Brookton Railway Station

Specification

Stage 1 and 2 Building Works

Revision	Date	Approved by
A	06.05.24	SC

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0000 HERITAGE CONSERVATION

1 GENERAL

1.1 RESPONSIBILITIES

The Brookton Railway Station is on the State Register of Heritage Places in recognition of its level of cultural heritage significance.

The Railway Station site is the subject to the requirements of the Heritage Act 2018. Conservation works are guided by the principles and practices of the Australia ICOMOS Burra Charter. Contractors need to recognise that the following principles form the basis for the proposed works:

- Conservation is based on a respect for the existing fabric, use, associations and meanings. It requires a cautious approach of changing as much as necessary but as little as possible.
- As a general principle works should be carried out on the basis of replacement of 'like for like'.
- Competent direction and supervision should be maintained at all stages, and any changes should be implemented by people with appropriate knowledge and skills.

The Contractor is advised that all fabric on the site is of heritage significance and should not be moved or removed damaged or destroyed, but must be retained and where instructed by the Consultants, reinstated or relocated on the site where directed. Particular care is to be taken with removal and storage and protection of internal fittings, doors and windows and timber floors.

1.2 INSPECTION

Give 10 working days' notice for the inspection of works by the Heritage Architect.

1.3 APPROVALS

The Contractor shall have 10 working days to seek a response and Heritage Approval. All issues to be reported to the Architect in writing. A marked up location plan and supporting photographs (where appropriate) shall be required to accompany the written query.

2 SITE

2.1 GENERAL

The site is of cultural heritage value to the owner and the State. The Contractor shall allow to use as much original material as possible, carry out work using traditional practices and materials as directed by the Heritage Architect. Ensure that all workers on the site are made aware of the heritage value of the site and no damage, defacement, unauthorised removal of remaining original material occurs.

No building fabric is to be removed from the site without the prior approval of the Heritage Architect.

Any work involving trenching or subsurface disturbance needs to be mindful of the archaeological resource. All trenching or sub surface works need to be approved prior to the commencement of works.

The aim of conservation work is to retain as much building fabric as possible. The existing building construction and materials may have some imperfections. The retention of these qualities is highly desirable and any improvements not specified in this schedule need to be approved prior to the commencement of any additional work.

Due to the cultural heritage significance of the place and specifically the building materials, no materials are to be replaced without agreement with the Heritage Architect. Patching or piecing in are preferred methods to replacement.

It is not just the main structure on the site that is important from a heritage point of view. Other elements of the site, such as landscaping, fences and gates, paving, garden furniture and

outbuildings, may all make their own contributions to the heritage significance of the place, and should be considered in your evaluation prior to carrying out any work.

Where there is the likelihood of disturbing archaeological relics, such as the foundations of an earlier building, be careful with the use of heavy equipment. If you propose to excavate, you need approval from the Heritage Architect to proceed.

3 STRUCTURE

3.1 GENERAL

Stabilize, consolidate or repair surviving structural members and systems. Supplement or replace only unsound material.

Avoid repairs which are stronger than the existing fabric and may lead to differential stress cracking.

Avoid disturbing existing footings with new excavations that could weaken the structure.

4 METAL

4.1 GENERAL

Form, or recast and replace, only missing or unsound elements.

Maintain protective coatings on ferrous metals.

Do not alter the colour, texture, tone or patina of the metal by inappropriate cleaning. All metal cleaners are abrasive to some degree.

Remove the cause of corrosion. If not, use the mildest cleaning agent, then a reversible sealant.

Conserve foundry nameplates or stencilled trademarks. Cast iron replacement is available.

Aluminium casting is acceptable but should be of the right profile.

5 ROOFING

5.1 GENERAL

Corrugated galvanized Custom Orb and galvanized Custom Blue Orb should be used in preference to Colorbond or Zincalume Custom Orb. Colorbond colours are generally not appropriate for heritage buildings. Custom Blue Orb is available in the traditional profile.

Traditional springhead nails to be used for fixings.

Refix existing battens to eaves and paint. Finish to match existing.

5.2 ROOF PLUMBING

The use of galvanised gutters and downpipes in association with galvanised corrugated roof sheets is preferred. When replacing existing downpipes, reuse existing fixing points where possible. If new fixing points are required, ensure to fix all astragals and hangers within mortar joints as opposed to directly into masonry surface. All previous fixing points that are no longer required should be repaired and filled to match.

6 TIMBER

6.1 GENERAL

Repair, rather than replace, unsound timber.

If epoxy resin is being considered for repairs seek approval from Heritage Architect.

Unless otherwise required, all timbers exposed to view shall be machine dressed and hand wrought to a smooth surface free from ripples, tears and other machining defects.

Sizes stated as finished sizes shall be the actual dimensions required. All other dimensions shall be considered as nominal and normal trade practice as to dressing allowances will apply.

Ensure in the early stages of the trade contract that the required timber is available, and if not available, immediately advise the Heritage Architect in writing.

All fixings, nails, bolts, washers and fastenings exposed to weather and/or in contact with mortar, water based paints used externally and in all other corrosive situations shall be hot dip galvanised steel unless otherwise required.

Use matching fastenings for hardware and fittings where exposed to view.

7 GLAZING

7.1 GENERAL

Remove all broken glazing, putties and rake out glazing channels ready for reglazing.

Before glazing commences, ensure that materials are dry and clean and that rebates are true and unobstructed.

7.2 CUTTING AND DRILLING

Perform all cutting, drilling, grinding and polishing as required by this and other sections.

Cut all glass square, to sizes that ensure correct clearance between edges of glass and frame.

Finish edges of glass smooth, even and free from chipping and other irregularities, glass with nipped edges will not be accepted.

8 HARDWARE

8.1 GENERAL

Allow to retain all original door and window hardware. Remove all recent and non-original hardware and patch all holes and make good doors, windows and frames as required.

9 PAINT AND OTHER FINISHES

9.1 GENERAL

Colours to be approved by Heritage Architect.

The Contractor shall allow to do paint scrapes using wet sanding method in locations nominated by the Heritage Architect and provide documented colour matches based on Dulux colour range - to Heritage Architect to prepare colour schedule based on paint scrapes results.

Before commencing painting provide in locations directed one metre long sample areas of each type of coating over the specified undercoats including preparation of surfaces in locations nominated by Heritage Architect. Contractor to provide one square metre panel of each colour nominated for Heritage Architect's approval. Allow to change sample colours on panel minimum twice as directed by the Heritage Architect to get to final approved colours. Do not order paint or commence final coats before obtaining the Heritage Architect's approval in writing of final colour schedule.

Apply coating to clean, dry surfaces in dry atmospheric conditions and after any previous coats have hardened.

Lightly sand priming and undercoats to a smooth surface with abrasive paper and remove dust before applying the next coat.

Do not use spray application unless approved by the Heritage Architect. Approval for spraying, if given, shall be conditional on the use of suitable methods and equipment for the conditions. Before spraying, mask adjacent surfaces liable to damage.

Water based acrylic paint is acceptable to use.

Traditional oil, wax, varnish and shellac finishes are generally more appropriate for timber than polyurethane, which is an impervious inflexible finish. Where polyurethane is necessary, use a satin finish in a 1:1 mix with thinner.

Colours to be approved by Heritage Architect.

10 PAINT AND RENDER REMOVAL

10.1 GENERAL

For paint removal only gentle treatments should be used which will not damage the masonry.

Sometimes it is better to leave traces of paint on the masonry if this means that the mortar joints are left intact.

The overall appearance is usually not spoiled by leaving these traces of paint which will eventually weather anyway.

Different paints respond to different methods and it is therefore helpful before deciding on the best way of removing paint, to identify the types (i.e. water thinned, oil-bound, cement, bitumen, polyurethane based, acrylic layers). Each layer will most likely need different removal methods.

A “response test” should be made first over a small and inconspicuous area to see if the paint can be lifted and to ensure that the substrate will not be damaged. The use of the wrong removal technique can make the process very difficult as well as damage the surface of the masonry. This test should decide the specifications for the job. Where old paintwork on the interior of a historic building is sound it is best left undisturbed. No removal system is completely effective and all are potentially hazardous.

When carrying out paint removal keep a record of the existing layers of paint.

When stripping paint it is important to be aware of all the potential hazards. Understanding the danger is the first step in minimizing the risks. One danger is from white lead, a white pigment which was commonly used as a component for oil-based paints until about 1950. For this reason it is recommended to take special precautions when stripping oil-based paints.

Take sample sections for each building and have tested, to assess the presence and percentage of lead, before starting the paint removal job. Samples of paint can be analysed for a fee by the W.A. Chemistry Centre. Testing takes approximately two weeks. If the paint contains lead, appropriate precautions should be taken for the safety of the operators and people living in the place. Proper arrangements must be made for the disposal of residues.

10.2 DISPOSING OF WASTE

When chemical strippers are used this effluent is a sludge, formed by chemicals strong enough to strip paint mixed with the softened old paint, which may contain lead. This sludge is classified as toxic waste.

Flushing strippers or sludge into the soil will contaminate the earth and well water for many years to come. If flushed down the sewers it may contaminate water sources and it is a prohibited discharge under regulations.

The effluent should be caught, (i.e tarps and soft matter) and disposed of properly. The disposal of toxic waste should be carried out by a licensed waste contractor.

10.3 WATER WASHING

Water washing can be helpful in removing some paints. Some emulsion paints can be softened with hot water then sponged, scrubbed or scraped off.

Old limewash and soft (size-bound) distemper can usually be removed with warm water and soft brushing. If the effect is spotty these spots can be carefully washed with vinegar and then rinsed. But some old distemper is virtually impossible to remove without damage to the masonry and should be left. Liquid neutral detergents are more suitable than alkaline soaps which may leave harmful residues and attack new paintwork.

10.4 STEAM STRIPPING

Steam at low pressure applied to the paint film via a hose capped with a perforated metal concentrator (of the type normally used for stripping wallpaper), can be very useful in the stripping of paint. Water thinned paints, including emulsion paints, are softened by the combination of heat and moisture and then removed with a sponge and water. Steam in conjunction with methylated spirits can be effective in removing multiple applications of old emulsion paint. Steam stripping can be faster and more effective than water washing, especially over large areas, but it can be difficult to remove multiple layers of old paint. The result may be a patchy surface.

10.5 CHEMICAL PAINT REMOVERS

There are two main types of chemical strippers: solvent (non caustic) and alkaline (caustic).

10.6 SOLVENT (NON CAUSTIC) REMOVERS

To this type belong the most common commercial paint strippers. They are usually based on methylene chloride waxes or gels are included to retard evaporation. They are very effective in removing oil-based and latex paints but may be less effective with other types of paint. The paint remover is applied with a brush; the solvent swells and softens the paint which is then removed by scraping, peeling or brushing and washing with water.

A test should always be done to determine:

- multiple layers of different types of paint;
- the type of stripper to be used;
- the concentration to be used;
- the optimum time for the chemicals to sit on the masonry;
- the optimum pressure and volume of rinse water.

After treatment the following shall occur:

- wash with water
- repointed where necessary.

Good paint removal practice, will not damage sound pointing or substrate.

Chemical strippers will produce toxic waste which needs to be disposed of appropriately.

10.7 ALKALINE (CAUSTIC) REMOVERS

These removers are based on caustic soda, potash, washing soda or similar materials and can create severe problems. They are particularly harmful to brickwork, stonework, metal, and most types of plaster or putty, if they are not thoroughly washed off. The harmful residues are easily absorbed by porous surfaces and very difficult to remove. Application of these removers should therefore be avoided.

11 SERVICES AND SAFETY REQUIREMENTS

11.1 GENERAL

Install new services (ductwork, pipework, wiring conduits, air conditioners and TV antennae, etc) inconspicuously to cause least damage to the fabric. Use sub-floor or roof spaces or bury them underground. Use surface mounted steel conduit rather than chasing electrical wiring.

It is preferable for fittings to be unobtrusive. Don’t use historical recreations unless you have evidence for such designs being used in the original building.

0142 PRELIMINARIES - ABIC SW-2018

1 GENERAL

1.1 GENERAL

General conditions
Contract: To ABIC SW-2018 Simple Works Contract, issued by the Australian Institute of Architects and Master Builders Australia.

Interpretation
General: The words owner and architect have the same meaning, respectively, as principal and contract administrator, unless the context requires otherwise.

Cross reference: **INTERPRETATION** in *0171 General requirements* also applies.

1.2 THE SITE

Site restrictions

Access to the site is provided off Robinson Road

Entry onto the railway track to the South/West of the site is restricted,

Access to the site is required to be arranged with the Shire of Bridgetown and the Public Transport Authority prior to works commencing.

Protection of persons and property
Temporary works: Provide and maintain required barricades, guards, fencing and signage around the site area. Traffic management will be required for works impacting Spencer Street. Impact to Spencer street to be outlined to the Shire of Bridgetown and Contract Administrator prior to works commencing.

Accessways, 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.

Property: Do not interfere with or damage trees and property which are to remain on or adjacent to the site, including adjoining property encroaching onto the site.

Secure areas
Conditions of entry: Rail Induction Certificated will be required for all contractors attending site prior to access and works commencing

Entry permits: Make available, to persons entering designated secure areas, valid entry permits. Make sure these persons comply with conditions of entry.

Personnel: Submit the full name, address, and date and place of birth of persons required to enter designated secure areas.

- Purpose of submission: For review.
- Timing of submission: At least 10 working days before entry is required.

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.

Adjoining properties

Notice: To be provided to the Department of Transport prior to works commencing. Detail on timeframes and areas of work to be provided. Department of Transport to approve access to track and extent of work prior to project start date.

Revealed encroachments: If the works reveal unknown encroachments of adjoining property on to the site or of existing site structures on to adjoining property, immediately seek instructions.

Records: For each property described in the **Adjoining properties to be recorded schedule**:

- Inspect the property with the architect and Shire Representative 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 record, including drawings, written descriptions, and photographs, 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 record. Keep the other endorsed copy on site.

- Purpose of submission: Information only.

1.3 CONSTRUCTION PLANT

General

Temporary works: Provide and maintain required hoardings, barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic management.

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 (JASANZ).

Temporary fence

Site fencing to be provided to secure site during works.

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 in the **Existing services schedule**.

Project signboards

General: Provide project specific signboards and as follows:

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

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

1.4 BUILDING THE WORKS

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 owner's survey marks in their true positions.

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

Safety

Accidents: Promptly notify the architect 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.

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 subcontractors and suppliers.

- Purpose of submission: For information.

Program of work

Construction program: Submit a construction program showing the following:

- Sequence of work.
- Critical paths of activities related to the work.
- Allowance for holidays.
- Activity inter-relationships.
- External dependencies including provision of access, document approvals and work by others.
- Periods within which various stages or parts of the work are to be executed.

Time scale: Working days.

Updated program: Identify changes since the previous issue, and show the estimated percentage of completion for each item of work.

Purpose of submission: For information.

- Frequency: Contract Administrator to be updated fortnightly on program.

Program chart: Display in the contractor's site office an up-to-date bar chart and network diagram based on the construction program.

Site meetings

General: Hold and attend site meetings throughout the contract and arrange for the attendance of appropriate subcontractors, architect and appropriate consultants.

Frequency: Contractor to allow for fortnightly site meetings

Minutes: Make a record of site meetings. Distribute a copy of the minutes to each party.

- Purpose of submission: For review.
- Timing of submission: Within 5 working days after each meeting.

Items supplied by owner

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 owner.

Changes to existing items

General: At least 5 working days before changing existing items, give notice.

1.5 COMPLETION OF THE WORKS

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.

Pest eradication

General: Employ suitably qualified pest exterminators. At practical completion, verify that completed works are free of pest types documented in the **Pest eradication treatment schedule**.

Pest eradication treatment schedule

Pest type to be treated	Eradication method
Termite Treatment	Termite Treatment Plan to be advised Shire of Brookton Maintenance team

Removal of plant

General: Within 10 working days after practical completion, remove temporary works and construction plant no longer required. Remove the balance before the end of the defects liability period.

1.6 PAYMENT FOR THE WORKS

Progress claims

Anticipated progress claims: Submit a schedule of anticipated progress claims for the contract period.

- Purpose of submission: For information.
- Timing of submission: At commencement of the works.

Progress claim breakdown: Submit a statement of amounts claimed in respect of each worksection or trade heading designated in the specification.

- Purpose of submission: For review.
- Timing of submission: With each progress claim.

Method of measurement

General: In conformance with the principles of the
Australian and New Zealand standard method of measurement of building works (ANZSMM) (2022).

1.7 MISCELLANEOUS

Compliance with the law

Requirements of authorities: The owner, before entering into the contract, has given the notices, paid the fees, and obtained the permits, approvals and other authorisations, as documented in the **Prior applications and approvals schedule**.

Prior applications and approvals schedule

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

Common requirements

Requirement: Conform to the following worksections:

- *0181 Adhesives, sealants and fasteners*.
- *0182 Fire-stopping*.
- *0183 Metals and prefinishes*.
- *0184 Termite management*.
- *0185 Timber products, finishes and treatment*.

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 March 2024.

Exception to current editions: If statutory requirements reference other editions or standards, conform to those other editions or standards. If the NCC (2022) references editions other than the current edition, the same editions cited in the NCC (2022) are referenced in each worksection.

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. IS EN or DIN EN) may be used in place of the equivalent referenced European Standard (EN).

Site copies: 1x physical copy of digital copy accessible at site.

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

Subsurface services: Information shown on the drawings relating to underground or submerged services shall be re-confirmed by the contractor prior to commencement of works.

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 and Volume Two: Building Code of Australia Class 1 and Class 10 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 the use of a tool, without hazard, 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 AS ISO/IEC 17025 (2018) to undertake the relevant tests.
- Appropriately qualified person: To NCC (2022) Schedule 1.
- 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.

- Consumable: Materials or components intended to be replaced within the service life of the associated plant or equipment.
- Contract administrator: Has the same meaning as architect, superintendent or principal's authorised person and is the person appointed by the owner or principal under the contract.
- Contractor: Has the same meaning as builder and is the person or organisation bound to carry out and complete the work under the contract.
- Default: Specified value, product or installation method that 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.
- Gas Network Operator: Has the same meaning as network operator in AS/NZS 5601.1 (2022).
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.
- High level interface: Systems transfer information in a digital format using an open system interface.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 (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 that 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 that 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. 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.
- 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.
- Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.
- Professional engineer: To NCC (2022) Schedule 1.
- 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.
- Recovered/reclaimed materials: Material previously used in a building or project that is then re-used in another project. The material may be altered, re-sized, refinished, or adapted, but is not reprocessed in any way, and remains in its original form.
- 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 that 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.

Submit to: Superintendents Representative

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.

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

- Shop drawings: 5 days
- Samples and prototypes: 5 days
- Manufacturers' or suppliers' recommendations: 5 days
- Product data: 5 days
- Product/design substitution or modification: 10 days

Proposed products schedules: Submit a schedule of proposed products that have not been specified as proprietary items within 3 weeks of starting work on site.

Identification

Requirement: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include relevant contract document references. If the submission covers more than one item, identify the item in the contract documents the submitted items relate to.

Non-conformance: Identify proposals that do not conform with project requirements, and characteristics that 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.

Electronic submissions

Electronic copies file format: .pdf or as agreed

CAD file format: .dwg

Quantity: 1x digital copy

Transmission medium: email or file transfer

Hard copy submissions

Hard copy quantity: 1 of, digital preferred

Standard contract drawing size: A1 drawings, A4 all other information

Project requirements

General: Submit the following, as documented:

- 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.
- Commissioning plan: For the whole of the work to **COMMISSIONING**.
- Commissioning program: For the whole of the work to **COMMISSIONING**.
- Design documentation: Drawings, calculations and specifications as documented.
- Electronic facility and asset management information: For the whole of the work to **ELECTRONIC FACILITY AND ASSET MANAGEMENT INFORMATION**.
- 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**.
- Safe Work Method Statement: For high risk construction works.
- Safety in design report: For the proposed work to **DESIGN DEVELOPMENT**, **Safety in design**.
- 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)

3.2 CORROSION RESISTANCE

Atmospheric corrosivity category
General: Atmospheric corrosivity category as defined in AS 4312 (2019)

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 provision of the works requires structural design, provide structures, installations and components as follows:

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

Importance level: refer structural, if nothing stated IL1

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.

Certification of the design
Requirement: Submit certification verifying conformance of the design to the documented and statutory requirements.

Certifier: To **DESIGNER**.

Safety in design
Requirement: Provide a design that allows for safe construction, operation and maintenance, and demolition in conformance with statutory requirements.

4.2 DESIGNER

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

5 PRODUCTS AND MATERIALS

5.1 GENERAL

Sources policy

General: Refer Preliminaries, if nothing stated a preference for Australian or New Zealand goods

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.
- Product data sheets.
- 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 or code of practice.
- Evidence that the performance is at least equal to that specified.
- Samples.

- Essential technical information, in English.
- Comparison between the products in relation to assembly method, finishes, installation methods and any protection/packaging.
- 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.
- Statement of consequent maintenance conditions of warranty.

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

Standard: To AS 1100.101 (1992), AS 1100.201 (1992), AS 1100.301 (2008), AS 1100.401 (1984) and AS/NZS 1100.501 (2002) as applicable.

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.

Submission medium: digital

Drawing size: digital, A3 preferable

CAD base drawings: to be provided by architect in native format .dwg for INFORMATION ONLY.

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 that 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.

6.5 SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS

General
Earthquake design category: refer structural

Seismic restraint to AS 1170.4 (2007): refer structural

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. Reinstate 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.

7.2 SERVICES INSTALLATION

General
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

Jointing: 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

Standard: To AS 4041 (2006) clause 3.28.

General: Provide hangers, brackets, saddles, clips, and support system components to resist live and dead loads and to control pipe movement caused by thermal and water pressure effects. Incorporate provisions for adjustment of spacing, alignment, grading and load distribution. Support pipework from associated equipment or building structure. Support valves, strainers and major line fittings so that no load is placed on connected piping or transmitted to it during operation and maintenance.

Fixings: Provide fixings to the associated equipment or building structure designed to withstand the loads imposed by the pipe supports.

Channel section supports: Proprietary channel section with clamps and hangers sized to match external diameter of pipe being supported. Provide all components from the same manufacturer.

Channel and fixing material: Metallic-coated steel or as documented.

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: Do not use saddle type supports for pipes larger than DN 20.

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.

Fixing to masonry and concrete: Provide metallic-coated steel or non-ferrous metal bolts or screws into chemical or expanding metal masonry anchors.

Uninsulated pipes: Clamp piping supports directly to pipes. Provide electrical isolation of dissimilar metals.

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.
- Vapour barriers: For cold pipes, apply aluminium foil tape over the circumference of the spacer to form a vapour barrier. Fit to spacer before installation of the bracket on the pipe.
- Metal sheathing: If metal sheathing is documented, provide a band of the documented sheathing materials between the aluminium foil tape and the support for the full width of the spacer.

Hanger sizes: Conform to the following:

- Gas installations: To AS/NZS 5601.1 (2022) Table 5.8.3.
- Other pipes: Provide hangers sized to the manufacturer's recommendations to suit operating conditions and regulatory requirements including the loads due to valves and other attached components, pipe material, pipe contents and temperature and seismic loads.

Support spacing: Provide supports at no greater spacing than the following:

- Cold and heated water: To AS/NZS 3500.1 (2021) Table 5.7.4.
- Sanitary plumbing: To AS/NZS 3500.2 (2021) Table 10.2.1.
- Stormwater: To AS/NZS 3500.2 (2021) clause 4.9.
- Fuel gas: To AS/NZS 5601.1 (2022) Table 5.8.2.
- Fire sprinklers and combined wet suppression systems: To AS 2118.9 (1995) Table 2.6.1.
- Fire hydrants:
  . Metal piping: To AS 2419.1 (2021) clause 10.6.
  . Plastic piping: To AS/NZS 3500.1 (2021).
- Gaseous fire suppression systems:
  . General gaseous fire suppression systems: To AS 4214 (2018) clause 6.3.4.
  . Carbon dioxide fire suppression systems: To AS 6183 (2011) clause 6.3.4.
- Medical gases: To AS 2896 (2021) Table 4.1.
- Refrigerant: To AS/NZS 5149.2 (2016) Tables 5 and 6.
- Other ferrous pipes under pressure: To AS 4041 (2006) Table 3.28.2.
- Other copper pipes: To AS 4809 (2017) Table 6.2.
- ABS pipes: To AS/NZS 3690 (2009) Table 6.2.
- PVC pipes: To AS/NZS 2032 (2006) Table 6.3.
- PE pipes: To AS/NZS 2033 (2008) Table 6.1.
- Other non-ferrous pipe carrying liquids: To AS/NZS 3500.1 (2021) Table 5.7.4.
- Other pipes carrying air or gases: To AS/NZS 5601.1 (2022) Table 5.8.2.
- Proprietary grooved piping systems: To the manufacturer's recommendations.

Additional supports: Provide additional supports as follows:

- Proprietary grooved piping systems: To the manufacturer's recommendations.
- Valves and other heavy pipe mounted components: Adjacent to the valve or component.
- Adjacent pipe mounted components requiring regular maintenance.
- At changes of direction and adjacent to wall or floor penetrations.
- Where required to anchor piping or control thermal or other movement.

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.

Access safety systems: Provide access safety systems to *0193 Building access safety systems.*

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:

- 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 that 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 20816-3 (2022).

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 ≥ 15 mm: Spring mountings.

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

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

Spring mountings: Provide freestanding laterally stable springs as follows:

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

Painting systems

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

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

Paint application

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

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

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

Underground metal piping

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.

Asset management labels and tags: Refer preliminaries, allow for labelling of assets and completion of asset register prior to Practical Completion.

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.

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: Label items including 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.

Wall mounted equipment in occupied areas

Location: Provide labels on wall mounted items in occupied areas including the following:

- Services control switches.
- Temperature and humidity sensors.

Points lists

Automatic control points: Provide plasticised, fade-free points lists for each automatic control panel 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.

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

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

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

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

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

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

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

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

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

Plastic pipe: Provide a detectable marker tape with trace wire to identify the route of buried piping. Terminate with 1000 mm coil in a readily accessible location. Tag to match 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:
  . ≥ DN 65: Minimum 25 mm.
  . < DN 65: 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 TOOLS AND SPARE PARTS

Spare parts

General: Provide spare parts listed as documented.

Replacement: Replace spare parts used during the maintenance period.

Tools and spare parts schedule

Submission timing: At least 8 weeks before the date for practical completion.

Requirement: Prepare a schedule of tools, portable instruments and spare parts necessary for maintenance of the installation. For each item state the recommended quantity and the manufacturer's current price. Include the following in the prices:

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

8.2 TRAINING

General

Standard: To SA TS 5342 (2021).

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

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

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

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

Demonstrators

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

Operation

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

Maintenance

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

Seasonal operation

General: For equipment requiring seasonal operation, demonstrate during the appropriate season.

8.3 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.

8.4 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 applicator or installer: If the warranty is conditional on the manufacturer's approval of the applicator or installer, submit the manufacturer's written approval of the installing company, and authorised personnel, with evidence of qualifications and experience in the specific use of the product, material or system.

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

Warranty types

Manufacturer warranty: Warranty to cover manufacturing defects and defects with products and materials delivered to site.

Manufacturer and applicator / installer interlocking warranty: Interlocking warranty to cover manufacturing defects and defects with products and materials delivered to site, including their application or installation.

Suppliers warranty: Warranty to defects in materials delivered to site.

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 training materials, conduct training sessions to **TRAINING**.
- 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 TACTICAL FIRE DRAWINGS

General

Requirement: Provide sets of colour coded tactical fire drawings, showing all items and systems relevant in a fire to BCA (2022) Spec 19.

Scale: 1:200 or larger if required to be easily read under emergency conditions.

Coordination: Agree the format, colour coding and contents of the tactical fire plans with the Local Fire Authority before beginning documentation.

Location: Provide one set of the laminated drawings fixed to the wall or supplied in a vertical plan hanger in the fire control room.

Loose set: Provide a second set of identical drawings.

Operation and maintenance manuals: Provide a set of colour coded tactical fire drawings in each copy of the operating and maintenance manual.

Inclusions

Requirement: Include the following on the tactical fire drawings:

- Legend sheet at front of set.
- Colour coding key.
- Building: As follows:
  - . Floor plans.
  - . Pressurised and non-pressurised fire isolated stairs and passages.

. Smoke and fire compartments.
. Special risk areas.

- Fire services: As follows:
  . Automatic fire detection systems.
  . Automatic suppression systems including gas flooding systems.
  . Communications including warden intercommunication points.
  . Fire control room.
  . Fire equipment including booster connections.
  . Fire hydrants, hose reels, portable fire extinguishers.
  . Fire detection control and indicating equipment (FDCIE).
  . Fire service lifts.
  . Fire telephone and control panel.
  . Hydrant and sprinkler pumps.
  . Hydrant/hose reels.
  . Sprinkler and hydrant, suction and booster connections.
  . Sprinkler control valves.
- Electrical services: As follows:
  . Emergency power supplies.
  . Essential services switchboards.
  . Evacuation warning panel.
  . Stand-by power plant.
  . Substations/transformers.
  . Switchboards, main switchroom.
- Mechanical ventilation and air handling equipment: As follows:
  . Air intakes, fans, ducts, shafts.
  . Conditioners and mixing boxes.
  . Fire dampers.
  . General exhaust air fans, ducts, shafts, discharges.
  . Smoke dampers.
  . Smoke fans including exhaust fans, zone and stair pressurisation fans.
  . Stair pressurisation systems.
  . Supply air system.
- Mechanical ventilation and air handling equipment operation: As follows:
  . Statement of normal condition.
  . Condition upon fire alarm.
  . Manual controls available.
- Hydraulic services: As follows:
  . Gas meters.
  . Gas supply control.
  . Incoming water supplies and valves for the sprinkler, hydrant and fire hose reel systems.
  . Water tank.

10.2 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 detail 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.

CAD base drawings: .dwg

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

10.3 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.
- Stand-by 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 such as:
  - 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.
. 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.

10.4 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.

Structure of manuals: Contractor to provide O+M manuals contents page / format for approval.

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.

Table of amendments: Include a table of amendments.

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**.

Commissioning records: Include commissioning records to SA TS 5342 (2021). Link commissioning records to item codes on the record drawings.

Training material: Include materials used to provide training, to **TRAINING**, in a form that can be used to train others.

Fire systems and equipment: Include documentation to AS 1851 (2012), including the schedule of essential functionality and performance requirements.

Digital photographic records: Include records to **MARKING AND LABELLING, Underground services**.

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.
- A list of special safety devices and their set points.
- Procedures for seasonal changeovers.
- Warnings to operators.
- Procedures for identifying and rectifying common faults.
- Recommendations for efficient plant operation.
- If the installation includes cooling towers, recommendations for water efficiency.
- Building tuning plan and procedure to **COMMISSIONING**, **Commissioning plan**.

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 logbook 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 logbook 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.

Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or subsystem failure, chemical release or spill, include the following:

- Emergency instructions.
- Emergency procedures including:
  . Instructions for stopping or isolating.
  . Shutdown procedures and sequences.
  . Instructions for actions outside the property.
  . Special operating instructions relevant to the emergency.
  . Contact details relevant to the emergency.

Emergency information manual

Form of emergency information: Provide one of the following:

- An index and coloured tabs identifying emergency information for each type of emergency within the Operation and maintenance manual.
- A separate Emergency manual containing copies of emergency information from the main Operation and maintenance manual.

Format – electronic copies

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

Delivery method: email / file transfer

Quantity and format: Conform to **SUBMISSIONS**, **Electronic submissions**.

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

Format – hard copies

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

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

- Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.

Number of copies: 3.

Date for submission

Draft submission: The earlier of the following:

- 4 weeks before the date for practical completion.
- Commencement of training.

Final submission: Within 2 weeks after practical completion.

10.5 ELECTRONIC FACILITY AND ASSET MANAGEMENT INFORMATION

Data

Refer to Preliminaries

11 MAINTENANCE

11.1 PERIODIC MAINTENANCE

General

Requirement: Provide documented maintenance so that the condition and performance of the maintained work throughout and at the end of the maintenance period is equal to or better than that at the beginning of the maintenance period including with respect to the following:

- Performance, service delivery.
- Service life and reliability.
- Compliance with statutory requirements.
- Compliance with building rating requirements.
- Energy and water efficiency.
- Environmental impact.
- Health and safety.
- Risk management.

Inclusions: Include the following:

- Periodic and statutory maintenance, cleaning and replacement of consumables.
- Emergency repairs.
- Condition reporting.

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

Maintenance period: The greater of the defects liability period and the period documented.

Faults: Rectify promptly.

Emergencies: Attend emergency calls promptly.

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

Maintenance program

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

Maintenance records

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

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

Certificates: Include test and approval certificates.

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

Site control

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

11.2 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.

12 SELECTIONS

12.1 SUBMISSIONS AND INSPECTIONS

Notices schedule

Item	Minimum notice
Inspection of commissioning	1 week and as agreed
General inspections	1 week

12.2 TESTS

Tests schedule

Test	Requirements
Contractor to develop testing and commissioning programme for approval. To be provided within 3 weeks of site possession	
Refer to individual trade sections and specialist engineering specifications	

0181 ADHESIVES, SEALANTS AND FASTENERS

1 GENERAL

1.1 RESPONSIBILITIES

General

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

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 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 SUBMISSIONS

Products and materials

Adhesives and sealants: Submit product data sheets.

Type tests: 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.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Tests

Site tests: Submit results as follows:

- Installed sealant tests: Floor test of all gutters and drainage systems

Warranties

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

2 PRODUCTS

2.1 GENERAL

Samples

Visible joint sealants: Provide colour samples.

2.2 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.

2.3 SEALANTS

Standards

General: To ISO 11600 (2002).

External masonry joints

General: Provide sealant and bond breaking materials that 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.

2.4 FASTENERS

General

Masonry anchors: Proprietary expansion or bonded type anchors, as documented.

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 A276/A276M (2024).

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).

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.

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.

3 EXECUTION

3.1 ADHESIVES

General

Requirement: Install to the manufacturer’s recommendations.

Preparation

Substrates: Conform to the following:
- Remove any deposit or finish that 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 that 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.

4 SELECTIONS

4.1 ADHESIVES

Application schedule

Application	Product	Relevant worksections
Adhesive fixed timber strip flooring and parquetry systems		*0655 Timber flooring*
Colourback glass faced wall panels or splashbacks		*0551 Joinery*, *0641 Applied wall finishes*
Drywall lining/wall panels		*0463 Glass blockwork*, *0511 Lining*, *0522 Partitions - framed and lined*
Multilayered board floors		*0654 Multilayered board flooring*
Joinery doors		*0453 Doors and access panels*

Application	Product	Relevant worksections
Mirrors		*0467 Glass components*
Stainless steel faced wall panels or splashbacks		*0551 Joinery*, *0553 Stainless steel benching*
Timber joinery fitments		*0551 Joinery*
Trim, mouldings, skirtings and architraves		*0511 Lining*

4.2 ANCHORS

Bonded anchor schedule
By Contractor

Expansion anchor schedule
By Contractor

4.3 SEALING, POINTING AND BEDDING

Application schedule

Application	Product	Relevant worksections
Metal flashings and rainwater goods	UV Stabilised and Formulated for roof conditions Silicone sealant - By Contractor Where visible confirm colour with Superintendent or as per finishes schedules.	*0421 Roofing - combined*, *0423 Roofing - profiled sheet metal*, *0424 Roofing - seamed sheet metal*, *0425 Roofing - shingles and shakes*, *0426 Roofing - slate*, *0427 Roofing - tiles*
Metal flashings and sealing non-porous substrates	UV Stabilised and Formulated for roof conditions Silicone sealant - By Contractor Where visible confirm colour with Superintendent or as per finishes schedules.	*0431 Cladding - combined*, *0432 Curtain walls*, *0434 Cladding - flat sheets and panels*, *0435 Cladding - planks and weatherboards*, *0436 Cladding - profiled and seamed sheet metal*
Window and external doors	By Contractor	*0432 Curtain walls*, *0451 Windows and glazed doors*, *0453 Doors and access panels*, *0463 Glass blockwork*
Hydraulic services	By Contractor	*0811 Sanitary fixtures*, *0812 Tapware*, *0813 Water heaters*, *0815 Drinking water dispensers*

Adhesives, sealants and fasteners combined function schedule

Application	Product	Relevant worksections
Fixing and sealing acoustic ceiling tiles		*0531 Suspended ceilings - combined*
Control joints, tile adhesives and wet area sealants		*0631 Ceramic tiling*, *0632 Stone and terrazzo tiling*
Timber floor control joints, adhesives and fixings		*0655 Timber flooring*, *0654 Multilayered board flooring*
Wet area sealants and lightweight detail items		*0525 Cubicle systems*, *0551 Joinery*, *0811 Sanitary fixtures*

4.4 SEALING STRUCTURALLY DESIGNED CONTROL JOINTS

Application schedule

Application	Sealant type	Bond breaking	Sealant colour	Relevant worksection
Masonry control joints	By Contractor – confirm colour with Superintendent			*0321 Precast concrete*, *0322 Tilt-up concrete*, *0331 Brick and block construction*, *0332 Stone masonry*
Trafficable masonry control joints	By Contractor – confirm colour with Superintendent			*0274 Concrete pavement*, *0275 Paving - mortar and adhesive bed*

0181P HILTI ANCHORS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide HILTI anchors, as documented.

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.
- Compatibility: Compatible with adjacently located products and materials.
- Movement: If a joint is subject to movement, select a system certified to accommodate the projected movement under the conditions of service.

1.2 COMPANY CONTACTS

HILTI technical contacts

Website: www.hilti.com.au/content/hilti/A2/AU/en/engineering/engineering-services/technical-advise.html or ask.hilti.com.au/

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 MANUFACTURER'S DOCUMENTS

Technical manuals

Product information: www.hilti.com.au/c/CLS_FASTENER_7135.

1.5 SUBMISSIONS

Subcontractors

HILTI anchor installer training: Submit evidence of supplier specific training or an AEFAC anchor installer certificate.

Tests

Site tests: Submit test results to confirm the quality of anchor installation.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.

Product identification

General: Marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

2.2 GENERAL - ANCHORS

Standards

Safety-critical fastening applications: The prequalification of post-installed fasteners and cast-in anchor channels for suitability and admissible service conditions to AS 5216 (2021) Appendix A.

General

HILTI filling washer set: Provide for mechanical and chemical anchors, as documented.

Plain washers: To AS 1237.1 (2002).

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

Stainless steel fasteners: To ASTM A276/A276M (2024).

Unified hexagon bolts, screws and nuts: To AS/NZS 2465 (1999).

Fasteners in CCA treated timber: 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).

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).

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**	
	Material	**Minimum local metallic coating thickness (µm)**
C1 and C2	Electroplated zinc or Hot-dip galvanized	30
C3	Hot-dip galvanized	45
C4	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.

2.3 HILTI CHEMICAL ANCHORS

Injectable adhesive anchors

HIT-RE 100: Premium class, heavy-duty odourless epoxy mortar for anchoring in concrete.

HIT-HY 170: Premium class, heavy duty hybrid mortar for anchoring in concrete and masonry.

HIT-HY 200-R V3: Ultimate class, high performance hybrid mortar with 100 year design life, for anchoring in concrete, with seismic performance C1 and C2 to AS 5216 (2021).

HIT-HY 270: Ultimate class, high performance hybrid mortar for anchoring in masonry.

HIT-RE 500 V3: Ultimate class, high performance epoxy mortar with 100 year design life, for anchoring in concrete and some types of natural stone, with seismic performance C1 and C2 to AS 5216 (2021).

HIT-RE 500 V4: Ultimate class, high performance epoxy mortar with 100 year design life, for anchoring in concrete and some types of natural stone, with seismic performance C1 and C2 to AS 5216 (2021).

