or nickel-cadmium batteries capable of operating each lamp at its rated output continuously for at least 2 hours during commissioning tests and 1.5 hours during subsequent tests.

Battery life: At least 5 years when operating under normal conditions at an ambient temperature of between 10°C and 40°C and subject to charging and discharging at 6 monthly intervals.

Marking: Indelibly mark each battery with its date of manufacture.

9.3 SINGLE POINT SYSTEM

Power supply

General: Provide an unswitched active supply to each luminaire and exit sign, originating from the test switch control panel.

Data monitoring

General: If a monitoring system is documented, provide a data cable system from each single point luminaire and connect to the monitoring computer.

9.4 PRE-COMMISSIONING

Mains supply

General: Before commissioning, make sure mains supply has been continuously connected for at least 24 hours.

9.5 COMMISSIONING

General

Standard: To AS/NZS 2293.1 (2018).

Requirement: Carry out tests, including out-of-hours tests, to demonstrate the emergency and evacuation system's performance, to the manufacturer's recommendations and as follows:

- Test components for correct function and operation.
- Demonstrate illumination performance on site, to at least the level stated in the manufacturer's recommendations for performance for that device.
- Test operation of battery discharge test and control test switch functions, including discharge and restoration.
- Demonstrate system functions under mains fail condition.
- Demonstrate operation of the battery and charger including a full discharge/recharge over the designated time.

10 ELECTRONIC SECURITY AND ACCESS CONTROL

10.1 SYSTEM DESCRIPTION

System components

Requirement: Provide the following components:

- Remote monitoring system.
- Access control system.
- Intruder detection system.
- Closed circuit television system.
- Intercom system.

10.2 STANDARDS

Communication between network clients and devices

Procedures: To AS/NZS IEC 60839.11.31 (2020).

Intruder alarm systems

General: To AS/NZS 2201.1 (2007).

Alarm transmission system: To AS/NZS 2201.5 (2008).

Internal detection devices: To AS 2201.3 (1991).

Wireless systems: To AS 2201.4 (1990).

CCTV systems

General: To AS 4806.2 (2006).

Remote monitored systems: To AS 4806.4 (2008).

10.3 SECURITY SYSTEMS

Alarm system panels or processors

Capacity: Provide separate sectors for each nominated internal zone, and for normally-closed and normally-open perimeter zones.

Sector time delay: Provide adjustable time delay entry/exit for each sector, with adjustment range 0 to 30 s.

Batteries and chargers:

- Sealed battery: Provide a sealed battery and charger system contained within each control panel with capacity to meet the performance required.

Uninterruptible power supply

General: Provide a dedicated uninterruptible power supply and connect to the security systems.

Capacity: At least 15 minutes, for the complete system in normal operation.

Activation devices

Activation devices: Provide keypads, cards, card readers and other activation devices for access control and intruder alarm systems as documented.

External: Provide weatherproof (IP56) hoods or housings for external units.

Default mounting height: 1100 mm from floor level.

External audible and visual alarms

General: Provide a corrosion-resistant weatherproof metal enclosures containing sirens and blue strobe lights. Fix in locations not readily accessible without a ladder.

Anti-tamper devices

Requirement: Provide anti-tamper devices to control panels, external equipment, control and activating devices, and access control devices.

Function: To register an instantaneous alarm if covers are removed or vital wiring is disconnected.

Remote monitoring

Monitoring system: Provide a monitoring system in the alarm panel or processor for transmission of alarms and monitoring of the system by parties responsible for attending to alarms.

10.4 ACCESS CONTROL

Access control processors or panels

Capacity: Provide separate entry/exit control modules for each designated access point.

Users: Program the system to match the number of authorised users with unique access codes.

Time zones: At least 4 per day, with provision for weekends and public holidays.

Door control devices

Requirement: Provide electric strikes, electric locks, drop bolts, or similar devices, as documented, to suit door construction and hardware.

Monitoring: Provide lock status and door position monitoring of door control devices, where documented.

Fail-safe: Connect door control devices in a fail-safe mode to permit egress in the event of power failure.

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.

Vehicle control

Vehicle access control: Provide vehicle access control system combining connection to vehicular doors and boom gates, and interconnection to the main access control system.

Exit loop detection: Provide a buried loop detection system adjacent to the exit point to activate boom gates or vehicular doors on approach by a vehicle. Connect so that doors or gates close after a pre-set time.

Interlock: Provide a photoelectric beam safety interlock.

Interlock function: To prevent door or gate from closing until the vehicle has cleared the exit point.

Push-buttons and readers: Provide direct wall mounting for push-buttons or readers, or provide a robust mounting bollard and extension arm.

- Mounting height: 1000 mm from floor level.

Reed switches: Provide heavy duty reed switches on both sides of vehicle doors to generate a door closed indication at the control panel.

Intercom

Base station: Provide intercom base station, interconnected with the individual local stations. Include speakers and microphones.

Entry station construction: Wall mounted flush stainless steel panel.

Weatherproofing: IP56.

Dial: Digital push-button type.

Schedule: Provide a weatherproof (IP56) schedule holder and card identifying individual local stations. Locate next to the base station intercom panel.

Local station: Provide wall mounted intercom local stations, interconnected with the base stations and external entry points.

Internal station type: Surface mounted, removable handset type.

Operation: Provide an audible tone device to indicate that the individual station is being called, and a press-to-talk switch so that the entry station can communicate with the internal station only when the switch is held down.

Door control: Provide integral momentary action door release switches to operate the door release or opening mechanisms at each external entry point.

10.5 SITE VIDEO MONITORING

CCTV system

General: Provide a closed circuit television system monitoring and recording the areas/spaces as required.

CCTV cameras

Selection: Provide cameras that allow coverage of designated areas and to allow persons within the field of view to be readily distinguishable on

monitors under all ambient night and day lighting conditions.

Motorised cameras: Provide camera drives that allow remote control of camera rotation and tilt, and of lens focal length.

External cameras: Provide corrosion-resistant weatherproof housings for cameras located externally, which allow cameras to perform to manufacturer's recommendations.

Fixing: Provide mounting brackets and hardware which rigidly fix cameras, monitors and accessories to buildings or structures.

CCTV monitors

General: Provide LCD colour monitors compatible with the security system, and provide fixing brackets and hardware for wall-mounted and ceiling-mounted monitors.

CCTV recording system

General: Provide CCTV recording hardware and software systems which store data from each camera in an industry standard compressed digital format.

Functionality: Provide the following:

- Index according to events.
- Fast search.
- Frame by frame search.
- Frame printing.
- Zoom and pan within a recorded frame.
- Back up daily to off-site storage.

Minimum data storage: 30 days.

CCTV video switching system

General: Provide switching software that allow cameras to be directed to specific monitors or for cameras to be scanned sequentially at predetermined intervals to a specific monitor and which, on receipt of an alarm signal, interrupts the scanning sequence and switches to the relevant security zones.

10.6 EQUIPMENT POWER SUPPLY

Mains supplies

Permanent power supply: Provide permanent power supply to the following:

- Intruder alarm panels and access control panels including sub panels.
- Electric door strike local panels or control equipment.
- Intercom stations.
- CCTV monitors and cameras.

Marking: Label the switchboard circuit breaker from which power for the security systems is obtained as follows:

- SECURITY SYSTEM - Do not switch off.

Interconnection to other services

General: Provide functions and equipment to allow the interconnection to other systems. Provide and connect wiring to the designated services.

Lifts: Arrange for installation and connection of lift readers and associated equipment.

10.7 COMMISSIONING

General

Requirement: Commission to AS/NZS 2201.1 (2007) and the manufacturer's recommendations.

1002 FIRE

1 FIRE SERVICES SYSTEMS**1.1 STANDARDS****Hydraulic fire services**

Plumbing and water supply: To AS/NZS 3500.1 (2021).

Hydrants: To AS 2419.1 (2021).

Hose reels: To AS/NZS 1221 (1997) and AS 2441 (2005).

Electrical fire services

Requirement: To AS/NZS 3000 (2018), unless otherwise documented.

Fire detection and alarms: To AS 1670.1 (2018), AS 1670.5 (2016), AS 4428.16 (2020), AS 7240.2 (2018), AS 7240.4 (2018) and AS 7240.13 (2021).

Emergency warning and intercommunication: To AS 1428.5 (2021), AS 1670.4 (2018), AS 1670.5 (2016), AS 4428.4 (2016), AS 4428.16 (2020), AS ISO 7240.24 (2018) and AS 60849 (2004).

Wiring fire and mechanical performance classification: To AS/NZS 3013 (2005).

Degrees of protection (IP code): To AS 60529 (2004).

Electromagnetic compatibility (EMC): To the AS/NZS 61000 series.

Communications systems: To AS/CA S008 (2020), AS/CA S009 (2020), AS/NZS 11801.1 (2019) and AS/NZS 14763.2 (2020).

1.2 SUBMISSIONS**Baseline data**

Requirement: Submit baseline data to **BASELINE DATA** in *0171 General requirements*.

Design documentation

Hydrants: Submit the following:

- Hydraulic calculations: Submit hydraulic calculations of the hydrant systems to AS 2419.1 (2021).
- Calculation method: Use commercially available software written and validated to conform to AS 2419.1 (2021).
- Drawings: Based on the calculations, submit drawings showing the most hydraulically advantaged and disadvantaged hydrants to AS 2419.1 (2021).

Sprinklers: Submit the following:

- Hydraulic calculations: Submit hydraulic calculations of the sprinkler systems to AS 2118.1 (2017) Section 14.
- Calculation method: Use commercially available software written and validated to conform to AS 2118.1 (2017).
- Drawings: Based on the calculations, submit drawings showing the most favourable and unfavourable areas to AS 2118.1 (2017).