Capsule adhesive anchors

HIT-HVU 2: Ultimate class, heavy-duty hybrid foil adhesive capsule for anchoring in concrete, with seismic performance C1 and C2 to AS 5216 (2021).

2.4 HILTI MECHANICAL ANCHORS

Expansion anchors

HSA: Premium class, medium-duty zinc-plated carbon steel anchor with an externally threaded head for anchoring in concrete. Material and configuration as follows:

- HSA-F: Galvanized carbon steel, with stainless steel sleeve.
- HSA-R: Stainless steel.

HSL-3: Ultimate class, heavy-duty A4 stainless steel anchor for anchoring in concrete. Suitable for dynamic loading including seismic, fatigue and shock, with seismic performance C1 and C2 to AS 5216 (2021). Configuration as follows:

- HSL-3-R: Hex head.
- HSL-3-SKR: Countersunk head.

HSL4: Ultimate class, heavy-duty zinc-plated carbon steel anchor with a hex head for anchoring in concrete. Suitable for dynamic loading including seismic, fatigue and shock, with seismic performance C1 and C2 to AS 5216 (2021). Configuration as follows:

- HSL4-B: Torque controlled red cap design.
- HSL4-G: Threaded rod connection.
- HSL4-SK: Countersunk head.

HST3: Ultimate class, medium-duty zinc-plated carbon steel anchor with an externally threaded head for anchoring in concrete, with seismic performance C1 and C2 to AS 5216 (2021).

Material and configuration as follows:

- HST3: Zinc-plated carbon steel.
- HST3-R: Stainless steel.

Undercut anchors

HDA: Ultimate class, heavy-duty self-undercutting anchor with externally threaded head for anchoring in concrete. Suitable for dynamic loading including seismic, fatigue, and shock, with seismic performance C1 and C2 to AS 5216 (2021). Material and configuration as follows:

- HDA-P: Zinc-plated carbon steel, pre-set.
- HDA-PF: Hot-dipped galvanized/Sherardised carbon steel, pre-set.
- HDA-PR: Stainless steel, pre-set.
- HDA-T: Zinc-plated carbon steel, through-set.
- HDA-TF: Hot-dipped galvanized/Sherardised carbon steel, through-set.
- HDA-TR: Stainless steel, through-set.

HMU: Ultimate class, heavy-duty self-undercutting anchor with externally threaded head for anchoring in concrete. Suitable for dynamic loading, including seismic performance C1 and C2 to AS 5216 (2021). Material and configuration as follows:

- HMU-P: Zinc-plated carbon steel (special order).
- HMU-PF: Hot-dipped galvanized/Sherardised carbon steel.

HSC: Ultimate class, heavy-duty, shallow undercutting anchor for anchoring in concrete. Suitable for dynamic loading including seismic and shock, with seismic performance C2 to AS 5216 (2021). Material and configuration as follows:

- HSC-A: Zinc-plated carbon steel, externally threaded head.
- HSC-AR: Stainless steel, externally threaded head.
- HSC-I: Zinc-plated carbon steel, inner thread.
- HSC-IR: Stainless steel, inner thread.

Screw anchors

HUS3: Ultimate class, medium duty, screw anchors for anchoring in concrete and masonry, with seismic performance C1 and C2 to AS 5216 (2021). Material and configuration as follows:

- HUS3-H: Zinc-plated carbon steel with hex head.
- HUS3-HF: Carbon steel with multi-layer coating with hex head.
- HUS3-C: Zinc-plated carbon steel with countersunk head.
- HUS3-P: Zinc-plated carbon steel with pan head.
- HUS3-I: Zinc-plated carbon steel, with internally threaded head.
- HUS3-I Flex: Zinc-plated carbon steel, with internally threaded head.
- HUS3-A: Zinc-plated carbon steel, with externally threaded head.

HUS4: Ultimate class, high to medium duty, screw anchors for anchoring in concrete and masonry with seismic performance C1 and C2 to AS 5216 (2021). Material and configuration as follows:

- HUS4-H: Galvanized carbon steel with hex head.
- HUS4-HF: Carbon steel with multi-layer coating with hex head.
- HUS4-C: Galvanized carbon steel with countersunk head.
- HUS4-A: Galvanized carbon steel with threaded rod connection.
- HUS4-AF: Carbon steel with multi-layer coating with threaded rod connection.

HUS4-Max Ultimate class, high to medium duty, screw anchors with the HUS4-Max foil capsule for anchoring in concrete and masonry with seismic performance C1 and C2 to EOTA TR 075 (2020). Same material and configuration as HUS4 in previous section.

HUS-HR: Ultimate class, stainless steel, medium duty, screw anchor with a hex head for anchoring in concrete and masonry, with seismic performance C1 to AS 5216 (2021).

HUS-CR: Ultimate class, stainless steel, medium duty, screw anchor with a countersunk head for anchoring in concrete and masonry, with seismic performance C1 to AS 5216 (2021).

Other anchors

HBI panel brace anchor: Standard class, heavy-duty, carbon steel expanding anchor bolt for panel bracing during construction.

HFB nail anchor: Premium class, light-duty, carbon steel fastener, with seismic performance assessment.

HKD flush anchor: Standard class, medium-duty, flush anchor with internal thread for bolts or threaded rods. Material and configuration as follows:

- HKD: Zinc-plated carbon steel, tool-set.
- HKD-D: Zinc-plated carbon steel, manual-set.
- HKD-SR: Stainless steel, tool set.

HRD plastic frame anchor: Premium class, plastic anchor with screw fixing. Material and configuration as follows:

- HRD-H: Carbon steel, hex head.
- HRD-HF: Hot-dipped galvanized, hex head.
- HRD-HR: Stainless steel, hex head.
- HRD-C: Carbon steel, countersunk head.
- HRD-CR: Stainless steel, countersunk head.

2.5 HILTI CAST-IN ANCHOR CHANNELS

General

Cast-in channels: Provide HILTI cast-in anchor channels for fixings to concrete elements, as documented.

T-Bolt fixings: For cast-in anchor channels, provide HILTI T-bolts.

Cast-in anchor channels

HAC: Ultimate class, cast-in anchor channel with optimised V-shaped profile formed by innovative rollshaping (TCRS). Available with hot-dipped galvanized coating.

HAC-T: Ultimate class, cast-in anchor channel with optimised V-shaped profile and serrated lip. Available with hot-dipped galvanized coating.

HAC-C: Standard cast-in anchor channel with traditional rectangular profile. Available with hot-dipped galvanized coating or in stainless steel.

HAC-C-P: Premium line cast-in anchor channel with traditional rectangular profile. Available with hot-dipped galvanized coating or in stainless steel.

HAC Edge: Ultimate class cast-in anchor channel assembly with optimised V-shaped profile, rebar and edge confinement plate

HAC Front-of-slab rebar: Cast-in anchor channel with optimised V-shaped profile and rebar in place of round head anchors. Available with hot-dipped galvanized coating.

T-bolts for anchor channels

HBC-C: T-bolt for HILTI cast-in anchor channels with V-shaped profiles. Available with hot-dipped galvanized coating or in stainless steel.

HBC-C-N: Notched T-bolt for HILTI cast-in anchor channels with V-shaped profiles. Available with hot-dipped galvanized coating.

HBC-T: Serrated T-bolt for HAC-T serrated lip V-shaped profile channel. Available with hot-dipped galvanized coating.

HBC: Standard T-bolt for cast-in anchor channels with rectangular profile. Available with hot-dipped galvanized coating or in stainless steel.

3 EXECUTION

3.1 GENERAL

General

Requirement: Install to HILTI's installation instructions.

Fastening into concrete and masonry

Concrete substrate: To AS 5216 (2021) Appendix B.

Masonry substrate: To AEFAC TN 09 (2019).

3.2 HILTI CHEMICAL ANCHORS

General

Installation: Install chemical anchors to HILTI installation instructions detailed in HILTI Technical Datasheets. Conform to the following for correct performance of the fixing:

- Minimum distances from edges of substrates.
- Required spacing between fasteners.
- Minimum required thickness of the base material.
- Preparation of holes for fixings: Drill to the correct hole depth and perpendicular to the surface of the base material. Conform to the documented hole drilling method and the following:
  - . HILTI SAFEset system: Additional cleaning not required.
  - . Conventional hammer drilling: Clean holes using a steel brush, hand pump or compressed air.
  - . Diamond core drilling: Use the HILTI hole roughening tool to roughen the sides of the holes along its full depth and thoroughly clean holes using a steel brush, water and compressed air.
- Injection method, including direction, depth and condition (e.g. water-filled) of injection.
- Do not load anchors until the curing time has elapsed.

3.3 HILTI MECHANICAL ANCHORS

General

Installation: Install mechanical anchors to HILTI installation instructions detailed in HILTI Technical Datasheets. Conform to the following for correct performance of the fixing:

- Minimum distances from edges of substrates.
- Required spacing between fasteners.
- Minimum required thickness of the base material.
- Preparation of holes for fixings: Drill to the correct hole depth and perpendicular to the surface of the base material. Conform to the documented hole drilling method and the following:
  - . HILTI SAFEset system: Additional cleaning and installation torque using torque wrench not required.
  - . Conventional hammer drilling: Clean holes using a steel brush, hand pump or compressed air.
  - . Diamond core drilling: Conform to product ETA or HILTI instructions.
- Setting depths.
- Installation of anchors and fixings using correct tools and required torque.

3.4 HILTI CAST-IN ANCHOR CHANNELS

General

Installation: Install cast-in anchor channels to HILTI installation instructions detailed in HILTI Technical Datasheets. Conform to the following for correct performance of the fixing:

- Minimum distances from edges of substrates.
- Leveling and positioning of the channels.
- Setting depths.
- Make sure channel and/or tied reinforcement does not move during pour.
- Appropriate compaction of concrete around channel.
- Installation of T-bolts to torque requirements.

3.5 TESTING

Site tests

Anchor installation: Verify the quality of the installation to the AEFAC TN 05series.

Test locations: As documented.

Test loads: As documented.

3.6 COMPLETION

Warranties

Manufacturer’s warranty: Provide the manufacturer’s published product warranties.

4 SELECTIONS

4.1 HILTI ANCHORS

HILTI chemical anchor schedule
By contractor

0182 FIRE-STOPPING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide fire-stopping, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

General
Service penetration fire-stopping systems: To AS 4072.1 (2005) and BCA (2022) C4D15.
Control/construction joint fire-stopping systems: To AS 4072.1 (2005) and BCA (2022) C4D16.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection, the definitions given in AS 4072.1 (2005) apply.

1.5 SUBMISSIONS

Certification
General: Submit evidence of conformity with the recommendations of AS 4072.1 (2005) Appendix B.
Certification: Submit a completed statement of compliance and schedule of installed fire-stopped penetrations and control/construction joints.
- Schedule: To AS 4072.1 (2005) Figure B1.
- Statement of compliance: To AS 4072.1 (2005) Figure B2.

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials
General: Submit the following:
- Evidence that systems conform to documented requirements.
- Copies of relevant manufacturers' instructions.
- Product data sheets (PDS).
- Safety data sheets (SDS), where applicable.

Type tests: Submit type test reports 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
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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

Warranties
Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.6 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 GENERAL

Samples

Requirement: Provide 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.

2.2 MATERIALS

Storage and handling

General: Deliver, unload and store products and accessories in unbroken manufacturer's packaging in a dry, well-ventilated and secure storage area, unaffected by weather.

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

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.

Toxicity before curing: Select products with very limited, or no health hazards, where applicable.

Total VOC limits

Requirement: Conform to the following maximum limits:

- Fire stopping sealants: 250 g/L.

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.

2.3 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.

Non-combustible mineral 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 that 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.

2.4 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
Permanent dam material: Non-combustible.

Stickers and labels: To **COMPLETION**, **Labelling**.

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 that 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.

Fire-resistance level (FRL): Install products to the manufacturer's recommendations. Install to achieve the documented FRL in accordance with the manufacturer's tested system.

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).

Environmental management: To the manufacturer's Safety Data Sheets for WHS and environmental management of the materials.

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.

Installation: To the manufacturer's recommendations to completely close and seal the joint.

Fire-stop mortars

Ambient conditions: Do not install below 5°C.

Installation: To the manufacturer's recommendations to completely close and seal the opening.

Formulated compound of incombustible fibres

Installation: To the manufacturer's recommendations to completely close and seal the opening.

Non-combustible mineral fibre stuffing

Installation: Install in accordance with a type-tested installation to achieve the required FRL. Completely close and seal the opening.

Fire-stop composite sheets

Installation: To the manufacturer's recommendations to completely close and seal the opening.

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.

Installation: To the manufacturer's recommendations to completely close and seal the opening.

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 to the manufacturer's recommendations. 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.

Installation: To the manufacturer's recommendations to completely close and seal the opening.

Fire-stop collars
Installation: To the manufacturer's recommendations.

Fire-stop pillows
Ambient conditions: Do not install in conditions outside the manufacturer's recommendations.

Installation: To the manufacturer's recommendations to completely close and seal the opening.

Cavity barriers
Installation: To the manufacturer's recommendations.

Multi-service cable transit box
Installation: To the manufacturer's recommendations.

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.

Operation and maintenance manuals
General: Prepare a manual that includes schedules showing type of system installed, fire rating, location, date of installation and inspection requirements. For fire-stopping systems that are intended to be modified in service, include the manufacturers' data as follows:

- Recommendations for changes in service and reinstallation.
- Recommendations for service use, care and maintenance.
- List of manufacturers and suppliers for replacement parts.

0183B METALS AND PREFINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirements: Provide metal and prefinishes, as documented.

Performance

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

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 SUBMISSIONS

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

2 PRODUCTS

2.1 GENERAL

Samples

Requirement: Provide samples of the following:

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

2.2 METALS

Stainless steel

Bars: To ASTM A276/A276M (2024).

Plate, sheet and strip: To ASTM A240/A240M (2023).

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-conductive 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 ISO 17672 (2023).

Soldering

Lap-joints: Provide a mechanically sound soldered joint with sufficient lap for roofing, guttering, metalwork.

Pipes: Make a leakproof soldered joint using joiners for copper pipes.

Solder: To AS 1834.1 (1991).

Welding

Aluminium: To AS/NZS 1665 (2004).

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

Steel: To AS/NZS 1554.1 (2014).

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 the 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.

3.2 FERROUS STEEL FINISHES

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).

3.3 STAINLESS STEEL FINISHES

General

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

Pre-assembly

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

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.

Electrolytically coloured finish: refer finishes schedule

Patterned/textured finish: refer finishes schedule

Post-assembly pre-treatment

Heat discolouration: Remove by pickling to ASTM A380/A380M (2017).

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.

3.4 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/NZS 1789 (2023).

3.5 ANODISED FINISHES

General

Standard: To AS 1231 (2000).

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

3.6 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 finish: refer finishes schedule

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

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.

3.7 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

General
Requirement: Provide termite management systems, as documented.

Performance
Requirement: Building protection from termite attack.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARD

General
Termite management systems: To AS 3660.1 (2014).

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the definitions given in AS 3660.1 (2014) apply.

1.5 SUBMISSIONS

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

Operation and maintenance manuals
Requirement: Submit manuals to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials
Manufacturer's data: Submit manufacturer’s data including the following:

- Product data sheet.
- Recommendations for installation or application.

Type tests: Submit results, as follows:

- Termite management systems to AS 3660.3 (2014).

Records
Chemical termite management systems: Submit report to **COMPLETION**, **Chemical termite management systems**.

Termite management system: Submit report to **MAINTENANCE**, **Inspection**.

Subcontractors
General: Submit names and contract details of proposed suppliers and installers.

Tests
Site tests: Submit results, as follows:

- Chemical termite management systems.

Warranties
Requirement: Submit warranties to **COMPLETION**

1.6 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.

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.

3.4 TESTING

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

3.5 COMPLETION

Chemical termite management systems
Requirement: Prepare a report including the following:

- Termiticide brand name and manufacturer.
- Date and time of application.
- Location and extent of application.
- For each location:
  - . Moisture content of soil before application.
  - . Volume of undiluted termiticide used and dilution rate.
  - . Method of application.
  - . Rate of application.
- Water source for application.

Termite management system notice
Signage: Permanently fix a durable notice in a prominent location to BCA (2022) B1D4(i)(ii).

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

Operation and maintenance manuals
Requirement: For systems requiring post-construction monitoring, prepare a maintenance manual that includes the following:

- Inspection frequency.
- Instructions for inspection of termite activity and treatment effectiveness.
- Contact details of installers and manufacturer's authorised supplier of replacement components.
- Recommendations for reapplication, if required.

Warranties
Management system warranty: Submit the manufacturer's warranty

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.

4 SELECTIONS

4.1 SCHEDULE

Termite management systems schedule
By Contractor

0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide timber products with finishes and treatments, as documented.

Performance

Requirements:

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

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0671 Painting*.

1.3 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).
- Particleboard flooring: To AS/NZS 1860.1 (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).

Timber grading methods:

- Stress graded: To the AS/NZS 1748 series.
- Visually graded F-grade: To AS 2082 (2007) or AS 2858 (2023).

1.4 INTERPRETATION

Abbreviations

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

- LVL: Laminated Veneer Lumber.

Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 4491 (1997) and the following apply:

- Dry process fibreboard: Panel material with a nominal thickness of 1.5 mm or greater, manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and

pressure, the bond of which is derived from a synthetic adhesive added to the fibres and the panels are manufactured with a forming moisture content less than 20%.

- Particleboard: Panel material manufactured under pressure and heat from particles of wood (wood flakes, strands, chips, shavings, sawdust and similar) and/or lignocellulosic material in particle form (flax shives, hemp hurds, bagasse fragments, rice hulls, wheat straw and similar) with the addition of an adhesive.
- Wet process fibreboard: Panel material with a nominated thickness of 1.5 mm or greater, manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and/or pressure, the bond of which is derived from the felting of the fibres and the panels are manufactured with a forming moisture content greater than 20%.

1.5 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.

Preservative treatment of timber: Submit a certificate from an independent testing authority to AS/NZS 1604.1 (2021) clause 1.5.3.6. Include details of treatment and a copy of the charge sheet.

Tests: Submit moisture content test results.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

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.

Product identification

Preservative treated timber: Marking to AS/NZS 1604.1 (2021) clause 1.5.3 and including the following:

- A unique identifier for the treatment plant.
- A unique identifier for the preservative.
- Hazard class.

2.2 CERTIFICATION

Timber source certification

Requirement: Use timber products originating from sustainably managed forests.

2.3 FIRE-RESISTANCE

General

Structural timber: To AS/NZS 1720.4 (2019) or alternative conforming to NCC (2022) A5G3.

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 (2022).

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: To AS 5604 (2022). Do not provide untreated timbers containing lyctid susceptible sapwood.

Untreated sapwood: Do not use in applications requiring treated timber or natural durability.

Preservative treatment

Wood-based products: To AS/NZS 1604.1 (2021) or preservative treated products conforming to NCC (2022) A5G3.

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

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

Moisture content

Test: Methods as follows:

- Timber and glued laminated timber products: To AS/NZS 1080.1 (2012).
- Plywood and LVL: 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.

2.5 FINISHING

Surface coating

Painting and staining: To *0671 Painting*.

Water-repellent treatment: [complete/delete]

Application: To the manufacturer's specification.

2.6 RECYCLED TIMBER

General

Type of species: To match Existing Timber, Jarrah

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

Classification: Visually graded.

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

General

Designer: By Contractor

Requirements

General: To DESIGN in *0171 General requirements*.

Responsibility: Provide roof access ladder hook and static line from maintenance compound

Performance requirements: to Australian Standards

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.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 STANDARDS

General

Fixed platforms, walkways, stairways and ladders for use by operating, inspection, maintenance and servicing personnel: To AS 1657 (2018).

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).

1.5 INTERPRETATION

Abbreviations

General: For the purposes of this worksection, the following abbreviation applies:

- PPE: Personal protective equipment.

Definitions

General: For the purposes of this worksection, the definitions given in AS 1657 (2018), AS/NZS 1891.1 (2020), AS/NZS 5532 (2013) and AS/NZS ISO 22846.1 (2020) apply.

1.6 SUBMISSIONS

Certification

General: Submit certification of installed system to **COMPLETION**, **Certification**.

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 roof access stairways and ladders, platforms and walkways.
  - . Details of stairways and ladders, walkways, including elevated walkways and required guardrailing.
  - . Layout of anchors, static lines and system components in plan and elevation.
  - . Proposed methods of fixing to each substrate type in the building.

Marking and labelling

Requirement: Samples and schedules of proposed marking and labels for each system component.

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

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:

- Proprietary stairways and fixed ladders: To **Error! Reference source not found.**, **Error! Reference source not found.**.
- Proprietary platforms, walkways and guardrailing: To **FIXED PLATFORMS, WALKWAYS AND GUARDRAILING**, **Tests**.
- Personal equipment for working at height: To **FALL PROTECTION SYSTEMS**, **Tests**.
- Rope access systems: To **FALL PROTECTION SYSTEMS**, **Tests**.
- Single point anchors: To **FALL PROTECTION SYSTEMS**, **Tests**.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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 all friction and glued-in anchors.

Warranties

Requirement: Submit warranties to **COMPLETION**

1.7 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 professional 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.

Signage

General: Include all mandatory and documented signage.

2.2 FIXED PLATFORMS, WALKWAYS AND GUARDRAILING

General

Product: Fixed platforms and walkways complete with all required guardrailing and toe boards.

Balustrades: Provide a proprietary or bespoke fabricated system, as documented.

Standard: To AS 1657 (2018).

Material: Aluminium, corrosion-resistant steel, fibre reinforced polymer.

Tests

Guardrailing: To AS 1657 (2018) Appendix B.

Infill: To AS 1657 (2018) Appendix C.

Test reports: To AS 1657 (2018) Appendix E.

2.3 FALL PROTECTION SYSTEMS

Access safety system

System: Stainless Steel ladder hook and static line by contractor

Anchors

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

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 and Appendix A to F.
- Horizontal lifeline and rail systems: To AS/NZS 1891.2 (2001) Appendix A to E.
- 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

General

Installation: To the manufacturers recommendations and the following:

- Fixed platforms, walkways, stairways and ladders: To AS 1657 (2018).
- Personal equipment for working at height: To the AS/NZS 1891 series.
- Rope access systems: To AS/NZS 4488.1 (1997).
- Incompatible materials: Separate using concealed layers of suitable materials in appropriate thicknesses.

Subcontractor

Installer: Registered installer, approved by the manufacturer.

Fixing to structure

General: Provide fabricated predrilled or purpose-made brackets and bases and attach to the building structure with fixings compatible with the substrate.

Proprietary items: Install to the manufacturers recommendations.

Labels and signage

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

3.2 TESTING

Testing of installed work

General: On completion of the installation, carry out tests to confirm the system's competence in accordance with AS/NZS 5532 (2013), AS/NZS 1891.2 (2001), and AS/NZS 1891.4 (2009) and issue certification confirming compliance with all installation requirements.

Proof load test for anchors

Testing: Following completion of the installation, proof load test all friction and glued-in anchors to 50% of the design ultimate strength capacity in conformance with AS/NZS 1891.4 (2009) clause 3.1.2(g).

Report: Record the following:

- Details of organisation and inspector performing the test.
- Date test was performed.
- Load cell details and calibration date.
- A reference of each item tested including a description of the item location.
- The item ultimate load.
- The test load applied.
- Duration of test.
- Results of test.
- Photo of each item showing peak load applied.

3.3 TRAINING

General

Responsibilities: Coordinate the training of owner’s facilities management personnel in conformance with *0171 General requirements*.

Training records: Video record all training sessions. Catalogue and include recordings with the operation and maintenance manuals.

3.4 COMPLETION

Certification

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 month period.

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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the following:

- Instructions and recommended procedures for operating and routinely maintaining the equipment.
- Technical information relating to all access and anchorage equipment provided including design, testing, installation, and conformance of the system to relevant industry standards and manufacturer’s instructions.
- Special provisions for use (e.g. training, additional equipment, rescue provisions).

- A statement that devices are for personnel use and note specific equipment that is not for personnel use.
- Include certification and equipment logs in conformance with AS 1657 (2018) Section 8 and Appendices, and AS/NZS 1891.4 (2009) Section 9.

As-built documentation: Suitable for use for long-term operations and maintenance.

Warranties

Warranty Items: 5 years or as per manufacturers warrantee, the greater of

3.5 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 competent person: To AS/NZS 1891.4 (2009) clause 1.4.8.

Regular scheduled periodic inspections

Standard: To AS/NZS 1891.4 (2009) Section 9.3 and the following:

- Provide inspection, testing and certification by an Accredited Installer and/or Accredited Height Safety Inspector.
- 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.

4 SELECTIONS

4.1 FIXED PLATFORMS, WALKWAYS AND GUARDRAILING

Fixed platforms, walkways and guardrailing schedule

By Contractor

4.2 FALL PROTECTION SYSTEMS

Fall protection system schedule

By Contractor

5 EXECUTION

5.1 JOINTS

General

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

Timber-to-timber interfaces: To the manufacturer’s recommendations and the following:

- 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.

5.2 SHRINKAGE RESTRAINT

General

Requirement: If possible, use seasoned timber, particularly where timber elements are integrated with steel and/or concrete.

Moisture content: Maintain a timber moisture content near the anticipated in-service equilibrium moisture content.

Fasteners: Where possible, align fasteners along member axis.

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

Unseasoned timber: Provide as follows:

- Drill bolt holes 2 mm or 10% larger than the bolt diameter.
- Use species with similar shrinkage values to reduce movement and shrinkage.
- Provide adequate clearance between unseasoned timber framing, and interfacing structures and materials to allow for movement.

5.3 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.

0194P RAVEN DOOR SEALS AND WINDOW SEALS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide RAVEN door seals and window seals, as documented.

Performance

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.

1.2 PERFORMANCE

Bushfire-prone areas

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

1.3 COMPANY CONTACTS

RAVEN technical contacts

Website: www.raven.com.au.

1.4 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.5 STANDARDS

Seals general

Quality management for manufacture: To ISO 9001 (2015).

Acoustic applications: Tested to AS 1191 (2002) or EN ISO 10140-2 (2021) and rated to AS/NZS ISO 717.1 (2004).

Fire door assemblies: To AS 1530.4 (2014) and AS 1905.1 (2015).

Smoke door assemblies: To BCA (2022) Spec 12, tested to AS 1530.7 (2007) and rated to AS 6905 (2007), and tested to EN 1634-3 (2004).

Combined fire and smoke door assemblies: To BCA (2022) Spec 12, AS 1530.4 (2014), AS 1905.1 (2015), AS 1530.7 (2007) and AS 3959 (2018) for weather seals providing BAL-FZ.

Buildings in bushfire-prone areas: To AS 3959 (2018):

- BAL-40: Flame retardant silicon, PVC and TPE weather seals with a Flammability Index not more than 5 when tested to AS 1530.2 (1993).
- BAL-FZ: Approved door seals for use with fire doorsets tested to AS 1530.4 (2014).

Weather and energy saving seals for proprietary windows and door assemblies: To AS 4420.1 (2016) clause 5 and clause 6, and AS 2047 (2014).

Door bottom and perimeter seals for glazed external doors: To AS 2047 (2014).

Threshold plates: To the NCC cited AS 1428.1 (2009).

1.6 MANUFACTURER'S DOCUMENTS

Technical manuals

Website: www.raven.com.au.

1.7 INTERPRETATION

Abbreviations and definitions

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

Ordering abbreviations:

- AI: Aluminium.

- B/A: Bronze anodised (15 µm for door bottom seals and perimeter seals, 25 µm for threshold plates).
- B/K: Black anodised (15 µm for door bottom seals and perimeter seals, 25 µm for threshold plates).
- C/A: Clear anodised (15 µm for door bottom seals and perimeter seals, 25 µm for threshold plates).
- EPDM: Ethylene Propylene Diene Monomer.
- PE: Painted Polyester Enamel finish (special order and extra cost).
- PVC: Polyvinyl Chloride.
- Si: Silicone Rubber.
- TPE: Thermoplastic Elastomer.

1.8 SUBMISSIONS

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

2 PRODUCTS

2.1 GENERAL

Product substitution
Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.
Product identification
General: Marked to show the following:
- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

2.2 MATERIALS

Aluminium
Material: Commercial grade alloy 6060, 6061 or 6063 with T5 or T6 temper.
Finish to visible extrusions:
- Satin clear, bright gold, bronze or black anodised, or as documented.
- Anodising thickness:
  . Perimeter seal extrusions: Minimum 15 µm.
  . Threshold plates and threshold plate seals: Minimum 25 µm.

PVC
RAVEN proprietary grade PVC extrusions:
- Highest quality available.
- Added UV inhibitors where exposed to sunlight.
- Self-extinguishing grade.
- Antimicrobial additive.
- Service temperature -5°C to +70°C.

Si
RAVEN proprietary grade silicon rubber extrusions:
- Are unique and where designated (SE) are self-extinguishing.
- Added UV inhibitors.
- Antimicrobial additive.
- Service temperature of -60°C to +230°C.

TPE
RAVEN proprietary grade TPE extrusions:

- Highest quality available.
- Added UV inhibitors.
- Flammability Index less than 5 to AS 1530.2 (1993) where indicated for bushfire-prone areas.
- Service temperature -40°C to +100°C.

EPDM

RAVEN proprietary grade closed cell EPDM rubber extrusions:

- Highest quality available as developed by the automotive industry.
- Added UV inhibitors.
- Classified SE/B self-extinguishing burn rate to SAE J 369 (2019), and ISO 3795 (1989).
- Service temperature -40°C to +70°C.

3 EXECUTION

3.1 INSTALLATION

Handing

Requirement: Match door seals to the handing of doors.

Supply

Factory fit and retrofit: Deliver door seals for door perimeter seals and door bottom seals in complete sets for each door, ready for installation.

Identification: Mark packaging with relevant floor level and door location number.

Packaging: For rigid length seals, provide recyclable cartons and recyclable polyethylene with fixings and fitting instructions.

Off-site installation to proprietary window and door assemblies: Supply RAVEN TPE and silicon rubber weather stripping on bulk reels.

Door assemblies

Modification: Rebate and groove door assemblies to suit the dimensions recommended by RAVEN.

Fitting instructions: Conform to RAVEN’s fitting instructions, supplied with each product.

Fixing

Fasteners:

- Unexposed applications: Zinc-plated self-tapping fasteners supplied by RAVEN with each product.
- External coastal exposure applications: Substitute the standard fasteners supplied with equivalent stainless steel fasteners.

Backset: Allow backset clearances as required for hinging, latching and automatic closers.

Proprietary aluminium door/window frames: Select the fixing options to suit the documented RAVEN perimeter/frame seals.

0195P DTAC TACTILE INDICATORS AND STAIR EDGINGS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide DTAC tactile indicators, stair nosing and edging, threshold transition strips, urban edge protectors and handrail tactile indicators, as documented.

1.2 COMPANY CONTACTS

DTAC technical contacts

Website: www.dtac.com.au/contact.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 STANDARDS

General

Tactile indicators: To AS/NZS 1428.4.1 (2009).

Stair edging: To the NCC cited AS 1428.1 (2009).

Slip resistance

Classification: To AS 4586 (2013).

1.5 MANUFACTURER'S DOCUMENTS

Technical manuals

DTAC Tactile ground surface indicators (TGSI):

- Warning tactiles: dtac.com.au/product-category/warning-tactiles.
- Directional tactiles: dtac.com.au/product-category/directional-tactiles.
- Integrated tactiles: dtac.com.au/product-category/integrated-tactiles.
- Carpet tactile systems: dtac.com.au/product-category/carpet-tactile-systems.

DTAC PEMKO® Stair treads nosing and edging, threshold transitions and edging strips:

- Stair nosing and edging: dtac.com.au/product-category/stair-nosing-edging.
- Thresholds and transition strips: dtac.com.au/product-category/thresholds-transition-strips.

DTAC Urban edge protectors: www.dtac.com.au/product-category/urban-edge-protectors.

DTAC Handrail tactile indicators (HRTI): www.dtac.com.au/product-category/handrail-tactile-indicators.

1.6 SUBMISSIONS

Products and materials

Type tests: Submit results, as follows:

- Slip resistance of tactile indicators and edgings to AS 4586 (2013).
- Luminance reflectance of tactile indicators and edgings to AS/NZS 1428.4.1 (2009) Appendix E and the NCC cited AS 1428.1 (2009) Appendix B.

Tests

Completion tests: Submit results of the following:

- Slip resistance.
- Luminance contrast.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the completed substrate ready for tactile indicators, and nosing and edging installation.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.

2.2 DTAC TACTILE INDICATORS, STAIR NOSING AND EDGING, THRESHOLD AND TRANSITION STRIPS, URBAN EDGE PROTECTORS AND HANDRAIL TACTILE INDICATORS

Warning tactile products

Classic: Tactile indicators with a concentric circle design machined or injection moulded on the horizontal face and a smooth outer edge.

Terraced: Tactile indicators with a concentric circle design machined or injection moulded on the horizontal face and a terraced slip-resistant outer edge.

Ecotac® Classic: Tactile indicators with a cupped underside, a concentric circle design machined on the horizontal face and a smooth outer edge.

Ecotac® Terraced: Tactile indicators with a cupped underside, a concentric circle design machined on the horizontal face and a terraced slip-resistant outer edge.

Directional tactile products

Ecotac® Classic: Tactile indicator with a cupped underside, a grooved design machined on the horizontal face and a smooth outer edge.

Ecotac® Terraced: Tactile indicator with a cupped underside, a grooved design machined on the horizontal face and a terraced slip-resistant outer edge.

Classic: UV stabilised thermoplastic urethane (TPU) injection moulded tactile with an undulating groove design on the horizontal face and a smooth outer edge.

Integrated tactile products

Classic: An integrated Type 316 stainless steel plate with Classic tactile indicators on the horizontal face.

Classic Black Top: An integrated Type 316 stainless steel plate with Classic Black tactile indicators on the horizontal face.

Ultimat® Tactile: An integrated UV stabilised thermoplastic urethane (TPU) injection moulded tactile with Classic tactile indicators on the horizontal face.

Ultimat Duo® Tactile: An integrated UV stabilised thermoplastic urethane (TPU) injection moulded tactile with contrasting coloured Classic tactile indicators on the horizontal face.

Carpet tactile systems

Classic (Low/High Pile): Tactile indicators with a concentric circle design machined on the horizontal face, a smooth outer edge and a female thread stud to affix to the carpet plate.

Terraced (Low/High Pile): Tactile indicators with a concentric circle design machined on the horizontal face, a terraced slip-resistant outer edge and a female thread stud to affix to the carpet plate.

Ecotac® Classic (High Pile): Tactile indicators with a cupped underside, a concentric circle design machined on the horizontal face, a smooth outer edge and an extended shaft. This product does not require steel carpet plates.

Stair nosing and edging products

PEMKO® Corduroy edging: Extruded aluminium sections with a continuous corduroy pattern.

PEMKO® Pinstripe edging: Extruded smooth, blunt edged aluminium sections with an intermittent high and low profile.

PEMKO® Pleat edging: Extruded smooth, aluminium sections with an intermittent continuous corduroy pattern.

PEMKO® Stitch edging: Extruded aluminium sections with a continuous stitch pattern.

PEMKO® Suede edging: Extruded anodised aluminium sections with a continuous band of silicon carbide.

PEMKO® Urban edging: Continuous band of silicon carbide inserted into anodised aluminium extrusions.

PEMKO® Rugged edging: Continuous band of fibre glass reinforced plastic extrusion.

Thresholds and transition strips

PEMKO® Threshold plates: Extruded aluminium sections, many featuring a ribbed profile and integrated gasket sills.

Urban edge protectors

Round button: 35 mm diameter urban edge protector featuring round edge.

Bevelled button: 35 mm diameter urban edge protector featuring bevelled edge.

Thin bar: 5 mm thick x 15 mm wide x 110 mm long.

Thick bar: 10 mm thick x 15 mm wide x 110 mm long.

Handrail tactile indicators

Handrail button: Machined domed Type 316 stainless steel button.

3 EXECUTION

3.1 GENERAL

Substrate preparation and installation of DTAC products

Requirement: To DTAC's recommendations and fitting instructions.

Location: As documented.

Classic and Terraced tactile and directional indicators:

- Stone, masonry, timber or vinyl substrates: Drill and pressure fit.
- Carpet or carpet tile substrates: Drill and screw.

Handrail tactile indicators: Drill and glue to substrate.

Ultimat® and Ultimat Duo® Tactile: Direct stick to substrate (excluding asphalt/bitumen) with DTAC tactile adhesive.

Urban edge protectors:

- Stone, masonry, timber or vinyl substrates: Drill and glue.
- Vitrified porcelain, ceramics, glass or metal substrates: Diamond core drill and glue.

Fixing DTAC PEMKO® stair nosing and edging, threshold and transition products

PEMKO® Corduroy, Pinstripe, Pleat, Stitch, Suede, Threshold plates:

- Stone, masonry, timber or vinyl substrates: Adhesive fix.
- Vitrified porcelain, ceramics, glass or metal substrates: Adhesive fix.
- Carpet or carpet tile substrates: Screw-fix or adhesive fix.

Urban edges protectors and Rugged stair nosing an edging: Screw-fix with optional adhesive.

3.2 TESTING

Completion tests

Slip resistance of completed installation: To AS 4663 (2013).

Luminance contrast testing of completed installation: Submit evidence of conformity to AS/NZS 1428.4.1 (2009) Appendix E and the NCC cited AS 1428.1 (2009) Appendix B.

3.3 COMPLETION

Warranties

Conditions: Installation by DTAC or DTAC approved installer.

Warranty period: 2 years.

0201 DEMOLITION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Carry out demolition, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Demolition: To AS 2601 (2001).

1.4 INTERPRETATION

Definitions

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

- Demolition: The complete or partial removal of a building or structure, by pre-planned and controlled methods or procedures.
- Dilapidation record: The photographic or video, and written record of the condition of the portion of the existing building retained, adjacent buildings, and other relevant structures or facilities, before the start of demolition work.
- Dismantle: The reduction of an item to its components in a manner to allow re-assembly.
- Recover: The disconnection and removal of an item in a manner to allow re-installation.

1.5 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 from the appropriate authority.
- A scaffold permit 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.
- Certificate from the relevant authority confirming treatment for any rodent infestation has been carried out.
- Fees and other costs have been paid.

Execution details

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan, including laboratory analysis of hazardous substances.
- Investigation and work plan.
- Safe Work Method Statement.

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, and the following:

- 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 m aterials for recycling in the works. Coordinate with the locations for storage of other waste streams. Prevent mixing and pollution.

Records

Dilapidation record:

- Before demolition: Submit to each owner of each adjoining or 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 or adjacent property affected.

Tests

Requirement: Submit compliance test results for building services components to be re-used.

1.6 INSPECTION

Notice

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

- Adjoining and adjacent structures before starting demolition.
- Services before disconnection or diversion.
- Trees documented to be retained, before starting demolition.
- Contents of building before starting demolition.
- Structure after stripping and removal of roof coverings and external cladding.
- Underground structures after demolition above them.
- Remaining excavations after removal of underground work.
- Site after removal of demolished materials.
- Services after reconnection or diversion.
- Adjoining and adjacent structures at completion of demolition.

2 PRODUCTS

2.1 DEMOLISHED MATERIALS

Demolished material classes table

Class	Requirement	Ownership
Recovered items for re-use in the works	Recover without damage items identified in the **Error! Reference source not found.**	Principal/proprietor
Recovered items for delivery to the principal	Recover without damage items identified in the **Error! Reference source not found.**	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified in the **Error! Reference source not found.**	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified in the **Error! Reference source not found.**	Contractor
Dismantle for relocation as part of the works	Dismantle without damage and store items identified in the **Error! Reference source not found.**	Principal/proprietor
Demolish for removal	Remove from site demolished materials identified in the **Error! Reference source not found.**Do not burn or bury on site Transit: Prevent spillage of demolished materials in transit	Contractor

3 EXECUTION

3.1 HAZARDOUS SUBSTANCES

Identified hazardous substances

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

Audit

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

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

Removal of hazardous substances

Standard: To AS 2601 (2001) clause 1.6.2.