Products and materials

Evidence of suitability: Submit evidence of suitability for use, to NCC (2022) A5G1 [BCA (2019) A5.0], for all fire protection products.

1.3 PRODUCTS**Bushfire-prone areas**

Site with Bushfire Attack Level (BAL) 12.5, 19, 29, 40 or FZ to AS 3959 (2018): If external and above ground, provide metal pipes and fittings to AS 3959 (2018).

1.4 COMMISSIONING**General**

Requirement: Provide commissioning as documented. Conform to *0171 General requirements* and SA TS 5342 (2021).

2 HYDRANTS**2.1 FIRE HYDRANT SYSTEMS****General**

Plumbing and water supply: To AS/NZS 3500.1 (2021).

Hydrants: To AS 2419.1 (2021).

2.2 VALVES**Isolating valves**

Below-ground metal seated isolating valves: To AS/NZS 2638.1 (2011).

Below-ground resilient seated isolating valves: To AS/NZS 2638.2 (2011).

Pressure reducing valve stations

Requirement: If required by AS 2419.1 (2021) to limit system pressure, provide pressure reducing valves to AS 4118.1.8 (1999). Provide isolating valves, pressure gauges and pressure tappings on each side of each pressure reducing valve.

2.3 FIRE HYDRANTS**General**

Upstand assemblies: DN100 hot-dip galvanized steel.

Internal hydrants: Single headed.

External hydrants: Double headed.

Fire hydrant valves

Standard: To AS 2419.2 (2009).

Requirement: Provide fire hydrant valves, as follows:

- To the requirements of the local fire brigade.
- Copper alloy construction.
- Matching non-ferrous dust cap and non-ferrous chain.

2.4 INSTALLATION**General**

System: To AS 2419.1 (2021).

Valves: Locate valves to permit satisfactory operation and maintenance.

Isolating valves: Provide isolating valves to AS 2419.1 (2021) clause 8.7.

Ring mains: To AS 2419.1 (2021) clause 8.6.

Pressure gauges: Provide pressure gauges at the hydraulically most disadvantaged fire hydrant in the installation and each pressure zone.

Proving test facilities

Requirement: Provide facilities to verify that the system flows and pressures meet AS 2419.1 (2021).

Flow sensor: Low loss pitot type averaging sensor, with 2 flared isolating valves for connection of pressure lines and stainless steel wetted parts.

Installation: Install to the manufacturer's recommendation for installation, connection and valving. Provide manufacturers recommended straight lengths of pipe upstream and downstream of tapping point. Mount in the piping using an adaptor bushing and welding boss.

Performance:

- Accuracy: Within $\pm 1.5\%$ over the range of flow anticipated.
- Stability: Within $\pm 0.125\%$ over five years.
- Repeatability: $\pm 0.1\%$.

2.5 PRE-COMMISSIONING

General

Flush: Before testing, flush the piping system with clean water to AS 2419.1 (2021). Flush until the piping has been thoroughly cleaned out. Operate the system until all foreign matter has been removed.

Hydrostatic test: Test the piping system to AS 2419.1 (2021). Maintain the test pressure for the minimum time required to AS 2419.1 (2021) or longer if necessary to complete the inspection of the system under test.

2.6 COMMISSIONING

General

System: To AS 2419.1 (2021).

Manufacturer's recommendations: Commission to manufacturer's recommendations.

Baseline data

Requirement: Provide baseline data to AS 1851 (2012), AS 2419.1 (2021) and **BASELINE DATA** in *0171 General requirements*.

3 HOSE REELS

3.1 FIRE HOSE REELS

General

Standard: To AS/NZS 1221 (1997).

Product certification: Required, to AS/NZS 1221 (1997) clause A3.

Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Type: Swivel hose guide.

Fire hose reel cabinets

Requirement: Provide fire hose reels in cabinets, as documented.

Construction: Form from machine-folded sheet metal with returns on free edges.

Material: Metallic-coated sheet steel minimum 1.6 mm thick.

Finish: Full gloss, solvent-borne, interior and exterior or an equivalent factory-applied coating system.

Doors: Provide doors with locks and signage to AS 2441 (2005).

External cabinets degree of protection: \geq IP44.

3.2 WATER SUPPLY

General

Supply: Provide water supply, as documented.

Backflow prevention: Provide backflow prevention to AS/NZS 3500.1 (2021) Section 4.

Service trenches: To *0223 Service trenching*.

3.3 INSTALLATION

Fire hose reels

Standard: To AS 2441 (2005).

Protection from damage: To AS 2441 (2005).

Below-ground resilient seated isolating valve: To AS/NZS 2638.2 (2011).

3.4 PRE-COMMISSIONING

General

Flush: Before testing, flush the piping system with clean water. Flush until the piping has been thoroughly cleaned out. Operate the system until all foreign matter has been removed.

Hydrostatic test: Test the piping system. Maintain the test pressure for the time required to complete the inspection of the system under test.

3.5 COMMISSIONING

General

Standard: To AS 2441 (2005) clause 12.

Manufacturer's recommendations: Commission to manufacturer's recommendations.

Baseline data

Requirement: Provide baseline data to AS 1851 (2012) and **BASELINE DATA** in *0171 General requirements*.

4 FIRE DETECTION AND ALARMS

4.1 SYSTEM

General

System type: Addressable.

Interface: Emergency warning and intercommunications system.

4.2 STANDARDS

General

Standards: To AS 1670.1 (2018), AS 1670.5 (2016), AS 4428.16 (2020), AS 7240.2 (2018), AS 7240.4 (2018) and AS 7240.13 (2021).

4.3 CONTROL AND INDICATING EQUIPMENT

Standards

General: To AS ISO 7240.1 (2018) and AS 7240.2 (2018).

Alarm signalling equipment: To AS 4428.6 (2018).

Power supply units: To AS 7240.4 (2018).

Fire brigade panel: To AS 4428.3 (2020).

Wire-free alarm zone circuits: To AS ISO 7240.25 (2015).

Fire detection control and indicating equipment (FDCIE) and mimic panels

General: Provide metal cubicle-type enclosures.

Isolation

Isolating facilities: Provide on FDCIE to allow testing without the transmission of alarm signals to the fire brigade.

Capacity

Spare zones: 50% minimum allowing for the addition of plug-in circuit cards.

4.4 DETECTORS

Type

Requirement: Provide detector type, as documented and as follows:

- Areas generally: Optical beam smoke detectors mounted on plug-in bases.
- Hot areas: Fixed temperature integral heat detector/alarm unit type.

Standards

Smoke alarms: To BCA (2022) Spec 20 [BCA (2019) Spec E2.2a].

Carbon monoxide (CO) fire detectors: To AS 7240.6 (2017).

Duct sampling units: To AS 1603.13 (2018) and AS 7240.22 (2018).

Heat detectors: To AS ISO 7240.5 (2018).

Point type smoke detectors: To AS 7240.7 (2018).

Integral heat detector/alarm units: To AS 1603.3 (2018).

Integral smoke detector/alarm units: To AS 3786 (2014).

Multi-sensor fire detectors: To AS 7240.15 (2018).

Multi-point aspirated smoke detectors: To AS 7240.20 (2012).

Optical beam smoke detectors: To AS 7240.12 (2018).

Visual warning devices: To AS 1603.11 (2018).

Warning equipment for people with hearing impairment: To AS 1603.17 (2020).

Self-indicating detectors

General: Provide a light-emitting diode mounted in a clearly visible position, which illuminates whenever detector operation causes an alarm condition to

register on the FDCIE. Provide self-indicating devices which, if faulty, will not render the detector inoperative under fire conditions.

Mounting positions of light-emitting diodes: Conform to the following:

- Visible detectors: On the outside of the detector or its base.
- Detectors concealed above ceilings: On the underside of the ceiling immediately below the detector.
- Detectors in other concealed spaces: On a visible panel close to the entry to the concealed space housing the detector.

Installation

General: Install detectors so they can be easily inspected and tested in situ, and readily withdrawn from service.

Integral smoke detector/alarm units: To AS 1670.6 (1997).

4.5 MANUAL CALL POINTS

General

Standard: To AS ISO 7240.11 (2018).

Type: Flush mounted break glass type.

Mounting: Mounted 1350 mm above floor level.

4.6 EXTERNAL ALARM INDICATION

Standards

Bell circuits: To AS 7240.2 (2018).

Strobe lights: To AS 1603.11 (2018).

Power supply

To the strobe light and not more than 2 others: From the fire detection control and indicating equipment battery power supply.

To additional strobe lights: From the mains supply. Provide appropriate interface relays, operated by the fire detection control and indicating equipment.

4.7 MAGNETIC DOOR HOLDERS

General

Requirement: Provide electromagnetic door holders, if required.

Control facilities

Standard: To AS 1905.1 (2015) clause 2.1.4.3 and AS 1670.1 (2018) clause 3.19.

Signals: Ancillary control device circuits and connections for automatically controlling and releasing magnetic door holders to operate the relevant doors under fire alarm conditions.

4.8 AIR HANDLING SYSTEMS

Fire fan control panels (FFCP)

Standard: To AS 1668.1 (2015) and AS 1670.1 (2018).

Signals: Provide fire detection and alarm signals for the fire fan control panel (FFCP).

4.9 SMOKE DETECTION IN BUILDINGS THAT DO NOT REQUIRE A FIRE ALARM TO AS 1670

General

Requirement: Provide smoke detection system conforming to BCA (2022) Spec 20 [BCA (2019) Spec E2.2a].

Connection: To mains power, conforming to AS/NZS 3000 (2018) clause 4.6.