3.2 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 adjoining or adjacent structures.
- 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.
- Structural engineering report and demolition methodology, as appropriate, if the structure is suspected to contain unbonded prestress tendons.
- If implosion methods are proposed, provide a separate report of methods and safeguards.
- Wheel loads of tipping or loading vehicles.

3.3 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, or parts of buildings, being retained and which normally rely on support from work to be demolished.

Suspended slabs: If mobile plant is required for use on suspended structural members, conform to structural engineering requirements and the work plan.

Ground support: Support excavations for demolition of underground structures.

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

Lateral and vertical supports: At least equal in capacity to that originally provided by the structural element or structure to be demolished.

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

3.4 PROTECTION

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

Weather protection
General: If walls or roofs are opened for alterations and additions, 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. Install to shed water to avoid damage to retained existing elements, and adjacent structures and contents.

Type: Timber framed screens sheeted 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 adjoining structures exposed by demolition.

Existing services
Location: Before starting demolition, locate and mark existing underground services by potholing or other non-destructive digging, in the areas that will be affected by the demolition operations.

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

Essential services: Shut off, cap or control services not required for the demolition work, at or outside the building line before commencing demolition. Conform to the requirements of the relevant existing utility authority, as appropriate.

Underground utility services to be retained: 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.

3.5 DEMOLITION - BUILDING WORKS

General
Requirement: To the approved Safe Work Method Statement and work plan.

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

Concrete slabs
Partial demolition or penetrations: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face. Do not overcut at corners. If required, provide protection to exposed reinforcement along the newly sawn concrete slab edge, as documented.

Storage: Do not store demolished materials on suspended slabs.

Material below grade
Remaining voids: Stabilise and provide barriers.

Explosives
General: Do not use explosives.

3.6 DEMOLITION - BUILDING SERVICES

General
Requirement: Decommission, isolate, demolish and remove from the site all equipment and associated components that have 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).

Components for re-use
General: Before returning to service, clean components and test for conformance to Australian Standards, as required.

3.7 COMPLETION

Notice of completion
General: Give at least 5 working days' notice of completion of demolition so that adjoining or 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 from the demolition work. Obtain written acceptance from the owner of each adjoining or adjacent property of the completeness and standard of the rectification work.

Removal of temporary supports
General: Obtain written instructions from the structural engineer at the completion of demolition before removing temporary supports.

0202 DEMOLITION (INTERIOR AND ALTERATIONS)

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Carry out demolition, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Demolition: To AS 2601 (2001).

1.4 INTERPRETATION

Definitions

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

- Demolition: The complete or partial removal of a building or structure, by pre-planned and controlled methods or procedures.
- Dilapidation record: The photographic or video, and written record of the condition of the portion of the existing building retained, adjacent buildings, and other relevant structures or facilities, before the start of demolition work.
- Recover: The disconnection and removal of an item in a manner to allow re-installation.

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 from the appropriate authority.
- A scaffold permit 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.
- Certificate from the relevant authority confirming treatment for any rodent infestation has been carried out.
- Fees and other costs have been paid.

Execution details

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan, including laboratory analysis of hazardous substances.
- Investigation and work plan.
- Safe Work Method Statement.

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, and a certificate as evidence of correct disposal of recycled materials.

Records

Dilapidation record:

- Before demolition: Submit to each owner of each adjoining or 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 or adjacent property affected.

Tests

Requirement: Submit compliance test results for building services components to be re-used.

1.6 INSPECTION

Notice

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

- Adjoining and adjacent structures before starting demolition.
- Services before disconnection or diversion.
- Contents of building before starting demolition.
- Site after removal of demolished materials.
- Services after reconnection or diversion.
- Adjoining and adjacent structures at completion of demolition.

2 PRODUCTS

2.1 DEMOLISHED MATERIALS

Demolished material classes table

Class	Requirement	Ownership
Recovered items for re-use in the works	Recover without damage items identified in the **Error! Reference source not found.**	Principal/proprietor
Recovered items for delivery to the principal	Recover without damage items identified in the **Error! Reference source not found.**	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified in the **Error! Reference source not found.**	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified in the **Error! Reference source not found.**	Contractor
Dismantle for relocation as part of the works	Dismantle without damage and store items identified in the **Error! Reference source not found.**	Principal/proprietor
Demolish for removal	Remove from site demolished materials identified in the **Error! Reference source not found.**. Do not burn or bury on site Transit: Prevent spillage of demolishing materials in transit	Contractor

3 EXECUTION

3.1 HAZARDOUS SUBSTANCES

Identified hazardous substances

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

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

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

Removal of hazardous substances
Standard: To AS 2601 (2001) clause 1.6.2.

3.2 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:

- Locations and details of service deviations and terminations.
- 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.
- Wheel loads of tipping or loading vehicles.
- Structural engineering report and demolition methodology, as appropriate, if the structure is suspected to contain unbonded prestress tendons.

3.3 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, or parts of buildings, being retained which normally rely on support from work to be demolished.

Suspended slabs: If mobile plant is required for use on suspended structural members, conform to structural engineering requirements, and the work plan.

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

3.4 PROTECTION

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

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

Security
General: If an internal wall is opened for alterations, provide security against unauthorised entry.

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. Install to shed water to avoid damage to retained existing elements, and adjacent structures and contents.

Type: Timber framed screens sheeted 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.

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.

3.5 DEMOLITION - BUILDING WORKS

General
Requirement: To the approved Safe Work Method Statement and work plan.

Concrete slabs
Partial demolition or penetrations: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face. Do not overcut at corners. If required, provide protection to exposed reinforcement along the newly sawn concrete slab edge, as documented.

Storage: Do not store demolished materials on suspended slabs.

3.6 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).

Components for re-use
General: Before returning to service, clean components and test for conformance to Australian Standards, as required.

3.7 COMPLETION

Notice of completion
General: Give at least 5 working days' notice of completion of demolition so that adjoining or 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 from the demolition work. Obtain written acceptance from the owner of each adjoining or adjacent property of the completeness and standard of the rectification work.

Removal of temporary supports
General: Obtain written instructions from the structural engineer at the completion of demolition before removing temporary supports.

0221 SITE PREPARATION

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide site preparation, as documented.

Performance

Areas for protection: Refer Preliminaries

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0172 Environmental management*.

1.3 INTERPRETATION

Definitions

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

- Authority: Any organisation with statutory authority relating to the project, including clearances.
- Clearances: A formal certificate, approval or condition issued by a statutory authority allowing work in a particular area.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.

1.4 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 the ground within and adjacent to tree driplines from compaction by proposed earthworks machinery.

1.5 INSPECTION

Notice

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

- Enclosures around trees requiring protection.
- Trees requiring removal.
- Trees for transplanting to determine final orientation.

2 EXECUTION

2.1 COMMUNITY LIAISON

Notification

General: Notify residents about construction activities that 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.

Construction plant: Conform to the utility service provider requirements for the operation of construction plant within the zone of influence of existing services. Maintain the required cover and do not exceed the allowable load limit.

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, trees, timber, stumps, boulders and rubble.

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, drains, 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 polyethylene 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

General

Erosion and sediment control measures: To *0172 Environmental management*.

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. Conform to the Network Utility Operator's requirements.

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.

2.7 TREE PROTECTION

General

Warning signs: Display warnings that trees and plantings require protection during the contract in a prominent position at each entrance to the site. 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 protection 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: 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 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 by volume (topsoil: well-rotted composts): 3:1.
- Neutral pH value.
- Free from weed growth and harmful materials.

Compaction protection: Protect ground adjacent to the tree dripline.

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

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

Mulching: Spread 100 mm thick organic mulch conforming to AS 4454 (2012), 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 plant 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 waste and surplus material arising from execution of the work from the site.

Waste disposal: To *0172 Environmental management*.

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 levels, dimensions and tolerances, as documented.

1.2 DESIGN

Requirements

General: To DESIGN in *0171 General requirements*.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0172 Environmental management*.

1.4 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).

1.5 INTERPRETATION

Abbreviations

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

- GITA: Geotechnical inspection and testing authority.
- OMC: Optimum moisture content.

Definitions

General: For the purposes of this worksection, the definitions given in AS 3798 (2007) 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 m^3 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.

1.6 TOLERANCES

General

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

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

1.7 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

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

- Dewatering and groundwater control and disposal of surface water.
- Excavation methods, stages, clearances, batters and temporary supports.
- Stockpiles and borrow pits.
- Placing and compaction methods and stages.

Geotechnical site investigations: Provide a geotechnical report supporting the excavation methods proposed.

Disposal location: Submit details of the location and evidence of compliance with the appropriate authority requirements for the disposal of material requiring removal from site.

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

Proof rolling: Submit details of proposed method and equipment.

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

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 from a GITA or test results of the imported fill as evidence of conformity with the contract, including the source.

Tests

Requirement: Submit test results of the following:

- Compaction control.

1.8 INSPECTION

Notice

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

- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Areas to be cleared and/or stripped of topsoil.
- Areas stripped of topsoil.
- Excavation completed to contract levels or founding material.
- Proof rolling of the subgrade.
- Proof rolled subgrade before placing fill.
- Filling and compaction completed to contract levels.
- Stockpiled topsoil before spreading.

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 concrete and cement bound elements (for example masonry) unless the elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material.

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

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

2.2 BORROW OR IMPORTED FILL

General
Requirement: Use only when suitable material obtained from site excavations are insufficient for completing the documented earthworks.

- 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 SITE PREPARATION

Erosion and sedimentation control
Requirement: To *0172 Environmental management*.

3.2 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
Frequency of testing: To AS 3798 (2007) Table 8.1.

3.3 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 in relation to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: By a 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 classes of rock have been determined.

3.4 REMOVAL OF TOPSOIL

General

Extent: Areas of cut or fill and areas to be 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.

3.5 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 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, as documented. 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.

Subgrade replacement: Excavate the full extent and depth of bad ground. Remove and replace with selected fill. Place and compact to **PLACING FILL** to achieve the required capacity and levels.

Disposal of excess excavated material

General: If not required or unsuitable for fill, remove from site.

Standard: To AS 3798 (2007) clause 6.1.8.

3.6 REINSTATEMENT

Deterioration of bearing surfaces

Requirement: If the bearing surface deteriorates, 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 move to spoil stockpile, 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.

Subsoil drains: Backfill over excavation of subsoil drains using coarse filter material conforming to AS/NZS 3500.3 (2021) clause 2.13.1.

3.7 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.

3.8 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.

Zone of influence

3.9 ROCK BOLTING

General

Requirement: For temporary or permanent support of rock faces, provide proprietary high strength steel bars or cables 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.

3.10 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.

3.11 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 loose material, debris, organic matter and material that inhibits or prevents satisfactory placement of fill layers.

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.

3.12 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.

3.13 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.

3.14 FILL MOISTURE CONTROL

General

Moisture content: Determine in conformance with AS 1289.5.1.1 (2017) or AS 1289.5.2.1 (2017), as appropriate. Adjust the moisture content of fill to ±2% OMC during compaction as required to achieve the documented density.

3.15 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.

3.16 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 RESPONSIBILITIES

General

Requirement: Provide trenching for underground services, as documented.

1.2 DESIGN

Requirements

General: To DESIGN in *0171 General requirements*.

Responsibility: Design and coordinate all trenching required for proposed inground services, as documented.

Existing services: Where possible, design to avoid all existing services. Locate existing services to EXECUTION, **EXISTING SERVICES**.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 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).

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection, the definitions given in AS 3798 (2007) 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 m^3 that cannot be removed until broken up by rippers or percussion tools.
- 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.

1.6 TOLERANCES

Excavation width

Requirement: ±50 mm, unless constrained by adjacent structures.

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.

1.7 SUBMISSIONS

Execution details

Excavation method: Submit details of proposed equipment and method of excavation, including the following:

- Service location and type: A plan of the trench works showing the location and type of service.
- Open excavation: Proposed duration.
- Shuttering and/or bracing of trench sides: If required for safety and stability, provide proposals.
- Geotechnical data: Geotechnical report supporting the trenching and/or boring procedures proposed.
- Boring: Proposals for the following:
  . Limits on length.
  . Existence of other services and method of protection.
  . Pressure grouting to voids.
  . The effect of pressure grouting on other services, ground heave and proposals for minimising such effects.
  . Access to properties outside the site.
  . Council permits.
  . Service interruptions including a plan for minimising unintended interruptions.
- Hazards: Identify WHS hazards that may be encountered with deep trenches including toxic gases and liquids.

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

Records

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

Tests

Trench backfill: Submit results of the following:

- Compaction control tests.

1.8 INSPECTION

Notice

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

- Items to be measured as listed in **GROUND CONDITIONS**, **Records of measurement**.
- Service trenches excavated before laying the service.
- Services laid in trenches and ready for backfilling.
- Completed surface restoration.

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 filling with sulfur content exceeding 0.5% within 500 mm of concrete and cement bound elements (for example masonry) unless such elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material.

Material in reactive clay areas: In sites classified M, M-D, H1, H1-D, H2, H2-D, E or E-D to AS 2870 (2011), re-use excavated site material at a moisture content within ±1% of that of the adjoining in situ clay.

2.2 SURFACE RESTORATION MATERIALS

General

Re-use: If existing surface materials removed during excavation conform to the documented material requirements, re-use if possible.

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 commence.

Concrete surfaces

Material requirements: 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).

Binder:

- Bitumen emulsion: To AS 1160 (1996).
- Conventional bitumen: Class 170 to AS 2008 (2013).
- Cutback bitumen: To AS 2157 (1997).

Pavers

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

Bedding and joint filling sand: Well-graded, free of deleterious material such as soluble salts that 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 that 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 to allow the concrete subbase to be removed and disposed of off-site.

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. 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

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

- Bad ground.
- Discrepancies from expected ground conditions.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

Records of measurement

Excavation and backfilling: If a schedule of rates applies, provisional quantities are specified, 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 in relation to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

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

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.
- Tree protection: To AS 4970 (2009).

Adjacent structures

Existing footings: 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.

Temporary supports: If required, provide supports to adjacent structures, sufficient to prevent damage arising from the works, as follows:

- Lateral supports: Provide lateral support using shoring.
- Vertical supports: Provide vertical support using piling or underpinning or both.

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

Encroachments: If encroachments from adjacent structures are encountered and are not documented, 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 that 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 capacity 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 or fences. Do not obstruct the free flow of water along drainage channels.

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 services, with appropriate labelling, to AS/NZS 2648.1 (1995) and as follows:

- Non-metallic services: Provide tape capable of being detected by inground scanning devices.
- Location: Locate tape approximately half the depth of the service being marked, to a maximum depth of 200 mm below the finished ground level.

Boring: If boring techniques are used to install the service, provide permanent on site labelling at the start and end of the service run and record on the as-built documentation.

Bedding, haunch, side and overlay zones

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

Bedding of services: Surround pipes or conduits on all sides with a minimum of 75 mm compacted bedding sand and 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

Backfill moisture control: 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 documented relative compaction before starting the next layer.

Compaction: To AS 3798 (2007) Section 5 and clause 6.2.4.

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

3.6 TESTING

General

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

Compaction control

Requirement: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).

See AS 3798 (2007) Section 5 for guidelines on compaction criteria for commercial and residential developments.

3.7 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 test every 2 layers, for each length of 40 linear metres.

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 with 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 bituminous fibreboard jointing material placed in line with joints in existing concrete.
- Control joints:
  - Form control joints 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.

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

Bedding: Replicate the bedding used for the original paved surface. Use bedding methods and materials that are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material.

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.

3.8 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

General
Requirement: Provide landscape walling and edging, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 SUBMISSIONS

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Error! Reference source not found.**.
Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.4 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 GENERAL

2.2 TIMBER

Durability
Natural durability class to AS 5604 (2022): Class 1.
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 treated timber: If proposed, provide details.
Hardwood
General: To AS 2796.1 (1999) Section 2.
Softwood
General: To AS 4785.1 (2002) Section 2.

2.3 STEEL

Steel posts
Hot-rolled steel bars and sections: To AS/NZS 3679.1 (2016).
Coating: Hot-dip galvanized to AS/NZS 4680 (2006).

2.4 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.

2.5 MASONRY SEGMENTAL WALLS

General
Requirement: As documented.

Type: Proprietary system of interlocking masonry segmental units with selected backfill placed and compacted progressively to form a retaining wall.

Masonry segmental retaining wall units: To AS/NZS 4455.3 (2008).

2.6 EDGING

Concrete
Requirement: As documented.

Standard: To AS 1379 (2007) – Grade N20.

Steel
Requirement: As documented.

Finish: Hot-dip galvanized.

Aluminium
Requirement: As documented.

Brick
Requirement: Provide masonry units, as documented.

3 EXECUTION

3.1 GENERAL

Set-out
General: Set out the position of walls and edging and mark the position of furniture.

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 DRY STONE WALLS

Construction
Generally: Select the stones for their locations and lay in the wall with minimum stonecutting as follows:

- Each stone is stable, non-rocking, and firmly interlocked with adjacent stones without mortar.
- The wall face shows reasonably regular, flat and vertical stone faces.
- Vertical joints or perpends between stones are spanned by the next stone above.
- Stones are laid generally as through stones whenever possible.
- At least 50% of footings, 30% of wall stones, and all coping stones are laid as through stones.

Footings: Select the largest, flattest and most regular stones for footings, and set them one third of their depth into the ground.

Copings: Select stones of reasonably uniform size and finish the top of the wall to a level line.

Retaining walls
Construction: If dry stone walls act as retaining walls, construct the stonework to be free draining through the wall. Secure the top course of the wall with cement mortar bedding. Backfill progressively, with a layer at least 300 mm thick of porous material, such as coarse aggregate or crushed rock in the size range 20 to 40 mm.

Minimum thickness: 300 mm.

Wall face batter: Batter back the wall face 50 to 70 mm for every 300 mm in height.

Rip-rap retaining walls

Construction: Construct as dry stone retaining walls with large random sized boulders recovered from excavations, to form gravity walls retaining, and supported by, embankments. Place boulders with large face down and stepped back from boulders below.

3.3 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.

3.4 CRIB WALLS

Construction

Requirement: Construct walls to the manufacturer's recommendations.

3.5 GABIONS

Assembly

Requirement: Assemble the baskets and join together by wiring along the horizontal and vertical edges before placing the rock fill. Fix the top of the basket by wiring to the sides and the diaphragms.

Filling

Requirement: Place rocks, by hand, at the front and other exposed faces to form a neat face free of bulges, depressions and voids.

3.6 REINFORCED EARTH WALLS

Construction

Requirement: Construct walls to the manufacturer's written recommendations.

3.7 EDGING

Log edges

Installation: Excavate to lay logs at least half diameter into the ground. Spike through logs with two 13 mm diameter galvanized mild steel rods per log, penetrating a minimum of 500 mm into the subgrade. Drive the rods flush with the upper surface of the log. Butt the logs together to a close neat fit. Select adjacent logs with similar diameter.

Sawn timber

Installation: Set edgings flush with adjoining surfaces. Drive pegs into the ground at 1200 mm centres on the planting side of the edging and on both sides of joints between boards, with peg tops 15 mm below top of edging. Fix the pegs with galvanized nails, two per fixing.

Curving: Space the pegs to hold edging to a uniform curve. Reduce edging thickness to 15 mm if required for bending.

Sleeper

Installation: Spike through sleepers with two 13 mm diameter galvanized mild steel rods per sleeper, penetrating a minimum of 500 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 face at 45 degrees to the edges.

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.

Steel

Fixing:

- Angle section: Fixed in place by the mass of surrounding soil works.

- Flats: Fix in place with 250 mm long x 10 mm galvanized steel spikes driven through 50 x 50 mm fixing plates. Weld holed plates at right angles to the face of the flat at 1000 mm centres on alternate sides set parallel and 25 mm below the top of the edging.

Aluminium

Flats: Place in a shallow trench. Fix in place with galvanized steel pegs at 2000 mm centres.

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.

Brick

Setting: On a 1:1:6 (cement:lime:sand) mortar haunch.

Laying: Lay edging bricks to the documented bond or coursing pattern.

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

Plastic

Flats: Place in a shallow trench. Fix in place with plastic pegs at 500 to 2000 mm centres.

0242B LANDSCAPE - FENCES AND BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide fences and barrier systems, as documented.

Performance
Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 SUBMISSIONS

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, Samples.

Shop drawings
Custom-built items: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.4 INSPECTION

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

- Boundary survey location.
- Set-out before construction.
- Foundation conditions after excavation.
- Completion of installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store components and accessories in unbroken manufacturer's packaging. Inspect upon delivery for the required quantity and quality.

2.2 TIMBER

Durability
Durability class to AS 5604 (2022) Section 6
Hazard class to AS/NZS 1604.1 (2021)

Posts and rails
Hardwood: To AS 2082 (2007).
Softwood: To AS 2858 (2023).

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.

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.

2.3 STEEL

Steel tubes

Posts, rails, stays and pickets: To AS/NZS 1163 (2016).

- Grade: C350L0.

Post and rail finish: Hot-dip galvanized.

Fencing wire

Chain link, cable wire, tie wire and barbed wire: To AS 2423 (2002).

2.4 CONCRETE

General

Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

2.5 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[a]	2700[a]
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[a] x 15	100 or 150[a] 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
a. Three rail fences only			

Gates

General: As documented.

Barriers for swimming pools

Design, construction and performance: To AS 1926.1 (2012).

Location of barriers for private swimming pools: To AS 1926.2 (2007).

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 the top with a 25 mm fall from the post to the footing edge.

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.

3.2 GATES

Hardware

General: 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

Requirement: Where required, provide hand holes to give access from outside to reach locking provision.

3.3 TIMBER FENCING

Radiata pine picket fencing

General: As documented.

Radiata pine paling fencing

General: As documented.

Hardwood paling fencing

General: As documented.

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 picket fencing
Requirement: As documented.

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
Requirement: As documented.

Protection: Make sure bottom rails have drain holes or clearance to posts and are at least 50 mm clear of the ground.

3.5 CHAIN LINK FABRIC FENCING

Security fencing and gates and Tennis court fencing - commercial
Tennis court fencing – private/residential
Requirement: As documented.

Standard: To AS 1725.3 (2010).

Gate frames: To AS 1725.3 (2010) Appendix D.

Bracing stays and backstays: To AS 1725.3 (2010) Appendix E.

Base plates: To AS 1725.1 (2010) Appendix F.

Cricket net enclosures and Sports ground fencing

3.6 WELDED MESH FENCING

Welded mesh fencing
Requirement: 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.

3.7 SWIMMING POOL BARRIERS

Pool barriers
Requirement: As documented.

Installation
Construction and performance: To AS 1926.1 (2012) and AS 1926.2 (2007).

Installation: Provide complete with accessories.

3.8 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.

3.9 COMPLETION

Cleaning

Requirement: Remove excess debris, metal swarf and unused materials. Clean all visible metal surfaces with soft clean cloth or brush and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

Powder coated aluminium architectural applications: Clean completed assembly to AS 3715 (2002) Appendix C.

Powder coated metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 (2005) Appendix D.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Warranties

Warranties: Provide manufacturer warranties

0250B LANDSCAPE - COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide landscaping, as documented.

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.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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.
- Investigative inspection: Any method of root inspection that involves the washing away of all or portions of the soil from the rootball to expose a section or all the roots.
- 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 that is suitable for surface application to turf and lawns.
- Topsoil: Includes landscape soil, low density soils and soils for turf and lawns.

1.4 SUBMISSIONS

Products and materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

2 PRODUCTS

2.1 GENERAL

Samples
Requirement: Provide 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.

2.2 TOPSOIL

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.

Imported topsoil
Requirement: Imported topsoil to AS 4419 (2018) Tables 1, 2 and 3, and as documented.

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_2O (1:5), pH in $CaCl_2$ (1:5) and Electrical Conductivity (EC) by Rayment & Higginson (1992) method 4A2, 4B2, 3A1.		

Nutrient	Unit	Sufficiency range
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.		

Site topsoil

Requirement: Site topsoil, as documented.

Soil blend: If required, stripped natural soil with sand and/or organic matter and recommended ameliorants.

2.3 GRASS

Turf

Description: Cultivated turf of even thickness, free from weeds and other foreign matter, as documented.

Supplier: A specialist grower of cultivated turf.

2.4 FERTILISER

General

Description: Proprietary fertilisers, delivered to the site in the manufacturer's labelled and unopened bags or containers, as documented.

Application rate: Vary the application rate to allow for the plant-available immediate fertiliser equivalence value of the soil conditioning compost.

Labelling

General: To the applicable statutory requirements, including manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Label type: To withstand transit without erasure or misplacement.

2.5 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.

Labelling

General: To the recommendations of the *National Plant Labelling Guidelines (2023)*.

Label type: To withstand transit without erasure or misplacement.

Label frequency: One for each plant.

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.

Defective samples: [complete/delete]

Rejection: Do not provide root bound stock.

2.6 IRRIGATION

General

Requirement: Provide automatically controlled, fixed irrigation systems, as documented.

Backflow prevention: To meet statutory requirements.

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.
- ≥ 4 on/off cycles per day.
- Day omit.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- Not less than 24 hour battery program backup.
- Power surge protection.
- Mounted in a lockable cabinet of minimum IP54 to AS 60529 (2004) in external locations.

Micro-irrigation systems

Tubing: Polyethylene micro-irrigation pipe.

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

Requirement: As documented.

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any registered formulae, at the recommended maximum application 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

Requirement: As documented.

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 that 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.

Cultivation

Requirement: As documented.

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.

3.5 TOPSOIL

Placing topsoil

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 that 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.

3.6 TURFING

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.

Application

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, 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: Lightly tamp to an even surface immediately after laying. Do not use a roller.

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 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.

Ripline planting: Prepare for planting as follows:

- Rip the row and excavate a plant hole for each plant large enough to accept the rootball plus 0.1 m^3 of backfilling with topsoil.
- Clear weeds and other vegetative material within 300 mm radius of the plants.
- If planting holes are excavated by mechanical means, increase the hole size by 100 mm and loosen compacted sides 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.

3.8 IRRIGATION

General

Requirement: As documented.

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: 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.

3.9 MULCHING

General

Requirement: As documented.

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.

Stabilisation:

- Leaf litter, pine flake and pine bark: Provide stabilisation on slopes greater than 1:3.
- River pebbles and gravels: Do not use on slopes greater than 1:6.

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.

3.10 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.

3.11 STAKES AND TIES

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 ≥ 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 ≥ 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.

Trunk protection

Collar guards: Provide proprietary collar guards or 200 mm length of 100 mm diameter agricultural pipe split lengthways.

3.12 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 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.

3.13 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.

0271B PAVEMENT BASE AND SUBBASE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide base and subbase courses as documented.

Performance

Surface level: Provide a finished surface level that is free draining and evenly graded between level points.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.

1.3 INTERPRETATION

Definitions

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

- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Subbase: Material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform. Usually designated as Dense graded base (DGS), NGS 40mm gravel, CRS, CCS or RCMS.

1.4 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.

1.5 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.

Tests

Compaction tests: Submit results of compaction testing to **TESTING**, **Site tests**.

1.6 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[a]	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash[b]	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Notes:		
a. For pavements using high percentages of crushed concrete, take into account the amount of available cement that will rehydrate when subjected to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking. b. 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%
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 m^2 for car parks.
- 3 tests per layer.
- 3 tests per visit.

0274B CONCRETE PAVEMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide concrete pavement, as documented.

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 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.

1.3 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).

1.4 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.
- Concrete class – normal: Concrete that is specified primarily by a standard compressive strength grade up to 50 MPa and otherwise in conformance with AS 1379 (2007) clause 1.5.3.
- Concrete class – special: Concrete that is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in conformance with AS 1379 (2007) clause 1.5.4.
- Sample: A portion of material taken for assessment, representative of the larger quantity of material from which it was taken.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.5 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.

1.6 SUBMISSIONS

Products and materials

Aggregates: Nominate the source for all aggregates.

Reinforcement: Submit the manufacturer's certificate of compliance with AS/NZS 4671 (2019), or submit test certificates.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), and the following:

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

Liquid curing compounds: Submit certified test results, including the application rate and the efficiency index to AS 3799 (1998) Appendix B.

Curing by covering: Submit details of the proposed covering material.

Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

Trial mix design report: Six weeks before commencing production, submit a report for each mix design containing the information required in AS 1012.2 (2014), the individual and combined aggregate particle size distribution, and the records and reports for the tests.

Tests

Requirement: Submit test results of the following:

- Concrete:
  - . Compressive strength.
  - . Drying shrinkage.
  - . Flexural strength.
  - . Slump.
- Luminance contrast of completed tactile ground surface indicator installations.
- Slip resistance of completed installations.

1.7 INSPECTION

Notice

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

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Concrete formwork, reinforcement and dowels in position.
- Commencement of concrete placement and compaction.
- Finishing and curing of concrete.
- Evaluation of surface finish.

2 PRODUCTS

2.1 REINFORCEMENT

Steel reinforcement

Standard: To AS/NZS 4671 (2019).

Surface condition: Provide surfaces conforming to the following:

- Free of loose or flaking mill scale and rust.
- Clean from 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 size with ends square and free from burrs.

Standard: To AS/NZS 3679.1 (2016).

Finish: Hot-dipped galvanized.

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 με after 21 days of air drying.

Special class concrete additional properties

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).

Manufactured pozzolans: To AS 3582.4 (2022).

2.5 WATER

General

Mixing water: To AS 1379 (2007) clause 2.4.

Requirement: Clean potable water, free from any material that 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 300 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.

Keyways: 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.

Cores, fixings and embedded items

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete providing minimum cover to reinforcement.

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.

Site mixed supply

Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in a plant located on the construction site.

3.6 TESTING

General

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

Standards

Sampling, identification, testing and recording: To the AS 1012 series.

Type and frequency: To AS 1379 (2007).

Concrete testing methods

Specimens: Sample the concrete on-site, at the point of discharge from the agitator.

Slump: To AS 1012.3.1 (2014).

Compressive strength: To AS 1012.8.1 (2014) and AS 1012.9 (2014).

Drying shrinkage: To AS 1012.8.4 (2015) and AS 1012.13 (2015).

Flexural strength: To AS 1012.8.2 (2014) and AS 1012.11 (2000).

Acceptance criterion for strength: The average strength of any set of 3 consecutive project samples must be equal to or greater than the specified minimum value.

Sampling frequency: Provide a minimum of one sample from each 50 m^3 of concrete.

Slip resistance tests

Slip resistance of completed installation: To AS 4663 (2013).

Tactile ground surface indicators

Luminance contrast of completed installation: To AS/NZS 1428.4.1 (2009) Appendix E.

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.

Fibre-reinforced concrete: For pumped concrete, use a 100 to 150 mm mesh screen on the pump hopper to catch fibre balls.

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

Logbook: Keep on site and make available for inspection a logbook 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: ≥ 5°C.
- Formwork and reinforcement before and during placing: ≥ 5°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 ≥ 5°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 formwork, materials, and equipment coming in contact with the concrete free of frost and ice.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Requirement: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Severe weather: If ambient shade temperature more than 38°C, do not mix concrete.

Temperature control: Select one or more of the following methods to make sure the temperature of the concrete mix does not exceed 35°C:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Forms and reinforcement before and during placing: ≤ 35°C.
- 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: ≤ 0.50 kg/m^2/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 strip formwork prematurely if damage to the concrete may be caused.

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, and 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 scratched finish: After screeding, use a stiff brush or rake drawn across the surface before final set to produce a coarse scored texture.

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.

Surface repairs

Method: If surface repairs are required, detail proposals.

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 continuous sprinkling that does not damage 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 has 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.

Joint layout: Install joints as documented.

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.

Dowelled joints and Tie bar joints

Construction joints

Installation: Place header board on the subbase or subgrade at right angles to the pavement centreline.

Planned location: Terminate each day's placing operation at a transverse construction joint located to coincide with a planned contraction or expansion joint.

Unplanned joints: If placement is interrupted for 30 minutes or longer, form a tied transverse construction joint within the middle third of the distance between planned joints but no closer than 1.5 m to the nearest planned joint. If necessary remove placed concrete back to the required location.

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.

Isolation joints and Formed joints

Sawn joints

Weakened plane joint: Saw the hardened concrete to depth at least 0.25 to 0.33 of the pavement thickness and to a uniform width in the range of 3 to 5 mm as follows:

- Timing: Commence sawing, regardless of time or weather conditions, as soon as the concrete has hardened sufficiently to permit cutting with only minor ravelling of the edges of the saw cut. Complete sawing no later than 24 hours after concrete placement.
- Sequence: If possible, saw every third transverse joint initially, then saw the intermediate joints. Start where concrete placement commenced.
- Cracking: If the concrete has already cracked near the location chosen for a joint, do not saw a joint in that location. If a crack develops ahead of the saw cut, discontinue sawing and submit proposals for extra sawn joints.
- Stand-by machines: Provide one stand-by sawing machine for each machine planned to be used.
- Cleaning and protection: Immediately after each joint is sawn, flush the saw cut and adjacent concrete surface using water, until the waste from sawing is removed from the joint.

Rebated groove joints: Saw straight, parallel-sided grooves for joint seals on top of and centred on the sawn weakened plane joints.

- Timing: Commence sawing after the curing period has ended, immediately before joint sealing. Saw during daylight hours.

Preparing joints

Stripping time: At least 12 hours.

Clean: Immediately before installation of the sealer, make sure the joint space is dry, clean and free from loose material. Remove laitance, curing compound and protrusions of hardened concrete from the sides and upper edges of the joint.

Joint sealing

Sealant type: Provide silicone sealant in conformance with the manufacturer's recommendations.

Backing rod: Compressible closed cell polyethylene foam with a bond breaking surface.

3.11 SURFACE SEALERS

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: Conform to the manufacturer's requirements and make sure surfaces are clean and free of dust and contaminants.

Installation

General: Install on a dry and flat surface. Conform to the manufacturer's recommendations.

3.13 COMPLETION

Material removal

Excavated material: Remove from site.

0276 PAVING - SAND BED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide paving, as documented.

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 DESIGN

Requirements

General: To DESIGN in *0171 General requirements*.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.
- *0224 Stormwater - site*.
- *0271 Pavement base and subbase*.

1.4 STANDARDS

General

Residential pavements: To AS 3727.1 (2016).

Slip resistance

Classification: To AS 4586 (2013).

1.5 INTERPRETATION

Abbreviations

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

- CBR: California Bearing Ratio.
- CMAA: Concrete Masonry Association of Australia.

Definitions

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

- Absolute level tolerance: Maximum deviation from design levels.
- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Concrete segmental pavers: Units of not more than 0.10 m^2 in gross plan area, manufactured from concrete, with top and bottom faces parallel, with or without chamfered edges and identified by the following shape types:
  - Shape Type A: Dentated chamfered units which key into each other on four sides, are capable of being laid in herringbone bond, and by plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.
  - Shape Type B: Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by plan geometry, when keyed together, resist the spread of joints parallel

to the longitudinal axes of the units and rely on dimensional accuracy and accuracy of laying to interlock on the other faces.

. Shape Type C: Units which do not key together rely on dimensional accuracy and accuracy of laying to develop interlock.

- Density ratio (soil): Percentage of the maximum density at optimum moisture content as determined by AS 1289.5.2.1 (2017).
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from concrete, clay, stone and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Soldier course: A course of whole or trimmed rectangular pavers at the pavement restraint edge.

1.6 TOLERANCES

Completed paving

Level tolerance:

- Absolute: ±8 mm.
- Relative: 8 mm.

Lippage: Less than 2 mm.

1.7 SUBMISSIONS

Authority approvals

Local authority: Submit authority approvals for paving products, laying patterns, alignment and drainage for footpaths or crossovers.

Execution details

Base material: Submit test results on quality, grading and compaction.

Margin: If it appears that minor variations to joint widths will minimise cutting, submit a proposal.

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 test: To AS 4586 (2013).
- Accelerated wear test: To AS 4586 (2013).

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.8 INSPECTION

Notice

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

- Completed base preparation.
- Trial set-out before execution to **INSTALLATION**, **Trial set-out**.
- Completed paving.

2 PRODUCTS

2.1 SAND

Bedding sand

Quality: Free of deleterious material, such as soluble salts that 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, free of deleterious material such as soluble salts that 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 BEDDING MORTAR

General

Cement: To AS 3972 (2010).

Water: Clean and free from any deleterious matter.

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

2.3 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.

2.4 CONCRETE AND CLAY PAVERS

General

Standard: To AS/NZS 4455.2 (2010).

Permeable interlocking concrete segmental pavers: To CMAA PE01 (2010).

Properties

Requirements: To AS/NZS 4455.2 (2010) Table 2.8.

2.5 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

2.6 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 to *0224 Stormwater - site*.

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 form.

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: Set on a 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 that will allow paver system compaction to be achieved.

3.5 INSTALLATION

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.

Trial set-out

Requirement: 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.

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 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.

4 SELECTIONS

Refer to architectural drawings and schedules for details, locations and extents.

0277 PAVEMENT ANCILLARIES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide pavement ancillaries, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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.

1.4 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.

Raised pavement markers

Plan position deviation: 20 mm.

Directional displacement: ±4°.

Vehicle barriers

Plan position deviation: 50 mm.

Length: ±20 mm.

Bollard plumb: H/100.

1.5 SUBMISSIONS

Products and materials

Linemarking material properties: Submit test reports to the AS 4049 series, at least seven days before work is scheduled to start, including paint and glass beads.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 INSPECTION

Notice

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

- Set-out of pavement ancillaries.

- Trial sections:
  . Channels and kerbs.
  . Linemarking.

2 PRODUCTS

2.1 KERB AND CHANNEL (GUTTER)

Concrete
Requirement: As documented.
Precast: Proprietary precast units as documented.
In situ: To AS 1379 (2007).

Stone
Requirement: As documented.
Kerb: To EN 1343 (2012).
Natural stone: Stone of uniform quality, sound and free from defects liable to affect its strength, appearance or durability.

2.2 LINEMARKING

General
Requirement: As documented.

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).

Glass beads
Standard: To AS/NZS 2009 (2006).
Bead type: B.

2.3 RAISED PAVEMENT MARKERS

General
Requirement: As documented.
Standard: To AS/NZS 1906.3 (2017).

2.4 VEHICLE BARRIERS

Timber log barriers and timber bollards
Hardwood: To AS 2082 (2007).
Softwood: To AS 2858 (2023) and AS 1720.2 (2006).
Timber preservative for softwood: Minimum hazard class H4 to AS/NZS 1604.1 (2021).

Precast concrete wheel stops
Material: Precast concrete units with pre-drilled holes located 300 mm from each end for fixing to ground surface.

Plastic/rubber wheel stops
Material: Proprietary plastic or rubber wheel stops with black and yellow chevron markings.

Steel tube bollards
Type: Bollards fabricated from heavy steel tube, to AS 1074 (1989).
Minimum nominal size: DN 100.

2.5 OTHER MATERIALS

Mortar materials
Cement: To AS 3972 (2010).
Sand: Fine aggregate free from deleterious matter.
Water: Clean and free from any deleterious matter.

Tactile ground surface indicators
Requirement: As documented.
Standard: To AS/NZS 1428.4.1 (2009).

3 EXECUTION

3.1 KERB AND CHANNEL (GUTTER)

General
Precast concrete: Install to manufacturer's recommendations.
In situ concrete: Construct kerbs and/or channels in fixed forms, by extrusion or by slip forming.
Stone: Lay butt jointed.