Smoke alarms: Photoelectric smoke alarms that are mains powered with a non-removable rechargeable battery, and that have an anti-tamper device requiring a tool to remove from the ceiling. Select from the following:

- Brooks EIB3016.
- PSA LIF6000RL.

Interconnection devices: Wireless smoke alarms. Select from the following:

- Brooks EIB3016: EIB100MRF.
- PSA LIF6000RL: LIF6000WB.

Alternatives: If alternatives are proposed, conform to **SUBSTITUTIONS** in *0171 General requirements*.

Installation: To the manufacturer's recommendations.

Marking: To AS 3786 (2014) clause 4.22.1.

4.10 COMMISSIONING

General

Requirement: Conform to the recommendations of AS 1670.1 (2018) Appendix A.

5 EMERGENCY WARNING AND INTERCOMMUNICATION

5.1 STANDARDS

General

Intercommunication system: To AS 1428.5 (2021), AS 1670.4 (2018), AS 1670.5 (2016), AS 4428.4 (2016) and AS 4428.16 (2020).

Sound system: To AS 1670.4 (2018), AS ISO 7240.24 (2018) and AS 60849 (2004).

5.2 SOUND SYSTEM

Loudspeakers

Standard: To AS ISO 7240.24 (2018).

Ceiling speakers: Requirements, as follows:

- 200 mm maximum diameter.
- 5 W minimum rated capacity.
- Minimum frequency response: 150 Hz to 10 kHz ± 3 dB.
- Minimum SPL: 89 dB at 1 m per watt at 1 kHz.
- Rated input voltage: 100 V.
- 1.25 W minimum tapping setting.
- To have grille, matching ceiling colour.

Horn speaker: Requirements, as follows:

- 200 mm maximum diameter at open end.
- 10 W minimum rated capacity.

- Minimum frequency response: 300 Hz to 10 kHz ± 3 dB.

- Minimum SPL: 100 dB at 1 m per watt at 1 kHz.

- Rated input voltage: 100 V.

- 5 W minimum tapping setting.

Mounting: Securely fix to building elements.

Flush mounting: Required in suspended ceilings.

Wall mounting: 150 mm below finished ceiling level to top of speaker enclosure.

5.3 INTERCOMMUNICATION SYSTEM

Warden intercommunication points (WIP)

Connection: Provide separate circuits for each WIP handset.

Conferencing switching facilities: Permit the initiation of conference calls, between up to 5 warden intercommunication points, from any emergency control panel.

Lift cars: Provide a terminal block outside the lift motor room. Cable from the terminal block to central control equipment. Provide a WIP handset in each emergency lift car.

5.4 COMMISSIONING

General

Standard: Conform the recommendations of AS 1670.4 (2018) Appendix A.

Manufacturer's recommendations: Commission to manufacturer's recommendations.

REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS/CA S008	2020	Requirements for customer cabling products
AS/CA S009	2020	Installation requirements for customer cabling (Wiring Rules)
AS ISO 354	2006	Acoustics - Measurement of sound absorption in a reverberation room
AS ISO 717		Acoustics - Rating of sound insulation in buildings and of building elements
AS/NZS ISO 717.1	2004	Airborne sound insulation
AS ISO 717.2	2004	Impact sound insulation
AS/NZS ISO 817	2016	Refrigerants - Designation and safety classification
AS 1012		Methods of testing concrete
AS 1012.1	2014	Sampling of concrete
AS 1012.9	2014	Compressive strength tests - Concrete, mortar and grout specimens
AS 1055	2018	Acoustics - Description and measurement of environment noise
AS 1074	1989	Steel tubes and tubulars for ordinary service
AS/NZS 1080		Timber - Methods of test
AS/NZS 1080.1	2012	Moisture content
AS 1110		ISO metric hexagon bolts and screws - Product grades A and B
AS 1110.1	2015	Bolts
AS 1110.2	2015	Screws
AS 1111		ISO metric hexagon bolts and screws - Product grade C
AS 1111.1	2015	Bolts
AS 1111.2	2015	Screws
AS 1112		ISO metric hexagon nuts
AS 1112.1	2015	Style 1 - Product grades A and B
AS 1112.2	2015	Style 2 - Product grades A and B
AS 1112.3	2015	Product grade C
AS 1112.4	2015	Chamfered thin nuts - Product grades A and B
AS 1141		Methods for sampling and testing aggregates
AS 1141.11.1	2020	Particle size distribution - Sieving method
AS 1141.12	2015	Materials finer than 75 µm in aggregates (by washing)
AS 1141.22	2019	Wet/dry strength variation
AS 1141.52	2019	Unconfined cohesion of compacted pavement materials
AS 1160	1996	Bitumen emulsions for the construction and maintenance of pavements
AS/NZS 1163	2016	Cold-formed structural steel hollow sections
AS/NZS 1167		Welding and brazing - Filler metals
AS/NZS 1167.1	2005	Filler metal for brazing and braze welding
AS/NZS 1170		Structural design actions
AS/NZS 1170.1	2002	Permanent, imposed and other actions
AS/NZS 1170.2	2021	Wind actions
AS 1192	2004	Electroplated coatings - Nickel and chromium
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)
AS/NZS 1221	1997	Fire hose reels
AS 1231	2000	Aluminium and aluminium alloys - Anodic oxidation coatings
AS 1237		Plain washers for metric bolts, screws and nuts for general purposes
AS 1237.1	2002	General plan
AS/NZS 1252		High-strength steel fastener assemblies for structural engineering - Bolts, nuts and washers
AS/NZS 1252.1	2016	Technical requirements
AS 1288	2021	Glass in buildings - Selection and installation
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.6.1	2009	Soil classification tests - Determination of the particle size distribution of a soil - Standard method of analysis by sieving
AS 1289.4.2.1	2020	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1289.5.1.1	2017	Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.2.1	2017	Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.3.2	2004	Soil compaction and density tests - Determination of the field dry density of a soil - Sand replacement method using a sand pouring can, with or without a volume displacer
AS 1289.5.3.5	1997	Soil compaction and density tests - Determination of the field dry density of a soil - Water replacement method
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.4.2	2007	Soil compaction and density tests - Compaction control test - Assignment of maximum dry density and optimum moisture content values
AS 1289.5.6.1	1998	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1289.5.7.1	2006	Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)

AS 1289.6.1.1	2014	Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
AS 1319	1994	Safety signs for the occupational environment
AS 1324		Air filters for use in general ventilation and airconditioning
AS 1324.1	2001	Application, performance and construction
AS/NZS 1328		Glued laminated structural timber
AS/NZS 1328.1	1998	Performance requirements and minimum production requirements
AS 1345	1995	Identification of the contents of pipes, conduits and ducts
AS 1366		Rigid cellular plastics sheets for thermal insulation
AS 1366.3	1992	Rigid cellular polystyrene - Moulded (RC/PS - M)
AS/NZS 1367	2016	Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analog signals in single and multiple dwelling installations
AS 1379	2007	Specification and supply of concrete
AS/NZS 1385	2007	Textile floor coverings - Metric units and commercial tolerances for measurement
AS/NZS 1390	1997	Cup head bolts with ISO metric coarse pitch threads
AS/NZS 1393	1996	Coach screws - Metric series with ISO hexagon heads
AS 1397	2021	Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium
AS 1417	2015	Receiving antennas for radio and television in the VHF and UHF broadcast bands - Design, manufacture and performance of outdoor terrestrial television antennas
AS 1420	2008	ISO metric hexagon socket head cap screws
AS 1428		Design for access and mobility
AS 1428.1	2021	General requirements for access - New building work
AS 1428.2	1992	Enhanced and additional requirements - Buildings and facilities
AS/NZS 1428.4.1	2009	Means to assist the orientation of people with vision impairment - Tactile ground surface indicators
AS 1428.4.2	2018	Means to assist the orientation of people with vision impairment - Wayfinding signs
AS 1428.5	2021	Communication for people who are deaf or hearing impaired
AS/NZS 1477	2017	PVC pipes and fittings for pressure applications
AS 1478		Chemical admixtures for concrete, mortar and grout
AS 1478.1	2000	Admixtures for concrete
AS 1530		Methods for fire tests on building materials, components and structures
AS 1530.1	1994	Combustibility test for materials
AS 1530.2	1993	Test for flammability of materials
AS/NZS 1530.3	1999	Simultaneous Determination of Ignitability, Flame Propagation, Heat Release and Smoke Release
AS 1530.4	2014	Fire-resistance tests for elements of construction
AS 1530.7	2007	Smoke control assemblies - Ambient and medium temperature leakage test procedure
AS 1531	1991	Conductors - Bare overhead - Aluminium and aluminium alloy
AS/NZS 1546		On-site domestic wastewater treatment units
AS/NZS 1546.1	2008	Septic tanks
AS/NZS 1546.2	2008	Waterless composting toilets
AS 1546.3	2017	Secondary treatment systems
AS/NZS 1547	2012	On-site domestic wastewater management
AS/NZS 1554		Structural steel welding
AS/NZS 1554.1	2014	Welding of steel structures
AS/NZS 1554.3	2014	Welding of reinforcing steel
AS/NZS 1554.6	2012	Welding stainless steels for structural purposes
AS 1562		Design and installation of sheet roof and wall cladding
AS 1562.1	2018	Metal
AS 1562.3	2006	Plastics
AS 1566	1997	Copper and copper alloys - Rolled flat products
AS 1571	2020	Copper - Seamless tubes for air-conditioning and refrigeration
AS/NZS 1594	2002	Hot-rolled steel flat products
AS 1603		Automatic fire detection and alarm systems
AS 1603.3	2018	Heat alarms
AS 1603.11	2018	Visual warning devices
AS 1603.13	2018	Duct sampling smoke detectors
AS 1603.17	2020	Warning equipment for people with hearing impairment
AS/NZS 1604		Preservative-treated wood-based products
AS/NZS 1604.1	2021	Products and treatment
AS/NZS 1604.2	2021	Verification requirements
AS/NZS 1604.3	2021	Test methods
AS 1627		Metal finishing - Preparation and pretreatment of surfaces
AS 1627.1	2003	Removal of oil, grease and related contamination
AS 1627.2	2002	Power tool cleaning
AS 1627.4	2005	Abrasive blast cleaning of steel
AS 1627.5	2003	Pickling
AS 1627.9	2002	Pictorial surface preparation standards for painting steel surfaces
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS/NZS 1664		Aluminium structures
AS/NZS 1664.1	1997	Limit state design
AS/NZS 1664.2	1997	Allowable stress design
AS/NZS 1665	2004	Welding of aluminium structures
AS 1668		The use of ventilation and air conditioning in buildings

AS 1668.1	2015	Fire and smoke control in buildings
AS 1668.2	2012	Mechanical ventilation in buildings
AS 1670		Fire detection, warning, control and intercom systems - System design, installation and commissioning
AS 1670.1	2018	Fire
AS 1670.4	2018	Emergency warning and intercom systems
AS 1670.5	2016	Special hazard systems
AS 1670.6	1997	Smoke alarms
AS 1672		Limes and limestones
AS 1672.1	1997	Limes for building
AS/NZS 1680		Interior and workplace lighting
AS/NZS 1680.1	2006	General principles and recommendations
AS/NZS 1680.2.4	2017	Industrial tasks and processes
AS 1684		Residential timber-framed construction
AS 1684.2	2021	Non-cyclonic areas
AS 1684.3	2021	Cyclonic areas
AS 1684.4	2010	Simplified - Non-cyclonic areas
AS 1720		Timber structures
AS 1720.1	2010	Design methods
AS 1720.2	2006	Timber properties
AS/NZS 1720.4	2019	Fire resistance of timber elements
AS 1720.5	2015	Nailplated timber roof trusses
AS 1725		Chain link fabric fencing
AS 1725.1	2010	Security fences and gates - General requirements
AS 1726	2017	Geotechnical site investigations
AS/NZS 1734	1997	Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate
AS 1742		Manual of uniform traffic control devices
AS 1742.2	2022	Traffic control devices for general use
AS 1746	1991	Conductors - Bare overhead - Hard-drawn copper
AS/NZS 1748		Timber - Solid - Stress-graded for structural purposes
AS/NZS 1748.1	2011	General requirements
AS 1769	1975	Welded stainless steel tubes for plumbing applications
AS 1774		Monolithic refractory products
AS 1774.36	2019	Determination of resistance to explosive spalling (ISO 16334:2013, MOD)
AS 1789	2003	Electroplated zinc (electrogalvanized) coatings on ferrous articles (batch process)
AS 1796	2022	Pressure equipment - Qualification of welders, welding supervisors and welding inspectors
AS/NZS 1801	1997	Occupational protective helmets
AS 1810	1995	Timber - Seasoned cypress pine - Milled products
AS/NZS 1841		Portable fire extinguishers
AS/NZS 1841.1	2007	General requirements
AS/NZS 1841.2	2007	Specific requirements for water type extinguishers
AS/NZS 1841.3	2007	Specific requirements for wet chemical type extinguishers
AS/NZS 1841.4	2007	Specific requirements for foam type extinguishers
AS/NZS 1841.5	2007	Specific requirements for powder type extinguishers
AS/NZS 1841.6	2007	Specific requirements for carbon dioxide type extinguishers
AS/NZS 1841.8	2007	Specific requirements for non-rechargeable type extinguishers
AS 1851	2012	Routine service of fire protection systems and equipment
AS/NZS 1859		Reconstituted wood-based panels - Specifications
AS 1859.1	2017	Particleboard
AS/NZS 1859.2	2017	Dry process fibreboard
AS/NZS 1859.3	2017	Decorative overlaid wood panels
AS/NZS 1859.4	2018	Wet process fibreboard
AS 1860		Particleboard flooring
AS/NZS 1860.1	2017	Specifications
AS 1860.2	2006	Installation
AS/NZS 1865	1997	Aluminium and aluminium alloys - Drawn wire, rod, bar and strip
AS/NZS 1866	1997	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
AS/NZS 1867	1997	Aluminium and aluminium alloys - Drawn tubes
AS 1874	2000	Aluminium and aluminium alloys - Ingots and castings
AS 1882	2002	Earth and bonding clamps
AS 1884	2021	Floor coverings - Resilient sheet and tiles - Installation practices
AS/NZS 1891		Personal equipment for work at height
AS/NZS 1891.1	2020	Manufacturing requirements for full body combination and lower body harnesses
AS/NZS 1891.2	2001	Horizontal lifeline and rail systems
AS/NZS 1891.2 Supp 1	2001	Horizontal lifeline and rail systems - Prescribed configurations for horizontal lifelines (Supplement to AS/NZS 1891.2:2001)
AS 1891.3	2020	Manufacturing requirements for fall-arrest devices
AS/NZS 1891.4	2009	Selection, use and maintenance
AS 1891.5	2020	Manufacturing requirements for lanyard assemblies and pole straps
AS 1892		Portable ladders
AS 1892.1	2018	Performance and geometric requirements
AS 1897	2016	Fasteners - Electroplated coatings
AS 1905		Components for the protection of openings in fire-resistant walls
AS 1905.1	2015	Fire-resistant doorsets
AS 1905.2	2005	Fire-resistant roller shutters

AS 1926		Swimming pool safety
AS 1926.1	2012	Safety barriers for swimming pools
AS 1926.2	2007	Location of safety barriers for swimming pools
AS/NZS 2032	2006	Installation of PVC pipe systems
AS 2047	2014	Windows and external glazed doors in buildings
AS 2049	2002	Roof tiles
AS 2050	2018	Installation of roof tiles
AS 2070	1999	Plastics materials for food contact use
AS 2082	2007	Timber - Hardwood - Visually stress-graded for structural purposes
AS/NZS 2098		Methods of test for veneer and plywood
AS/NZS 2098.1	2006	Moisture content of veneer and plywood
AS/NZS 2107	2016	Acoustics - Recommended design sound levels and reverberation times for building interiors
AS 2118		Automatic fire sprinkler systems
AS 2118.1	2017	General systems
AS 2118.6	2012	Combined sprinkler and hydrant systems in multistorey buildings
AS 2150	2020	Asphalt - A guide to good practice
AS 2157	1997	Cutback bitumen
AS/NZS 2179		Specifications for rainwater goods, accessories and fasteners
AS/NZS 2179.1	2014	Metal shape or sheet rainwater goods, and metal accessories and fasteners
AS 2201		Intruder alarm systems
AS/NZS 2201.1	2007	Client's premises - Design, installation, commissioning and maintenance
AS 2201.3	1991	Detection devices for internal use
AS 2201.4	1990	Wire-free systems installed in client's premises
AS/NZS 2201.5	2008	Alarm transmission systems
AS/NZS 2208	1996	Safety glazing materials in buildings
AS/NZS 2269		Plywood - Structural
AS/NZS 2269.0	2012	Specifications
AS/NZS 2270	2006	Plywood and blockboard for interior use
AS/NZS 2271	2004	Plywood and blockboard for exterior use
AS/NZS 2272	2006	Plywood - Marine
AS/NZS 2293		Emergency lighting and exit signs for buildings
AS/NZS 2293.1	2018	System design, installation and operation
AS/NZS 2293.3	2018	Emergency luminaires and exit signs
AS/NZS 2310	2002	Glossary of paint and painting terms
AS/NZS 2311	2017	Guide to the painting of buildings
AS/NZS 2312		Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS 2312.1	2014	Paint coatings
AS/NZS 2312.2	2014	Hot dip galvanizing
AS/NZS 2327	2017	Composite structures - Composite steel-concrete construction in buildings
AS 2334	1980	Steel nails - Metric series
AS 2419		Fire hydrant installations
AS 2419.1	2021	System design, installation and commissioning
AS 2419.2	2009	Fire hydrant valves
AS 2423	2002	Coated steel wire fencing products for terrestrial, aquatic and general use
AS/NZS 2425	2015	Bar chairs in reinforced concrete - Product requirements and test methods
AS 2439		Perforated plastics drainage and effluent pipe and fittings
AS 2439.1	2007	Perforated drainage pipe and associated fittings
AS 2441	2005	Installation of fire hose reels
AS 2444	2001	Portable fire extinguishers and fire blankets - Selection and location
AS 2455		Textile floor coverings - Installation practice
AS 2455.1	2019	General
AS 2455.2	2019	Carpet tiles
AS/NZS 2465	1999	Unified hexagon bolts, screws and nuts (UNC and UNF threads)
AS/NZS 2588	2018	Gypsum plasterboard
AS/NZS 2589	2017	Gypsum linings - Application and finishing
AS 2601	2001	The demolition of structures
AS/NZS 2638		Gate valves for waterworks purposes
AS/NZS 2638.1	2011	Metal seated
AS/NZS 2638.2	2011	Resilient seated
AS/NZS 2648		Underground marking tape
AS/NZS 2648.1	1995	Non-detectable tape
AS 2663		Textiles - Fabrics for window furnishings
AS 2663.1	1997	Uncoated fabrics
AS 2663.2	1999	Coated curtain fabrics
AS 2663.3	1999	Vertical and holland blinds
AS 2676		Installation, maintenance, testing and replacement of secondary batteries in buildings
AS 2688	2017	Timber and composite doors
AS 2699		Built-in components for masonry construction
AS 2699.1	2020	Wall ties
AS 2699.2	2020	Connectors and accessories
AS 2699.3	2020	Lintels and shelf angles (durability requirements)
AS/NZS 2712	2007	Solar and heat pump water heaters - Design and construction
AS/NZS 2728	2013	Prefinished/prepainted sheet metal products for interior/exterior building applications - Performance requirements