Preparation
Subgrade or subbase material: Compact to form a firm base extending at least 150 mm beyond the proposed alignment of the back of the kerb. Match the adjoining pavement subgrade/subbase compaction or compact to 95% standard maximum dry density to AS 1289.5.1.1 (2017), as appropriate.
Concrete base: Provide a concrete base and mortar bed for stone and kerb channels above the compacted subgrade or subbase, as documented.

Setting out
General: Set out the work so that all channels and kerbs are placed with tolerances, as documented.

Joints
Joint type and location: As documented.
Contraction joint: Provide as follows:

- Extruded kerb: Cut a minimum of 50% of the cross-sectional area. Do not distort the kerb or adjacent surfaces. Tool the top of the joint to create a groove minimum 20 mm deep and 5 mm wide.
- Formed kerb: Form joint at the documented locations.

Construction joint in concrete kerb and channel: Roughen the surface of the set concrete at the location of the joint. 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 joint: Form joint, as documented.
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 that 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.

Setting out

General: Set out the work so that all linemarkings are placed within tolerances, as documented.

Application of linemarking

Longitudinal lines: Spray all longitudinal lines with a self-propelled machine. For a one-way or two-way barrier line pattern, concurrently spray the two sets of lines.

Hand spraying: Hand spray transverse lines, symbols, letters, arrows and chevrons using templates.

Paint thickness: Uniform wet film thickness: 0.35 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.

Glass bead application

Glass beads: Apply glass beads immediately after the application of the paint, at the following minimum rates:

- Longitudinal lines: 0.5 kg/m^2.
- Other markings: 0.3 kg/m^2.

3.3 RAISED PAVEMENT MARKERS

Preparation

Surface: For concrete wearing surfaces, scabble the full area below each marker to remove the fine mortar material.

Adhesive preparation: Freshly heat and mix the adhesive to the manufacturer's recommendations. Do not allow the adhesive to cool and do not reheat before use.

Setting out

General: Set out the work so that all raised pavement markers are placed within tolerances, as documented.

Installation to regular surfaces

Application of adhesive: Spread the adhesive uniformly over the underside of the raised pavement marker to a depth of approximately 10 mm.

Adhesion of marker to pavement: Conform to the following:

- Press the raised pavement marker onto the pavement surface in its correct position and rotate slightly until the adhesive is squeezed out around all edges of the marker.
- Do not disturb the raised pavement marker until the adhesive has set.

Installation to rough surfaces

Adhesion of marker: Conform to the following:

- Apply an initial pad of adhesive of diameter 20 mm larger than the diameter of the base of the raised pavement marker.
- Apply the adhesive to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper level.
- Allow the adhesive pad to set.
- Apply adhesive to the raised pavement marker and adhere to the adhesive pad on the pavement surface, in conformance with **Installation to regular surfaces**.

3.4 VEHICLE BARRIERS

General

Requirement: As documented.

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.

Timber bollards

Installation: Encase buried end of bollard in concrete footing, minimum 600 mm deep x 300 mm diameter. Finish top of footing minimum 100 mm below finished surface level.

3.5 TACTILE GROUND SURFACE INDICATORS

Preparation

Requirement: Conform to the manufacturer's recommendations and make sure surfaces are clean and free of dust and contaminants.

Installation

General: Install on a dry and flat surface. Conform to the manufacturer's recommendations.

3.6 COMPLETION

Cleaning

Completion: Clean progressively and leave adjoining surfaces, pavements and ancillaries clean on completion.

0315 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide finishes to formed and unformed concrete surfaces, as documented.

Performance
Requirement: Compatible with documented applied finishes.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General
Formed surfaces: To AS 3610.1 (2018).

Slip resistance
Classification: To AS 4586 (2013).

1.4 INTERPRETATION

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

- Green concrete: Concrete that has recently set but has not achieved any design strength.

1.5 TOLERANCES

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
Surface repairs: If surface repairs are required, submit proposed methods.

Tests
Site tests: Submit test results of the following:

- Slip resistance test of completed installations.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.7 INSPECTION

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

- Completed formwork with all dust and debris removed from forms.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

2 PRODUCTS

2.1 MATERIALS

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 SURFACE MODIFIERS

General

Application: Apply to clean surfaces, to the manufacturer’s recommendations.

3.2 FORMED SURFACES

General

Surface finish: To AS 3610.1 (2018) Table 3.3.3.1 and as documented.

Damage: Do not strip formwork prematurely if damage to the concrete may be caused.

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, and within an hour of exposure.

Evaluation of formed surfaces

General: If evaluation of a 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.

Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: While the concrete is green, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Floated finishes:

- Sand floated finish: 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 is 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 is 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 is produced.

3.3 UNFORMED SURFACES

General

Surface finish: As documented.

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.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratched 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.

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 a proprietary finishing system.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

3.4 TESTING

Slip resistance tests

Slip resistance of completed installation: To AS 4663 (2013).

0331B BRICK AND BLOCK CONSTRUCTION

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide brick and block construction, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

General
Materials and construction: To AS 3700 (2018).

1.4 TOLERANCES

General
Requirement: To AS 3700 (2018) clause 12.5 and Table 12.1.

1.5 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.
- Bottoms of core holes, before grouting.
- Reinforcement type and diameter.
- Positioning of reinforcement before grouting.
- Control joints, ready for insertion of joint filler.
- Damp-proof courses, in position.
- Flashings, in position.
- 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

Exposure locations: To AS 3700 (2018) clause 5.4.

2.3 MATERIALS

Masonry units
Selections: As documented.
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.

Mortar materials

Mortar class: To AS 3700 (2018) Table 5.1.

Cement: To AS 3972 (2010).

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/m^3.

Characteristic compressive strength: Minimum 12 MPa.

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).

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.

Storage and handling
Masonry units: Store above the surface of the ground and cover to prevent entry of rainwater and contaminants. Locate away from surface and ground water runoff.

Mortar materials: Protect from contamination and as follows:

- Sand: Store away from surface and ground water runoff and allow for free drainage of rainwater.
- Cement and lime: Store bags in a dry, under cover and above ground environment.

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 at 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.

Joining to existing
General: Provide a control joint where joining to existing structures. Do not tooth new masonry into existing work unless approved by a professional engineer.

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 perpends solid. Cut mortar flush.

Hollow units: Face-shell bedded. Fill perpends 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: 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.

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.

Underpinning
Requirement: Install underpinning, without causing damage to the building.

Grouting: Pack dry mix M4 mortar between the top of the underpinning and the underside of the existing structure at the completion of each panel of underpinning.

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: Minimum 40 mm for cavity masonry walls and masonry veneer walls, in conformance with AS 3700 (2018) clause 4.7.1.

Openings
Jambs 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 perpends.

Maximum spacing: 1200 mm.

Weephole guards: Provide insect barrier.

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.
- Within 300 mm from the line of horizontal or vertical lateral supports, control joints or the perimeter of 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 or side face of timber frames with fasteners to AS 3566.1 (2002).
- To concrete: Masonry anchors.
- To steel frames: Screw fix to outer or side 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 that 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 that 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 BED JOINT REINFORCEMENT

Location

Stack bonded masonry: Conform to AS 3700 (2018) clause 4.12 and the following:

- Spaced vertically at centres not exceeding six times the thickness of the stack bonded leaf.
- In the first bed joint above or below an unrestrained horizontal edge of the masonry.
- One bed joint minimum, within 300 mm above or below a horizontal line of lateral support.

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 that 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.

Locations and details: As documented.

3.14 ARCHES

Arch voussoirs

General: Cut units using a masonry saw.

Shapes and dimensions

General: Form arches using solid or cored masonry units.

3.15 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.

Textured bagging

Application: Apply laying mortar to the surface using a sponge float. Flush up irregularities, but leave approximately 2 mm of mortar on the surface. When initial set is reached, texture using a hand bristle brush.

0344B STEEL - HOT-DIP GALVANIZED COATINGS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide hot-dip galvanized coatings, as documented.

Performance

Requirement: Control atmospheric corrosion to structural steelwork and steel products until the first scheduled maintenance.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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).

1.4 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.

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 µm.
- Abrasive grade (range): 150 to 180 µm.
- Abrasive type: Clean ilmenite or garnet.
- Blasting angle to surface: 45° maximum.
- Blast pressure (maximum): 275 kPa.
- Distance of nozzle from surface (range): 350 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.

0382 LIGHT TIMBER FRAMING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide light timber floor, wall and roof framing, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0181 Adhesives, sealants and fasteners*.
- *0185 Timber products, finishes and treatment*.

1.3 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).

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection, the definitions given in the AS 1684 series apply.

1.5 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[a] in 2 m	3 mm
Features[b]: Verticality in 2 m	1:1000
Features[b]: Horizontality in 2 m	1:1000
a. Flatness: Measured under a straightedge laid in any direction on a surface. b. Features: Conspicuous horizontal or vertical lines including external corners, parapets, reveals, heads, sills.	

1.6 SUBMISSIONS

Certification

Requirement: Submit certification by an appropriately qualified person of the design, documentation and erected work to the AS 1684 series and/or by a professional engineer to AS 1720.1 (2010). Include the following:

- Reactions: Provide location and magnitude of reactions to be accommodated by the support structure. If part of the structure is manufactured by a prefabricator (e.g. roof trusses), provide location and magnitude of reactions and tie down forces.
- 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 to AS/NZS 1080.1 (2012).

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, showing 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 and lifting.
- Location and details of tie 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 and lifting.
- Location and details of tie down and bracing.

Subcontractors

Prefabricated items: Submit the name and contact details of proposed manufacturers, suppliers and installers.

1.7 INSPECTION

Notice

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

- Prefabricated units before installation.
- Fabricated items before priming or water-repellent treatment.
- Bolts after final tightening.
- Timber work after erection but before it is covered.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Handling: Do not distort or damage timber or timber products. Do not mark or stain the surface of architecturally expressed structural elements. Use identified loading and lifting points.

Storage: To manufacturer's specifications and the following:

- Maintain integrity of structural timber and treatments.
- Store architecturally expressed structural elements and elements for internal use under cover.

Moisture content of seasoned timber: Provide protection throughout handling and storage to maintain a moisture content within the targets for seasoned timber (15% maximum) and ideally near the equilibrium moisture content anticipated in service.

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 that 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 label each truss to show:

- Manufacturer.
- Tag or number with reference to location.
- Support and tie down points.
- Labelling in coordination with installation documentation.

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).

Softwood: To AS 4785.1 (2002).

Trusses

Design: To AS 1720.1 (2010).

Nailplated roof trusses: To AS 1720.5 (2015).

Overhangs: Free from spring or splits.

Glued laminated timber

Standard: To AS/NZS 1328.1 (1998).

2.3 STRUCTURAL PLYWOOD

General

Standard: To AS/NZS 2269.0 (2012).

Bond: Type A to AS/NZS 2754.1 (2016).

Veneer

Veneer quality to visible surfaces: CD (minimum) to AS/NZS 2269.0 (2012).

2.4 COMPONENTS

Nailplated joined beams

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 and to the manufacturer's recommendations.

Location: To timber posts supported off concrete slabs or footings.

Finish: Galvanized.

Fasteners

Requirement: Conform to *0181 Adhesives, sealants and fasteners.*

CCA treated timber: If in contact with CCA treated timber, provide hot-dip galvanized bolts with plastic sheaths, or bituminous or epoxy coatings to manufacturer's recommendations.

Damp-proof course

Material: To AS/NZS 2904 (1995) or suitable alternative material conforming to NCC (2022) A5G3.

Flashings

Material: To AS/NZS 2904 (1995) or suitable alternative material conforming to NCC (2022) A5G3.

2.5 FINGER JOINTED STRUCTURAL TIMBER

General

Performance: To AS/NZS 8008 (2022).

Adhesive bond performance: To AS/NZS 8008 (2022).

Production: To AS 5068 (2006).

Material requirements: As documented.

2.6 RECONSTITUTED WOOD PRODUCTS

Wet process fibreboard (including hardboard)

Standard: To AS/NZS 1859.4 (2018).

Bending strength: To AS/NZS 1859.4 (2018) Section 7.

Material requirements: As documented.

3 EXECUTION

3.1 GENERAL

Installation

Framing: To the AS 1684 series.

Fastener installation: To *0181 Adhesives, sealants and fasteners*. Do not split or otherwise damage the timber.

3.2 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 that 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.

Trimmers or blocking dimensions:

- Depth: Joist depth less 25 mm.
- Minimum thickness: 25 mm.

Engineered timber joists: Provide lateral restraint to the manufacturer’s recommendations.

3.3 WALL FRAMING

Bracing

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.

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.

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.

3.4 ROOF AND CEILING FRAMING

Wall plates

Fixing: Fix timber wall plates to masonry, with straps, bolts or both.

Fixing plates

Requirement: Provide timber fixing plates to transfer the design loads where timber joists, rafters or purlins bear on or into steel members, as documented. 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 that allow for the design vertical movements.

3.5 ROOF TRIM

Fascia, valley and barge boards

Requirement: Fix fascia, valley gutter boards and barge boards.

3.6 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 roof trusses and top of any non-supporting internal wall is clear.

0383 DECKING, SHEET AND PANEL FLOORING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide decking, sheet and panel flooring, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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).

1.4 INTERPRETATION

Definitions

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

- Butt joints (flooring): Floor units cross cut square with plain ends for joining over battens or joists.
- 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 that is supported by, and spans across joists or battens.
- Flooring - sprung: A subfloor structure engineered to absorb shocks, usually fixed on resilient pads, typically finished with a decorative flooring material.
- 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.

1.5 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.

1.6 SUBMISSIONS

Certification

Requirement: Submit one of the following, as evidence of conformity to documented requirements for grading, species and board size:

- 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**.

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials
Type tests: Submit results, as follows:

- Slip resistance of decking.

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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

Warranties
Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.7 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

Samples
Requirement: Provide samples of each timber or synthetic decking type, showing the range of variation in colour and figure.

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): As documented.
- Hardwood to AS 2796.1 (1999) Section 4.
  - Grade to AS 2796.2 (2006): As documented.

Durability:

- Natural durability classification to AS 5604 (2022): 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.

Composite decking

General: Proprietary composite decking boards, as documented.

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 E_1.

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 that 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: A.

2.5 SPRUNG FLOORS

General

System: Proprietary system of plywood on an interwoven batten frame or other resilient frame.

Components

Framing and sheeting: To the manufacturer’s recommendations.

Flooring: As documented.

Moisture protection: To the manufacturer’s recommendations.

Resilient pads: Closed cell pads.

Skirting: Vermin proof.

Accessories

Ramped threshold gradients: 1 in 8 maximum.

Floor fittings: As documented.

2.6 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.

2.7 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

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 FIXING SPRUNG FLOORS

General

Method: To the manufacturer's recommendations.

Control and expansion joints: To the manufacturer's recommendations.

3.5 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.

3.6 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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes details for the care and maintenance of the decking, sheet and panel flooring, including manufacturer's published instructions.

0411B WATERPROOFING - EXTERNAL AND TANKING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide external waterproofing and tanking systems to substrates, as documented.

Performance

Requirements:

- 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 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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).

Slip resistance

Classification: To AS 4586 (2013).

1.4 INTERPRETATION

Abbreviations

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

- APP: Atactic polypropylene.
- SBS: Styrene butadiene styrene.

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 disulfide, 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 that cures to form an elastomeric membrane.
- Polyurethane: Water or solvent-based formulations that 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 that form waterproof barriers and that may be:
  . Loose-laid.
  . Bonded to substrates.

1.5 SUBMISSIONS

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Records
General: Submit photographic records to EXECUTION, **GENERAL**, **Reporting**.

Flood tests: Submit photographic records to **TESTING**, **Flood tests**.

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

Substrate acceptance: Submit evidence of installer’s acceptance of the flooring substrate before starting installation.

Tests
Site tests: Submit test results of the following:
- Substrate moisture content to **TESTING**, **Substrate moisture tests**.
- Flood test, including results of retesting after rectification, to **TESTING**, **Flood tests**.
- Slip resistance of completed installation to **TESTING**, **Slip resistance tests**.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.6 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Substrates prepared and ready for installation of the waterproofing and tanking systems.
- Secondary layers prepared and ready for subsequent layers.
- Membranes after installation and before concealment.
- Underflashings after installation and before installation of overflashings.
- After flood testing, if applicable.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Store and handle to the manufacturer's recommendations and as follows:
- Protect materials from damage.

2.2 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.

2.3 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.

3 EXECUTION

3.1 GENERAL

Reporting
General: Make progressive photographic records of the waterproofing installation. Label photographs with the date, location and weather.

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 m^2 and compare to the manufacturer's requirements.
- On completion of every 100 m^2 of each coat, compare the amount of membrane used with the manufacturer's application rate and record the result.

3.2 PREPARATION

Substrates
General: Prepare substrates as follows:

- Clean and remove any deposit or finish that 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.

3.3 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, as follows:

- 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 the 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 around skylights and hatches

Requirement: Install membranes to upstands before the installation of the skylight or hatch.

Upturn height above roof surface: To AS 4654.2 (2012) Table A1.

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 recommendations.

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.

3.4 TESTING

Substrate moisture tests

Moisture content of concrete substrate: Test substrate in-slab relative humidity to ASTM F2170 (2019). Perform three tests for the first 100 m^2 of subfloor area and an additional test for each additional 100 m^2.

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 tests

Requirement: 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.

Records:

- Make photographic records of the flooded areas and adjacent areas.
- Label photographs with the date and location.

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.

Slip resistance tests

Slip resistance of completed installation: To AS 4663 (2013).

3.5 COMPLETION

Reinstatement

Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer's maintenance recommendations, including the following:

- Preventative maintenance procedures.
- Instructions and procedures for the repair of the membrane.

0421 ROOFING - COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide a roofing system and associated work, as documented.

Performance

Thermal qualities: Provide glazing with U-Value and Solar heat gain coefficient (SHGC), as documented.

Ambient climatic conditions

Corrosion resistance

Material: To the manufacturer's recommendations for distance from marine influence.

Roof access

Requirement: To *0193 Building access safety systems*.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0461 Glazing*.

1.3 INTERPRETATION

Abbreviations

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

- EPS: Expanded polystyrene.
- EPS-FR: Expanded polystyrene with fire retardant.
- MRF: Mineral fibre.
- PF: Phenolic foam.
- PIR: Rigid polyisocyanurate.
- PUR: Rigid polyurethane.
- XPS: Extruded polystyrene.

Definitions

General: For the purposes of this worksection, the definitions given in AS 1562.1 (2018), AS 2049 (2002), AS 2050 (2018) and AS 4597 (1999), and the following apply.

- Roof shake: A non-interlocking product made from split or sawn timber used to form the field of the roof.

1.4 TOLERANCES

Sheet metal roofing

Supporting members: To AS 1562.1 (2018) clause 4.2.3.

Shingles, shakes and slate roofing

Battens: To AS 4597 (1999) clause 3.2.

Tile roofing

Roof tiles: Dimensional tolerance to AS 2049 (2002) clause 5.2.

Battens: To AS 2050 (2018) clause 3.2.

Insulated panel roofing

Requirement: To manufacturer's recommendations.

Structural steelwork for insulated panel roofing system: ±5 mm between bearing planes of adjacent supports.

Supporting members: To AS 1562.1 (2018) clause 4.2.3.

1.5 SUBMISSIONS

Certification

Design of glazed roofing: Submit an engineer's certificate confirming conformance to AS 1288 (2021).

Execution details

Site glazing: If site glazing is intended, submit proposals.

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: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS 2208 (2023) Appendix A.

Thermal insulation performance: Submit evidence of performance to AS/NZS 4859.1 (2018) and AS/NZS 4859.2 (2018).

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 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.
- Shingle, shake and slate roofing: Dynamic weather resistance test to AS 4597 (1999) Appendix C.
- Tile roofing: Dynamic weather resistance test to AS 4046.9 (2002).

Subcontractors

Installer experience: Submit evidence of experience with non-ferrous, shingle and shake, slate, insulated panel or glazed roofing installation.

Site glazing: Submit evidence of glazier's acceptance of the supporting structure and framing before starting the installation.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 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

Samples

Requirement: Provide samples of the following, showing the range of variation available:

- Trim and accessories with a colour finish.
- Custom profiled flashings and cappings.
- Tile roofing:
  - . Bedding and pointing mortar.
  - . Tiles.

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, slate, shingles and shakes roofing: Store clear of the ground, protected from damage.
- Insulated panel roofing materials: Store off the ground, in sealed unopened packaging on a slightly sloped surface to prevent ponding on panel faces.
- Glazed roofing materials: Protect from building materials and loose debris such as wet plaster, mortar, paint and welding splatter.

Handling: Handle metal roofing material 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

Insulated panel system and glazed roofing: Tested to AS 1530.1 (1994).

Fire hazard properties

Insulated panels: Group number to AS 5637.1 (2015).

Insulation materials: 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.

Plastics glazing: 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 SEAMED SHEET METAL ROOFING

General
Description: Sheet metal roll formed into pan profiles, laid with seamed joints on flush finished, continuous plywood sheeting over an underlayer and separation layer.

Plywood sheeting
Standard: To AS/NZS 2269.0 (2012):

- Surface grade: DD.

Plywood formaldehyde emission class to AS/NZS 2269.0 (2012): E_1.

Bond: Type A to AS/NZS 2754.1 (2016).

Thickness: 19 mm.

Identification: Sheets labelled under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment.*

Underlayer
Description: Self-adhesive, rubberised asphalt/polyethylene waterproofing membrane.

Separation layer
Description: Fire-resisting mat of a nylon core of fused entangled filaments.

Fasteners
Requirement: Starter clips, fixing clips and fastenings to the roofing system supplier's recommendations.

Components
Solder (tin/lead): 40/60 soft solder.

Flux: Z-04-S.

Sealant: 100% neutral cure non-acid based silicone rubber to match roofing.

2.5 TIMBER SHINGLE AND SHAKE ROOFING

Material
Description: Canadian western red cedar No. 1 Grade, taper sawn to form shingles and taper sawn or hand split and resawn, to form shakes of set length and thickness and random width.

Timber capping: Factory manufactured hip and ridge capping to match shingles or shakes.

Battens
Standard: To AS 4597 (1999).

Plywood sheeting
Standard: To AS/NZS 2269.0 (2012):

- Surface grade: DD.

Plywood formaldehyde emission class to AS/NZS 2269.0 (2012): E_1.

Bond: Type A to AS/NZS 2754.1 (2016).

Thickness: 19 mm.

Identification: Sheets labelled under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment.*

Finish
Shingles: Sawn both sides.

Shakes: Taper sawn or split and resawn.

Fasteners
Standard: To AS 4597 (1999) clause 2.4.

Stainless steel fasteners: To ASTM A240/A240M (2023).

2.6 SLATE ROOFING

Natural slate
Description: Natural slate, free from pyrites and other metallic intrusions.

Battens
Standard: To AS 4597 (1999).

Fasteners
Standard: To AS 4597 (1999) clause 2.4.

2.7 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.

Battens
Standard: To AS 2050 (2018).

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.

2.8 INSULATED PANEL SYSTEMS

General
Description: Proprietary panels comprising prefinished metal skin factory-bonded to both faces of an insulating core, as documented.

Panel joints and control joints: Integral.

Standards
Design, installation and materials: To AS 1562.1 (2018).

Insulation core
Standard: To AS/NZS 4859.1 (2018):

- Rigid cellular foam insulation (EPS, PF, PIR, PUR and XPS): To AS/NZS 4859.1 (2018) Section 8.

Insulation blowing agents
Restricted agents: Conform to PRODUCTS AND MATERIALS, **GENERAL**, **Prohibited materials** in *0171 General requirements*.

Internal and external skins
Factory pre-coating: Polyester to a dry film thickness of 25 µm.

Profile: Internal and external panel profiles as documented.

System accessories
Requirement: Proprietary insulated roofing system accessories colour matched to panels, as documented.

Fasteners
Requirement: To manufacturer’s recommendations.

Sealants
Materials: Non-staining and to the manufacturer’s recommendations.

2.9 GLAZED ROOFING

General
Description: Sloped overhead glazing fixed to glazing bars or directly to the roof framing with the necessary supports, trim, flashings and sealants.

Glass roofing: To AS 1288 (2021) Section 6.

Plastic sheet roofing: To AS 1562.3 (2006).

Glass and glazing materials
Requirement: To *0461 Glazing*.

Identification
Safety glazing materials: Identify each piece or panel, to AS 1288 (2021).

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, colourfastness grade B.

2.10 ROOF PLUMBING

General

Description: Flashings, cappings, gutters, rainheads, outlets, external downpipes and accessories necessary to complete the roofing system.

Flashing and capping: Notched to match profile of roofing.

Matching fascia/barge 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.

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).

2.11 SKYLIGHTS

General

Standard: To AS 4285 (2019).

Description: A proprietary skylight system for installation in roofs pitched less than 15°, including framing, fixing, trim, seals, accessories and flashings.

2.12 ROOF HATCHES

General

Description: A proprietary roof hatch system, including framing, fixing, trim, seals, accessories and flashings.

2.13 ROOF WINDOWS

General

Standard: To AS 4285 (2019).

Description: A proprietary window system designed for non-vertical installation in roofs pitched greater than 15° and less than 90°, consisting of the following:

- Timber frame and sash, shop clear primed or prefinished.
- External anodised aluminium protective profiles.
- Sealed double glazing.
- Horizontally pivoted sash, 180° reversible, on patent friction hinges.
- Opening and locking by patent control bar.
- Ventilation flap.

2.14 ROOF VENTILATORS

General

Description: A proprietary roof ventilator system including framing, fixing, trim, seals, accessories and flashings.

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.

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.

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 SEAMED SHEET METAL ROOFING

Plywood sheeting

Installation: Lay the length of the sheets at right angles to the supports.

End joints: Stagger the end joints and locate centrally over framing members.

Edge support: If panels are not tongue and grooved, provide noggings or trimmer joists to support the edges.

Fixing: 300 mm centres to each support:

- Timber: Screw or adhesive and nail.
- Steel: Metallic-coated, self-drilling/tapping screws with the heads finishing below the surface.

Control joints: 12 mm gap at abutting building elements.

Fabrication

Requirement: Factory fabricate roofing trays.

Minimum bending radius: 1.75 mm.

Fixing

Method: Fix pans to the plywood sheeting with concealed clips screw fixed at 250 mm maximum centres.

Seams

Roof pitch 3° to 25°: Double standing seam.

Roof pitch > 25°: Roll cap seam.

Method: Mechanically form and welt seal in situ using a self-propelled seaming machine, to stand 25 mm high on completion. Dress seams flat at gutters, ridges and hips, and fold both pan and seam down into gutters and up to form stop ends at ridges and hips.

Ridge and hip capping

Installation: Lock welt to the upturn of the roofing.

End laps

General: To the roofing manufacturer's recommendations.

3.5 TIMBER SHINGLE AND SHAKES ROOFING

Installation

Standard: To AS 4597 (1999).

Minimum roof pitch: 17.5°.

Shingles:

- Starter course: Double or triple layer at gutter edge of roof.
- Joints: 6 to 10 mm spacing between edges.

Shakes:

- Starter course: Single or double layer at gutter edge of roof.
- Joints: 10 to 16 mm spacing between edges.

Fasteners: Place nails minimum 19 mm from side edges and 40 mm above the butt line of the following course.

- Minimum penetration into battens or plywood sheeting: 15 mm.

3.6 SLATE ROOFING

Installation

Standard: To AS 4597 (1999).

Slates:

- Minimum roof pitch: 17.5°.

Fasteners: Place nails minimum 25 mm from long edges.

- Minimum penetration into battens: 15 mm.

3.7 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.

3.8 INSULATED PANEL SYSTEMS

General

Fixing method: To the manufacturer's recommendations.

Installation: Install panels as follows:

- Minimum falls: To the manufacturer's recommendations.
- Plumb, level, straight and true within acceptable building tolerances.
- Fixed or anchored to the building structure in conformity with the wind action loading recommendations.
- Isolated from any building loads, including loads caused by structural deflection or shortening.
- Allowing for thermal movement.

Site cut panels:

- Provide accurate, true lines with no distortion.
- Cut with a suitable metal cutting circular type saw and treat exposed edges with a proprietary edge protection lacquer.
- Cut openings to the minimum size necessary.

Penetrations larger than 300 x 300 mm: Provide additional structural support.

Swarf: Remove swarf and any foreign matter immediately from the external surface of panels.

Protection: Protect surfaces and finishes, including the retention of protective coatings during installation.

Horizontal flashing and capping surfaces:

- Minimum slope: 1:15.
- Staining: Slope away from visible vertical facade areas to prevent staining.

Defective components: Do not install components that are defective, including warped, bowed, dented, abraded or broken members.

Damaged parts: Remove and replace damaged members during installation.

Joints

Requirement: Rigidly secure joints other than movement and open joints. Reinforce as required and fix with hairline abutments or as documented.

Panel to panel end joints: If roof lengths exceed maximum manufactured panel lengths, join panels using the manufacturer's recommended details.

Control joints: Locate to coincide with structural movement joints, as documented.

Subcontractors

General: Use panel manufacturer approved installers for installation and commissioning.

Accessories and trim

Requirement: Provide accessories and trim necessary to complete the installation, or as documented.

Ridges and eaves

Sheet ends: Treat as follows:

- Project panel ends with a 75 mm cut back at the eaves.
- Close off ridges with purpose-made ridge fillers of closed cell polyethylene foam.

Ridges and barge

Capping: Finish off along ridge and verge lines with purpose-made ridge capping or barge rolls.

Profiled fillers

Sealing: Seal the top, bottom and sides of each profile filler with a single line of non-setting gun-grade sealant.

Fixing: Provide a tight fit, without gaps.

Fasteners

Requirement: To manufacturer's recommendations.

3.9 GLAZED ROOFING

Glass roofing

Standard: To AS 1288 (2021) Section 6.

Plastic sheet roofing

Standard: To AS 1562.3 (2006).

Fixing to timber: 30 mm minimum penetration.

3.10 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 for every two lengths of flashing, at a maximum of 12 m centres.

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 flashing over the roofing to the ridge to prevent ponding behind the penetrating element.

Wall abutments: If a roof abuts a wall, provide overflashing 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.

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.

3.11 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 oxidisation.

Roof plumbing: Clean out spoutings, gutters and rainwater pipes after completion of roof installation.

Glazed roofing: Clean all glazing and framing with soft clean cloths and clean water, finishing with a clean squeegee. Do not use abrasive or alkaline materials.

Protection: After completion, remove protective coatings using methods to the manufacturer's recommendations.

Insulated panels: Clean surfaces to the manufacturer's recommendations.

Spares

Number:

- Tiles: Provide one spare matching tile for every hundred on the roof. Provide spare accessories in the same ratio.
- Slates, shingles or shakes: Provide one spare matching slate, shingle or shake 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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes 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.

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 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

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

- AAC: Autoclaved aerated concrete.
- ACP: Aluminium composite panel.
- CCA: Copper chrome arsenate.
- CFC: Compressed fibre cement.
- EIFS: Exterior insulation and finish system.
- EPS: Expanded polystyrene.
- EPS-FR: Expanded polystyrene-fire retardant.
- FC: Fibre cement.
- GRP: Glass fibre reinforced polyester.
- LOSP: Light organic solvent preservative.
- MRF: Mineral fibre.
- PF: Phenolic foam.
- PIR: Rigid polyisocyanurate foam.
- PUR: Rigid polyurethane foam.
- XPS: Extruded polystyrene.

1.4 TOLERANCES

Permitted deviations
Flat sheet and panel cladding: To the manufacturer's recommendations.

Insulated panel systems: To the manufacturer's recommendations.

Plank and weatherboard 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.

1.5 SUBMISSIONS

Fire performance
Combustibility: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Error! Reference source not found.**.

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Error! Reference source not found.**.

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Error! Reference source not found.**.

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials
Thermal insulation performance: Submit evidence of performance to AS/NZS 4859.1 (2018) and AS/NZS 4859.2 (2018).

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
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Shop drawings
General: Submit shop drawings to a scale that best describes the detail, showing the following:

- Dimensioned elevations of all elements.
- Details of construction, connections and all support systems.
- Dimensions of all typical elements and of any special sizes and shapes.
- Provision for the exclusion and/or drainage of moisture.
- Jointing details and method of fixing between individual elements and between this installation and adjacent work, including adjustment.
- Sealant types and full size sections of all sealant-filled joints and backing rods.
- Provision for thermal movement.
- Provision for movement under seismic and wind loads.
- Sequence of installation.
- Coordination requirements with other work.
- Schedule of materials, finishes, componentry, hardware and fittings.

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

Seamed sheet metal cladding: Submit evidence of experience with non-ferrous cladding installation.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 INSPECTION

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

- Workshop assemblies before delivery to the site.
- Framing, pliable membranes and insulation before covering up or concealing.
- Completion of a prototype.

2 PRODUCTS

2.1 GENERAL

Samples
Requirement: Provide samples of the cladding material showing the range of variation available.

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 that 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).

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.

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.

Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4 (2014).

Fire-stops

Requirement: If 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 AUTOCLAVED AERATED 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 ALUMINIUM WEATHERBOARDS

General

Requirement: Proprietary prefinished aluminium weatherboards.

Standard: To AS/NZS 1734 (1997).

Finishes

Anodising: To AS 1231 (2000).

- Thickness: 15 to 20 µm.

2.5 COMPOSITE PANELS

General

Requirement: Proprietary panels comprising prefinished skins continuously laminated over a panel core, as documented.

Panel joints and control joints: Integral.

Flexible sealant: Non-staining to the manufacturer's recommendations.

Aluminium composite panels (ACPs)

Product identification: Permanent labelling to SA TS 5344 (2019).

2.6 COMPRESSED FIBRE CEMENT (CFC) SHEETS

General

Requirement: Proprietary compressed fibre cement sheets.

Standard: To AS/NZS 2908.2 (2000) and the following:

- Type A Category 5.

Finish: Smooth and even with factory sealed edges, free of imperfections such as chips.

Edge profile: Square.

Sealant and bond breaking tape: To the manufacturer's recommendations.

2.7 EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

General

Requirement: Proprietary system comprising rigid insulation panels, fixed to a subframe and finished on one or both sides with a cementitious base coat and finish coat.

Insulation

Standard: To AS/NZS 4859.1 (2018):

- Rigid cellular foam insulation (EPS and XPS): To AS/NZS 4859.1 (2018) Section 8.

Insulation blowing agents

Restricted agents: Conform to PRODUCTS AND MATERIALS, **GENERAL**, **Prohibited materials** in *0171 General requirements*.

2.8 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.

2.9 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.

2.10 HARDBOARD PLANKS

General

Requirement: Proprietary wet process fibreboard planks.

Standard: To AS/NZS 1859.4 (2018).

Classification: Exterior.

Plank thickness: 9.5 mm.

External corners: Preformed metal joining pieces.

Internal corners: Scribed.

2.11 INSULATED PANEL SYSTEMS

General

Description: Proprietary panels comprising prefinished metal skin factory-bonded to both faces of an insulating core, as documented.

Panel joints and control joints: Integral.

Insulation core

Standard: To AS/NZS 4859.1 (2018):

- Rigid cellular foam insulation (EPS, PF, PIR, PUR and XPS): To AS/NZS 4859.1 (2018) Section 8.

Insulation blowing agents

Restricted agents: Conform to PRODUCTS AND MATERIALS, **GENERAL**, **Prohibited materials** in *0171 General requirements*.

Internal and external skins

Factory pre-coating: Polyester to a dry film thickness of 25 µm.

Profile: Internal and external panel profiles as documented.

System accessories

Requirement: Proprietary insulated cladding system accessories colour matched to panels, as documented.

Sealants

Materials: Non-staining and to the manufacturer's recommendations.

2.12 PLASTIC SHEETS

General

Requirement: Proprietary plastic sheets.

Unplasticised polyvinyl chloride (PVC-U) sheet: To AS 4256.4 (2006).

Glass fibre reinforced polyester (GRP) sheet: To AS 4256.3 (2006).

Polycarbonate: To AS 4256.5 (2006).

2.13 PLYWOOD SHEETS

General

Requirement: Proprietary plywood sheets.

Standard: To AS/NZS 2271 (2004).

Bond: Type A.

Presealed plywood: Sides and edges presealed with a machine applied sealer.

Visible surfaces with a clear finish: Veneer quality A.

Other visible surfaces: Veneer quality B.

Hidden surfaces: Veneer quality C or D.

Identification: Sheets labelled under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment*.

Fasteners

LOSP treated timber and non-corrosive timber cladding: Hot-dip galvanized steel.

CCA treated timber and corrosive timber cladding (including western red cedar or redwood): Stainless steel Type 316 or silicon bronze.

2.14 PROFILED SHEET METAL

General

Requirement: Proprietary profiled sheet metal cladding.

Design and installation: To AS 1562.1 (2018).

2.15 SEAMED SHEET METAL

General

Description: Sheet metal roll formed into pan profiles, laid with seamed joints on a breathable waterproof membrane on flush finished, continuous plywood sheeting or to manufacturer's recommendations.

Plywood sheeting

Standard: To AS/NZS 2269.0 (2012):

- Surface grade: D.
- Bond: Type A.
- Formaldehyde emission class: E_1.

Thickness: 15 mm.

Identification: Sheets labelled under the authority of a recognised certification scheme to *0185 Timber products, finishes and treatment.*

Underlayer

Requirement: Breathable waterproof membrane to internal face of cavity when cladding including a plywood or FC substrate, is installed as a vented cavity or rainscreen system. Minimum 40 mm ventilation gap between substrate and framing.

Separation layer

Requirement: Breathable waterproof membrane between cladding material and substrate.

Accessories

Solder (tin/lead): 40/60 soft solder.

Flux: Z-04-S.

Sealant: 100% neutral cure non-acid based silicone rubber to match cladding.

Fasteners: Provide starter clips, fixing clips and fastenings as recommended by the cladding system supplier.

2.16 TERRACOTTA PANELS AND TILES

General

Requirement: Proprietary cladding system comprising prefinished, fired, extruded clay panels and mechanical fixing system.

Finish: Smooth or profiled factory finish, free of imperfections such as chips.

Edge profile:

- Vertical: square.
- Horizontal: tongue and groove.

Suspension rails: Proprietary aluminium, galvanized steel or stainless steel extrusions.

Accessories: Proprietary powder coated aluminium profiles to the manufacturer’s recommendations.

2.17 TIMBER WEATHERBOARDS

General

Hardwood: To AS 2796.1 (1999).

- Grade: To AS 2796.2 (2006).

Seasoned cypress pine: To AS 1810 (1995).

Softwood: To AS 4785.1 (2002).

- Grade: To AS 4785.2 (2002).

Fasteners

LOSP treated timber and non-corrosive timber cladding: Hot-dip galvanized steel.

CCA treated timber and corrosive timber cladding (including western red cedar or redwood): Stainless steel Type 316 or silicon bronze.

Hardwood cladding: Bullet head and plain shank nails, if the cladding is painted and nails are punched and stopped.

Softwood cladding: Flat head and plain shank nails, if cladding is painted.

CCA treated softwood cladding: Deformed shank (ring or annular) flat head nails.

Unpainted cladding/framing joints: Do not use machine driven T head nails.

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.

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 that 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 CFC SHEET CLADDING

Joints

Control joint:

- 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.

Prefinished metal backing/jointing strip: Fix proprietary backing strip to the rear face of the panel with proprietary closed cell self-adhering foam and horizontal gasket.

- Seal the joint with a 3 mm epoxy fillet.

Vertical joints: Vertical gasket or prefinished jointing strip to framing member.

Arrangement: Set out in even panels with joints coinciding with framing or as documented.

Fixing

General: Screw fix to proprietary framing supports at centres to the manufacturer's recommendations.

Concealed fixings:

- Predrill oversized holes.
- Countersink so that the top of the screw is 2 to 3 mm below the surface.
- Finish: Stop screw heads with epoxy filler. Smooth and level upon application and sand flush after curing.