AS 2753	2018	Adhesives - for bonding gypsum plaster linings to wood and metal framing members
AS/NZS 2754		Adhesives for timber and timber products
AS/NZS 2754.1	2016	Adhesives for manufacture of plywood and laminated veneer lumber (LVL)
AS 2758		Aggregates and rock for engineering purposes
AS 2758.1	2014	Concrete aggregates
AS 2758.2	2021	Specification for sealing aggregate
AS 2758.5	2020	Specification for aggregates for asphalt
AS/NZS 2785	2020	Suspended ceilings - Design and installation
AS 2796		Timber - Hardwood - Sawn and milled products
AS 2796.1	1999	Product specification
AS 2796.2	2006	Grade description
AS 2796.3	1999	Timber for furniture components
AS 2832		Cathodic protection of metals
AS 2832.1	2015	Pipes and cables
AS 2845		Water supply - Backflow prevention devices
AS/NZS 2845.1	2022	Materials, design and performance requirements
AS 2845.2	2010	Registered air gaps and registered break tanks
AS/NZS 2845.3	2020	Field testing and maintenance of testable devices
AS 2848		Aluminium and aluminium alloys - Compositions and designations
AS 2848.1	1998	Wrought products
AS 2858	2008	Timber - Softwood - Visually stress-graded for structural purposes
AS 2865	2009	Confined spaces
AS 2870	2011	Residential slabs and footings
AS 2876	2000	Concrete kerbs and channels (gutters) - Manually or machine placed
AS 2890		Parking facilities
AS/NZS 2890.1	2004	Off-street car parking
AS/NZS 2890.6	2009	Off-street parking for people with disabilities
AS/NZS 2904	1995	Damp-proof courses and flashings
AS/NZS 2908		Cellulose-cement products
AS/NZS 2908.2	2000	Flat sheets
AS/NZS 2924		High pressure decorative laminates - Sheets made from thermosetting resins
AS/NZS 2924.1	1998	Classification and specifications
AS/NZS 2967	2014	Optical fibre communication cabling systems safety
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008		Electrical installations - Selection of cables
AS/NZS 3008.1.1	2017	Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions
AS/NZS 3013	2005	Electrical installations - Classification of the fire and mechanical performance of wiring system elements
AS/NZS 3084	2017	Telecommunications installations - Telecommunications pathways and spaces for commercial buildings
AS/NZS 3085		Telecommunications installations - Administration of communications cabling systems
AS 3085.1	2022	Basic requirements
AS/NZS 3111	2009	Approval and test specification - Miniature overcurrent circuit-breakers
AS/NZS 3112	2017	Approval and test specification - Plugs and socket-outlets
AS/NZS 3123	2005	Approval and test specification - Plugs, socket-outlets and couplers for general industrial application.
AS 3133	2020	Approval and test specification - Air-break switches
AS/NZS 3190	2016	Approval and test specification - Residual current devices (current-operated earth-leakage devices)
AS/NZS 3500		Plumbing and drainage
AS/NZS 3500.0	2021	Glossary of terms
AS/NZS 3500.1	2021	Water services
AS/NZS 3500.2	2021	Sanitary plumbing and drainage
AS/NZS 3500.3	2021	Stormwater drainage
AS/NZS 3500.4	2021	Heated water services
AS/NZS 3504	2006	Fire blankets
AS 3565		Meters for water supply
AS 3565.4	2007	In-service compliance testing
AS 3566		Self-drilling screws for the building and construction industries
AS 3566.1	2002	General requirements and mechanical properties
AS/NZS 3582		Supplementary cementitious materials
AS/NZS 3582.1	2016	Fly ash
AS 3582.2	2016	Slag - Ground granulated blast-furnace
AS/NZS 3582.3	2016	Amorphous silica
AS 3600	2018	Concrete structures
AS 3607	1989	Conductors - Bare overhead aluminium and aluminium alloy - Steel reinforced
AS 3610		Formwork for concrete
AS 3610.1	2018	Specifications
AS 3645	2017	Essential requirements for gas equipment
AS 3660		Termite management
AS 3660.1	2014	New building work
AS 3660.2	2017	In and around existing buildings and structures
AS 3660.3	2014	Assessment criteria for termite management systems
AS/NZS 3666		Air-handling and water systems of buildings - Microbial control

AS/NZS 3666.1	2011	Design, installation and commissioning
AS/NZS 3666.2	2011	Operation and maintenance
AS/NZS 3666.3	2011	Performance-based maintenance of cooling water systems
AS/NZS 3666.4	2011	Performance-based maintenance of air-handling systems (ducts and components)
AS/NZS 3678	2016	Structural steel - Hot-rolled plates, floorplates and slabs
AS/NZS 3679		Structural steel
AS/NZS 3679.1	2016	Hot-rolled bars and sections
AS/NZS 3679.2	2016	Welded I sections
AS 3700	2018	Masonry structures
AS 3705	2012	Geotextiles - Identification, marking, and general data
AS 3715	2002	Metal finishing - Thermoset powder coating for architectural applications of aluminium and aluminium alloys
AS 3727		Pavements
AS 3727.1	2016	Residential
AS 3730		Guide to the properties of paints for buildings
AS 3730.6	2006	Solvent-borne - Interior/exterior - Full gloss enamel
AS 3730.15	2006	Primer - Latex - For metallic zinc surfaces
AS 3730.21	2006	Primer - Solvent-borne - For ferrous metallic surfaces
AS/NZS 3733	2018	Textile floor coverings - Cleaning maintenance of residential and commercial carpeting
AS 3735	2001	Concrete structures retaining liquids
AS 3740	2021	Waterproofing of domestic wet areas
AS/NZS 3750		Paints for steel structures
AS/NZS 3750.9	2009	Organic zinc-rich primer
AS/NZS 3750.13	1997	Epoxy primer (two pack)
AS/NZS 3750.14	1997	High-build epoxy (two-pack)
AS/NZS 3750.16	1998	Waterborne primer and paint for galvanized, zinc/aluminium alloy-coated and zinc-primed steel
AS/NZS 3750.19	2008	Metal primer - General purpose
AS/NZS 3750.20	2008	Anticorrosive metal primer - Solvent borne - Lead and chromate free
AS/NZS 3750.21	2008	Undercoat - Solvent borne
AS/NZS 3750.22	2008	Full gloss enamel - Solvent borne
AS 3786	2014	Smoke alarms using scattered light, transmitted light or ionization
AS 3798	2007	Guidelines on earthworks for commercial and residential developments
AS 3799	1998	Liquid membrane-forming curing compounds for concrete
AS 3814	2018	Industrial and commercial gas-fired appliances
AS 3818		Timber - Heavy structural products - Visually graded
AS 3818.2	2010	Railway track timbers
AS/NZS 3823		Performance of electrical appliances - Airconditioners and heat pumps
AS/NZS 3823.1.1	2012	Non-ducted airconditioners and heat pumps - Testing and rating for performance (ISO 5151:2010, MOD)
AS/NZS 3823.1.2	2012	Ducted airconditioners and air-to-air heat pumps - Testing and rating for performance (ISO 13253:2011, MOD)
AS/NZS 3823.2	2013	Energy labelling and minimum energy performance standards (MEPS) requirements
AS 3958		Ceramic tiles
AS 3958.1	2007	Guide to the installation of ceramic tiles
AS 3959	2018	Construction of buildings in bushfire-prone areas
AS 3972	2010	General purpose and blended cements
AS 3996	2019	Access covers and grates
AS 3999	2015	Bulk thermal insulation - Installation
AS/NZS 4020	2018	Testing of products for use in contact with drinking water
AS/NZS 4026	2008	Electric cables - For underground residential distribution systems
AS 4032		Water supply - Valves for the control of heated water supply temperatures
AS 4032.1	2005	Thermostatic mixing valves - Materials design and performance requirements
AS 4032.3	2022	Requirements for field-testing, maintenance or replacement of thermostatic mixing valves, tempering valves and end-of-line temperature control devices
AS 4040		Methods of testing sheet roof and wall cladding
AS 4040.2	1992	Resistance to wind pressures for non-cyclone regions
AS 4040.3	2018	Resistance to wind pressures for cyclone regions
AS/NZS 4040.5	1996	Resistance to impact (sandbag) for wall boards
AS 4046		Methods of testing roof tiles
AS 4046.9	2002	Determination of dynamic weather resistance
AS 4049		Paints and related materials - Pavement marking materials
AS 4049.1	2005	Solvent-borne paint - For use with surface applied glass beads
AS 4049.3	2005	Waterborne paint - For use with surface applied glass beads
AS 4049.4	2006	High performance pavement marking systems
AS 4055	2021	Wind loads for housing
AS 4072		Components for the protection of openings in fire-resistant separating elements
AS 4072.1	2005	Service penetrations and control joints
AS 4086		Secondary batteries for use with stand-alone power systems
AS 4086.1	1993	General requirements
AS 4100	2020	Steel structures
AS/NZS 4114	2020	Spray painting booths, designated spray painting areas and paint mixing rooms
AS 4118		Fire sprinkler systems
AS 4118.1.8	1999	Components - Pressure-reducing valves
AS 4145		Locksets and hardware for doors and windows
AS 4145.1	2008	Glossary of terms and rating system

AS 4145.2	2008	Mechanical locksets for doors and windows in buildings
AS 4145.3	2001	Mechanical locksets for windows in buildings
AS 4145.4	2002	Padlocks
AS 4145.5	2011	Controlled door closing devices (EN 1154:1997, MOD)
AS/NZS 4200		Pliable building membranes and underlays
AS/NZS 4200.1	2017	Materials
AS 4200.2	2017	Installation
AS 4253	2019	Mailboxes
AS 4254		Ductwork for air-handling systems in buildings
AS 4254.1	2021	Flexible duct
AS 4254.2	2012	Rigid duct
AS 4256		Plastic roof and wall cladding materials
AS 4256.2	2006	Unplasticized polyvinyl chloride (uPVC) building sheets
AS 4256.3	2006	Glass fibre reinforced polyester (GRP)
AS 4256.5	2006	Polycarbonate
AS 4262		Telecommunication overvoltages
AS 4262.1	1995	Protection of persons
AS 4262.2	1999	Protection of equipment
AS/NZS 4266		Reconstituted wood-based panels - Methods of test
AS/NZS 4266.1	2017	Base panels
AS/NZS 4284	2008	Testing of building facades
AS 4288	2003	Soft underlays for textile floor coverings
AS 4312	2019	Atmospheric corrosivity zones in Australia
AS/NZS 4357		Structural laminated veneer lumber
AS/NZS 4357.0	2022	Specifications
AS 4373	2007	Pruning of amenity trees
AS 4386	2018	Cabinetry in the built-in environment - Commercial and domestic
AS/NZS 4389	2015	Roof safety mesh
AS 4397	2007	Electroplated coatings of zinc on steel fasteners with imperial threads
AS/NZS 4402	2015	Hexagon head tapping screws
AS/NZS 4403	2015	Slotted pan head tapping screws
AS/NZS 4404	2015	Slotted countersunk (flat) head tapping screws (common head style)
AS/NZS 4405	2015	Slotted raised countersunk (oval) head tapping screws (common head style)
AS/NZS 4406	2015	Cross-recessed pan head tapping screws
AS/NZS 4407	2015	Cross-recessed countersunk (flat) head tapping screws (common head style)
AS/NZS 4408	2015	Cross-recessed raised countersunk (oval) head tapping screws
AS/NZS 4409	2015	Hexagon washer head tapping screws
AS/NZS 4410	2015	Hexagon flange head tapping screws
AS 4419	2018	Soils for landscaping and garden use
AS 4428		Fire detection, warning, control and intercom systems - Control and indicating equipment
AS 4428.3	2020	Fire brigade panel
AS 4428.4	2016	Emergency intercom control and indicating equipment
AS 4428.6	2018	Alarm signalling equipment
AS 4428.16	2020	Emergency warning control and indicating equipment
AS 4440	2004	Installation of nailplated timber roof trusses
AS 4446	1999	Manufacture of nailplate-joined timber products
AS 4454	2012	Composts, soil conditioners and mulches
AS/NZS 4455		Masonry units, pavers, flags and segmental retaining wall units
AS/NZS 4455.1	2008	Masonry units
AS/NZS 4455.2	2010	Pavers and flags
AS/NZS 4455.3	2008	Segmental retaining wall units
AS/NZS 4488		Industrial rope access systems
AS/NZS 4488.1	1997	Specifications
AS/NZS 4505	2012	Garage doors and other large access doors
AS 4506	2005	Metal finishing - Thermoset powder coatings
AS/NZS 4509		Stand-alone power systems
AS/NZS 4509.1	2009	Safety and installation
AS/NZS 4509.2	2010	System design
AS/NZS 4534	2006	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 4548		Guide to long-life coatings for concrete and masonry
AS/NZS 4552		Gas fired water heaters for hot water supply and/or central heating
AS/NZS 4552.2	2010	Minimum energy performance standards for gas water heaters
AS 4566	2005	Flue cowls - Gas appliances
AS 4586	2013	Slip resistance classification of new pedestrian surface materials
AS/NZS 4600	2018	Cold-formed steel structures
AS 4602		High visibility safety garments
AS 4602.1	2011	Garments for high risk applications
AS/NZS 4645		Gas distribution networks
AS/NZS 4645.2	2018	Steel pipe systems
AS 4654		Waterproofing membranes for external above-ground use
AS 4654.1	2012	Materials
AS 4654.2	2012	Design and installation
AS 4663	2013	Slip resistance measurement of existing pedestrian surfaces
AS 4666	2012	Insulating glass units
AS/NZS 4667	2000	Quality requirements for cut-to-size and processed glass

AS/NZS 4671	2019	Steel for the reinforcement of concrete
AS 4678	2002	Earth-retaining structures
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4692		Electric water heaters
AS/NZS 4692.1	2005	Energy consumption, performance and general requirements
AS/NZS 4692.2	2005	Minimum Energy Performance Standard (MEPS) requirements and energy labelling
AS 4750	2003	Electrogalvanized (zinc) coatings on ferrous hollow and open sections
AS/NZS 4766	2020	Rotationally moulded buried, partially buried and non-buried storage tanks for water and chemicals
AS/NZS 4777		Grid connection of energy systems via inverters
AS/NZS 4777.1	2016	Installation requirements
AS/NZS 4777.2	2020	Inverter requirements
AS/NZS 4782		Double-capped fluorescent lamps - Performance specifications
AS/NZS 4782.1	2020	General (IEC 60081:1997+AMD1:2000 CSV (ED.5.1), MOD)
AS 4782.2	2019	Minimum Energy Performance Standard (MEPS)
AS/NZS 4783		Performance of electrical lighting equipment - Ballasts for fluorescent lamps
AS/NZS 4783.1	2001	Method of measurement to determine energy consumption and performance of ballasts lamp circuits
AS/NZS 4783.2	2002	Energy labelling and minimum energy performance standards requirements
AS 4785		Timber - Softwood - Sawn and milled products
AS 4785.1	2002	Product specification
AS 4785.2	2002	Grade description
AS 4785.3	2002	Timber for furniture components
AS/NZS 4791	2006	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
AS/NZS 4792	2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS 4806		Closed circuit television (CCTV)
AS 4806.2	2006	Application guidelines
AS 4806.4	2008	Remote video
AS 4809	2017	Copper pipe and fittings - Installation and commissioning
AS/NZS 4847		Self ballasted lamps for general lighting services
AS/NZS 4847.1	2010	Test methods - Energy performance
AS 4847.2	2019	Minimum energy performance standard (MEPS)
AS/NZS 4858	2004	Wet area membranes
AS/NZS 4859		Thermal insulation materials for buildings
AS/NZS 4859.1	2018	General criteria and technical provisions
AS/NZS 4859.2	2018	Design
AS/NZS 4879		Performance of transformers and electronic step-down converters for ELV lamps
AS/NZS 4879.1	2008	Test method - Energy performance
AS/NZS 4879.2	2010	Minimum Energy Performance Standards (MEPS) requirements
AS 4934		Incandescent lamps for general lighting services
AS 4934.2	2021	Energy performance and marking requirements
AS/NZS 4961	2003	Electric cables - Polymeric insulated - For distribution and service applications
AS 4970	2009	Protection of trees on development sites
AS/NZS 5000		Electric cables - Polymeric insulated
AS/NZS 5000.1	2005	For working voltages up to and including 0.6/1 (1.2) kV
AS 5007	2007	Powered doors for pedestrian access and egress
AS/NZS 5033	2021	Installation and safety requirements for photovoltaic (PV) arrays
AS 5039	2008	Security screen doors and security window grilles
AS 5040	2003	Installation of security screen doors and window grilles
AS 5101		Methods for preparation and testing of stabilized materials
AS 5101.4	2008	Unconfined compressive strength of compacted materials
AS/NZS 5125		Heat pump water heaters - Performance assessment
AS/NZS 5125.1	2014	Air source heat pump water heaters
AS/NZS 5131	2016	Structural steelwork - Fabrication and erection
AS/NZS 5139	2019	Electrical installations - Safety of battery systems for use with power conversion equipment
AS/NZS 5141	2018	Residential heating and cooling systems - Minimum applications and requirements for energy efficiency, performance and comfort criteria.
AS 5146		Reinforced autoclaved aerated concrete
AS 5146.1	2015	Structures
AS 5146.3	2018	Construction
AS/NZS 5149		Refrigerating systems and heat pumps - Safety and environmental requirements
AS/NZS 5149.1	2016	Definitions, classification and selection criteria (ISO 5149-1:2014, MOD)
AS/NZS 5149.2	2016	Design, construction, testing, marking and documentation (ISO 5149-2:2014, MOD)
AS/NZS 5149.3	2016	Installation site (ISO 5149-3:2014)
AS/NZS 5149.4	2016	Operations, maintenance, repair and recovery (ISO 5149-4:2014, MOD)
AS 5203	2016	Protection of openable windows/ fall prevention – Test sequence and compliance method
AS 5216	2021	Design of post-installed and cast-in fastenings in concrete
AS/NZS 5263		Gas appliances
AS/NZS 5263.0	2017	General requirements
AS/NZS 5263.1.2	2020	Gas fired water heaters for hot water supply and/or central heating
AS 5488		Classification of subsurface utility information
AS 5488.1	2022	Subsurface utility information