3.5 EIFS CLADDING

Joints

Requirement: Close butt. Make sure joints are supported and finished level.

Control joint: To coincide with structural movement joints and as documented.

- Sealant: Do not apply finish coating over joint sealants.

Installation

Trim: Install PVC-U around windows, along bottom of walls and at external corners.

Junctions: Make sure junctions are effectively sealed when installing PVC-U or other rigid window flashings.

Saddle and back flashings: Install before fixing the panels.

Parapet and cap flashings: Complete as soon as practicable after finishing the system.

Finishing

Preparation: Remove any oxidisation from polystyrene before plastering.

Base coat reinforcement: Embed alkali resistant fibreglass reinforcing mesh into the wet base coat.

Render and texture finish: Apply render and texture finish coats to the manufacturer's recommendations.

3.6 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.

3.7 INSULATED PANEL SYSTEMS

Site cut panels

Site cut panels:

- Provide accurate, true lines with no distortion.
- Cut with a suitable metal cutting circular type saw and treat exposed edges with a proprietary edge protection lacquer.
- Cut openings to the minimum size necessary.

Penetrations larger than 300 x 300 mm: Provide additional structural support.

Swarf: Remove swarf and any foreign matter immediately from the external surface of panels.

Joints

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.

3.8 PLASTIC SHEET CLADDING

Installation

Standard: To AS 1562.3 (2006).

3.9 PLYWOOD SHEET CLADDING

Preparation

Requirement: Cut sheets to suit the layout, as documented.

Cut edges: Seal before fixing and install facing upwards.

Bottom edges: Prime or pre-coat before fixing.

Installation

Layout for sheets with shiplap joints: Start at a corner and install shiplap joints facing away from the prevailing weather.

Labels: Install panels so that any certification scheme labels are concealed.

Joints

Movement allowances:

- Between sheets: 2 mm minimum gap. Apply elastomeric sealant.
- Between the bottom of sheets and flashings: 5 mm gap.

Control joints: To coincide with structural movement joints and as documented.

Fixing

Timber frames: 12 mm thick sheets:

- Nails: 40 x 2.5 mm.
- Screws: No. 8 x 40 mm.

Steel frames: 12 mm thick sheets:

- 1.5 mm steel: 10 gauge to 16 thread pitch x 45 mm screws.
- 2.8 mm steel: 10 gauge to 16 thread pitch x 45 mm screws.

Nail fixing centres:

- Edges: At 150 mm centres and not less than 9 mm from sheet edge.
- Intermediate framing: At 300 mm centres.
- Sheet corners: Not less than 50 mm from corner on vertical edges.

Finish: Flush with surface. Do not punch.

Shiplap joint top lap: Do not nail.

3.10 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.

Fixing

3.11 SEAMED SHEET METAL CLADDING

Plywood sheeting

Installation: Lay the length of the sheets at right angles to the supports.

End joints: Stagger the end joints and locate centrally over framing members.

Edge support: If panels are not tongue and grooved, provide noggings or trimmer joists to support the edges.

Fixing: 300 mm centres to each support:

- Timber: Adhesive and nail.
- Steel: Metallic-coated self-drilling/tapping screws with the heads finishing below the surface.

Control joints: 12 mm gap at abutting building elements.

Fabrication

Requirement: Factory fabricate pans.

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.

Minimum bending radius: 1.75 mm.

Swarf: Remove swarf and other debris as soon as it is deposited.

Fixing

Requirement: Fix pans to the sheeting with concealed clips at 250 mm maximum centres or to manufacturer’s recommendations.

Seams

Walls: Single angle standing seams.

3.12 TERRACOTTA PANELS AND TILES

Installation

Set-out: Confirm set-out before starting the installation. Minimise cut panels and tiles.

Substrate: Install proprietary suspension rails to manufacturer's details over pliable membrane. Use fasteners conforming to wind load requirements.

Panels and tiles: Install to manufacturer’s recommendations.

Trim: Install proprietary trim and flashings.

3.13 TIMBER WEATHERBOARD CLADDING

Preparation

Preservative treatment: For cladding with a natural or stained finish, prefinish the boards by dipping or brushing with water repellent preservative.

Compatibility: Make sure preservative is compatible with the documented pigmented stain finish.

Cut surfaces: Treat freshly cut surfaces with water repellent preservative before fixing.

Installation

Single lengths: If installed vertically, use single lengths. If installed horizontally, use single lengths whenever possible.

Edge finish to lowest board: Cut the bottom edge of the lowest board to slope inwards and upwards at an angle of 15°.

Fixing

Fixings at supports:

- Seasoned milled weatherboards: 2.
- Unseasoned hardwood, sawn weatherboards, or secret nailed profiles: 1.
- Do not fix through the overlap of adjacent weatherboards.

Nailheads: Treat visible nailheads as follows:

- Stained or clear finishes: Drive flush with weatherboard surface.
- Opaque finishes: Punch below the weatherboard surface and fill flush with putty after the surface has been primed.

Joints

Overlapping joints: Lap boards at least 30 mm.

End grain joints: Install boards so that butt joints are in compression. Fix all board ends to support framing. Stagger joints vertically or as documented.

Internal and external corners: Butt against a stop bead that projects at least the thickness of the cladding.

Timber boards abutting masonry: Leave a gap between boards and masonry to prevent moisture uptake.

3.14 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 oxidisation.

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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer’s published use, care and maintenance requirements.

0451B WINDOWS AND GLAZED DOORS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide windows and glazed doors, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Selection and installation: To AS 2047 (2014).

Building classification: Class 9b - Assembly Building

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).

1.4 SUBMISSIONS

Certification

Windows and glazed doors: Submit evidence of conformity 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.

Toughened glass: For each batch of glass, submit certification from the manufacturer of heat soaking.

Fire performance

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire-resistance of building elements**.

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS 2208 (2023) Appendix A.

Type tests: Submit results, as follows:

- Acoustic performance of windows and doors.
- Protection of openable windows.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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.
- 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.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Openings prepared to receive windows.
- Fabricated window assemblies at the factory ready for delivery to the site.
- Fabricated window assemblies delivered to the site, before installation.
- Commencement of window installation.

2 PRODUCTS

2.1 GENERAL

Samples
Requirement: Provide samples labelled with the series code reference and date of manufacture.
Window and door framing: Provide samples of the following:
- Prefinished production materials showing the limits of the range of variation in the documented colour.
- Joints made by proposed techniques.
- Sections for frames, sashes and slats.

Glazing: Provide 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 plastics glazing.
- Surface modified or surface coated glass.
- Patterned or obscured glass or plastics glazing.
- Wired glass.
- Mirror glass.

Hardware and accessories: Provide 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: Provide samples of generic hardware not documented as proprietary items.

Storage and handling
Storage: Store in a clean, dry area 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 frames to the manufacturer's recommendations and as follows:
- Stack upright, off the ground and against a flat, vertical surface.
- Carry in the vertical position with sashes locked.
- Do not rack frames out of square.
- Do not remove any bands and corner bracing until after installation.

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.

Marking
Window assemblies: To AS 2047 (2014) Section 8.

2.2 FIRE PERFORMANCE

Fire-resistance of building elements
Fire-resistance level: Tested to AS 1530.4 (2014).

2.3 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, if documented.

PVC-U frames
Standard: To AS 2047 (2014) clause 3.3.

2.4 GLAZING

Performance
Glass: Free from defects that detract from appearance or interfere with performance under normal conditions of use.

Plastics glazing: 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 glass to AS 1288 (2021) clause 3.8.

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 2208 (2023).

Type: Grade A to AS 1288 (2021).

Certification: Required.

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

Marking: To AS 2208 (2023) clause 1.6.

Heat-strengthened glass
Requirement: Heat-strengthened annealed glass that requires extra strength and thermal resistance.

Standard: To ASTM C1048 (2018).

Insulating glass units (IGUs)
Requirement: Provide insulating glass units, as documented.

Manufacture, testing and installation: To AS 4666 (2012).

2.5 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: Jointing and pointing materials that are compatible with each other and the contact surfaces, and non-staining to finished surfaces to manufacturer's recommendations. Do not provide bituminous materials on absorbent surfaces.

Elastomeric sealants

Sealing compounds (polyurethane, polysulfide, acrylic): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compounds (silicone): To ASTM C920 (2018) or ISO 11600 (2002).

Sealing compounds (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.

2.6 SCREENS

General

Requirement: Provide screens, as documented.

Fixed screens

General: Fixed screens fitted to the window frames with a clipping device that allows for removal for cleaning.

Hinged screens

General: Screens hinged at the top to give access to opening sash.

Retractable screens

General: Proprietary retractable screens, comprising aluminium frames and fibreglass mesh, fitted between the guide channels incorporated in the frames, and a retraction system including tension spring, bearings, positive self-locking device and elastomeric sealing strip at sill.

Sliding screens

General: Screens that are part of the window frame, with matching aluminium head guide, sill runner, and frame stile sections.

Hardware: Nylon slide runners and finger pull handle. Provide pile strip closers against sash if necessary to close gaps.

Aluminium framed screens

General: Aluminium extruded or folded box frame sections with mesh fixing channel, mitred, staked and screwed at corners. If necessary to adapt to window opening gear, provide an extended frame section.

Mesh: Bead the mesh into the frame channel with a continuous resilient gasket, so that the mesh is taut and free of distortion.

2.7 SECURITY WINDOW GRILLES

General

Requirement: Proprietary metal security grilles, or operable screen and frames, fixed to the building structure with tamper resistant fastenings.

Standard: To AS 5039.1 (2023).

2.8 ALUMINIUM FRAME FINISHES

Powder coatings

Service condition category to AS 3715 (2002)

Anodised

Standard: To AS 1231 (2000).

Thickness:

- Internal: 15 µm.
- External: 20 µm.

2.9 OTHER MATERIAL FRAME FINISHES

Finish

Standard: To AS 2047 (2014) clause 3.4.1.4.

2.10 ANCILLARY COMPONENTS AND FITTINGS

Trim

General: Provide trim, shadow angles 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, colourfastness grade B.

Flashings

General: Corrosion-resistant, compatible with the other materials in the installation, and coated with a non-staining compound if 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

General: Provide weatherstrips, as documented.

Standard: To AAMA 701/702 (2023).

Material: Pile and backing or equivalent polypropylene, 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.

2.11 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.

Window locks and latches

Standard: To AS 4145.2 (2008).

Window catches: Provide 2 catches per sash to manually latched awning or hopper sashes over 1000 mm wide.

Sash balances

Requirement: Match the spring strength of the balances to the sash weight they support.

Sash operators

Requirement: Provide sash operators, as documented.

3 EXECUTION

3.1 GLAZING PROCESSING

General

Processing: Perform required processes on glazing, including cutting, obscuring, silvering and bending. Form necessary holes, including for fixings, equipment, access openings and speaking holes. Process exposed glass edges to a finish not inferior to ground arrised.

3.2 INSTALLATION

General

Requirement: Install windows and glazed doors 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 glazing materials.
- No transfer of building movements to the glazing.
- Watertight and airtight for external glazing.

Temporary marking: Use a method that does not damage the glazing. Remove marking only after certification and acceptance of the installation.

Toughened glass: Do not cut, drill, edgework or permanently mark after toughening. Use installation methods that 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

Packing: Pack behind fixing points with durable full width packing.

Fasteners: Conceal fasteners.

Fasteners and fastener spacing: Conform to the recommendations of the manufacturer.

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 depression 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 before completion of the works.

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.

3.3 SECURITY WINDOW GRILLES

General
Installation: To AS 5040 (2003).

3.4 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 if appropriate.

Opening force performance: To the NCC cited AS 1428.1 (2009).

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.

3.5 COMPLETION

Hardware
Adjustment: Leave the hardware with working parts in working order, and clean, undamaged, properly adjusted, and lubricated if appropriate.

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, acidic or alkaline materials.

Extent: All frames and glass surfaces internally and externally.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the following:

- Window and glazed door manufacturer’s published recommendations for operation, care and maintenance.
- Hardware manufacturer’s published recommendations for use, care and maintenance.

4 SELECTIONS

Refer to drawings and schedules for details, locations and extents.

0455 DOOR HARDWARE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide door hardware, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

Abbreviations

General: For the purposes of this worksection, the abbreviations given in AS 4145.1 (2008) Appendix D apply.

Definitions

General: For the purposes of this worksection, the general definitions given in AS 4145.1 (2008) Section 2 and Appendix E apply.

1.4 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 t esting of recovered items and the location where each is to be re-used.

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

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

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

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

2 PRODUCTS

2.1 GENERAL

Samples

Generic items: Provide samples of hardware items offered as meeting the description of items not specified as proprietary items.

Reconditioned items: Provide samples of hardware items offered as meeting the standard of cleaning, repair and testing of recovered items.

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.

Replacement items

Door hardware: Replacement items to match existing, or as documented.

Hinges: If required, upgrade hinges to conform to **Hinges for timber doors table** and **Hinges for aluminium doors table**.

2.2 LOCKS AND LATCHES

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 (L x W x T) (mm)	Door leaf weight (kg)	Knuckles (minimum)	Screws/hinge leaf (minimum)
100 x 70 x 3	≤ 30	3	3
100 x 80 x 3.5	≤ 50	5	4
130 x 50 x 3.4	≤ 75	Interfold	3
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 SLIDING DOOR HARDWARE

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.

Door seals

Acoustic applications: Tested to AS 1191 (2002) or EN ISO 10140-2 (2021) and rated to AS/NZS ISO 717.1 (2004).

Weather and energy saving seals: To AS 4420.1 (2016) Sections 5 and 6, and AS 2047 (2014).

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, colourfastness 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 (2023).

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.

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 if 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 that, when deflected by foot pressure, operates a switch that 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 PANIC EXIT DEVICES

General

Standard: To EN 1125 (2008).

Requirements:

- Field sizable.
- Keyed dogging.

2.9 KEYING

Keying requirements

Standard: To AS 4145.1 (2008) for keying security.

Requirement: Provide door hardware and keys, as documented.

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

Great grandmaster, grandmaster and master keys: Arrange for delivery direct to the principal.

Locks keyed to differ and locks keyed alike: Check the quantity against key records, and deliver keys to the contract administrator at practical completion.

Group keying

Keying system: As documented.

Existing system extension: Obtain the details of existing group or master key systems of the system to be extended.

Future extensions: Provide master and grandmaster group keying systems capable of accommodating future extensions.

Proprietary keying control security system: Provide for cylinder or pin-tumbler locks that accept a group key (e.g. master key, maison key).

Stamping: Stamp keys and lock cylinders to show the key codes and/or door number as scheduled.

Identification

Labelling: Supply each key with a purpose-made plastic or stamped metal label legibly marked to identify the key, attached to the key by a metal ring.

Key material

Lever locks: Malleable cast iron or mild steel.

Pin tumbler locks: Nickel alloy, not brass.

Number of keys table

Key code	Key type	Minimum number of keys
GGMK	Great grandmaster keys	2
GMK	Grandmaster keys	2

Key code	Key type	Minimum number of keys
MK	Master keys	2 per code group
KD	Locks keyed to differ	2 per lock
KA	Locks keyed alike:	
	2 locks in code group	4
	3 to 10 locks in code group	6
	11 to 40 locks in code group	10
	41 and over locks in code group	1 per 4 locks or part thereof

3 EXECUTION

3.1 INSTALLATION

General

Handing: Before supply, verify on site, the correct handing of hardware items.

Operation: Make sure working parts are accurately fitted to smooth close bearings, without binding or sticking, free from rattle or excessive play, lubricated if appropriate.

Mounting height

Locks and latches: Centreline of the door knob or lever spindle above finished floor: To AS1428.1

Locks

Cylinders: Fix vertically and with consistent key alignment.

Door stops

Fixing: Fix on the floor, skirting or wall, as appropriate, to prevent the door or door furniture striking the wall or other surface.

Fasteners

Materials: Provide materials compatible with the item being fixed, and of sufficient strength, size and quality to perform their function, and as follows:

- 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:

- Hardware fasteners: Provide appropriate back support, such as lock stiles, blocking, wall noggings and backing plates.
- 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.

3.2 COMPLETION

Adjustment

General: Leave the hardware properly adjusted with working parts in working order, and clean, undamaged, properly adjusted, and lubricated if appropriate.

Opening force performance: To the NCC cited AS 1428.1 (2009).

Automatic door operators: Maintain and adjust the system throughout the defects liability period.

Keys

Contractor's keys: Immediately before practical completion, replace or reset cylinders to which the contractor has had key access during construction to exclude the contractor's keys.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer's published recommendations for use, care and maintenance of the hardware provided.

Automatic door operators: Include the installer's proposal for continuing maintenance after completion on an annual renewal basis.

Warranties

Warranties - Provide all Manufacturer Warranties

0461B GLAZING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide glazing, as documented.

Performance

Thermal qualities: U-Value and Solar heat gain coefficient (SHGC) as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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).

Roof glazing: To AS 1288 (2021) Section 6.

1.4 SUBMISSIONS

Certification

Design: Submit an engineer's certificate confirming conformance to AS 1288 (2021).

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.

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 manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials

Safety glazing materials: Submit evidence of conformity to AS 2208 (2023) Appendix A.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Shop drawings

Requirement: Submit shop drawings showing the following:

- Method of glazing.
- Rebate depth.
- Edge restraint.

- Clearances and tolerances.
- Glazing gaskets and sealant beads.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

2 PRODUCTS

2.1 GENERAL

Samples
Requirement: Provide 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 plastics glazing.
- Surface modified or surface coated glass.
- Patterned or obscured glass or plastics glazing.
- Ceramic-coated glass.
- Wired glass.
- Insulating glass units.
- Mirror glass.

Storage and handling
Storage: Store glass and glazing materials in a clean, dry area 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 GLAZING

Performance
Glass: Free from defects that detract from appearance or interfere with performance under normal conditions of use.

Plastics glazing: 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 glass to AS 1288 (2021) clause 3.8.

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 2208 (2023).

Type: Grade A to AS 1288 (2021).

Certification: Required.

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

Marking: To AS 2208 (2023) clause 1.6.

Heat-strengthened glass
Requirement: Heat-strengthened annealed glass that requires extra strength and thermal resistance.

Standard: To ASTM C1048 (2018).

Insulating glass units (IGUs)
Requirement: Provide insulating glass units, as documented.

Manufacture, testing and installation: To AS 4666 (2012).

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, colourfastness grade B.

Pile weatherstrips
Standard: To AAMA 701/702 (2023).

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 GLAZING PROCESSING

General
Processing: Perform required processes on glazing, including cutting, obscuring, silvering and bending. Form necessary holes, including for fixings, equipment, access openings and speaking holes. Process exposed glass edges to a finish not inferior to ground arrised.

3.2 INSTALLATION

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 glazing materials.
- No transfer of building movements to the glazing.
- Watertight and airtight for external glazing.

Temporary marking: Use a method that does not damage the glazing. Remove marking only after certification and acceptance of the installation.

Toughened glass: Do not cut, work, or permanently mark after toughening. Use installation methods that 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, acidic or alkaline materials.

Extent: All frames and glass surfaces internally and externally.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturers' published recommendations for in-service use.

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.

0471 THERMAL INSULATION AND PLIABLE MEMBRANES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide thermal insulation and pliable membrane systems, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 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 fibre (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 fibre (glass and rock fibre) or polyester fibre, and may be combined with reflective facings.
- Fire hazard properties: To NCC (2022) Schedule 1.
- Pliable building membrane: To AS 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.

1.4 SUBMISSIONS

Fire performance

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).

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.5 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 GENERAL

Storage and handling

Labelling: Deliver mineral fibre products to site in packaging with third party mark of conformity indicating product is bio-soluble and not listed as hazardous material in the Safe Work Australia *Hazardous Chemical Information System* (HCIS).

2.2 FIRE PERFORMANCE

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).

2.3 MATERIALS

Thermal insulation
Standard: To AS/NZS 4859.1 (2018).

Wet process fibreboard (softboard): To AS/NZS 1859.4 (2018).

Mineral fibre 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 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.

2.4 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: Proprietary item.

R-Value (m^2.K/W): ≥ 0.2.

3 EXECUTION

3.1 GENERAL

Thermal insulation
Requirement: To AS 3999 (2015) and BCA (2022) J4D3.

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.

Pliable building membrane
Installation: To AS 4200.2 (2017) and BCA (2022) J4D3.

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, as documented.

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 that 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 that 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 if 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 and shingle roofing.

0511B LINING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide internal lining systems, as documented.

Performance

Requirement: Provide lining system with a surface that is:

- Resistant to impacts expected in use.
- Resistant to moisture encountered under expected environmental conditions.
- Free of irregularities.
- A suitable substrate for the nominated final finish.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

Abbreviations

General: For the purposes of this worksection, the following abbreviation applies:

- MDF: Medium density fibreboard.

Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 4491 (1997) and the following apply:

- Decorative overlaid wood panels: Particleboard or fibreboard with a bonded decorative finishing surface such as thermosetting resin (low pressure melamine), PVC film, paper foils or wood veneer.
- Dry process fibreboard: Panel material with a nominal thickness of 1.5 mm or greater, manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and pressure, the bond of which is derived from a synthetic adhesive added to the fibres and the panels are manufactured with a forming moisture content less than 20%.
- Fibre cement sheet linings: Treated cellulose fibre in a matrix of cement and sand autoclaved sheet, sealed on one side.
- High pressure decorative laminates (HPDL):
  - . Panels consisting of core layers impregnated with phenolic and/or aminoplastic resins and a surface layer(s) impregnated with aminoplastic resins (mainly melamine resins).
  - . Sheets consisting of a decorative face and layers of fibrous sheet material (e.g. paper) impregnated with thermosetting resins and bonded together under heat and pressure of at least 5 MPa.
- Wet process fibreboard: Panel material with a nominated thickness of 1.5 mm or greater, manufactured from lignocellulosic fibres (derived from wood or other materials) with application of heat and/or pressure, the bond of which is derived from the felting of the fibres and the panels are manufactured with a forming moisture content greater than 20%.

1.4 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.

1.5 SUBMISSIONS

Fire performance
Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.6 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).

2.4 FIBRE CEMENT

General
Standard: To AS/NZS 2908.2 (2000).

Wall and ceiling linings: Type B category 2.

Minimum thickness: 4.5 mm.

2.5 TONGUE AND GROOVE BOARDS

Hardwood
Standard: To AS 2796.1 (1999).

Seasoned cypress pine
Standard: To AS 1810 (1995).

Softwood
Standard: To AS 4785.1 (2002).

2.6 PLYWOOD AND BLOCKBOARD

General
General interior use: To AS/NZS 2270 (2006).

General exterior use and 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.

2.7 PARTICLEBOARD

General

Standard: To AS 1859.1 (2017).

2.8 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 has been 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.

Supports

General: Install timber battens or proprietary cold-formed galvanized steel furring channels as follows:

- If framing member spacing exceed the recommended spacing.
- If direct fixing of plasterboard is not possible, due to the arrangement or alignment of the framing or substrate.
- If 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:

- If framing member spacing exceed the recommended spacing.
- If direct fixing of fibre cement is not possible, due to the arrangement or alignment of the framing or substrate.
- If 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.

Steel framed construction: Screw only or combine with adhesive.

Wall framing: Conform to the following:

- Do not fix to top and bottom plates or noggings.
- In tiled areas: Provide an extra row of noggings immediately above wall-to-floor flashings. Fix sheet at 150 mm centres to each stud and around the perimeter of the sheet.

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.
- Expressed joints: 10 mm maximum.

Joint backing for expressed joints: Black self-adhesive polyurethane tape.

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.

External corner joints: Make joints over metallic-coated steel corner beads.

Dry joints: Provide square edged sheet and finish with a PVC-U joining section.

Control joints: Provide control joints to coincide with structural control joints and as follows:

- Walls:
  - . Timber framing: ≤ 7.2 m centres.
  - . Steel framing 0.55 to 0.75 mm BMT: ≤ 9.0 m centres.
  - . Steel framing 0.8 to 1.6 mm BMT: ≤ 6.0 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:
  - . Timber framing: Not more than 4.2 m centres and space to suit joints required in tiling.
  - . Steel framing: Not more than 4.8 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 TONGUE AND GROOVE BOARDS

Installation

General: Conform to the following:

- Horizontal installation: Provide single lengths of boards if possible.
- Vertical installation: Provide single lengths only.

Stained or clear finished boards: Select board to give a random pattern. At corners, return the same board to give a continuous grain pattern.

Fixing: Nail twice to each crossing, except for secret nailed profiles.

Secret nail fixing: Fix nail diagonally through the tongue only. Punch nails to maintain correct alignment of the next board.

Nailheads: Treat visible nailheads as follows:

- In stained or clear finishes: Drive flush.
- In opaque finishes: Punch below surface and fill flush with putty after the surface has been primed.

Corners and junctions: Allow for movement at all corners and junctions.

Joints

Requirement: Select board lengths to give minimum number of joints.

End grain joints: Install boards so that butt joints are in compression.

Internal corners: Scribe.

External corners: Mitre.

3.5 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.

3.6 TRIM AND ACCESSORIES

General

Requirement: Provide trim such as beads, mouldings and stops to make neat junctions between lining components, finishes and adjacent surfaces.

Proprietary items: Provide complete with installation accessories.

Timber and MDF trim: Fix using full length so that trim is secure and without movement. Where nail or screw fixings are used, make sure fastener finishes sufficiently below face of trim so that stopping piece finishes flush with the face.

3.7 COMPLETION

General

Damaged or marked lining and components: Replace.

Exposed surfaces: Touch up shop applied finishes and restore damaged or marked areas.

Timber panels: If appearance is not uniform, replace panels.

Cleaning: Clean completed surfaces to remove irregularities and leave panels smooth and clean, to the manufacturer’s recommendations. If required, sand with fine paper to remove irregularities and refinish panel surface.

- Debris and unused material: Remove from site.

0531B SUSPENDED CEILINGS - COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide suspended ceilings, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

General
Suspended ceilings: To AS/NZS 2785 (2020).

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection, the definitions given in AS/NZS 2785 (2020) and the following apply:
- Ceiling unit: Tile, panel, plank, strip or open grid supported within or to a suspended ceiling system.

1.5 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.

1.6 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**.
Products and materials
Type tests: Submit results as follows:
- Weighted suspended ceiling normalised 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).

Shop drawings
Set-out drawings: Submit proposed set-out, indicating the grid module, type and ceiling unit layout, before installation. Coordinate with plenum services layouts, building structure and other factors affecting the layout.
Subcontractors
General: Submit names and contact details of proposed suppliers and installers.

1.7 INSPECTION

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

- The suspension system before the installation of ceiling units or 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, as documented.

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 CEILING UNITS

General
Ceiling units: As documented.

2.5 LININGS

Ceiling linings
General: As documented.

Plasterboard
Standard: To AS/NZS 2588 (2018).

Minimum thickness: 10 mm.

Fibre cement
Standard: To AS/NZS 2908.2 (2000).

Internal ceiling linings: Type B Category 2.

External ceiling linings: Type A Category 3.

Minimum thickness: 4.5 mm.

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 match the ceiling system’s acoustic performance.

2.6 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 that 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.

Curtain recesses

General: Provide curtain recesses, including the following:

- Lining.
- Curtain track support.
- Accommodation for motors and cabling.

3.2 SUSPENSION SYSTEM

Ceiling grid

Set-out: Align ceiling unit joints and centrelines of visible suspension members with documented set-out points. If not documented, set out with equal margins.

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 CEILING UNITS

Installation

Fitting: Fit ceiling units accurately and neatly, without distortion.

Lock clips: If ceiling units are exposed to loads from wind actions or if required for security, insert lock clips at the junction of carrier rails and units.

Pattern and texture: Set out patterned or heavily textured materials with a consistent direction of pattern or texture, or as documented.

Service penetrations

General: Provide openings for all services elements, including light fittings, ventilation outlets, detectors, sprinklers and loudspeakers. If services pass through ceiling grid members, provide additional grid members and support.

Cut ceiling unit edges

General: Conceal, or finish to match prefinished edges, including at openings for services elements.

3.4 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.

3.5 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 to 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.

3.6 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.

3.7 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.

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.

3.8 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.
- Ceiling units: One spare unit for every 50 units or part thereof installed in the ceiling.
- Accessories: One spare of each type for every 50 units or part thereof installed in the ceiling.

0551B JOINERY

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide joinery, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.
- *0185 Timber products, finishes and treatment*

1.3 SUBMISSIONS

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

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.

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.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.4 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Shop fabricated or assembled items ready for delivery to the site.
- Openings prepared to receive assemblies.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.
- Surfaces prepared for, and immediately before, site applied finishes.

- Completion of installation.

2 PRODUCTS

2.1 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.

Non-structural glued laminated timber
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).

High pressure decorative laminate (HPDL) sheets
Standard: To AS/NZS 2924.1 (2024).

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.

Stone facings
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.

Splashbacks
Glass: Toughened safety glass to AS 2208 (2023).

Stainless steel: Type 304, No. 4 finish.

2.3 VENEERS

Timber veneer
Requirement: Provide veneers in specified matching arrangement flitch batched and falling within the visual range of the approved sample.

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).

Product certification

Plinths
Thickness: 16 mm.

Fabrication: Form up with front and back members and full height cross members at not more than 900 mm centres.

Fasteners: Conceal with finish.

Installation: Scribe to floor and secure to wall to provide level platform for carcasses.

Carcasses
Thickness: 16 mm.

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
Thickness: 16 mm.

Door size: Not exceeding 1.5 m^2 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
Exposed edges: Conform to one of the following:
- Extend laminate over shaped nosing, finishing more than 50 mm back on underside. Splay outside corners at 45°.
-

Provide solid timber profiled edge

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.

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 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

3.2 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.

Openings: Provide openings for the following: hydraulic, electrical and mechanical services as required

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 that are to have clear or tinted finish, provide matching wood plugs showing face (not end) grain. In surfaces that 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, 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 that match sheet faces.

Solid timber edge strips: Colour matched ABS edging to front face panels

Matching: For surfaces that 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 wall/floor junctions, and cable and pipe entries with silicone beads for vermin proofing. Apply water resistant sealants around all plumbing fixtures and make sure sealants are fit for purpose.

Benchtops

Installation: Fix to carcass at least twice per 600 mm length of benchtop.

Joint sealing: Fill joints with sealant matching the finish colour and clamp with proprietary mechanical connectors.

Edge sealing: Seal to walls and carcasses with a sealant that 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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer’s published recommendations for service use.

Warranties

Warranty: By contractor

4 SELECTIONS

Refer to drawings and schedules for details, locations and extents.

Lile for like timber trim profiles to be provided throughout the building as documented.

0552B METALWORK - FABRICATED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide metal fixtures, as documented.

Performance

Requirements:

- Undamaged, plumb, level and straight or as documented.
- Free of surface defects or distortions or as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Structural design actions: To AS/NZS 1170.1 (2002).

Stairs and balustrades: To the NCC cited AS 1428.1 (2009).

1.4 TOLERANCES

General

Requirement: ±2 mm from design dimensions.

1.5 SUBMISSIONS

Design documentation

General: Engage a professional engineer and submit certification for the design and installation of:

- FENCING
- EXTERNAL FENCE POSTS
- GATE
- BALLUSTRADE

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

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.

Certification: Submit certification for the following:

- Fencing
- External Fence Posts
- Gate
- Ballustrade
- Handrails

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.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Arrival of materials on site or in workshop.
- Shop fabricated or assembled items ready for delivery to the site.
- Commencement of shop or site welding.
- Site erected assemblies on completion of erection, before covering up by cladding and encasing.
- Steel surfaces prepared for, and immediately before, site applied finishes.

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 (2023).

Bar: To ASTM A276/A276M (2024).

Tube: To ASTM A554 (2021).

Type: 316

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 fixing devices 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.

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 that 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 CUSTOM-BUILT STEEL STAIRS

General
Design and construction: To BCA (2022) D3.

Fabrication
Method: Welding.

Joints: Produce smooth unbroken surfaces at joints or as documented. Scribe the joints to all steel members. 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 and bases, and attach the steel member to the building structure with fixings compatible with the substrate.

Proprietary items: Install to the manufacturer’s recommendations.

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.

3.5 PROPRIETARY STAIR SYSTEMS

General
Design and construction: To BCA (2022) D3.

Straight flight stair assembly: A proprietary system, pre-assembled and fixed in place, comprising the following:

- Stair flights with treads and risers.
- Landings.
- Balustrade and handrail to stair flight and landings.
- Security gates where documented.

Circular stairs: A proprietary system, mechanically assembled and fixed in place, comprising the following:

- A central steel tube column.
- Prefabricated metal treads sleeved over and cantilevered from the column.
- Landings.
- Balustrade and handrail to stair and landings.
- Spacers, fixings and accessories necessary to complete the system.

3.6 RETRACTABLE CEILING ACCESS STAIRS

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.

3.7 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 that 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.

Operation and maintenance manuals
Requirement: Prepare a manual that includes the manufacturer's published recommendations for service use.

Warranties
Requirement: Cover materials and workmanship in the terms of the warranty from the fabricator

Warranty: By Contractor

0554P MODDEX STEEL HANDRAILS, GUARDRAILS, BALUSTRADES AND OTHER BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide MODDEX steel handrails, guardrails, balustrades and other barriers, as documented.

1.2 DESIGN

Requirements

Performance requirement: Conform to MODDEX's specification sheets including the following:

- Maximum stanchion spacing.
- Mount dimensions and fixing details to the substrate.

1.3 COMPANY CONTACTS

MODDEX technical contacts

Website: www.moddex.com/contact-us.

1.4 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.5 STANDARDS

General

Access for maintenance: To AS 1657 (2018).

Access for people with a disability: To the NCC cited AS 1428.1 (2009).

Structural design action: To AS/NZS 1170.1 (2002).

Structural bridge design: To AS 5100.2 (2017) clause 12.5.

Tactile indicators: To AS/NZS 1428.4.1 (2009).

1.6 MANUFACTURER'S DOCUMENTS

MODDEX technical manuals

Products: www.moddex.com/products.

Specification sheet downloads: moddex.com/resources/downloads/.

1.7 SUBMISSIONS

Certificate

Requirement: Submit installation compliance certificate for the installed system from a MODDEX recommended installer.

Products and materials

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

- Product data sheets.
- Installation and maintenance recommendations.

Type test: Submit results, as follows:

- Guardrail and balustrade systems: To AS 1657 (2018).

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Records

Requirement: Submit as-built documentation from a MODDEX recommended installer.

Shop drawings
General: Submit shop drawings to a scale that best describes the detail, showing the following information:
- Overall and detail dimensions, including stanchion spacing.
- Mount dimensions and fixing details to the substrate.
- 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
Requirement: Submit evidence of MODDEX approved installer.

Substrate acceptance: Submit evidence of installer's acceptance of the substrate, including load capacity, before starting installation.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

2 PRODUCTS

2.1 GENERAL

Product substitution
Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.

Storage and handling
General: Store and handle to the manufacturer's recommendations and as follows:
- Protect materials from damage.

Product identification
General: Marked to show the following:
- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

2.2 MODDEX BARRIER SYSTEMS

General
Description: Heavy duty no-weld pedestrian and property protection barrier systems comprising posts, rails, balustrades and connectors for ground level protection of workplace and public thoroughfares including disabled assistance and bikeway protection.

Access for maintenance: To AS 1657 (2018).

Balustrading: To BCA (2022) D3D17.

Handrails: To BCA (2022) D3D22.

Balustrading and handrails for people with a disability: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

Bikeway barriers: To Austroads AGRD06A (2017).

Galvanized coating: To AS/NZS 4680 (2006).

Structural design: To AS/NZS 1170.1 (2002).

Assistrail® disability handrails
Assistrail® handrail systems: moddex.com/products/assistrail-disability-handrails/.

Description: Engineered for ramps, stairs and walkways, with smooth connections for a safer finish. Standard and fire stair configurations available.

Material - Tubular sections: G390 hot-dip galvanized steel.

Material - Connector/clamps: Cast iron, steel or aluminium with stainless steel clamp locking screws.

Bikesafe® bikeway barriers

Bikesafe® barrier systems: moddex.com/products/bikesafe-bikeway-barriers/.

Description: Engineered for bikeway and footpath safety, providing the ultimate protection for pedestrians and cyclists travelling at speed.

Material – Tubular sections: G390 hot-dip galvanized steel.

Material – Connector/clamps: Cast iron, steel or aluminium with stainless steel clamp locking screws.

Bridgerail™ bridge rail barriers

Bridgerail™ barrier systems: moddex.com/products/bridgerail-bridge-barriers/.

Description: Prevents injuries or falls from elevated pedestrian access pathways, cycle paths and service areas adjacent to roads. Standard and raked configurations available.

Material – Tubular sections: Hot-dip galvanized steel.

Material – Connector/clamps: Cast iron or steel with stainless steel clamp locking screws.

Conectabal® commercial balustrades

Conectabal® balustrade systems: moddex.com/products/conectabal-commercial-balustrades/.

Description: Prevents injuries or falls from retaining walls, elevated areas, ramps and stairs. Standard and fire stair configurations available.

Material – Tubular sections: G390 hot-dip galvanized steel and/or marine grade aluminium.

Material – Connector/clamps: Cast iron, steel or aluminium with stainless steel clamp locking screws.

Material – Kerbrail (where documented): Marine grade structural aluminium.

Tuffrail® industrial handrails-guardrails

Tuffrail® industrial handrail-guardrail systems: moddex.com/products/tuffrail-industrial-handrails/.

Description: Robust handrail-guardrail protection for workers across mezzanines, service platforms, pedestrian walkways and fall edges. Safety yellow options available.

Material – Tubular sections: G390 hot-dip galvanized steel, Type 316 stainless steel or marine grade aluminium.

Material – Connector/clamps: Cast iron, steel or aluminium with stainless steel clamp locking screws.

Material – Toeboard (where documented): Magnelis, marine grade stainless steel or marine grade structural aluminium.

2.3 MODDEX SAFETY ACCESSORIES

General

Description: Surface products used for pedestrian safety in all public locations such as stairways, ramps, escalators and platforms.

Tactile indicators: To AS/NZS 1428.4.1 (2009).

Slip resistance: To AS 4586 (2013).

Intac® tactile indicators

Intac® surface tactile indicators: moddex.com/products/intac-tactile-indicators/.

Description: Tactile indicators for ramps, stairs and walkways for the blind or visually impaired. Ceramic tile or self-adhesive PVC options available.

Material: PVC-U or ceramic.

3 EXECUTION

3.1 INSTALLATION

General

Requirement: To MODDEX's recommendations using MODDEX approved installers for installation.

Fixing

Requirement: Fix to the structure with documented mounts and/or brackets.

3.2 TRAINING

General

Requirement: Provide training in the safe use and maintenance of the system to all users.

3.3 COMPLETION

Cleaning

Temporary coatings: Before completion, or before joining up to other surfaces, remove all temporary coatings used for protection.

Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer's published recommendations for service use.

Warranties

Type: Warrant as follows:

- Product warranty by MODDEX.
- Installed system warranty by a MODDEX recommended installer.

4 SELECTIONS

Refer to drawings and schedules for details, locations and extents.

0573 FIRE EXTINGUISHERS AND BLANKETS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide portable fire extinguishers and fire blankets, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.
- *0581 Signage*.

1.3 SUBMISSIONS

Products and materials
Requirement: Submit evidence of suitability for use, to NCC (2022) A5G1, for all fire protection products.

Records
General: Submit any routine service records to AS 1851 (2012).

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

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.

Baseline data

Requirement: Provide baseline data to AS 1851 (2012).

0581B SIGNAGE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide signage systems, as documented.

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 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0921 Low voltage power systems*.

1.3 STANDARDS

Signs

Safety signs - design and use: To AS 1319 (1994).

Signs and graphics for disability access: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

Tactile wayfinding signs: To AS 1428.4.2 (2018).

1.4 SUBMISSIONS

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

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 (2022).

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).

Adhesive
General: Proprietary solvent based contact adhesive compatible with the substrate and signage material.

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.

Large format digital printing: Lettering and graphic images screen printed film with self-adhesive backing.

Signwriting: Lettering and graphic images hand painted direct to the background by a tradesman with recognised qualifications and demonstrated skills.

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. Install signs and conceal cabling to *0921 Low voltage power systems*.

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: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the applicator,

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

4 SELECTIONS

4.1 STATUTORY SIGNS

Termite protection

Location	In or near meter box or similar
Message	Details of termite management system Indicate: The method of protection The date of installation The life expectancy of a chemical barrier as listed on the appropriate authority's pesticides register label The installer's recommendation for inspections
Sign type	Laminated page(s)
Conformance	BCA (2022) B1D4(i)(ii) AS 3660.1 (2014) Appendix A

Required fire door and required smoke door

Location	On or adjacent to the door, on the side of the door that faces a person seeking egress, and if the door is in the held open position, on either the wall adjacent the doorway or both sides of the door.
Message if auto door with auto hold open device	FIRE SAFETY DOOR – DO NOT OBSTRUCT
Message if self-closing door	DO NOT OBSTRUCT DO NOT KEEP OPEN FIRE SAFETY DOOR
Message if door discharging from a fire isolated exit	FIRE SAFETY DOOR – DO NOT OBSTRUCT
Letter height (minimum)	20 mm
Sign type	
Conformance	BCA (2022) D3D28

Non-required stair, ramp or escalator

Location	Outside the shaft near all doors opening to the shaft
Message	DO NOT USE THIS STAIRWAY IF THERE IS A FIRE (or) Do not use this stairway if there is a fire
Letter height (minimum)	20 mm (upper case) 16 mm (lower case)
Sign type	
Conformance	BCA (2022) Spec 14

Exit signs, Class 2 or 3 buildings and Class 4 parts, in lieu of illuminated exit signs

Location	On, above, or adjacent every door described in BCA (2022) E4D5, BCA (2022) E4D6 and BCA (2022) E4D7.
Message	EXIT (with arrow in the direction of egress, if required)

Letter height (minimum)	25 mm
Sign type	
Conformance	BCA (2022) E4D5, BCA (2022) E4D6 and BCA (2022) E4D7

Braille and tactile exit signage

Location	To BCA (2022) Spec 15 for every door described in BCA (2022) E4D5
Message	Exit (and) Level (followed by the floor level number) (Braille and tactile signage)
Letter height (minimum)	BCA (2022) Spec 15
Mounting height	Braille and tactile signage between 1200 mm and 1600 mm above finished floor level
Sign type	
Conformance	BCA (2022) E4D5, BCA (2022) D4D7 and BCA (2022) Spec 15

Fire hose reels and fire hydrants

Location	Cupboard door or adjacent the FHR
Message	FIRE HYDRANT (and/or) FIRE HOSE REEL
Letter height (minimum)	50 mm
Sign type	Adhesive backed vinyl
Conformance	AS 2441 (2005) clause 10.4.4 AS 2419.1 (2021) clause 11.3.5

Portable fire extinguishers – Cabinet

Location	Cabinet
Message	FIRE EXTINGUISHER
Letter height (minimum)	32 mm
Sign type	Adhesive backed vinyl
Conformance	AS 2444 (2001) clause 3.6

Portable fire extinguishers – Location sign

Location	As nominated in AS 2444 (2001) clause 3.2 at every installed extinguisher nominated in BCA (2022) E1D14
Message	FIRE EXTINGUISHER (and prescribed graphic)
Letter height (minimum)	16 mm
Mounting height (minimum)	2000 mm above finished floor level
Sign type	Computer generated adhesive backed vinyl graphic
Conformance	AS 2444 (2001) clause 3.3

Fire blankets

Location	As nominated in AS 2444 (2001) clause 6.4 at every blanket location nominated in

	AS 2444 (2001) clause 6.3
Message	FIRE BLANKET (and prescribed graphic)
Letter height (minimum)	16 mm
Mounting height (minimum)	2000 mm above finished floor level
Sign type	Computer generated adhesive backed vinyl graphic
Conformance	AS 2444 (2001) clauses 6.3, 6.4 and Figure 6.1

Regulatory car park signs – Low clearance

Location	Entry to overhead obstruction where clearance is: 3 m or less – car and light van use only 4.6 m – all other cases
Message	LOW CLEARANCE (measured minimum clearance rounded down to the nearest 0.1 m)
Sign type	AS/NZS 2890.1 (2004) R6-11 or R6-16
Conformance	AS/NZS 2890.1 (2004) clause 4.3.4

Regulatory car park signs – Stop and Give Way

Location	As required for traffic control
Message	Graphic nominated in AS/NZS 2890.1 (2004) clause 4.3.4(b)
Sign type	AS/NZS 2890.1 (2004) R1-1 (Stop), R1-2 (Give Way)
Conformance	AS/NZS 2890.1 (2004) clause 4.3.4

Regulatory car park signs – Speed limit

Location	As required for traffic control
Message	Graphic nominated in AS/NZS 2890.1 (2004) clause 4.3.4(c)
Sign type	AS/NZS 2890.1 (2004) R4-1
Conformance	AS/NZS 2890.1 (2004) clause 4.3.4

Regulatory car park signs – Hump warning

Location	As required for traffic control
Message	Graphic nominated in AS/NZS 2890.1 (2004) clause 4.3.4(d)
Sign type	AS/NZS 2890.1 (2004) W5-10
Conformance	AS/NZS 2890.1 (2004) clause 4.3.4

Regulatory car park signs – Steep grade warning

Location	As required for traffic control
Message	Graphic nominated in AS/NZS 2890.1 (2004) clause 4.3.4(e)
Sign type	AS/NZS 2890.1 (2004) W5-12 (Down), W5-13 (Up)
Conformance	AS/NZS 2890.1 (2004) clause 4.3.4

Regulatory car park signs – Accessible parking facilities

Location	Designated car space
Symbol	Graphic size and position nominated in the NCC

	cited AS/NZS 2890.6 (2009) clause 3.1, Figure 3.1. Space delineation and shared space markings to the NCC cited AS/NZS 2890.6 (2009) clause 3.2.
Sign type	Pavement marking paint.
Conformance	NCC cited AS/NZS 2890.6 (2009) clause 3.1

Unisex accessible sanitary facilities

Location	To BCA (2022) Spec 15
Message	Braille and tactile signage incorporating the international symbol of access. Indicate suitability for left or right handed use.
Symbol size	AS 1428.2 (1992) clause 16, Table 1.
Letter height (minimum)	Braille: BCA (2022) Spec 15 Raised characters: Sans serif type font 20 mm.
Sign type	
Conformance	NCC cited AS 1428.1 (2009) clause 8.1 BCA (2022) D4D7

Airlocks to sanitary facilities

Location	Entry doors to airlocks serving areas containing sanitary facilities
Message	Braille and tactile signage incorporating the symbols identifying each sanitary facility within
Symbol size	AS 1428.2 (1992) clause 16, Table 1
Letter height (minimum)	Braille: BCA (2022) Spec 15 Raised characters: Sans serif type font 20 mm
Sign type	
Conformance	NCC cited AS 1428.1 (2009) clause 8.1

Non-accessible pedestrian entrance

Location	At each non-accessible pedestrian building entrance
Message	Signage incorporating the international symbol of access to direct a person to the location of the nearest accessible pedestrian entrance
Letter height	AS 1428.2 (1992) clause 17, Table 2
Symbol size	AS 1428.2 (1992) clause 16, Table 1
Sign type	
Conformance	NCC cited AS 1428.1 (2009) clause 8.1 BCA (2022) D4D7

Hearing augmentation

Location	Where hearing augmentation is installed to BCA (2022) D4D8
Message	Braille and tactile signage incorporating the international symbol of deafness in white on a blue background. Identify: Type of hearing augmentation. Area covered within the room. If receivers are being used and where the

	receivers can be obtained.
Letter height (minimum)	BCA (2022) Spec 15
Symbol size	AS 1428.2 (1992) clause 16, Table 1
Sign type	
Conformance	NCC cited AS 1428.1 (2009) clause 8.2.2 BCA (2022) D4D8 BCA (2022) Spec 15

Main switchboard – Main entry, excluding Class 1 dwellings

Location	Each entry that may be used by emergency services or at Fire detection control and indicating equipment (FDCIE)
Message	Indicate location of main switchboard. Incorporate the term Main Switchboard into notice
Letter height (minimum)	
Sign type	
Conformance	AS/NZS 3000 (2018) clause 2.10.2.4

Main switchboard – Room or enclosure, excluding Class 1 dwellings

Location	The room or enclosure containing the main switchboard
Message	MAIN SWITCHBOARD
Letter height (minimum)	
Sign type	
Conformance	AS/NZS 3000 (2018) clause 2.10.2.4

0621 WATERPROOFING - WET AREAS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide wet area waterproofing systems, as documented.

Performance

Requirements:

- Graded to floor wastes, to dispose of water without ponding.
- Able to prevent moisture entering the substrate or adjacent areas.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

Waterproofing wet areas

Standard: To AS 3740 (2021).

1.4 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 that form waterproof barriers and that may be:
  - . Loose-laid.
  - . Bonded to substrates.
- Wet area: An area within a building supplied with a floor waste.

1.5 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 to EXECUTION, **GENERAL**, **Reporting**.

Flood tests: Submit photographic records to **TESTING**, **Flood tests**.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

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.

Subcontractors
General: Submit names and contact details of proposed suppliers and installers as recommended by the manufacturer.
Substrate acceptance: Submit evidence of installer's acceptance of the flooring substrate before starting installation.

Tests
Site tests: Submit results, as follows:
- Substrate moisture content test.
- Flood test.
- Electronic leak detection test.
- Seam probe test.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Error! Reference source not found.**.

1.6 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 GENERAL

Samples
Requirement: Provide 300 x 300 mm samples of each type of membrane.

Storage and handling
General: Store and handle to the manufacturer's recommendations and as follows:
- Protect materials from damage.

2.2 MEMBRANES

Standards
Standard: To AS/NZS 4858 (2004).

Membrane system
Requirement: Proprietary membrane system suitable for the intended internal wet area waterproofing.
Certification: Provide to demonstrate conformance with NCC

Total VOC limits
Requirement: Conform to the following maximum TVOC content:
- Waterproof membrane: 250 g/L.

2.3 ACCESSORIES

Shower tray
General: Purpose-made jointless shower tray, with wall upstands at least 50 mm higher than the hob upstands. Set hob on the inside of the tray upstands.

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 GENERAL

Prototypes

Reporting
General: Make progressive photographic records of the waterproofing installation. Label photographs with the 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 m^2 and compare to the manufacturer's requirements.
- On completion of every 100 m^2 of each coat, compare the amount of membrane used with the manufacturer's application rate and record the result.

3.2 PREPARATION

Substrates
General: Prepare substrates as follows:

- Clean and remove any deposit or finish that 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, hob/wall junctions and at control joints where the membrane is bonded to the substrate.

Sealant fillet bond breakers:

- Application: Form a triangular fillet or cove of sealant to internal corners within the period recommended by the membrane manufacturer after the application of the primer.
- Width: Conform to AS 3740 (2021) Table 4.10.

3.3 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

Waterproof or water resistant surfaces: To BCA (2022) F2D2.

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.
- Overlap shower tray upstands at least 50 mm.
- 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.

Floor wastes in shower trays: Provide drainage of the tile bed and a waterproof connection between the tray and the drain.

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 with hobs and step-downs: Minimum 150 mm above the highest finished tile level of the shower area or 25 mm above the maximum retained water level, whichever is the greater.
- Shower areas without hobs: 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 with hobs

General: Provide masonry, concrete or corrosion-resistant metal hobs. Fix securely to the floor, seal against walls and make flush all gaps, joints and intersections before applying the membrane.

Masonry or concrete hob: Extend membrane over the hob and into the room at least 50 mm.

- Autoclaved aerated concrete hobs: Prime before applying the membrane.

Metal hob: Provide metal angle with height at least 15 mm above the finished floor level of the floor outside the shower. Terminate the membrane within 5 mm from the top of the angle. Seal the gap between the shower screen and the angle.

Showers with step-downs

Level of shower area: At least 15 mm below the finished floor level outside the shower.

Framed shower screens:

- Terminate the membrane directly below the floor tiles below the shower screen sill mounted on the upper level of the step-down.
- Support and adhere the membrane to a waterstop angle fixed securely to the substrate.

Frameless shower screens:

- Install a waterstop angle where the base of the shower screen will be installed and across the opening of the shower.
- Install membranes on both sides of the waterstop angle and turn the membranes up against the angle. Extend the membrane at least 50 mm into the adjacent area
- Finish membrane flush with the underside of tiles.
- Provide a sealant joint between the waterstop angle and tiles.
- Install the shower screen with the inside face flush with the step-down.

Showers without hobs or step-downs

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.

Preformed shower bases

Preformed shower bases with integral perimeter upstands:

- Support shower bases to prevent distortion or cracking.
- Recess shower base into walls or batten off wall lining sufficiently to allow water resistant wall finishes to overlap the integral upstands along the top edge of the shower base.
- Maintain the structural integrity of walls that are rebated.

Baths and spas

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 recommendations.

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.

3.4 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.

Flood tests

Requirement: To AS 3740 (2021) Appendix C2.

Records:

- Make photographic records of the flooded areas and adjacent areas.
- Label photographs with the date and location.

Electronic leak detection test

Requirement: To AS 3740 (2021) Appendix C3.

Seam probe test

Requirement: To AS 3740 (2021) Appendix C4.

3.5 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 the failure of materials and execution under normal environment and use conditions.

Period: As offered by the supplier.

0631B CERAMIC TILING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide tiling systems to walls, floors and other substrates, as documented.

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 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

Tiling

General: Conform to the recommendations of those parts of AS 3958 (2023) referenced in this worksection.

Slip resistance

Classification: To AS 4586 (2013).

1.4 TOLERANCES

Completed tiling

Requirement: To the recommendations of AS 3958 (2023) clause 5.4.8.

1.5 SUBMISSIONS

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

Products and materials

Type tests: Submit results, as follows:

- Slip resistance test: To AS 4586 (2013).
- Accelerated wear test: To AS 4586 (2013).

Evidence of delivery: Submit delivery docket as evidence of delivery of specified tiles.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 INSPECTION

Notice

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

- Substrate immediately before tiling.
- Control joints before sealing and grouting.
- Grout and sealant colours before application.

2 PRODUCTS

2.1 GENERAL

Samples

Requirement: Provide labelled samples of tiles, including accessories, grout and sealants, showing the range of variation in colour and finish.

Sample panels: Prepare a sample panel of each type of tiling system as follows:

- Size: > 2 m^2.
- Include samples of junction details and trim.
- Preserve the panel until related work is complete.

2.2 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.

2.3 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 that match the composition, colour and finish of the surrounding tiles.

Tile trim: Provide proprietary trim for wall tiles and floor tiles, as documented.

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

2.4 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.

2.5 MORTAR

Materials

Cement type to AS 3972 (2010): GP.

- White cement: Iron salts content ≤ 1%.
- Off-white cement: Iron salts content ≤ 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 (2023) clause 5.5.

Water

General: Clean and free from any deleterious matter.

2.6 GROUT

Type

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

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.

2.7 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 (2023) 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 that 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 that 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 joins 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

Sequence

Cutting and laying

Cutting: Cut tiles neatly to fit around fixtures and at margins where necessary. Drill holes without damaging tile faces. Cut recesses for fixtures such as soap holders. Rub edges smooth without chipping.

Laying: Return tiles into sills, reveals and openings. Butt up to returns, frames, fixtures, 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 centrelines of tiles. Continue tiling fully behind fixtures that 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 for NCC Classes 1, 2, 3 and 4 parts of a building: 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 (2023) clause 5.6.

Cement mortar: To AS 3958 (2023) 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 that 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 (2023) clause 5.6.5. 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.

3.8 CONTROL OF MOVEMENT

General

Requirement: Provide control joints carried through the tile and the bedding to the recommendations of AS 3958 (2023) clause 5.4.7 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 tile 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 trim

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 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.

Operation and maintenance manuals

Requirement: Prepare 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.

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

0651B RESILIENT FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide resilient floor finishes to substrates, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

General
Installation: To AS 1884 (2021).

Slip resistance
Classification: To AS 4586 (2013).

1.4 SUBMISSIONS

Fire performance
Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Operation and maintenance manuals
Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

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 or plank.
- 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:
- Moisture content test.
- Surface pH test.

Warranties
Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Substrate immediately before fixing resilient finishes or underlay.
- Completed underlay, if any.
- Finished surface before applying sealers or polishes, if any.
- 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 ADHESIVES

General
Requirement: To the resilient finishes manufacturer's recommendations.

2.5 SHEETS, TILES AND PLANKS

Cork tiles
Standard: To EN 12104 (2023).

Linoleum
Standard: To EN ISO 24011 (2012).

Corklinoleum
Standard: To EN 688 (2011).

Rubber
Standard:
- Smooth rubber: To EN 1817 (2020).
- Textured/relief rubber: To EN 12199 (2020).

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 ISO 11638 (2022).
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).

2.6 OTHER MATERIALS

Edge strips and threshold strips
General: Heavy duty metal moulding or extruded edge strip appropriate to the floor covering type, capable where necessary of accommodating different levels of adjacent floor finishes.
Type: As documented.
Location: At exposed edges of the floor covering, and at junctions with differing floor finishes or f inishes of a different thickness. Where edge strips occur at doorways, locate the junctions directly below the closed door.

Stair and landing nosings
Standard: To BCA (2022) D3D14 and BCA (2022) D3D15.

Type: As documented.

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.

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.

3.3 TESTING

Moisture content tests
General: Test substrate for suitability for the installation of resilient floor coverings to AS 1884 (2021) Appendix A.

- Maximum relative humidity of concrete: To AS 1884 (2021) Appendix A3.2.
- Moisture content of timber, plywood and particleboard subfloors: To AS 1884 (2021) Appendix A3.3.

Surface pH tests
General: Test concrete subfloor for suitability for the installation of resilient floor coverings to AS 1884 (2021) Appendix C.

- Maximum pH: 10.

3.4 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.

Plank set-out
General: Set out planks from centre of room. Align patterns, texture and grain in one direction.

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.

3.5 TILING

Vinyl tiles and planks
Laying: Lay as follows:

- Loose lay: Interlock tongue and groove edges of rigid planks. Tap down with rubber mallet.
- Adhesive fix: Apply acrylic adhesive over whole subfloor surface.

Cork tiles
Laying: Provide a water-based latex adhesive. Do not use pins.

Finishing: Sand after laying.

Rubber tiles
General: Keep tiles flat during storage. Before laying, allow the tiles to relax and decompress, and make sure that the backs are free of loose material.

Laying: Lay tiles in stretcher bond. Match edges and align joints and studs. Make sure the whole surface of the tile or accessory is in contact with the substrate.

Stair finish: Provide as follows:

- Smallest tiles: Half tile.
- Nosing tiles: Purpose-made matching tread, nosing and riser tile. Accurately scribe, cut and fit to perimeters. Close butt seams.

3.6 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.

3.7 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.

Stair and landing nosing

Installation: To the manufacturer's recommendations.

3.8 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 and threshold strips

Installation: To the NCC cited AS 1428.1 (2009) and the manufacturer's recommendations.

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.

Rubber coved skirtings and margins

General: Form from smooth flat sheet matching the colour and total thickness of the rubber flooring. Scribe and mitre at internal corners.

External corners and stop ends: Provide purpose-made matching moulded pieces.

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.

3.9 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 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.

Operation and maintenance manuals

General: Prepare a manual that includes manufacturer's recommendations for care and maintenance for each type of finish.

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

4 SELECTIONS

Refer to drawings and schedules for details, locations and extents.

0655 TIMBER FLOORING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide timber strip and parquet flooring systems to subfloors, as documented.

Performance

Requirements:

- Securely fixed.
- Smooth and flat, suitable for intended use.
- Pattern as documented.
- Structurally adequate.
- Able to accommodate expected shrinkage or expansion.
- Suitable for the applied finish.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0656 Floor sanding and finishing*.

1.3 STANDARD

General

Timber flooring: To the recommendations of Australasian Timber Flooring Association (ATFA) *Solid timber flooring industry standard (2022)*.

1.4 INTERPRETATION

Abbreviations

General: For the purposes of this worksection, the following abbreviation applies:

- MDF: Medium density fibreboard.

Definitions

General: For the purposes of this worksection the definitions in the AS 1684 series, the AS 1860 series and the following apply:

- Acoustic underlay: A resilient material laid between the subfloor and the flooring material to provide sound isolation.
- Butt joints (flooring): Floor boards cross cut square with plain ends for joining over battens or joists.
- End-matched joints (flooring and decking): Floor boards tongue and grooved at the ends to allow jointing between supports.
- Feature: The grade will determine the level of feature present. Natural characteristics of the wood including gum veins, past borer activity and knots present in the flooring.
- Flooring - continuously-supported: Flooring that is supported by, and directly fixed to, continuous structural supporting surfaces, including concrete slabs and sheet flooring subfloors.
- Flooring - fitted: Flooring fitted between the walls of each room i.e. not platform floors.
- Flooring - intermittently-supported: Flooring that is supported by, and spans across joists or battens.
- Flooring - strip flooring: Flooring made from machined timber with tongues and grooves along the length of the strips.
- Grade: The grade is an indication of the number and size of features in the flooring.
- Moisture content: The percentage by mass of water present in the material.
- Parquet: Timber mosaic parquet panels or wood block parquet bonded to a subfloor either directly or over an underlay, as follows:

. Mosaic parquet panels: Pre-assembled timber finger modules held together to form tiles or panels.
. Wood block parquet: Rectangular blocks of timber with length a multiple of width (e.g. 260 x 65 mm, 300 x 60 mm and 400 x 80 mm) laid individually to produce a pattern.

- Subfloor: The structure that supports the flooring.
- Underlay: A non-structural layer of rubber, cork, plywood or in situ levelling compound to provide a smooth and flat surface for flooring installation. Rubber and cork underlays have acoustic sound absorbing properties.

1.5 SUBMISSIONS

Certification

Requirement: Submit one of the following, as evidence of conformity to documented requirements for grading, species and board size:

- 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 manufactured moisture content of timber flooring products.

Fire performance

Fire hazard properties: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Tests

Site tests: Submit results, as follows:

- Subfloor moisture content test.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.6 INSPECTION

Notice

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

- Subfloor and any subfloor space before installation of flooring material.
- Trial set-out of parquet flooring before execution.
- Flooring material on site, before installation.
- Control and expansion joints, after installation.
- Perimeter expansion allowance, before concealing.
- Completed installation before sanding and application of finishing coatings.

2 PRODUCTS

2.1 GENERAL

Samples

Requirement: Provide samples representative of the timber flooring being supplied, illustrating the range of variation in colour, grade features and figure.

Storage and handling

General: Deliver timber flooring to site in unbroken plastic wrapping or packs. Store in dry conditions equivalent to those suitable for the installation of the floor, preferably in the installation location, a minimum 100 mm above the subfloor, to the supplier or manufacturer’s recommendations. Do not store in areas of wet plaster or paint.

Adhesive

Requirement: A flooring adhesive (polyurethane or polymer) to the flooring manufacturer’s recommendations, compatible with the subfloor, underlay and documented flooring.

Adhesive fixed flooring acoustic underlay
General: Provide proprietary acoustic underlay, if required, compatible with the subfloor, any levelling compound and the documented flooring, fixed to subfloor with compatible adhesive.

Levelling compound
General: Self-smoothing levelling compound applied to subfloor, compatible with the subfloor, any underlay and the documented flooring, including any adhesive.

Slab moisture vapour barrier protection
Applied barrier: Provide a moisture vapour retarding barrier applied to the subfloor surface, compatible with the subfloor, adhesive, any levelling compound and the documented flooring.

Polyethylene barrier: 200 µm high-impact resistant polyethylene film.

2.2 FIRE PERFORMANCE

Fire hazard properties
Critical radiant flux: Tested to AS ISO 9239.1 (2003).

2.3 SHEET SUBFLOOR

Plywood
Standard: To AS/NZS 2269.0 (2012).

Formaldehyde emission class to AS/NZS 2269.0 (2012): Class E_1.

Surface grade: CD.

Bond: Type A to AS/NZS 2754.1 (2016).

Particleboard
Particleboard: To AS/NZS 1860.1 (2017), Class 1.

Formaldehyde emission class to AS/NZS 1860.1 (2017): Class E1.

2.4 STRIP AND PARQUET FLOORING

New hardwood
Standard: To AS 2796.1 (1999).

Grading: To AS 2796.2 (2006).

New softwood
Standard:

- Seasoned cypress pine: To AS 1810 (1995).
  . Grade: 1.
- Softwood – pinus ssp: To AS 4785.2 (2002).
  . Grade: Appearance.
- Softwood – other: To AS 4785.2 (2002).
  . Grade: Select.

Recycled timber
Standard: To FWPA PN06.1039 (2008).

- Product requirements: To Section 3.
- Grading: To Section 5.1.

2.5 OTHER MATERIALS

Cork and filler
Requirement: Provide cork and filler compatible with, and matching, the documented flooring.

3 EXECUTION

3.1 GENERAL

Floor sanding and finishing
Requirement: To *0656 Floor sanding and finishing.*

3.2 PREPARATION

Clean subfloor

Requirement: Before installation remove loose material and dust and any deposits or existing finishes from the subfloor that may impair adhesive performance or floor performance.

Floors over enclosed subfloor spaces

Requirement: Make sure the ground beneath is dry and remains dry after floor installation. If dry conditions cannot be achieved and maintained, provide one or more of the following:

- Sealed drainage systems beneath and at the perimeter of the building.
- Soil membranes beneath the building, such as 200 µm builders plastic.

Subfloor flatness

Flatness of concrete subfloor:

- Floors laid on plywood or battens: Not greater than 3 mm deviation of the surface under a 1.5 m straightedge laid in any direction.
- Floors laid by direct adhesive fix: Not greater than 3 mm deviation of the surface under a 3 m straightedge laid in any direction.

Flatness of joist and sheet flooring subfloor:

- Not greater than 3 mm deviation of the surface under a 1.5 m straightedge laid in any direction.

Subfloor preparation

Concrete subfloors: Remove excessive projections by abrasion or grinding. Fill hollows and depressions with a levelling compound. Feather the levelling compound at all edges to make sure that any primer used beneath the levelling compound has been covered (or removed), before flooring installation.

Plywood and particleboard subfloors: Rough sand particleboard subfloors to remove the wax surface layer. Clean plywood subfloors may only need sheet joints sanded. Make sure that the subfloor is soundly fixed and free of squeaks.

Existing timber flooring subfloors: Sand to a flat and smooth surface. Make sure that the subfloor is sound, soundly fixed and free of squeaks.

Subfloor moisture content

Concrete subfloor: Test the in-slab relative humidity of the concrete slab to **TESTING**, **Subfloor moisture tests**. If 80 to 90% RH, provide slab moisture vapour barrier protection. If above 90% RH, the suitability of the slab needs further consideration and special precautions are required. Do not start installation of the flooring until testing is complete.

Timber, plywood or particleboard flooring subfloors: Do not start installation of the flooring until the moisture content of the subfloor, tested to **TESTING**, **Subfloor moisture tests**, is within 2% of the expected average in-service moisture content of the floor.

Timber flooring: Confirm that the moisture content of the timber flooring, as delivered, is within the range set by the manufacturer.

Acclimatisation

Requirement: If the moisture content of the supplied flooring differs significantly from its expected in-service moisture content, acclimatise or provide extra provision for expansion.

3.3 TESTING

Subfloor moisture tests

Moisture content of concrete subfloor - In-slab relative humidity test: Test subfloor in-slab relative humidity to ASTM F2170 (2019). Perform three tests for the first 100 m^2 of subfloor area and an additional test for each additional 100 m^2.

Moisture content of concrete subfloor - Impedance meter test: If in-slab relative humidity testing is not possible, test by impedance meter.

Moisture content of timber, plywood and particleboard subfloors: Test subfloors to AS/NZS 2098.1 (2006) for plywood and AS/NZS 1080.1 (2012) for timber and particleboard.

3.4 FIXING SHEET SUBFLOORS

Plywood subfloor adhesive fixed on concrete slabs

Vapour barrier: Provide a liquid applied moisture vapour barrier compatible with the adhesive system, as documented.

Subfloor sheet layout: Fix sheets in a stretcher bond or at 45° to the floor board direction.

Adhesive fix: Apply adhesive with a notched trowel to the adhesive manufacturer's recommendations. Provide downward pressure during curing.

Control joints: Provide joint widths as follows:

- Against vertical building elements: 10 mm.
- Between sheets: 6 mm.

Plywood subfloor mechanically fixed on concrete slabs

Vapour barrier: As documented.

Subfloor sheet layout: Fix sheets in a stretcher bond or at 45° to the floor board direction.

Mechanical fixing: Provide fixings as follows:

- 15 mm thick plywood: 4 rows of 5 fixings down the sheet length, minimum 75 mm from edges. Use spike fixings. Do not use nylon sleeve anchors.
- 12 mm thick plywood: 4 rows of 7 fixings down the sheet length, minimum 75 mm from edges. Use spike fixings. Do not use nylon sleeve anchors.

Control joints: Provide joint widths as follows:

- Against vertical building elements: 10 mm.
- Between sheets: Loosely butt sheets together.

Sheet subfloor fixed on joists

Installation: Lay the length of the sheets at right angles to the supports so that their top surfaces are aligned. Stagger the end joints and locate them centrally over joists. If sheets are not tongue and grooved, provide noggings or trimmer joists to support the edges.

Fixing centres: To the AS 1684 series or to the sheet manufacturer's recommendations.

Particleboard and plywood sheet flooring:

- Timber joists and battens: Adhesive and mechanically fix.
- Steel joists: Fix with adhesive and countersunk self-drilling winged screws.

3.5 FIXING TIMBER FLOORING

Battens for strip flooring on concrete slabs

General: Make sure support members align over the full width of the floor.

Framing fixed direct: Fix seasoned battens to the concrete slab so that their top surfaces are aligned.

- Battens: 70 x 35 mm (min) seasoned timber or 60 x 19 mm (min) seasoned high density hardwood.
- Spacing of fasteners: < 900 mm with spike fixings. Do not use nylon sleeve anchors.

Vapour barrier under battens: 200 µm high-impact resistant polyethylene film. Lap 300 mm, seal the laps with water-resistant plastic tape and return up the vertical surfaces and trim at the level of the flooring.

Battens for strip flooring on steel joists

General: Fix seasoned battens along the steel joists with countersunk screws so that their top surfaces are aligned.

- Batten size: Minimum 35 mm thick.
- Spacing of fasteners: < 600 mm.

Span table for strip flooring on battens or joists

Strip flooring timber (average species density)	Standard	Grade	Flooring thickness (mm)	Acceptable batten/joist spacings (mm)		Maximum board span (mm)	
				Butt jointed	End matched	Butt jointed	End matched
Australian hardwood	AS 2796.1 (1999)	Select	19	450 or 600	450	630	500
		Medium feature - Standard	19	450	450	570	450
Cypress	AS 1810 (1995)	Grade 1	19	450	450	510	410

Strip flooring timber (average species density)	Standard	Grade	Flooring thickness (mm)	Acceptable batten/joist spacings (mm)		Maximum board span (mm)	
				Butt jointed	End matched	Butt jointed	End matched
		Grade 2	20	450	450	510	410
Softwood: Slash pine	AS 4785.1 (2002)	Select and standard	19	450	450	510	410
Softwood: Other pinus species		Select and standard	19	450	350	470	350
Softwood: Araucaria (Hoop pine)		Manufacturer grade	20	450	450	510	410
Minimum board length: Equivalent length of two joist spacings. Angled board span: Not to exceed the maximum board span nominated. Decrease batten spacings to account for increased length of angled boards.							

Room environment

Requirement: Make sure the internal environment at the time of laying is to be suitable for installation to the manufacturer's recommendations, and as follows:

- Building enclosed and weathertight.
- Intense sunlight screened.
- Wet trades complete.
- Conditions close to the expected average in-service conditions.

Control joints

Requirement: To the manufacturer's recommendations or as follows if undocumented:

- Perimeters: Provide 10 mm wide expansion joints against vertical building elements.
- Strip flooring (and parquetry where block edges are parallel): For floors greater than 6000 mm (measured perpendicular to the run of the boards), provide for intermediate expansion using one of the following methods:
  - Regular spaced gaps: Provide a gap of 1.5 mm every 800 mm.
  - Intermediate expansion joints: Provide 12 mm wide cork filled expansion joints at maximum widths of 6000 mm. Install cork 2 mm proud of floor surface and sand flat with the floor.
- Fixing: Provide adhesive fixing in addition to mechanical fixing with staples, nails or cleats.

Parquet flooring: If joints are required, locate in inconspicuous locations. Cut a 12 mm wide full depth joint and fill with cork.

Adhesion check

Strip flooring

General: Blend floor boards to make sure of a relatively even distribution of the colour range and grade features throughout the floor.

Set-out: Locate joints in boards so that they are evenly distributed as follows:

- General: Not stepped, clustered or aligned and at least 300 mm apart.
- Butt joints: Centrally on supports.
- End-matched joints: Not adjacent within the same span between joist/battens.
- Minimum number of spans across supports: 2.

Installation: Lay in straight and parallel lines with each board firmly butted to the next and firmly in contact with the subfloor. If laid over joists or battens cramp as required to bring the boards tight at edges.

Strip flooring mechanically fixed to sheet subfloor:

- To plywood or particleboard on joists or battens: Nail through sheeting to joists or battens or secret fix into sheeting only.

- To plywood or particleboard over concrete slab: Secret fix only, as follows:
  . Boards up to 85 mm wide: Mechanically fix at up to 450 mm spacing over either a full trowel bed of flooring adhesive or with beads of adhesive, 6 to 10 mm, in a zigzag pattern placed midway between and at fixing points.
  . Boards over 85 mm wide: Mechanically fix at up to 450 mm spacing over a full trowel bed of flooring adhesive and in compliance to flooring manufacturer's recommendations.

Strip flooring direct mechanically fixed to joists: To the AS 1684 series and as follows:

- Boards up to 135 mm wide: Top nail or secretly fix.
- Boards over 135 mm wide: Top nail to joists.
- Top nailing boards 80 to 135 mm wide: Fix with 2 nails at each joist crossing. Punch nails 3 mm below finished surfaces.
- Top nailing boards over 135 mm wide: Fix with 3 nails at each joist crossing. Punch nails 3 mm below finished surfaces.
- Plain end flooring: If nails are less than 12 mm from ends of boards, pre-drill nail holes 0.8 mm undersize.
- Secret fixing: Fix with one staple or cleat at each joist crossing, angled at 45° through the base of the tongue.
- Adhesive: Use a 6 to 10 mm bead of polyurethane adhesive along each joist for both secret fixing and top nailing.

Strip flooring direct mechanically fixed to battens:

- Boards up to 135 mm: Top nail or secretly fix.
- Boards over 135 mm wide: Top nail to minimum 35 mm thick seasoned battens.
- Top nailing boards 80 to 135 mm wide: Fix with 2 nails at each batten crossing. Punch nails 3 mm below finished surfaces.
- Top nailing boards over 135 mm wide: Fix with 3 nails at each batten crossing. Punch nails 3 mm below finished surfaces.
- Plain end flooring: If nails are less than 12 mm from ends of boards, pre-drill nail holes 0.8 mm undersize.
- Secret fixing: Fix with one staple or cleat at each batten crossing, angled at 45° through the base of the tongue.
- Adhesive: Use a 6 to 10 mm bead of polyurethane adhesive along each batten for both secret fixing and top nailing.

Parquet

Vapour barrier under adhesive fixed flooring: A liquid applied membrane compatible with the adhesive system.

Trial set-out: Prepare a trial block parquet or mosaic panel set-out to:

- Demonstrate arrangement for more complex patterns.
- Maximise the size of equal margins of cut parquet blocks or panels.
- Locate control joints. Provide control joints where all blocks run parallel to each other and for large or more complex floors .

Laying method: To the flooring manufacturer's recommendations.

Performance: Spread adhesive and lay blocks or panels to achieve the following:

- Lay in documented pattern.
- Blend blocks for colour and feature.
- Use a full trowel bed of flooring adhesive over the subfloor in conformance with the adhesive manufacturer's recommendations.
- Make sure contact between adhesive and subfloor to address possible hollow sounds.
- If laying over acoustic underlays, make sure the correct firmer underlay is used to prevent movement at board edges after completion.
- If laying over a less stable subfloor (e.g. solid timber direct to joists), provide a 6 mm plywood underlay. Fix with adhesive beads at 100 mm intervals, staples at 75 mm around sheet perimeter, 12 mm in from edges and at 100 mm intervals through the body of the sheets.

3.6 COMPLETION

Protection

General: Provide protection as follows:

- Floors: With MDF taped at all butt joints. Do not cover with sheet plastic.
- Stair treads: Full MDF or plywood casing.

Spare flooring products

General: Supply an extra 5% of flooring products, to be stored on site as spares.

Storage location: TBA

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

4 SELECTIONS

Refer to drawings and schedules for details, locations and extents.

0671B PAINTING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide coating systems to substrates, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

Painting
General: To the recommendations of those parts of AS/NZS 2311 (2017) referenced in this worksection.

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.
- The published recommendations for maintenance.

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Opaque paint finishes:
  - . After surface preparation.
  - . After application of final coat.
- Clear finishes
  - . Before surface preparation of timber.
  - . After surface preparation.
  - . After application of final coat.

2 PRODUCTS

2.1 GENERAL

Samples
Requirement: Provide samples, as follows:
- Clear finishes: Labelled samples of each clear finish on representative timber or timber veneer substrates, including putty, stain, seal and coat, showing surface preparation, gloss level and other physical properties.
- Opaque paint finishes: Labelled samples of each system on representative substrates, showing surface preparation, colour, gloss level, texture and other physical properties.

Samples schedule

Substrate	Coating system	Colour	Number of samples	Sample size

Substrate	Coating system	Colour	Number of samples	Sample size

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 that are colour tinted by the manufacturer or supplier.

Toxic ingredients

General: To the *Therapeutic Goods (Poisons standard) Instrument (2023)* Part 2 Division 9.

3 EXECUTION

3.1 PREPARATION

Order of work

Other trades: 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 applying opaque paint finishes in the same area.

Protection

General: Clean the area and protect from dust contamination. Use drop sheets and masking agents to protect surfaces, including finished surfaces and adjacent finishes, during painting.

Fittings and furniture: Remove door furniture, switch plates, light fittings and other fittings. Attach labels or mark fittings using a non-permanent method, identifying location and refixing instructions, if required. Store and protect against damage.

Difficult to remove fittings fixtures: If removal is impractical or difficult, apply surface protection before substrate preparation and painting.

Substrates

General: Prepare substrates to receive the documented paint systems to the manufacturer's recommendations and as follows:

- Generally: Clean the substrate surface without damaging the substrate or the surroundings.
- Timber surfaces where clear finishes will be applied: Prepare the surface so that its attributes will show through the clear finish without blemishes, including the following:
  - . Remove bruises.
  - . Remove discolourations, including staining by oil, grease and nail heads.
  - . Bleach where necessary to match the timber colour sample.

. Fine sanding, with the last abrasive no coarser than 220 grit, so that there are no scratches across the grain.

- Sound external surfaces other than timber: Prepare the surface as follows:
  . 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.

Filling: Conform to the following:

- Generally: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth:
- Timber surfaces where clear finishes will be applied: Provide filler or putty tinted to match the surface.

Efflorescence: Before cleaning, eliminate the source of salt and water. Before repainting, allow surface to dry for 15 to 30 days.