AS/NZS 5532	2013	Manufacturing requirements for single-point anchor device used for harness-based work at height
AS/NZS 5601		Gas installations
AS/NZS 5601.1	2013	General installations
AS 5604	2005	Timber - Natural durability ratings
AS 5637		Determination of fire hazard properties
AS 5637.1	2015	Wall and ceiling linings
AS 6669	2016	Plywood - Formwork
AS 6905	2007	Smoke doors
AS 7240		Fire detection and alarm systems
AS ISO 7240.1	2018	General and definitions
AS 7240.2	2018	Fire detection control and indicating equipment (ISO 7240-2:2017, MOD)
AS 7240.4	2018	Power supply equipment (ISO 7240.4:2017, MOD)
AS ISO 7240.5	2018	Point-type heat detectors
AS 7240.6	2017	Carbon monoxide fire detectors using electro-chemical cells
AS 7240.7	2018	Point type smoke detectors using scattered light, transmitted light or ionization (ISO 7240.7:2018, MOD)
AS ISO 7240.11	2018	Manual call points
AS 7240.12	2018	Line type smoke detectors using a transmitted optical beam (ISO 7240-12:2014, MOD)
AS 7240.13	2021	Compatibility assessment of system components (ISO 7240-13:2018 (ED.2.0) MOD)
AS 7240.15	2018	Point type fire detectors using smoke and heat sensors (ISO 7240.15:2014,MOD)
AS 7240.20	2012	Aspirating smoke detectors
AS 7240.22	2018	Smoke-detection equipment for ducts (ISO 7240-22:2017, MOD)
AS ISO 7240.24	2018	Fire alarm loudspeakers
AS ISO 7240.25	2015	Components using radio transmission paths
AS ISO 9239		Reaction to fire tests for floor coverings
AS ISO 9239.1	2003	Determination of the burning behaviour using a radiant heat source
AS ISO 11654	2002	Acoustics - Rating of sound absorption - Materials and systems
AS 11801		Information technology - Generic cabling for customer premises
AS/NZS 11801.1	2019	General requirements (ISO/IEC 11801-1:2017, MOD)
AS 11801.2	2019	Office premises (ISO/IEC 11801-2:2017, MOD)
AS 11801.4	2019	Single-tenant homes (ISO/IEC 11801-4:2017, MOD)
AS 13006	2020	Ceramic tiles - Definitions, classification, characteristics and marking (ISO 13006:2018 (ED.3.0) MOD)
AS ISO 13007		Ceramic tiles
AS ISO 13007.1	2020	Grouts and adhesives - Terms, definitions and specifications for adhesives
AS/NZS 14763		Information Technology - Implementation and operation of customer premises cabling
AS/NZS 14763.2	2020	Planning and installation (ISO/IEC 14763-2 (ED. 2.0) MOD)
AS/NZS 14763.3	2017	Implementation and operation of customer premises cabling - Testing of optical fibre cabling (ISO/IEC 14763-3:2014, MOD)
AS/NZS ISO 22846		Personal equipment for protection against falls - Rope access systems
AS/NZS ISO 22846.1	2020	Fundamental principles for a system of work
AS/NZS ISO 22846.2	2020	Code of practice
AS/NZS 60335		Household and similar electrical appliances - Safety
AS/NZS 60335.2.35	2013	Particular requirements for instantaneous water heaters
AS/NZS 60335.2.40	2019	Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers
AS/NZS 60335.2.80	2016	Particular requirements for fans
AS/NZS 60335.2.97	2017	Particular requirements for drives for rolling shutters, awnings, blinds and similar equipment (IEC 60335-2-97 Ed 2.1, IDT)
AS 60529	2004	Degrees of protection provided by enclosures (IP Code)
AS/NZS 60598		Luminaires
AS/NZS 60598.1	2017	General requirements and tests (IEC 60598-1, Ed. 8.0 (2014) MOD)
AS/NZS IEC 60839		Alarm and electronic security systems
AS/NZS IEC 60839.11.31		2020 Electronic access control systems - Core interoperability protocol based on Web services
AS 60849	2004	Magnetic field strength in audio-frequency induction loops for hearing aid purposes
AS/NZS 60898		Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations
AS/NZS 60898.1	2004	Circuit-breakers for a.c. operation
AS/NZS 60929	2020	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements (IEC 60929:2011+AMD1:2015 CSV (ED.4.1) MOD)
AS/NZS IEC 60947		Low voltage switchgear and controlgear
AS/NZS 60947.1	2021	General rules (IEC 60947-1:2020 (ED. 6.0) MOD)
AS/NZS IEC 60947.2	2015	Circuit-breakers
AS 60947.3	2018	Switches, disconnectors, switch-disconnectors and fuse-combination units (IEC 60947-3:2015 (ED. 3.2) MOD)
AS/NZS IEC 60947.5.5	2015	Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function
AS/NZS 60968	2001	Self ballasted lamps for general lighting services - Safety requirements (IEC 60968:1988, MOD)
AS/NZS 61000		Electromagnetic compatibility (EMC)
AS/NZS 61009		Residual current operated circuit-breakers with integral protection for household and similar uses (RCBOs)
AS/NZS 61009.1	2015	General rules (IEC 61009-1, Ed. 3.2 (2013) MOD)

AS/NZS 61347		Lamp controlgear
AS/NZS 61347.2.3	2016	Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps
AS/NZS 61439		Low-voltage switchgear and controlgear assemblies
SA/SNZ TR 61439.0	2016	Guide to specifying assemblies (IEC TR 61439-0, Ed. 2.0 (2013), MOD)
AS/NZS 61439.1	2016	General rules (IEC 61439-1, Ed. 2.0 (2011), MOD)
AS/NZS 61439.2	2016	Power switchgear and controlgear assemblies (IEC 61439-2, Ed. 2.0 (2011), MOD).
AS/NZS 61439.3	2016	Distribution boards intended to be operated by ordinary persons (DBO) (IEC 61439-3, Ed 1.0 (2012), MOD)
AS/NZS 61558		Safety of power transformers, reactors, power supply units and combinations thereof
AS/NZS 61558.1	2018	General requirements and tests. (IEC 61558-1:Ed 3 MOD)
SA/SNZ HB 32	1995	Control of microbial growth in air-handling and water systems of buildings
SA HB 230	2008	Rainwater tank design and installation handbook
SA HB 326	2008	Urban greywater installation handbook for single households
SA TS 102	2016	Structural steel – Limits on elements added
SA TS 5342	2021	Technical specification for building commissioning
ACCC SS	2014	Competition and Consumer (Corded Internal Window Coverings) Safety Standard
ACMA		Australian Communications and Media Authority (ACMA)
AGA		Australian Gas Association
AIRAH DA19	2019	HVAC&R maintenance
ATFA	2016	Solid Timber Flooring Industry Standard
NCC Schedule 3	2019	Schedule 3 Definitions
NCC Schedule 5	2019	Schedule 5 Fire-resistance of building elements
BCA A5.0	2019	Governing requirements - Documentation of design and construction - Suitability
BCA B1.4	2019	Structure - Structural provisions - Determination of structural resistance of materials and forms of construction
BCA C3.15	2019	Fire resistance - Protection of openings - Openings for service installations
BCA C3.16	2019	Fire resistance - Protection of openings - Construction joints
BCA Spec C3.4	2019	Fire resistance - Fire doors, smoke doors, fire windows and shutters
BCA D2.13	2019	Access and egress - Construction of exits - Goings and risers
BCA D2.14	2019	Access and egress - Construction of exits - Landings
BCA D2.23	2019	Access and egress - Construction of exits - Signs on doors
BCA D2.24	2019	Access and egress - Construction of exits - Protection of openable windows
BCA D3.6	2019	Access and egress - Access for people with a disability - Signage
BCA D3.7	2019	Access and egress - Access of people with a disability - Hearing augmentation
BCA Spec D1.12	2019	Access and egress - Non-required stairways, ramps or escalators
BCA Spec D3.6	2019	Access and egress - Braille and tactile signs
BCA E4.5	2019	Services and equipment - Visibility in an emergency, exit signs and warning systems - Exit signs
BCA E4.6	2019	Services and equipment - Visibility in an emergency, exit signs and warning systems - Direction signs
BCA E4.7	2019	Services and equipment - Visibility in an emergency, exit signs and warning systems - Class 2 and 3 buildings and Class 4 parts: Exemptions
BCA E4.8	2019	Services and equipment - Visibility in an emergency, exit signs and warning systems - Design and operation of exit signs
BCA Spec E2.2a	2019	Services and equipment - Smoke detection and alarm systems
BCA F1.7	2019	Health and amenity - Damp and weatherproofing - Waterproofing of wet areas in buildings
BCA F1.12	2019	Health and amenity - Damp and weatherproofing - Subfloor ventilation
BCA G1.2	2019	Ancillary provisions - Minor structures and components - Refrigerated chambers, strong-rooms and vaults
BCA J1.2	2019	Energy efficiency - Building fabric - Thermal construction - General
BCA J5.4	2019	Energy efficiency - Air-conditioning and ventilation systems - Fan systems
BCA J8.3	2019	Energy efficiency - Facilities for energy monitoring - Facilities for energy monitoring
NCC Schedule 1	2022	Schedule 1 Definitions
NCC Spec 1	2022	Governing requirements - Fire-resistance of building elements
NCC S2C16	2022	Governing requirements - Descriptions of elements referred to in Specification 1 - Gypsum-perlite or gypsum-vermiculite plaster or metal lath - walls
NCC S2C17	2022	Governing requirements - Descriptions of elements referred to in Specification 1 - Gypsum-perlite or gypsum-vermiculite plaster or metal lath - columns
NCC S2C18	2022	Governing requirements - Descriptions of elements referred to in Specification 1 - Gypsum-perlite or gypsum-vermiculite plaster or metal lath - beams
NCC S2C7	2022	Governing requirements - Descriptions of elements referred to in Specification 1 - Plaster reinforcement
NCC A5G1	2022	Governing requirements - Documentation of design and construction - Suitability
BCA B1D4	2022	Structure - Structural provisions - Determination of structural resistance of materials and forms of construction
BCA C4D15	2022	Fire resistance - Protection of openings - Openings for service installations
BCA C4D16	2022	Fire resistance - Protection of openings - Construction joints
BCA Spec 12	2022	Fire resistance - Fire doors, smoke doors, fire windows and shutters
BCA D3D14	2022	Access and egress - Construction of exits - Goings and risers
BCA D3D15	2022	Access and egress - Construction of exits - Landings
BCA D3D28	2022	Access and egress - Construction of exits - Signs on doors
BCA D3D29	2022	Access and egress - Construction of exits - Protection of openable windows
BCA D4D7	2022	Access and egress - Access for people with a disability - Signage
BCA D4D8	2022	Access and egress - Access for people with a disability - Hearing augmentation
BCA Spec 14	2022	Access and egress - Non-required stairways, ramps and escalators