New masonry: Before painting, allow masonry to cure and pH level to stabilise for 30 days.

Treated surfaces: If surfaces have been treated with preservatives or fire retardants, make sure the coating system is compatible with the treatment and does not adversely affect its performance.

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.

Unpainted surfaces

Standard: To AS/NZS 2311 (2017) Section 3.

Previously painted surfaces

General: Prepare previously painted surfaces, as documented.

Preparation of a substrate in good condition: To AS/NZS 2311 (2017) clause 7.4.

Preparation of a substrate in poor condition: To AS/NZS 2311 (2017) clause 7.5.

Preparation of steel substrates with protective coatings: To AS 2312.1 (2014) Section 8 and AS 1627.1 (2003).

PVC-U: Clean with methylated spirit and a nylon scouring pad.

Wallcovering: Remove wallcovering and residual paste with clean water. Patch and repair substrate to a uniform surface before painting.

Lime wash paints: Remove by brushing with warm water or pressure washing.

Reconditioned damaged surfaces in galvanized steel: To AS/NZS 4680 (2006) Section 8.

3.2 PAINTING SYSTEMS

General

Number of coats: Except where one or two coat systems are documented, provide each coating systems with at least 3 coats or to the manufacturer’s recommendations.

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.

Previously painted interior surfaces

Standard: To AS/NZS 2311 (2017) Table 8.2.

Previously painted exterior surfaces

Standard: To AS/NZS 2311 (2017) Table 8.3.

Specialised paint systems

Standard: To AS/NZS 2311 (2017) clause 5.2

3.3 APPLICATION

General

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.

Light levels

General: ≥ 400 lux.

Conditions

General: Unless the coating is recommended by the manufacturer for such conditions, do not apply under the following conditions:

- Rainy conditions.
- Dusty conditions.
- Relative humidity: > 85%.
- Surface temperature: < 10°C or > 35°C.
- Temperature: Within 3°C of the dew point.

Priming timber before fixing

General: Before fixing in position, apply 1 coat of wood primer and 2 coats to end grain to the back of the following:

- External fascia boards.
- Timber door and window frames.
- Tops and bottoms of external doors.
- Associated trim and glazing beads.
- Timber board cladding.

Spraying

General: If the application is by spraying, use conventional or airless equipment that conforms to the following:

- Satisfactorily atomises coating being applied.
- Does not require coating to be thinned beyond the maximum amount recommended by the manufacturer.
- Does not introduce oil, water or other contaminants into the applied coating.

Coatings with known health hazards: Not permitted on site.

Sanding

Clear finishes: Sand the sealer using abrasives no coarser than 320 grit without cutting through the colour. Take special care with round surfaces and edges.

Repair

Requirement: Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition.

Repair of galvanizing

Cleaning: For galvanized surfaces that 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).

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 notices 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: Remove splatters by washing, scraping or other methods that do not scratch or damage the surface.

Reinstatement: Repair, replace or refinish any damage, including damage made by other trades. Touch up new damaged paintwork or misses only with the paint batch used in the original application.

Fittings: Refix removed and undamaged fittings 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 authority.

4 SELECTIONS

Refer to drawings and schedules for locations and extents.

0671P DULUX PAINTING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide DuluxGroup/Dulux coating systems to substrates, as documented.

Performance

Requirement:

- Consistent in colour, gloss level, texture and dry film thickness.
- Free of runs, sags, blisters or other discontinuities.
- Opaque paint finishes that 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 COMPANY CONTACTS

DuluxGroup/Dulux technical contacts

Architects and Specifiers' Hotline (Paint, Acratex, Protective Coatings): 13 23 77.

Powder Coatings Technical Advice Hotline: 13 24 99.

Website: www.dulux.com.au/contact-us

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 STANDARDS

Painting

General: To the recommendations of those parts of AS/NZS 2311 (2017) referenced in this worksection.

1.5 MANUFACTURER'S DOCUMENTS

Technical manuals

Product Guide: www.dulux.com.au/specifier/products

Duspec Product Data Sheets, SDS, paint system selection: www.duluxconstructionsolutions.com.au

1.6 INTERPRETATION

Abbreviations

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

- ASU: Acrylic sealer undercoat multipurpose combo product.
- DFT: Dry film thickness.
- OFC: Off form concrete.
- PDS: Product data sheet.
- PRN: Paint reference number.
- PSU: Primer sealer undercoat multipurpose combo product.

Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 2310 (2002) and the following apply:

- 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 are defined as follows:
  . Full gloss: > 85 gloss units.
  . Gloss: > 50 and ≤ 85 gloss units.
  . Semi-gloss (satin): > 20 and ≤ 50 gloss units.
  . Low gloss (low sheen): > 5 and ≤ 20 gloss units.
- Matt: > 3 and ≤ 7 gloss units.
  . Flat: ≤ 5 gloss units.
- Paint: A product in liquid form that, 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 coating system that helps bind subsequent coats to the substrate and which may inhibit its deterioration.
- 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.

1.7 SUBMISSIONS

Products and materials

General: Dulux coatings systems have been selected for this project. Submit the following at least 3 weeks before the paint is required:

- Paint brand name and product range quality statement.
- Safety data sheets (SDS) showing the health and safety precautions to be taken during application.
- The published recommendations for maintenance.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Subcontractors

Specialist applicators: Submit names and contact details of proposed specialist applicators.

Substrate acceptance: Submit evidence of the applicator's acceptance of the substrate before starting application.

Warranties

Requirement: Before the application of the paint system, submit proposed warranties to PRODUCTS, **GENERAL**, **Warranties**.

1.8 INSPECTION

Notice

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

- Opaque paint finishes:
  . After surface preparation.
  . After application of final coat.
- Clear finishes:
  . Before surface preparation of timber.
  . After surface preparation.
  . After application of final coat.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.

Samples

Requirement: Provide samples, as follows:

- Clear finishes: Labelled samples of each clear finish on representative timber or timber veneer substrates, including putty, stain, seal and coat, showing surface preparation, gloss level and other physical properties.
- Opaque paint finishes: Labelled samples of each paint system on representative substrates, showing surface preparation, colour, gloss level, texture and other physical properties.

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.

Product identification

General: Marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

Warranties

Manufacturer's material warranty: Include the following:

- Extent: Paintwork generally.
- Terms: Paint systems are suitable for their intended use.
- Period: As defined by the manufacturer.

Alternative material performance warranty: Include the following:

- Terms: Provide the performance criteria as defined by the manufacturer.
- Measure: As defined by the manufacturer.
- Period: As defined by the manufacturer.

2.2 PAINTING MATERIALS

Combinations

General: Do not combine paints from different manufacturers in a paint system. Dulux paint products and coating systems have been selected and specified for this project. Any unauthorised product substitution will void the warranties.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the topcoats.

Tinting

General: Provide only products that are colour tinted by the manufacturer or supplier.

Toxic ingredients

General: To the *Therapeutic Goods (Poisons standard) Instrument (2023)* Part 2 Division 9.

Standards

Paint types: Conform to the Australian Standard referenced in the **DuluxGroup/Dulux paint type reference table**.

DuluxGroup/Dulux paint type reference table legend

Key:

ASU = Acrylic Sealer/Undercoat.

NE = No Equivalent.

PSU = Primer/Sealer/Undercoat.

Low VOC products are noted in the Table and the **Low VOC compliance reference table**.

^ Use is discouraged in favour of water based paints because of environmental concerns.

These paints have either limited availability or low requirement in the Building Industry.

DuluxGroup/Dulux paint type reference table

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2017) (Table 4.2)	Standard
Semi-gloss solvent-borne: interior	Dulux Super Enamel Semi-Gloss	DU00098	B3	AS 3730.5 (2006)
Semi-gloss water-borne, interior /exterior trim (alt B8b)	Dulux Aquanamel Semi Gloss (low VOC)	DU00075	B41	AS 3730.2 (2006)
Gloss solvent-borne: aerosols	Dulux Spray Pak	DU00016	B4#	NE
Full gloss solvent-borne: exterior	Dulux Metalshield Premium UV Resistant High Gloss	PC00281	B5a	AS 3730.6 (2006)
Full gloss solvent-borne: interior	Dulux Super Enamel Full Gloss	DU00090	B5b	AS 3730.6 (2006)
Full gloss waterborne interior/exterior trim (alt B9b)	Dulux Aquanamel Gloss (low VOC)	DU00176	B42	AS 3730.2 (2006)
Flat latex: interior ceilings	Dulux White Ceiling Paint (low VOC)	DU00125	B6a	AS 3730.1 (2006)
Flat latex: interior ceilings (tinted colours)	Dulux EnvirO_2 Ceiling Flat (low VOC)	DU00164	B6a	AS 3730.1 (2006)
Low gloss latex: exterior	Dulux Weathershield Low Sheen Acrylic	DU00073	B7b	AS 3730.8 (2006)
Low gloss latex: interior	Dulux Wash&Wear Low Sheen Acrylic (low VOC)	DU00110	B7a	AS 3730.3 (2006)
Low gloss latex: interior	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen (low VOC)	DU00114	B7a	AS 3730.3 (2006)
Low gloss latex: interior	Dulux Professional Steriguard Acrylic Low Sheen	PR00036	B7a	AS 3730.3 (2006)
Semi-gloss latex: exterior	Dulux Weathershield Semi Gloss Acrylic	DU00084	B8b	AS 3730.9 (2006)
Semi-gloss latex: interior	Dulux Wash&Wear Semi Gloss Acrylic (low VOC) Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss (low VOC)	DU00111 DU00115	B8a	AS 3730.2 (2006)
Semi-gloss waterborne latex: interior	Dulux Professional Steriguard Water Based Enamel Semi Gloss	PR00038	B42	AS 3730.2 (2006)
Gloss latex: exterior	Dulux Weathershield Gloss	DU00083	B9b	AS 3730.10 (2006)

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2017) (Table 4.2)	Standard
Gloss latex: interior	Dulux Wash&Wear Gloss	DU00112	B9a	AS 3730.12 (2006)
Gloss waterborne interior/exterior trim (alt B9a/B9b)	Dulux Aquanamel Gloss (low VOC)	DU00176	B42	AS 3730.1 (2006)
Gloss waterborne latex: interior	Dulux Professional Steriguard Water Based Enamel Gloss	PR00037	B42	AS 3730.1 (2006)
Wood primer, solvent-borne	Dulux 1 Step Oil Based Primer Sealer Undercoat	DU00179	B10	AS 3730.13 (2006)
Wood primer, latex	Dulux 1 Step Acrylic Primer Sealer Undercoat	DU00148	B10a	AS 3730.17 (2006)
Metal primer for steel – solvent-borne	Dulux Metalshield All Surface Primer	DU03647	B11	AS 3730.21 (2006)
Metal primer, latex (domestic)	Dulux Precision All Metal Primer (water based, low VOC)	DU00123	B11a#	AS 3730.15 (2006)
Galvanised metal (Zincalume) undercoat (domestic)	Dulux Professional Galvanised Iron Primer (water based, low VOC)	PR00023	B12a	AS 3730.15 (2006)
Metal primer for non ferrous metals (domestic)	Dulux Precision All Metal Primer (water based, low VOC)	DU00123	B13	AS 3730.17 (2006)
Zinc-rich organic binder/primer for steel	Dulux Zinc Rich 1P Primer	PC00319	B14	AS 3730.9 (2006)
White Set Plaster and powdery surface sealer	Dulux Precision Sealer Binder	DU00124	B15	AS 3730.22 (2006)
Concrete and masonry sealer	Dulux Acratex Acraprime 501/2	AC00077	B15	AS 3730.22 (2006)
Concrete and masonry sealer	Berger Gold Label Acrylic Block Filler	BG00016	B15	AS 3730.22 (2006)
Clear low viscosity paint for concrete (domestic)	Dulux AquaTread Concrete Sealer (low VOC)	BE00035	B15a	NE
Clear low viscosity paint for concrete floors	Dulux Luxafloor WB Acrylic Dust Sealer Gloss	PC00021	B15a	NE
Moisture resistant	Dulux 1 Step Acrylic Primer Sealer Undercoat (low VOC)	DU00148	B15a	AS 3730.18 (2006)

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2 017) (Table 4.2)	Standard
plasterboard				
Concrete and masonry, latex wallboard sealer, sealer/undercoat,	Dulux Acrylic Sealer Undercoat (low VOC) Dulux 1 Step Acrylic Primer Sealer Undercoat (low VOC)	DU175 DU00148	B16	AS 3730.18 (2006)
Undercoat, solvent-borne	Dulux 1 Step Oil Based Primer Sealer Undercoat	DU00179	B17	AS 3730.14 (2006)
Undercoat, latex: exterior	Dulux 1 Step Acrylic Primer Sealer Undercoat (low VOC) Dulux Acratex Water Based 501/1	DU00148 AC00077	B17a	AS 3730.18 (2006)
Undercoat, latex: interior	Dulux 1 Step Acrylic Primer Sealer Undercoat (low VOC) Dulux Acrylic Sealer Undercoat (low VOC)	DU00148 DU175	B17a	AS 3730.18 (2006)
Wood Stain - spirit	Feast Watson Prooftint	FW00069	B18	NE
Wood Stain - oil	Feast Watson Liming White Cabot’s Interior Stain Oil Based	FW00103 CA00063	B18	
Wood Stain - latex	Intergrain UltraDeck® Timber Stain (interior/exterior) (low VOC) Cabot’s Interior Stain Water Based	IN00039 CA00022	B18a	NE
Interior clear varnish, solvent-based, one-pack	Feast Watson Floorclear – Gloss, Satin, Matt	FW00033 FW00028 FW00031	B19	AS 3730.25 (2006) or AS 3730.27 (2006) (for floors)
Interior clear latex varnish, water-based, one-pack	Cabot's Cabothane Clear Water Based Gloss, Satin or Matt (low VOC) Cabot’s Stain & Varnish Water Based Gloss, Satin	CA00020 CA00021 CA00068 CA00007 CA00012	B19a	NE or AS 3730.27 (2006) (for floors)
Floor varnish, solvent based, clear (moisture cure)	Feast Watson Commercial Maxithane – Gloss, Satin	FW00074 FW00081 FW00065 FW00064	B20	AS 3730.27 (2006)
Floor Varnish, water-based, one-pack	Intergrain Enviropro Endure 1 Pack - Matt, Satin, Gloss (low VOC)	IE00028 IE00026	B20	AS 3730.27 (2006)
Floor varnish, clear or tinted, two-pack	Intergrain Enviropro Endure 2 Pack - Gloss, Satin, Matt	IE00028 IE00026 IE00017	B20	AS 3730.27 (2006)
Exterior latex	Intergrain UltraDeck® Timbe	IN00039	B22	AS 3730.16 (2006)

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2017) (Table 4.2)	Standard
stain, semi-transparent	r Stain (low VOC)			
Fence stain, latex paints, opaque	Dulux Weathershield Garden Shades – Low Sheen Cabot's Timbercolour Deck & Exterior Paint	DU00097 CA00073	B22b	AS 3730.16 (2006)
Exterior stain, solvent-borne, opaque	Feast Watson Timber & Deck Stain	FW00097	B23#	AS 3730.28 (2006)
Exterior stain, solvent-borne, semi-transparent	Feast Watson Exterior Stain & Varnish Gloss	FW00106	B23a	NE
Paving paint for concrete, solvent	Berger Jet Dry Paving Paint range	BE00034	B24	AS 3730.29 (2006)
Paving paint for concrete, latex	Berger Jet Dry Aqua Tread Satin	BE00035	B24a	NE
Roofing paint, latex (Solar reflectance)	Dulux AcraTex 962 COOLROOF with InfraCOOL Technology™	AC00084	B25	
Intumescent paints	Dulux Protective Coatings	Protective Coatings link	B28#	NE
Epoxy paint, two-pack, solvent-borne topcoats, interior only	Dulux Durebild STE 2 Pack Epoxy (high build & surface tolerant) Dulux Duremax GPE	PC00237 PC00349	B29	AS/NZS 3750.1 (2008)
Epoxy paint, two-pack, solvent-borne topcoats, exterior & pools		N/A	B29	AS/NZS 3750.1 (2008)
Epoxy paint, two-pack, water based, interior only	Dulux Luxafloor ECO2 (low VOC) Dulux Enviropoxy WBE	PC00392 PC00283	B29a	NE
High Build Recoatable two-pack, solvent-borne gloss polyurethane	Dulux Weathermax HBR Luxathane HPX	PC00382 PC00367	B29c B29c	NE
Stain sealer, solvent-borne for water soluble stains	Dulux Precision High Opacity Stain Blocker	DU00108	B30	NE
Stain sealer, water based	Dulux Precision Maximum Strength Adhesion Primer	DU00119	B30	

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2017) (Table 4.2)	Standard
for oil stains				
Chalk sealer, surface conditioner	Dulux Sealer Binder Dulux Acraprime Solvent Based Primer	DU00124 AC00078	B31	NE
Anti-mould (treatment or wash for timber)	Intergrain Ultraprep Mould Killer	IN00042	B32	NE
Water-repellent for masonry	Dulux AquaBan	DU00055	B33	NE
Creosote stain	No longer used	Poly	B35	NE
Paint remover, solvent-borne	Selleys Polystrippa Paint Stripper	Poly	B36a	NE
Paint remover, chemical	Selleys Polystrippa Renovators' Choice	Poly	B36b	NE
High build membrane or texture coatings for masonry and concrete: exterior	Dulux Acratex Range	Acratex	B38b	AS/NZS 4548.1 (1999) AS/NZS 4548.2 (1999) AS/NZS 4548.3 (1999) AS/NZS 4548.4 (1999)
Texture finish latex coatings for masonry and plasterboard: interior only	Dulux Effects Range (interior)	Effects range link	B38a	NE
Clear or colourless coatings (waterborne) for timber, exterior	Intergrain UltraClear Exterior – Gloss, Satin Note: not suitable for decking.	IN00015 IN00006	B39	NE
Clear coatings (waterborne) for timber, interior	Cabot's Cabothane Clear Water Based Gloss, Satin & Matt (low VOC)	CA00020 CA00021 CA00068	B39	NE
Clear or colourless coatings (waterborne) for timber, interior floors	Intergrain Enviropro Endure 1 Pack - Matt, Satin, Gloss (low VOC) Intergrain Enviropro Endure 2 Pack - Matt, Satin, Gloss	IE00028 IE00026 IE00017 IE00025 IE00027 IE00018	B39	AS 3730.27 (2006)
Sanding sealer	Feast Watson Sanding Sealer	FW00021	B40	NE

Paint type	DuluxGroup/Dulux material description	Dulux PDS No.	PRN AS/NZS 2311 (2017) (Table 4.2)	Standard
Semi-gloss latex, interior trim (alt B8b)	Dulux Aquanamel Semi-Gloss (low VOC)	DU00075	B41	NE
Gloss or full gloss latex, interior trim	Dulux Aquanamel Gloss (low VOC)	DU00176	B42	NE
Penetrating tung oil type varnish or wax for timber floors: interior	Intergrain Enviropro Hard Wax Oil Feast Watson Tung Oil	IE00035 FW00058	B43	NE
Penetrating tung oil type varnish for timber decks: exterior	Intergrain Nature's Timber Oil Feast Watson Traditional Timber Oil	IN00012 FW00085	B43	NE
Gloss pigmented polyurethane	Dulux Luxathane R Dulux Luxathane HPX Dulux Weathermax HBR	PC00368 PC00367 PC00382	B44	AS/NZS 3750.6 (2009)
Powder coatings for non-ferrous metals	Dulux Powder Coat Range	duluxpowders.com.au	B45b	AS 3715 (2002)
Powder coatings for ferrous metals	Dulux Powder Coat Range	duluxpowders.com.au	B45b	AS 4506 (2005)

Low VOC emitting paints

General: Provide paints that conform to the documented VOC limits.

Low VOC compliance reference table

Green Star Interiors	VOC Limits MAX g/litre	DULUX Products compared to the GBCA specification	VOC g/litre Untinted
COMPLIANCE CRITERIA – GBCA specifications (obtain latest figures).			
Walls and ceilings - interior semi-gloss	16	Dulux EnvirO_2 Interior Semi-Gloss	1
Walls and ceilings - interior semi-gloss	16	Dulux Wash&Wear Semi Gloss Dulux Wash&Wear +Plus Kitchen&Bathroom Semi Gloss	16 16
Walls and ceilings - interior low sheen	16	Dulux EnvirO_2 Interior Low Sheen	1
Walls and ceilings - interior low sheen	16	Dulux Wash&Wear Low Sheen Dulux Wash&Wear +Plus Kitchen& Bathroom Low Sheen	16 16
Walls and ceilings - interior flat-washable	16	Dulux EnvirO_2 Interior Matt	1
Ceilings - interior flat	14	Dulux EnvirO_2 Interior Tintable ceiling Flat	1
Ceilings - interior flat	14	Dulux White Ceiling Paint	14
Trim - interior gloss	75	Dulux Aquanamel Gloss Dulux Professional Steriguard Water	60

Green Star Interiors	VOC Limits MAX g/litre	DULUX Products compared to the GBCA specification	VOC g/litre Untinted
		Based Enamel Gloss	74
Trim - interior semi-gloss	75	Dulux Aquanamel Semi Gloss Dulux Professional Steriguard Water Based Enamel Semi Gloss	53 74
Trim - interior semi-gloss	75	Dulux EnvirO_2 Water Based Enamel Semi Gloss	1
Wall primer	65	Dulux Acrylic Sealer Undercoat	5
Latex primer for galvanized iron and zincalume NOT FOR HDG	65	Dulux Professional Total Prep	45
Latex primer for galvanized iron and zincalume NOT for HDG	65	Dulux Professional Galvanised Iron Primer	< 60
Interior latex undercoat	65	Dulux EnvirO_2 Acrylic Sealer Undercoat (ASU)	1
Interior latex undercoat	65	Dulux Prepcoat Acrylic Sealer Undercoat	< 5
Exterior latex undercoat	65	Dulux 1 Step Acrylic Primer Sealer Undercoat (PSU) Dulux Professional Total Prep	<37 45
Interior sealer	65	Dulux EnvirO_2 Acrylic Sealer Undercoat (ASU)	1
Interior concrete sealer	65	Dulux Luxafloor Eco2 (clear) + colours Dulux Luxafloor WB (Clear) + colours	10 10
One and two pack performance coatings for floors	140	Dulux Luxafloor Eco2 concrete Dulux Luxafloor WB concrete Intergrain Enviropro Timber Endure One Pack Intergrain Enviropro Timber Endure Two Pack	10 10 < 75 <140 (Part A & B)

3 EXECUTION

3.1 PREPARATION

Standard

General: To AS/NZS 2311 (2017) Section 3.

Order of work

Other trades: 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 applying opaque paint finishes in the same area.

Protection

General: Clean the area and protect from dust contamination. Use drop sheets and masking agents to protect surfaces, including finished surfaces and adjacent finishes, during painting.

Fittings and furniture: Remove door furniture, switch plates, light fittings and other fittings. 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 fittings and fixtures: If removal is impractical or difficult, apply surface protection before substrate preparation and painting.

Substrates

General: Prepare substrates to receive the documented paint systems to Dulux's recommendations and as follows:

- Generally: Clean the substrate surface without damaging the substrate or the surroundings.
- Timber surfaces where clear finishes will be applied: Prepare the surface so that its attributes will show through the clear finish without blemishes, including the following:
  . Remove bruises.
  . Remove discolourations, including staining by oil, grease and nail heads.
  . Bleach where necessary to match the timber colour sample.
  . Fine sanding, with the last abrasive no coarser than 220 grit, so that there are no scratches across the grain.
- Sound external surfaces other than timber: Prepare the surface as follows:
  . 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.
- Iron and steel: Remove weld spatter, slag, burrs, or any other objectionable surface irregularities and radius all edges to a minimum of 2 mm. Degrease by solvent or alkaline cleaning.
- Iron and steel blast cleaning: To AS 1627.9 (2002) and to the class specified in the specified protective treatment. Provide a surface roughness or profile appropriate for the specified treatment. If steelwork to be abrasive cleaned includes irregular shapes, allow for special equipment to achieve required abrasive cleaning.
- Structural steel: Paint exposed fixings, including bolts and screws, to match adjacent steelwork paint system.
- Concrete and masonry: Before application to very smooth concrete, brick or masonry, either acid etch, mechanically grind or abrasive track blast the surface as appropriate to provide a suitable key for the subsequently applied coating and to remove laitance. Remove loose friable matter before filling surface discontinuities.
- Set plaster surfaces: Do not apply solvent borne paint or other impervious coatings if the moisture content at the surface, tested with a moisture meter, exceeds 12%.

Efflorescence: Before cleaning, eliminate the source of salt and water. Before repainting, allow surface to dry for 15 to 30 days.

New masonry: Before painting, allow masonry to cure and pH level to stabilise for 30 days.

Treated surfaces: If surfaces have been treated with preservatives or fire retardants, make sure the coating system is compatible with the treatment and does not adversely affect its performance.

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.

Unpainted surfaces

Standard: To AS/NZS 2311 (2017) Section 3.

Previously painted surfaces

General: Prepare previously painted surfaces, as documented.

Preparation of a substrate in good condition: To AS/NZS 2311 (2017) clause 7.4.

Preparation of a substrate in poor condition: To AS/NZS 2311 (2017) clause 7.5.

Preparation of steel substrates with protective coatings: To AS 2312.1 (2014) Section 8 and AS 1627.1 (2003).

PVC-U: Clean with methylated spirit and a nylon scouring pad.

Wallcovering: Remove wallcovering and residual paste with clean water. Patch and repair substrate to a uniform surface before painting.

Lime wash paints: Remove by brushing with warm water or pressure washing.

Reconditioned damaged surfaces in galvanized steel: To AS/NZS 4680 (2006) Section 8.

3.2 PAINTING SYSTEMS

Dulux paint systems

Requirement: Apply the paint system nominated for each substrate to the **INTERIOR PAINTING SCHEDULES** and the **EXTERIOR PAINTING SCHEDULES**. Conform to the referenced manufacturer's Product Data Sheets (PDS) and Spec Sheets, including the following:

- The number and order of coats.
- The paint type for each coat.

Additional coats: Apply if necessary to:

- Prepare porous or reactive substrates with prime or seal coats consistent with the manufacturer's recommendations.
- Achieve the total film thickness or texture specified.
- Achieve the required opacity, in the specified or required colour.

Painting systems

Standards: The scheduled DuluxGroup/Dulux paint systems override AS/NZS 2311 (2017) as follows:

- New unpainted interior surfaces: To AS/NZS 2311 (2017) Table 5.1.
- New unpainted exterior surfaces: To AS/NZS 2311 (2017) Table 5.2.
- Standard: To AS/NZS 2311 (2017) clause 5.2. Provide the following final coats:
  - . High build textured or membrane finishes for concrete and masonry: B38 using products conforming to the AS/NZS 4548 series.
  - . Two-pack gloss pigmented polyurethane: B44.
  - . Two-pack epoxy: B29.
  - . Two-pack water-based epoxy: B29A.

Paint Reference Number (PRN): The number in brackets against the individual product refers to the Paint Ref. No. (PRN) listed in the **DuluxGroup/Dulux paint type reference table** and AS/NZS 2311 (2017) Table 4.2.

3.3 APPLICATION

General

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.

Light levels

General: During preparation of surfaces, painting and inspection, maintain light levels such that the luminance (photometric brightness) of the surface is equal to the specified permanent artificial illumination conditions or 400 lux, whichever is the greater.

Conditions

General: Unless the coating is recommended by Dulux for such conditions, do not apply under the following conditions:

- Rainy conditions.
- Dusty conditions.
- Relative humidity: > 85%.
- Surface temperature: < 10°C or > 35°C.
- Temperature: Within 3°C of the dew point.

Priming timber before fixing

General: Before fixing in position, apply 1 coat of wood primer and 2 coats to end grain to the back of the following:

- External fascia boards.
- Timber door and window frames.
- Tops and bottoms of external doors.
- Associated trim and glazing beads.
- Timber board cladding.

Spraying

General: If the application is by spraying, use conventional or airless equipment that conforms to the following:

- Satisfactorily atomises coating being applied.
- Does not require coating to be thinned beyond the maximum amount recommended by the manufacturer.
- Does not introduce oil, water or other contaminants into the applied coating.

Coatings with known health hazards: Not permitted on site.

Sanding

Clear finishes: Sand the sealer using abrasives no coarser than 320 grit without cutting through the colour. Take special care with round surfaces and edges.

Repair

Requirement: Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition.

Repair of galvanizing

Cleaning: For galvanized surfaces that 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).

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 notices in a conspicuous location and do not remove until the paint is dry.

Exclusions

General: Exclude the following surfaces from paint systems (unless specifically requested):

- Flexible duct connections, rubber hoses and mountings and other non-metallic flexible fittings.
- Wire rope and machined surfaces.
- Metals plated or specially finished for appearance, bronze, brass, copper and stainless steel (except as specified in the *Pipe identification* clause of the *Services* worksections).
- Aluminium frames.
- Prefinished aluminium frames to windows and doors, and trim.
- Metal floor duct covers.
- Raised access floors.
- Floors.
- Fair faced brickwork, blockwork, stonework, artificial stone and exposed aggregates.
- Sprayed vermiculite.
- Floors, paving, roads unless otherwise specified.
- Timber roof structure.
- Concealed timber roof structure.
- Timber ceiling and eaves lining.
- Exterior timber sheeting.
- Exterior timber stairs and decking.
- Plastic finishes generally
- Inside of service ducts, heat exchangers, pipes and valves.
- Shower seats, store shelving, work benches.
- Those parts of timber fixtures, such as insides of cupboards, not visible when doors are closed, unless otherwise specified. Insides of bathroom cabinets are not excluded and shall be painted.
- Self-finished surface such as glass and plastic laminates.
- Door hardware, including hinges.

3.4 COMPLETION

General

Protection and masking: Remove masking and protection coverings before paint has dried.

Cleaning: Remove splatters by washing, scraping or other methods that do not scratch or damage the surface.

Reinstatement: Repair, replace or refinish any damage, including damage made by other trades. Touch up new damaged paintwork or misses only with the paint batch used in the original application.

Fittings: Refix removed and undamaged fittings 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 authority.

Spares

Spare material: Supply clearly labelled sealed containers of each type, coat and colour of paint/coating from the same batch.

Quantity of each type: [complete/delete]

Storage location: [complete/delete]

4 SELECTIONS

4.1 INTERIOR PAINTING SCHEDULES

Flat and matt latex - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Matt	Dulux Wash&Wear Matt	DU00290
Plasterboard (Ultra low VOC system)	Dulux EnvirO_2 Interior Acrylic Sealer Undercoat	Dulux EnvirO_2 Interior Matt	Dulux EnvirO_2 Interior Matt	DU00160
Plasterboard (ceilings) (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux White Ceiling Paint	Dulux White Ceiling Paint	DU02398
Plasterboard (ceilings) (Ultra low VOC system)	Dulux EnvirO_2 Interior Acrylic Sealer Undercoat	Dulux EnvirO_2 Interior Ceiling Flat	Dulux EnvirO_2 Interior Ceiling Flat	DU04471
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Wash&Wear Matt	Dulux Wash&Wear Matt	DU00338
Fibrous/set plaster (with glancing light issues)	Dulux Sealer Binder (solvent based)	Dulux Wash&Wear Matt	Dulux Wash&Wear Matt	DU00338
Fibre cement products (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Matt	Dulux Wash&Wear Matt	DU00290
Timber and veneers	Dulux Professional Total Prep	Dulux Aquanamel Low-Gloss	Dulux Aquanamel Low-Gloss	DU01538
Cement render (low VOC system)	Dulux Prepcoat Acrylic Sealer Undercoat	Dulux Wash&Wear Matt	Dulux Wash&Wear Matt	DU00361
Acoustic ceiling tiles, vents & grids Vermiculite	Dulux Professional Acousticoat Flat			PR00396

Low-gloss latex - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02391
Plasterboard (Ultra low VOC system)	Dulux EnvirO_2 Interior Acrylic Sealer Undercoat	Dulux EnvirO_2 Interior Low Sheen	Dulux EnvirO_2 Interior Low Sheen	DU02822
Plasterboard (Dark colours)	Dulux EnvirO_2 Interior Acrylic Sealer Undercoat	Porter's Aqua Enamel Satin	Porter's Aqua Enamel Satin	PP00319
Fibrous/set plaster	Dulux Precision Sealer Binder	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU04651
Fibre cement products (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02896
Timber and veneers	Dulux Professional Total Prep	Dulux Aquanamel Low Gloss	Dulux Aquanamel Low Gloss	DU01538
Timber and veneers (walls)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02618
Concrete (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02966
Cement render (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02560
MDF	Dulux Professional Total Prep	Dulux Aquanamel Low Gloss	Dulux Aquanamel Low Gloss	DU01538
MDF (walls)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02539
Brick and masonry (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02966
Concrete blockwork (low VOC system)	Berger Gold Label Acrylic Block Filler	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU00488

Low-gloss latex (mould resistant) – Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03227
Plasterboard (MR grade) (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03227
Fibrous/set plaster	Dulux Sealer Binder (solvent	Dulux Wash&Wear +Plus Kitchen &	Dulux Wash&Wear +Plus Kitchen &	DU03340

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
	based)	Bathroom Low Sheen	Bathroom Low Sheen	
Fibre cement products (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03242
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03350
Cement render (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03350
MDF	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03010
Brick and masonry (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU03350
Concrete blockwork (low VOC system)	Berger Gold Label Acrylic Block Filler	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	Dulux Wash&Wear +Plus Kitchen & Bathroom Low Sheen	DU02850

Low-gloss latex (mould and bacteria resistant) - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00236
Plasterboard (MR grade) (low VOC system)	Dulux Professional Total Prep	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00902
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00129
Timber and veneers	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00237
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00238
MDF	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00237
Brick and masonry (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00238
Concrete blockwork (low VOC	Berger Gold Label Acrylic Block Filler	Dulux Professional Steriguard Acrylic Low Sheen	Dulux Professional Steriguard Acrylic Low Sheen	PR00169

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
system)				

Semi-gloss latex - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU2392
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02488
Fibre cement products (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02508
Timber and veneers	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU03000
Concrete (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02478
Cement render (low VOC system)	Dulux Total Prep	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02544
MDF (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU03000
Brick and masonry (low VOC system)	Dulux Acrylic Primer Sealer Undercoat	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02478
Concrete blockwork (low VOC system)	Berger Gold Label Acrylic Block Filler	Dulux Wash&Wear Semi Gloss	Dulux Wash&Wear Semi Gloss	DU02860

Semi-gloss latex (mould resistant) - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03235
Plasterboard (MR grade) (low VOC system)	Dulux EnvirO_2 Interior Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU02457
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03346
Fibre cement products (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03228

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Concrete (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03349
Cement render (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03347
MDF	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03348
Brick and masonry (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU03349
Concrete blockwork (low VOC system)	Berger Gold Label Acrylic Block Filler	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	Dulux Wash&Wear +Plus Kitchen & Bathroom Semi Gloss	DU02989

Semi-gloss water based enamel - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU02831
Plasterboard (MR grade)	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU02831
Plasterboard (MR grade) (Ultra low VOC system)	Dulux EnvirO2 Interior Acrylic Sealer Undercoat	Dulux EnvirO_2 Interior Enamel Semi Gloss	Dulux EnvirO_2 Interior Enamel Semi Gloss	DU04533
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU02922
Fibre cement products	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU03558
Timber and veneers (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU04571
Timber and veneers (ultra low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux EnvirO_2 Interior Enamel Semi Gloss	Dulux EnvirO_2 Interior Enamel Semi Gloss	DU04339
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU01004
Cement render	Dulux Professional Acrylic Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00414
MDF (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU04571
Brick and masonry	Dulux Acrylic Sealer	Dulux	Dulux	DU03356

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
	Undercoat	Aquanamel Semi Gloss	Aquanamel Semi Gloss	
Concrete blockwork	Berger Gold Label Acrylic Block Filler	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU03370
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal) (low VOC system)	Dulux Galvanised Iron Primer (water based)	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU01005
Shop primed or red oxide primed (ROZP) ferrous metal	Dulux Metalshield All Surface Primer	Dulux Aquanamel Semi Gloss Acrylic	Dulux Aquanamel Semi Gloss Acrylic	DU05329
Non-ferrous metals (incl. aluminium, brass, copper, tin plate) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00715
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU05239

Semi-gloss water based enamel (mould and bacteria resistant) - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00062
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00147
Fibre cement products	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00240
Timber and veneers (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00241
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00242
MDF (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00243
Concrete blockwork	Berger Gold Label Acrylic Block Filler	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00245

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel) (low VOC system)	Dulux Galvanised Iron Primer (water based)	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00246
Shop primed or red oxide primed (ROZP) ferrous metal (low VOC system)	Dulux Metalshield All Surface Primer (water based)	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00247
Non-ferrous metals (incl. aluminium, brass, copper, tin plate) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00248
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	Dulux Professional SteriGuard Water Based Enamel Semi Gloss	PR00249

Semi-gloss, solvent-borne - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and primed hardboard veneers	Dulux 1 Step Oil Based Primer Sealer Undercoat (solvent based)	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU02412
MDF	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU02569
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel)	Dulux Galvanised Iron Primer	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU00599
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Metalshield All Surface Primer (water based)	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU00544
Non-ferrous metals (incl. aluminium, brass, copper, tin plate)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU03013
Plastics (solvent resistant types e.g. FRP, PVC-U)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU02993
Plastics (solvent sensitive types e.g. polystyrene)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel Semi Gloss	Dulux Super Enamel Semi Gloss	DU02993

Full gloss water based enamel - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU02514

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard (MR grade)	Dulux Precision Sealer Binder	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU05334
Fibrous/set plaster	Dulux Sealer Binder (solvent based)	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03097
Fibre cement products	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03357
Timber and veneers (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU02436
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03375
Cement render	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU02747
MDF (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU02972
Brick and masonry	Dulux Acrylic Sealer Undercoat	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03375
Concrete blockwork	Berger Gold Label Acrylic Block Filler	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03375
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel) (low VOC system)	Dulux Galvanised Iron Primer (water based)	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU04438
Shop primed or red oxide primed (ROZP) ferrous metal	Dulux Metalshield All Surface Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU05336
Non-ferrous metals (incl. aluminium, brass, copper, tin plate) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU03014
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01011

Full gloss water based enamel (mould and bacteria resistant) - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Plasterboard	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00250
Fibrous/set plaster	Dulux Sealer Binder (solvent	Dulux Professional SteriGuard Water	Dulux Professional SteriGuard Water	PR00154

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
	based)	Based Enamel Gloss	Based Enamel Gloss	
Fibre cement products	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00251
Timber and veneers (low VOC system)	Dulux 1 Step Acrylic Primer Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00252
Concrete	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00253
MDF (low VOC system)	Dulux Acrylic Sealer Undercoat	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00254
Concrete blockwork	Berger Gold Label Acrylic Block Filler	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00255
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel) (low VOC system)	Dulux Galvanised Iron Primer (water based)	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00256
Shop primed or red oxide primed (ROZP) ferrous metal (low VOC system)	Dulux Metalshield All Surface Primer (water based)	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00259
Non-ferrous metals (incl. aluminium, brass, copper, tin plate) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00257
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Professional SteriGuard Water Based Enamel Gloss	Dulux Professional SteriGuard Water Based Enamel Gloss	PR00258

Full gloss solvent-borne – Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and primed hardboard veneers	Dulux 1 Step Oil Based Primer Sealer Undercoat	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU02410
MDF	Dulux 1 Step Acrylic Primer Undercoat	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU02568
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-	Dulux Galvanised Iron Primer (water based)	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU00599