BCA Spec 15	2022	Access and egress - Braille and tactile signs
BCA E4D5	2022	Services and equipment - Visibility in an emergency, exit signs and warning systems - Exit signs
BCA E4D6	2022	Services and equipment - Visibility in an emergency, exit signs and warning systems - Direction signs
BCA E4D7	2022	Services and equipment - Visibility in an emergency, exit signs and warning systems - Class 2 and 3 buildings and Class 4 parts: Exemptions
BCA E4D8	2022	Services and equipment - Visibility in an emergency, exit signs and warning systems - Design and operation of exit signs
BCA Spec 20	2022	Services and equipment - Smoke detection and alarm systems
BCA F1D8	2022	Health and amenity - Surface water management, rising damp and external waterproofing - Subfloor ventilation
BCA F2D2	2022	Health and amenity - Wet areas and overflow protection - Wet area construction
BCA G1D3	2022	Ancillary provisions - Minor structures and components - Refrigerated chambers, strong-rooms and vaults
BCA J4D3	2022	Energy efficiency - Building fabric - Thermal construction - General
BCA J6D5	2022	Energy efficiency - Air-conditioning and ventilation - Fans and duct systems
BCA J9D3	2022	Energy efficiency - Energy monitoring and on-site distributed energy resources - Facilities for energy monitoring
BCA J9D4	2022	Energy efficiency - Energy monitoring and on-site distributed energy resources - Facilities for electric vehicle charging equipment
BCA Schedule 11 WA B2		2022 Changes to AS/NZS 1170.2:2021
CA C524	2013	External Telecommunication Cable Networks. Industry Code
CMAA PE01	2010	Permeable interlocking concrete pavements - Design and construction guide
FWPA PN06.1039	2008	Interim industry standard – Recycled timber – Visually graded recycled decorative products
GAA DG HDG Bolts	2020	Best practice guide for hot dip galvanized bolts and bolted joints
Aus Gov Telecom	2020	Telecommunications in new developments
ICANZ	2003	Industry code of practice for the safe use of glass wool and rock wool insulation
Master Builders	2014	Smart Waste Guide
NASH		NASH Standard Residential and Low-rise Steel Framing
NASH-1	2005	Design criteria
NASH-2	2014	Design solutions
NBN Guideline	2021	Preparation and installation guide - SDUs and MDUs
PCA	2019	National Construction Code Series Volume 3 - Plumbing Code of Australia
PCA	2022	National Construction Code Series Volume 3 - Plumbing Code of Australia
NGIA	2013	National Plant Labelling Guidelines
RMS T276	2012	Foreign materials content of recycled crushed concrete
SUSMP	2022	Poisons Standard (SUSMP)
Safe Work Australia		Hazardous chemical information system
Safe Work Australia	2020	Code of Practice: How to manage and control asbestos in the workplace
Safe Work Australia	2020	Code of Practice: How to safely remove asbestos
WA Gov S.R. Clearing	2004	Environmental Protection (Clearing of Native Vegetation) Regulations 2004
WA Gov S.R. Environ	1987	Environmental Protection Regulations 1987
WA Gov S.R. Health	1974	Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974
WA Gov S.R. Landfill	2002	Environmental Protection (Rural Landfill) Regulations 2002
WA Gov S.R. Pesticides	2011	Health (Pesticides) Regulations 2011
WA Gov S.R. UD	2004	Environmental Protection (Unauthorised Discharges) Regulations 2004
WA Gov S.R. Waste	2004	Environmental Protection (Controlled Waste) Regulations 2004
WA Gov S.R. Wastewater	2013	Code of Practice for Product Approval of Onsite Wastewater Systems (Department of Health)
WAER	2019	WA Electrical Requirements (WAER)
WA Gov Act No. 024	2011	Building Act 2011
WA Gov Act No. 034	1911	Health (Miscellaneous Provisions) Act 1911
WA Gov Act No. 036	2007	Waste Avoidance and Resource Recovery Act 2007
WA Gov Act No. 36	2020	Work Health and Safety Act 2020
WA Gov Act No. 053	1972	Aboriginal Heritage Act 1972
WA Gov Act No. 074	1995	Local Government Act 1995
WA Gov Act No. 087	1986	Environmental Protection Act 1986
BS 2571	1990	Specification for general-purpose flexible PVC compounds for moulding and extrusion
BS 8102	2022	Protection of below ground structures against water ingress. Code of practice.
BS 8313	1997	Code of practice for accommodation of building services in ducts
AAMA 701/702	2011	Voluntary specification for pile weatherstripping and replaceable fenestration weatherseals
AAMA 2603	2021	Voluntary specification, performance requirements and test procedures for pigmented organic coatings on aluminium extrusions and panels
AAMA 2604	2021	Voluntary specification, performance requirements and test procedures for high performance organic coatings on aluminium extrusions and panels
AAMA 2605	2020	Voluntary specification, performance requirements and test procedures for superior performing organic coatings on aluminum extrusions and panels
ASHRAE 52.2	2017	Method of testing general ventilation air-cleaning devices for removal efficiency by particle size
ASTM A240/A240M	2022	Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications
ASTM A276/A276M	2017	Standard Specification for Stainless Steel Bars and Shapes

ASTM A554	2021	Standard Specification for Welded Stainless Steel Mechanical Tubing
ASTM C1279	2013	Standard Test Method for Non-Destructive Photoelastic Measurement of Edge and Surface Stresses in Annealed, Heat-Strengthened, and Fully Tempered Flat Glass
ASTM C171	2020	Standard specification for sheet materials for curing concrete
ASTM C920	2018	Standard Specification for Elastomeric Joint Sealants
ASTM C1048	2018	Standard specification for heat-strengthened and fully tempered flat glass
ASTM C1311	2022	Standard Specification for Solvent Release Sealants
ASTM D1248	2016	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM E72	2015	Standard Test Method of Conducting Strength Tests of Panels for Building Construction
ASTM E695	2003	Standard Method for Measuring Relative Resistance of Wall, Floor and Roof Construction to Impact Loading
ASTM F2170	2018	Standard test method for determining relative humidity in concrete floor slabs using in situ probes
IEEE 802		Standard for local and metropolitan area networks
IEEE 802.11	2020	Wireless LAN medium access control (MAC) and physical layer (PHY) specifications
EN 650	2012	Resilient floor coverings. Polyvinyl chloride floor coverings on jute backing or on a polyester felt backing or on polyester felt with polyvinyl chloride backing. Specification
EN 651	2011	Resilient floor coverings. Polyvinyl chloride floor coverings with foam layer. Specification
EN 779	2012	Particulate air filters for general ventilation. Determination of the filtration performance
EN ISO 10581	2020	Resilient floor coverings - Homogeneous poly(vinyl chloride) floor covering - Specifications
EN ISO 10582	2018	Resilient floor coverings - Heterogeneous poly(vinyl chloride) floor covering - Specifications
EN ISO 10595	2012	Resilient floor coverings. Semi-flexible/ vinyl composition (VCT) poly(vinyl chloride) floor tiles. Specification
EN 12878	2014	Pigments for the colouring of building materials based on cement and/or lime. Specifications and methods of test
EN 13055	2016	Lightweight aggregates
EN 13845	2017	Resilient floor coverings - Polyvinyl chloride floor coverings with particle based enhanced slip resistance - Specification
EN 14179		Glass in buildings - Heat soaking thermally toughened soda lime silicate safety glass
EN 14179-1	2016	Definition and description
IEC 60085	2007	Electrical insulation - Thermal evaluation and designation
IEC 60793		Optical fibres
IEC 60793-2-10	2019	Product specifications - Sectional specification for category A1 multimode fibres
IEC 60794		Optical fibre cables
IEC 60794-1-2	2021	Generic specification - Basic optical cable test procedures - General guidance
IEC 61215		Terrestrial photovoltaic (PV) modules - Design qualification and type approval
IEC 61215-1-1	2021	Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61836	2016	Solar photovoltaic energy systems - Terms, definitions and symbols
IEC 61935		Specification for the testing of balanced and coaxial information technology cabling
IEC 61935.1	2019	Installed balanced cabling as specified in ISO/IEC 11801 and related standards
ISO/IEC 8802		Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements
ISO/IEC/IEEE 8802-11	2018	Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications
ISO 10580	2010	Resilient, textile and laminate floor coverings - Test method for volatile organic compound (VOC) emissions
ISO 10816		Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts
ISO 10816-3	2009	Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15 000 r/min when measured in situ
ISO 11600	2002	Building construction - Jointing products - Classification and requirements for sealants
ISO 16890		Air filters for general ventilation
ISO 16890-1	2016	Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)
ISO/IEC 17025	2017	General requirements for the competence of testing and calibration laboratories
ISO 20816		Mechanical vibration - Measurement and evaluation of machine vibration
ISO 20816-1	2016	General guidelines



Government of **Western Australia**
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BCA Class 2 & 3 Building Specification

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