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
primed steel)				
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Metalshield All Surface Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	PR05342
Non-ferrous metals (incl. aluminium, brass, copper, tin plate)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU03012
Plastics (solvent resistant types e.g. FRP, PVC-U)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU02428
Plastics (solvent sensitive types e.g. polystyrene)	Dulux Precision Maximum Strength Adhesion Primer	Use water based paints, not solvent based.	Use water based paints, not solvent based.	N/A

Full gloss, epoxy primed enamel - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel)	Dulux Durebild STE to 100 µm DFT	Dulux Metalshield Prem UV Resistant Enamel Topcoat Gloss	Dulux Metalshield Prem UV Resistant Enamel Topcoat Gloss	DU00248

Full gloss, epoxy primed two-pack polyurethane - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Zinc-coated metals (incl. HD Galvanized steel, zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel)	Dulux Duremax GPE Zinc Phosphate to 125 µm DFT	Dulux Duremax GPE to 100 µm DFT	Dulux Weathermax HBR to 75 µm DFT	DU03559

Clear over stain on timber or veneers - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and timber veneer (solvent based system)	Cabot's Cabothane (solvent based) Gloss or Satin	Cabot's Cabothane (solvent based) Gloss or Satin	Cabot's Cabothane (solvent based) Gloss or Satin	CA00114 CA00162
Timber and timber veneer (low VOC water based system)	Cabot's Cabothane Clear Water Based Gloss or Satin Apply 10.8 m^2/litre	Cabot's Cabothane Clear Water Based Gloss or Satin Apply 10.8 m^2/litre		CA00216 CA00218

Clear coat two-pack polyurethane - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber (low VOC water based system)	Intergrain Enviropro Timberseal	Intergrain Enviropro Endure 2 Pack Matt	Intergrain Enviropro Endure 2 Pack Matt	IE00110
Timber (low VOC	Intergrain	Intergrain Enviropro	Intergrain Enviropro	IE00050

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
water based system)	Enviropro Timberseal	Endure 2 Pack Satin	Endure 2 Pack Satin	
Timber (low VOC water based system)	Intergrain Enviropro Timberseal	Intergrain Enviropro Endure 2 Pack Gloss	Intergrain Enviropro Endure 2 Pack Gloss	IE00047

Clear coat single pack polyurethane - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and timber veneer (low VOC water based system)	Cabot's Cabothane Clear Water Based Gloss or Satin Apply 12 m^2/litre	Cabot's Cabothane Clear Water Based Gloss or Satin Apply 12 m^2/litre		CA00216 CA00218

Two pack gloss pigmented polyurethane - Interior joinery

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber (Factory applied)	Dulux Luxepoxy 4 White Primer to 50 µm DFT.	Dulux Luxathane SPX Satin		PC00046

Clear finishing oils for timber - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber	Feast Watson Scandinavian Oil Apply at 16 m^2/litre	Feast Watson Scandinavian Oil Apply at 16 m^2/litre		FW00181
Timber	Feast Watson Tung Oil Apply 12-14 m^2/litre	Feast Watson Tung Oil Apply 12-14 m^2/litre		FW00182

Tung oil (Semi-gloss finish) - Interior (timber floors)

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber (soft wood)	Feast Watson Proofseal	Feast Watson Tung Oil (Commercial)	Feast Watson Tung Oil (Commercial)	FW00194
Timber (hardwood)	Feast Watson Proofseal	Feast Watson Tung Oil (Commercial)	Feast Watson Tung Oil (Commercial)	FW00194

Clear single pack polyurethane - Interior (timber floors)

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber (floors) (low VOC water based system)	Intergrain Enviropro Endure 1 Gloss, Satin or Matt	Intergrain Enviropro Endure 1 Gloss, Satin or Matt	Intergrain Enviropro Endure 1 Gloss, Satin or Matt	IE00104 IE00115 IE00106
Timber (floors)	Feast Watson Floorproof (solvent based) Gloss or Satin	Feast Watson Floorproof (solvent based) Gloss or Satin	Feast Watson Floorproof (solvent based) Gloss or Satin	FW00153 FW00154

Paving paint for concrete – Interior or exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Concrete (solvent based system)	Berger Jet Dry Non-Slip Paving Paint	Berger Jet Dry Non-Slip Paving Paint	Berger Jet Dry Non-Slip Paving Paint	BE00100
Concrete (low VOC, water based system)	Berger Jet Dry Aqua Tread Satin	Berger Jet Dry Aqua Tread Satin		BE00155

Clear sealer for concrete – Interior or exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Concrete (Domestic) (low VOC, water based system)	Berger Jet Dry Aqua Tread Satin	Berger Jet Dry Aqua Tread Satin	Berger Jet Dry Aqua Tread Satin	BE00155
Concrete (commercial) (low VOC, water based system)	Dulux Luxafloor WB	Dulux Luxafloor WB	Dulux Luxafloor WB	PC00214
Concrete (commercial) (water based system)	Dulux Protective Coatings Luxafloor WB Sealer Gloss	Dulux Protective Coatings Luxafloor WB Sealer Gloss	Dulux Protective Coatings Luxafloor WB Sealer Gloss	PC00214
Concrete (commercial) (solvent based system)	Dulux Luxafloor ACS	Dulux Luxafloor ACS		PC00130

Previously painted surfaces - Interior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
e.g. Painted Plasterboard	Dulux ASU	Dulux Wash&Wear Low Sheen	Dulux Wash&Wear Low Sheen	DU02391

4.2 EXTERIOR PAINTING SCHEDULES

Low-gloss latex – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Weatherboard - hardboard cladding (Weathertex) Restricted application	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU05348
Weatherboard -fibre cement board cladding (Hardiboard) Restricted application	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU02593
Fibre cement products (soffits)	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen		DU04504
Timber and veneers	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00611
Concrete (OFC, tilt slab or precast) Restricted application	Dulux Acratex Green Render Sealer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04491
Concrete (OFC, tilt slab	Dulux Acratex	Dulux AcraTex	Dulux AcraTex	AC02778

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
or precast) (High-build performance coating system)	Green Render Sealer	AcraShield Roller Finish	AcraShield Roller Finish	
Cement render (High-build performance coating system)	Dulux Acratex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	AC00860
Clay brick and masonry Restricted application	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00421
Concrete blockwork Restricted application	Berger Gold Label Acrylic Blockfiller	Dulux Weathershield Low Sheen Acrylic	Dulux Weathershield Low Sheen Acrylic	DU02631
Concrete blockwork (High-build performance coating system)	Dulux AcraTex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	DU04938
Zinc coated metals (incl. Zincalume, Galvabond, Zincanneal, zincseal, zinc-primed steel)	Dulux 1 Step Prep	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04608
HD Galvanized steel or zinc-primed steel (Domestic)	Dulux Durebuild STE Two Pack Epoxy	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU05261
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Luxaprime Zinc Phosphate Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00478
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04610

Semi-gloss latex – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Weatherboard - hardboard cladding Non rebated Jointed (Weathertex) Restricted application	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU05348
Weatherboard -fibre cement board cladding Non rebated Jointed (Hardiboard) Restricted application	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU02593
Fibre cement products Soffits	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen		DU04504
Timber and veneers	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00611
Concrete (OFC, tilt slab or precast) Restricted application	Dulux Acratex Green Render Sealer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04491

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Concrete (OFC, tilt slab or precast) (High-build performance coating system)	Dulux Acratex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	AC02778
Cement render (High-build performance coating system)	Dulux Acratex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	AC00860
Clay brick and masonry Restricted application	Dulux Professional Acrylic Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00421
Concrete blockwork Restricted application	Berger Gold Label Acrylic Blockfiller	Dulux Weathershield Low Sheen Acrylic	Dulux Weathershield Low Sheen Acrylic	DU02631
Concrete blockwork (High-build performance coating system)	Dulux AcraTex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	DU04938
Zinc coated metals (incl. Zincalume, Galvabond, Zincanneal, zincseal, zinc-primed steel)	Dulux 1 Step Prep	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04608
HD Galvanized steel or zinc-primed steel (Domestic)	Dulux Durebuild TE Two Pack Epoxy	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU05261
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Luxaprime Zinc Phosphate Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU00478
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU04610

Gloss latex – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Fibre cement products Restricted application	Dulux Weathershield Gloss	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU05350
Timber and veneers	Dulux Professional Acrylic Primer	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU00623
Concrete (OFC, tilt slab or precast) Restricted application	Dulux AcraPrime 501/1 Water Based Primer	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU02639
Concrete (OFC, tilt slab or precast) (High-build performance coating system)	Dulux Acratex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	AC02778
Cement render	Dulux Acratex Green	Dulux AcraTex	Dulux AcraTex	AC01415

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
(High-build performance coating system)	Render Sealer	AcraShield Roller Finish	AcraShield Roller Finish	
Clay brick and masonry	Dulux Professional Acrylic Primer	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU05353
Concrete blockwork	Berger Gold Label Acrylic Blockfiller	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU03378
Concrete blockwork (High-build performance coating system)	Dulux Acratex Green Render Sealer	Dulux AcraTex AcraShield Roller Finish	Dulux AcraTex AcraShield Roller Finish	DU04938
Zinc coated metals (incl. Zincalume, Galvabond, Zincanneal, zincseal, zinc-primed steel)	Dulux Professional Galvanised Iron Primer	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU05354
HD galvanized steel or zinc-primed steel (Domestic)	Dulux Durebuild STE Two Pack Epoxy	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU05355
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Luxaprime Zinc Phosphate Primer (solvent based)	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU00480
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Weathershield Gloss	Dulux Weathershield Gloss	DU05299

Acrylic paint system for bagged masonry – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Brickwork and concrete Restricted application	Berger Gold Label Block Filler	Dulux Weathershield Low Sheen	Dulux Weathershield Low Sheen	DU02631
Brickwork and concrete – bagged slight texture finish	Dulux AcraPrime 501/1 Water Based Primer	Dulux Acratex Contempo Advance Coarse Bagged Look (2nd coat Optional)	Dulux Acratex Contempo Advance Coarse Bagged Look	AC01825
Brickwork and concrete – flush finish – medium texture	Dulux AcraTex Mediterranean Classique	Dulux AcraTex Mediterranean Classique	Dulux AcraTex AcraShield	AC02669

Textured acrylic paint system – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Concrete, blockwork and cement render	Dulux Acraprime 501/1 Water Based Primer	Dulux Acratex Contempo 959 Advance Base Coat	Dulux Acratex Contempo 959 Advance Finish Coat	AC01825
Concrete,	Dulux Acraprime	Dulux Acratex Roll	Dulux Acratex	AC01629

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
blockwork and cement render	501/1 Water Based Primer (B15)	On 00 Low Profile Texture	Acrashield Finish	
Concrete, masonry, blockwork and cement render	Dulux Acraprime 501/1 Water Based Primer	Dulux Acratex Acrashield 955 Low Gloss Rolana Finish	Dulux Acratex Acrashield 955 Low Gloss Rolana Finish	AC01958

Semi-gloss water based enamel – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Fibre cement products Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00432
Timber and veneers	Dulux Professional Acrylic Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU04571
Concrete Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU01004
Cement render Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00414
Brick and masonry Restricted application	Berger Gold Label Acrylic Block Filler	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU03370
Concrete blockwork Restricted application	Berger Gold Label Acrylic Block Filler	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU03370
Zinc coated metals Zincalume, Galvabond, Zincanneal, zincseal, zinc-primed steel) (low VOC system)	Dulux Professional Galvanised Iron Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU01005
Shop primed or red oxide primed (ROZP) ferrous metal	Dulux Metalshield All Surface Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU04575
Non-ferrous metals (incl. aluminium, brass, copper, tin plate) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00715
Plastics (solvent resistant types e.g. FRP, PVC-U) (low VOC system)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Semi Gloss	Dulux Aquanamel Semi Gloss	DU00413

Full gloss water based enamel – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Fibre cement products Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU00431

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and veneers	Dulux Professional Acrylic Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU00548
Concrete Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01006
Cement render Restricted application	Dulux Professional Acrylic Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU00415
Brick and masonry Restricted application	Berger Gold Label Acrylic Blockfiller	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01008
Concrete blockwork Restricted application	Berger Gold Label Acrylic Blockfiller	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01008
Zinc-coated metals (Zincalume, Galvabond, Zincanneal, zincseal, & zinc-primed steel)	Dulux Professional Galvanised Iron Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU04438
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Luxaprime Zinc Phosphate Primer (solvent based)	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU00436
Non-ferrous metals (incl. aluminium, brass, copper, tin plate)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01010
Plastics (solvent resistant types e.g. FRP, PVC-U)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Aquanamel Gloss	Dulux Aquanamel Gloss	DU01011

Full gloss, solvent borne – Exterior

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
Timber and primed hardboard veneers	Dulux 1 Step Oil Based PSU (solvent based)	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU02410
Zinc-coated metals (zincalume, Galvabond, zincanneal, zincseal, zinc-primed steel)	Dulux Professional Galvanised Iron Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU05331
Shop primed or red oxide primed (ROZP) ferrous metal.	Dulux Luxaprime Zinc Phosphate Primer (solvent based)	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU00481
Non-ferrous metals (incl. aluminium, brass, copper, tin plate)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU03012
Plastics (solvent resistant types e.g. FRP, PVC-U)	Dulux Precision Maximum Strength Adhesion Primer	Dulux Super Enamel High Gloss	Dulux Super Enamel High Gloss	DU02428
Plastics (solvent	Dulux Precision	Don't use	Don't use	N/A

Substrate	1st coat	2nd coat	3rd coat	Manufacturer's Spec Sheet Ref
sensitive types, e.g. polystyrene)	Maximum Strength Adhesion Primer	Solvent Based, Use Water Based Paints	Solvent Based, Use Water Based Paints	

Car parking line marking

Requirement:

- Apply nominally 70 mm wide line marking for car parking spaces nominated on drawings.
- Materials:
- Paint System: Dulux Roadmaster WB2, spray applied to manufacturers written recommendations.
- Colour shall be white and shall not be subject to discolouration by the bitumen from the road surface.

Application: Unless approved all paint shall be applied by a mechanical line marking sprayer. The road surface shall be clean and dry at the time of painting. Paint shall be applied at wet thickness in the range of 0.35 to 0.40 mm. Bitumen shall be at least 30 days old before coating.

Standard: To AS/NZS 2890.1 (2004).

0702 MECHANICAL DESIGN AND INSTALL

1 MECHANICAL SYSTEMS

1.1 RESPONSIBILITIES

General

Requirement: Design systems and provide mechanical services, as documented.

1.2 DESIGN

General

Requirement: To DESIGN in *0171 General requirements*.

Designer qualifications

Designer qualification: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience. Conform to **DESIGNER** in *0171 General requirements*.

Design for durability and maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

Access for maintenance: Develop the design so the systems conform to **ACCESS FOR MAINTENANCE** in *0171 General requirements*.

Energy efficiency

Requirement: To BCA (2022) J6.

Seismic restraint

Requirement: To **SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS** in *0171 General requirements*.

Design, application and calculations

Standards: Conform to the recommendations of one or more of the following:

- AIRAH Design Application Manuals.
- ASHRAE Handbooks.
- CIBSE Guides.

Methods of calculation: Manual or software that employs the data and methods in the applicable standard.

Air conditioning system design

Requirement: Provide engineering design that:

- Maximises the functionality, performance, safety, flexibility and reliability of the mechanical services.
- Is technically sound.
- Can be constructed using methods that are good practice and in common use.
- That provide the lowest combined owning and operating cost over the design life of the systems.

Heating

Requirement: Provide reverse cycle heating.

Outdoor design conditions

General: Use design conditions listed in AIRAH DA09 (2022) or ASHRAE Handbook - Fundamentals (2021) for:

- The design conditions location selected to the recommendations of AIRAH DA09 (2022) clause 3.4.2.
- Cooling design: Annual cooling, dehumidification and enthalpy design conditions, 1% DB (dry bulb) and MCWB (mean coincident wet bulb) for the selected location.
- Heating design: Annual heating and humidification design conditions, 99% Heating DB (dry bulb) for the selected location.

Indoor design conditions

General: Conform to the following:

- Summer: 24°C dry bulb, 50% relative humidity.
- Winter: 21°C dry bulb.

Cooling performance

Requirement: Maintain the air conditioned spaces, as measured at the points of control, within the documented cooling indoor design conditions at the highest cooling load due to the combination of the following:

- Cooling loads imposed by the outdoor design conditions.
- Other cooling loads when they are at their maximum.
- Full solar load.
- Loads due to system and other losses.

Heating performance

Requirement: Maintain the air conditioned spaces, as measured at the points of control, within the documented heating indoor design conditions at the highest heating load due to the combination of the following:

- Heating loads imposed by the outdoor design conditions.
- Other documented cooling loads are zero.
- Solar cooling load is zero.
- Loads due to system and other losses.

Temperature variation

Requirement: Limit the temperature difference in air conditioned spaces served by the same zone or system to 2°C as follows:

- Between any 2 points in the space from floor level to 1500 mm above floor level.
- > 2000 mm from cooking equipment and > 1000 mm from any other appliance.
- When the documented outdoor conditions are not exceeded.
- After the plant has been operating for one hour.
- With the temperatures measured in the same 5 minute period.

Zoning

Requirement: Divide the systems into temperature controlled zones to meet the stated permissible limits in temperature variation, and the system divisions documented.

Fresh air: Supply fresh air to spaces with air conditioning systems via the air handling system.

Building fabric loads

Requirement: Allow for loads from the construction documented.

Internal window shading: As documented.

Lighting loads

Requirement: Allow for heat loads from the lighting as documented but not less than 5 W/m^2.

Internal equipment loads

Requirement: Allow for loads from the equipment as documented but not less than 5 W/m^2.

People loads

Number of people in each space: To AS 1668.2 (2012) but no fewer than 1 person/10 m^2.

Heat gain from people: To AIRAH DA09 (2022).

Supply air

Minimum supply air to each air conditioned space: ≥ 4.5 L/s/m^2 at all times the plant is operational.

Outside air

Standard: To AS 1668.2 (2012) but not less than 10 L/s/person.

Means of supply: Provide outside air only through the air conditioning system or a mechanical ventilation system. Do not offer natural ventilation lieu of mechanical ventilation to AS 1668.2 (2012).

Design life

General: To *0171 General requirements*.

Design life:

- Equipment to PACKAGED AIR CONDITIONING: 15 years.
- Equipment to ROOM AIR CONDITIONERS: 10 years.

- All other systems and components other than consumables: 20 years.

Noise levels

Ambient noise emitted: Lower than the level that can be heard within a habitable room in any neighbouring premises, regardless of whether any door or window to that room is open.

Noise levels in occupied spaces: To **NOISE LEVELS** in *0171 General requirements*.

Acoustic treatment of air handling systems: Provide acoustically insulated ducts, attenuators, acoustic louvres and/or cross-talk attenuators to achieve the documented space and ambient noise levels and acoustic separation.

Fire separation

Requirement: As documented.

Control

Requirement: To PACKAGED AIR CONDITIONING, ROOM AIR CONDITIONERS, AUTOMATIC CONTROLS and BCA (2022) J6D3.

Mechanical ventilation

Requirement: To AS 1668.2 (2012).

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0201 Demolition*.

1.4 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).

Refrigeration systems: To AS/NZS 5149.1 (2016), AS/NZS 5149.2 (2016), AS/NZS 5149.3 (2016) and AS/NZS 5149.4 (2016).

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), AS/NZS 3500.4 (2021) and the PCA (2022).

Residential heating and cooling systems: To AS/NZS 5141 (2018).

Electrical services

Requirement: To AS/NZS 3000 (2018).

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 11801.1 (2019) and AS/NZS 14763.2 (2020).

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in *0171 General requirements* and the following apply:

- Sealants: Material in liquid (including aerosol) form or mastic form (including mastic embedded in fabric) designed to prevent air, water and vapour leakage. If mastic sealant is specified, do not use liquid sealant. If liquid sealant is specified, do not use mastic sealant.

1.6 SUBMISSIONS

General

Requirement: Conform to *0171 General requirements*.

Submissions: Before starting work, submit the following:

- Outdoor design conditions, corresponding geographic location and source of data.
- Calculated total and sensible cooling capacities and heating capacity.
- Name of calculation method used.
- Makes and model numbers of proposed equipment.
- Total and sensible cooling capacities and heating capacity of the proposed equipment, adjusted for the documented outdoor and indoor conditions and any effects of the proposed plant configuration.
- Any assumptions on which the calculations are based.
- Details of any departures from this specification.
- Method of heating and % of total heating load in the case of electric heating.
- Mechanical contractor provision for attendance to breakdowns.
- Availability of service network of plant manufacturer.
- Licence numbers and type of licences held by persons responsible for the installation.

Authority approvals

Authority submissions: Submit evidence of approval from authorities relating to the works.

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.

Drawings

Requirement: Submit drawings at minimum 1:100 scale showing the following:

- Areas to be air conditioned.
- Areas to be mechanically ventilated including car parks, toilets and kitchens.
- Details demonstrating compliance with mechanical ventilation requirements of NCC.
- Details demonstrating compliance with energy requirements of NCC.
- Make, model and principal performance parameters of each item heating and cooling equipment.
- Make, model and principal performance parameters of ventilation fans.
- Make, model and principal performance parameters of air filtration equipment and details of compliance with statutory requirements.
- Air conditioning zones and sensor locations and methods of heating.
- Functional descriptions of automatic control systems.
- Duct, pipe, equipment layouts and plant locations. Show proposed zoning and methods of heating.
- Details of equipment supports, including seismic restraints to *0171 General requirements*.
- Mechanical services electrical diagrams and details.
- Provisions for maintenance access, balancing and commissioning.
- If necessary to convey the requirements of the design, provide additional schematic diagrams of air, control and refrigeration systems.
- Details of fire provisions demonstrating compliance with NCC.
- Other details and information to meet statutory requirements.

Existing systems

Shutdowns: Submit detailed shutdowns schedule, including the date and time of shutdowns, details of proposed work and affected systems and locations, to **WORK ON EXISTING SYSTEMS**.

Existing condition: Submit proposals to rectify deficiencies If the existing condition does not conform to the documented requirements.

Operation and maintenance manuals

Requirement: Conform to **OPERATION AND MAINTENANCE MANUALS** in *0171 General requirements*.

Subcontractors

General: Submit names, contact details, licence numbers and type of licence of proposed suppliers and installers.

1.7 WORK ON EXISTING SYSTEMS

Equipment removal

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

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

Recovered items

Requirement: To *0201 Demolition*.

Recovered materials: Recover all components associated with the items documented for recovery. Minimise damage during removal and deliver to the locations documented.

Existing air and water systems

General: Before starting work on equipment measure the following:

- Existing air and water quantities.
- Total flows and pressure drops.
- Total and static pressures at significant points in the system.

Condition of existing systems:

- If the existing condition does not conform to the documented requirements in the contract documents, provide proposals to rectify the deficiencies with related costing, time and other impacts.
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

Work on live electrical installations: Conform to WHS regulations.

Shutdowns

Requirement: Carry out shutdowns at scheduled times. Keep shutdown times to a minimum. In no case exceed documented or scheduled times.

Completion of shutdowns: Return systems to normal operation at the end of shutdowns.

1.8 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 when 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 the material 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.

1.9 INSTALLATION

Pipe support

Requirement: To **SERVICES INSTALLATION**, **Pipe support systems** in *0171 General requirements*.

2 PACKAGED AIR CONDITIONING

2.1 EQUIPMENT

Operating conditions

Requirement: Provide equipment that operates within an ambient temperature range of 0°C to 45°C, without excessive head pressure, unstable operation or icing.

Split systems

General: Supply indoor and outdoor condensing units of split systems designed and rated by the manufacturer to operate together.

Outdoor units: Provide packaged outdoor condensing units consisting of refrigerant condensers, compressors and associated piping and electrical connections, mounted within the condenser enclosure.

Indoor units: Provide units consisting of coils, piping, supply air fan, accessories and electrical connections, mounted within an insulated enclosure.

One-piece packages

Requirement: Provide packaged units consisting of refrigerant condensers, compressors, supply air fan, cooling coil and associated piping and electrical connections, mounted within the same enclosure.

Construction

Insulation: Insulate and vapour seal to prevent external condensation under all operating conditions.

Supply fan: Centrifugal with multi-speed or variable speed motor.

Condenser fans: Low speed propeller or axial.

Coils: Copper tube, aluminium plate fin type with no moisture carry over.

Drains: Provide aluminium, stainless steel or plastic drain trays to collect all moisture generated inside unit. Provide trapped drain to waste.

2.2 EQUIPMENT ENCLOSURES

General

Requirement: Provide enclosures, materials and finishes that are corrosion-resistant, assembled and reinforced to prevent flexing and drumming.

External equipment enclosures: Weatherproof.

Insulation

Requirement: Insulate enclosures to prevent external surface condensation under all operating conditions. Fix insulation to panels with adhesive applied to at least 50% of the panel area.

2.3 FILTERS

General

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): ≥ Coarse 90%.

2.4 REFRIGERATION PIPING

General

Requirement: Conform to equipment manufacturer's recommendations for the refrigerant used. Provide refrigeration piping designed and installed so that the complete system meets the documented performance under the documented operating conditions.

2.5 CONDENSATE DRAINS

General

Condensate drains: Provide trapped drain lines with uniform and continuous fall to connect condensate trays to the nearest building drain point. Provide drains from:

- Each indoor coil.

- Each outdoor coil, unless the casing freely drains to a roof or other location where condensate and/or rain water will not cause damage or ponding.
- Each safety tray.
- Other moisture or rainwater collecting areas.

2.6 SAFETY TRAY

Location

General: If leaks or condensation can damage or become a nuisance to the building or its contents, provide a safety tray under packaged unit and indoor unit of split systems.

Reverse cycle units: If reverse cycle outdoor units do not have drain connections, locate safety tray below unit and pipe drain to waste.

2.7 UNIT INSTALLATION

General

Requirement: Supply all necessary components, including but not limited to the following:

- Means of attachment to the structure.
- Anti-vibration mounting.
- Appropriate flexible connections.
- Trim and 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.

Outdoor equipment

Arrangement: Provide clearance around units for condenser air flow and maintenance access. Make sure discharge air does not short-circuit to condenser intake.

Plinths: If located on grassed or similar permeable surfaces, provide concrete plinths under outdoor equipment.

Wind and rain: Conform to AS/NZS 1170.2 (2021) for wind action. Design to prevent entry of rain to the supply air duct under all likely conditions.

Duct connections

Supply duct: Provide internal or external flexible duct connection.

Return, outside air and condenser duct connections: Provide external flexible duct connection.

3 ROOM AIR CONDITIONERS

3.1 GENERAL

Split systems

General: Supply indoor and outdoor units of split systems designed and rated by the manufacturer to operate together.

Standards

Safety: Conform to AS/NZS 60335.2.34 (2021) and AS/NZS 60335.2.40 (2023).

Condensate tray falls: To AS/NZS 3666.1 (2011).

Construction

Insulation: Insulate and vapour seal to prevent external condensation under all operating conditions.

Supply fan: Centrifugal with multi-speed or variable speed motor.

Condenser fans: Low speed propeller or axial.

Coils: Copper tube, aluminium plate fin type with no moisture carry over.

Drains: Provide aluminium, stainless steel or plastic drain trays to collect all moisture generated inside unit. Provide trapped drain to waste.

Filters

Filters and media: Supply filters and media that are odourless, non-toxic, non-migrating, non-evaporating, non-hardening, resistant to microbial growth, resistant to vermin and which do not shed fibres in service.

Filter pressure drop: To BCA (2022) J6D5.

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): ≥ Coarse 90%.

3.2 CONDENSATE DRAINS

General

Condensate drains: Provide trapped drain lines with uniform and continuous fall to connect condensate trays to the nearest building drain point. Provide drains from:

- Each indoor coil.
- Each outdoor coil, unless the casing freely drains to a roof or other location where condensate and/or rain water will not cause damage or ponding.
- Each safety tray.
- Other moisture or rainwater collecting areas.

4 FANS

4.1 DESIGN

Fan efficiency

Requirement: Provide fans with efficiencies to BCA (2022) J6D5.

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.

4.2 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, as documented.

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.

4.3 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.

4.4 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 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.

4.5 WINDOW/WALL FANS

General

Run-on timer: Conform to BCA (2022) F8D4.

Impeller: Plastic or metallic-coated steel propeller type, adjustable pitch axial or centrifugal.

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.

4.6 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.

5 DUCTWORK

5.1 DESIGN

Rigid ductwork

Duct design: Size ductwork as follows:

- Velocity: ≤ 6 m/s.
- Pressure loss: ≤ 1.2 Pa/m.

Flexible duct

Requirement: Conform to the following:

- Velocity: ≤ 4.0 m/s.
- Length: No more than 6 m total flexible duct length in the air path between the fan and furthest outlet or grille served. Provide rigid duct for the remainder of the air path between the fan and furthest outlet or grille served.

5.2 STANDARDS

General

Flexible ductwork: To AS 4254.1 (2021).

Rigid ductwork: To AS 4254.2 (2012).

5.3 MATERIALS AND COMPONENTS

Fittings

Requirement: Provide fittings, including fittings between flexible duct, fabricated from sheet metal.

5.4 SHEET METAL DUCTWORK

Material

Galvanized steel duct and steel components less than 3 mm thick: Prime quality lock-forming galvanized steel to AS 1397 (2021) Grade G2 or G3 with Z275 coating to AS 1397 (2021).

5.5 FLEXIBLE DUCT

Standard

Requirement: To AS 4254.1 (2021).

Materials

Uninsulated flexible duct: Aluminised fabric clamped on a formed metal helix. Do not use adhesives. If a metal helix is provided, make sure it does not come in contact with the air stream.

Insulated flexible duct: As for uninsulated flexible duct with flexible blanket insulation wrapped around duct and covered with an outer vapour barrier and the following:

- Insulation joints: Lap insulation at least 50 mm at longitudinal and transverse joints.
- Minimum insulation R-Value (m^2.K/W): To BCA (2022) J6D6.

Adhesives and sealants: Conform to MECHANICAL SYSTEMS, **ADHESIVES AND SEALANTS**.

5.6 FLEXIBLE CONNECTIONS

General

Requirement: Isolate fans and air handling unit casings from ductwork, by means of airtight flexible connections.

Materials:

- Generally: Heavy duty, waterproof.
- In kitchen exhaust ductwork: To AS 4254.2 (2012) clause 2.1.3.

5.7 DAMPERS – GENERAL

Construction

Material: Galvanized steel or aluminium.

Location

Balancing dampers: Provide at each branch duct or tee, as follows:

- Splitter type: Use only for supply branches up to 300 mm maximum dimension and with velocity in main duct less than 10 m/s. Do not use on return or exhaust ducts.
- Opposed blade dampers: Use for any size supply and for all return and exhaust ducts. Locate in each branch.

5.8 ACCESS OPENINGS – LOCATION

Access panels

Location: Conform to the following:

- Next to each component located inside the duct requiring regular inspection and maintenance including, but not limited to:
  - . Fire and smoke dampers.
  - . Smoke detectors.
  - . Motorised dampers.
  - . Filters.
  - . On the air entering side of electric duct heaters.
  - . On the air entering side of duct mounted heating coils.
- In air handling units where unit size is insufficient to fit an access door.
- In the vicinity of moisture producing equipment, to AS/NZS 3666.1 (2011) clause 2.11.3.

5.9 ELECTRIC DUCT HEATERS

General

Standards: To AS/NZS 3102 (2002) and AS 1668.1 (2015).

Elements: Sheathed in steel or nickel alloy. Provide brazed spiral steel fins.

Connections: Connect the elements in each heater bank so that the load is balanced over the three phases. Earth cover plate and frame.

Frames: Assemble elements in a metal frame with terminal connections in an enclosed terminal box.

Heating section: Install to allow access to the terminal box and removal of the assembly without disturbing other components.

Fin rating: < 20 W/m^2.

Heat distribution: Provide uniform heating across the duct cross-section.

Maximum temperature air rise across the heater: 7.5 K at the maximum supply air flow rate.

Airflow: Maintain uniform air velocity across the duct cross-section.

Velocity: Between 2 m/s and 5 m/s.

Electrical connection: Permanent electrical connection to the heater.

5.10 DUCTWORK INSTALLATION

Arrangement

Ductwork: Arrange ductwork neatly. Provide access to ductwork components that require inspection, entry, maintenance and repairs to **ACCESS FOR MAINTENANCE** in *0171 General requirements*. Where possible, arrange duct runs adjacent and parallel to each other and to building elements.

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).

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 ≥ 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.

Support: To AS 4254.1 (2021). Limit sag to less than 120 mm between supports.

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:
  - Not more than 2 in an individual run of flexible duct.
  - Constrictions in not more than 20% of all flexible duct runs.

6 DUCTWORK INSULATION

6.1 STANDARDS

General

Ductwork insulation: To AS 4254.1 (2021) and AS 4254.2 (2012).

Performance and technical provisions: To AS/NZS 4859.1 (2018).

6.2 SUBMISSIONS

Fire performance

Fire hazard properties: Submit evidence of conformity to **FIRE PERFORMANCE**, **Fire hazard properties**, including assembled duct systems.

6.3 INSULATION PERFORMANCE

General

Insulation R-Value (m^2.K/W): To BCA (2022) J6D6.

6.4 FIRE PERFORMANCE

Fire hazard properties

Insulation materials: Tested to AS/NZS 1530.3 (1999). Fire hazards indices as follows:

- Spread-of-Flame Index: 0.
- Smoke-Developed Index: ≤ 3.

Facing materials: Tested to AS 1530.2 (1993): Flammability index ≤ 5.

6.5 INSULATION MATERIALS

Insulation materials

Standard: To AS/NZS 4859.1 (2018).

Insulation blowing agents

Restricted agents: Conform to PRODUCTS AND MATERIALS, **GENERAL**, **Prohibited materials** in *0171 General requirements*.

Bulk insulation

Form: Batt, board or blanket. Select from the following:

- Glass wool.
- Rock wool.
- Polyester: Thermally bonded polyester fibres.
- Polyolefin: Closed cell cross-linked polyolefin foam.

Aluminium foil laminate sheet

Standard: To AS 4200.1 (2017) as follows:

- Internal insulation: Heavy duty before perforation.
- External insulation: Heavy duty unperforated.

Test criteria: To UL 181 (2013) with performance to AS 4254.1 (2021).

6.6 INTERNAL INSULATION – LAMINATE FACED

System description

Insulation type: Semi-rigid board or batt.

Surface facing: Factory applied perforated aluminium foil laminate.

Fixing method

Method: Select from the following:

- Corner angle and end nosing method.
- Free edge method.

Fixing pins: Provide to AS 4254.2 (2012) clause 2.7.1.

Corner angle and end nosing method

Installation: Conform to the following:

- Overlap insulation on adjacent sides at corners.
- Hold insulation in position with metallic-coated steel corner angles.
- Fix corner angles under the turn back of the end nosing.
- For corner angles longer than 1600 mm, provide additional fixing at 1600 mm maximum centres.

Free edge method

General: Use only where larger duct side is no more than 300 mm.

Edges: Extend insulation proud of ductwork at each end, to provide cushion joints that fully seal during assembly.

6.7 EXTERNAL INSULATION – LAMINATE FACED

System description

Insulation type: Flexible batts or blanket.

Surface facing: Factory applied aluminium foil laminate.

Application

General: Wrap insulation around the outside of ducts, covering the parts designated to be insulated. Minimise the number of joints.

Fixing method

Materials other than polyolefin foam: Select from the following:

- Pin method: Provide pins to each face of the duct as follows:
  - . Horizontal ducts < 380 mm wide: Pins not required.
  - . Horizontal ducts > 380, < 760 mm wide: One row of pins along centreline to side and bottom duct faces at 380 mm maximum centres.
  - . Horizontal ducts ≥ 760 mm wide: Pins spaced at 380 mm maximum centres.
  - . Vertical ducts < 610 mm wide: Pins not required.
  - . Vertical ducts ≥ 610 mm wide: Pins spaced at 380 mm maximum centres.
- Strap and pin method: Provide 12 mm wide polypropylene strapping at maximum 600 mm intervals.
  - . Horizontal ducts ≥ 600 mm wide: Hold insulation in position on the underside with fixing pins spaced at 400 mm maximum centres with at least one row per duct face.

. Vertical ducts ≥ 600 mm wide: Provide pins to all faces at 400 mm maximum centres.

- Corner angle and strap method: Provide metallic-coated sheet steel corner angles on all four sides of the duct. Retain with 12 mm wide polypropylene strapping at maximum 750 mm intervals. Provide angles as follows:
  . 25 mm nominal thickness insulation: 38 x 38 mm.
  . 50 mm nominal thickness insulation: 63 x 63 mm.

Polyolefin foam: Tape all joints to manufacturer's recommendations. Fix as follows:

- Pin fixing: Provide pins spaced 50 mm from all edges and spaced 200 to 300 mm apart in all directions.

Self-adhesive sheet: Provide self-adhesive insulation with demonstrated ability to remain attached for the life of the duct system. Install to insulation manufacturer's recommendations including cleaning the whole duct surface before attaching insulation.

6.8 INSULATION OF DUCTWORK COMPONENTS AND FITTINGS

Insulation R-Value

Minimum: To BCA (2022) J6D6.

Plenum and cushion head boxes on air grilles

Insulation type: Internal insulation, with perforated aluminium foil laminate, black finish.

Insulation fixing: Turn facing back over raw edges of insulation for at least 75 mm and bond the turn back to the insulation before installation. Provide fixing pins at 250 mm maximum centres with at least one pin per face. Fully bond insulation around neck with adhesive.

6.9 INSULATION OF DUCT FLEXIBLE CONNECTIONS

General

Requirement: Insulate duct flexible connections if the temperature of the air inside the duct may cause condensation on the outside of the flexible connection.

Minimum insulation R-Value: Same as the connected duct.

7 AIR GRILLES

7.1 DESIGN

General

Requirement: Design air grilles and other air distribution equipment.

Supply air

Requirement: Provide supply air grilles, diffusers, registers or unducted room air conditioners as follows:

- Evenly distribute supply air within the space, free from draughts, and to achieve the documented permissible temperature variation.
- With at least one air grille, diffuser, register or unducted room air conditioner in each room or space served.

Return air

Requirement: Provide return air grilles as follows:

- Return air to the air conditioning plant in an energy efficient manner.

Door grilles

Requirement: Provide door grilles to:

- Return air to the plant if the return air path is through the door opening.
- Provide make-up air to exhaust ventilated spaces.
- In other locations, as required, to prevent excessive space air pressures and achieve energy efficient plant operation.

Exhaust air grilles

Requirement: Provide exhaust grilles to meet the statutory ventilation requirements.

Outside air grilles and louvres

Requirement: Provide air grilles and louvres on the face of the building as follows:

- Supply fresh air to air conditioning and ventilation plant.
- Provide relief of exhaust and return air.
- Prevent the entry of rain and vermin.

7.2 MANUFACTURE

General

Requirement: Provide proprietary air grilles:

- That are free from distortion, bends, surface defects and irregular joints.
- With flange corners neatly mitred, butted and buffed, with no joint gaps.
- That are free from vibration or rattling in operation.

Material: Steel or aluminium.

Finish:

- Exposed surfaces: Powder coated to the nominated colour.

7.3 CUSHION HEADS

Air grilles

Requirement: If the air grille is connected to a flexible duct, provide a cushion head box to **INSTALLATION OF AIR GRILLES**, **Plenum and cushion head boxes**.

7.4 AIR GRILLE TYPES

Louvre ceiling diffusers

Type: Select from:

- Multi-bladed, removable core 4-way blow configuration, fitted with a blanking plate for 1, 2, or 3-way blow, as appropriate; or
- Multi-bladed, removable core 1, 2, 3 or 4-way blow configuration.
- 4-way multi-directional with 4 separate 1-way cores, each independently rotatable to 4 positions.

Reducer necks: If the outlet neck is smaller than the outlet necessary to suit the louvre face size, provide a reducer neck.

Frame: To suit the type of ceiling and ceiling grid mounting requirements.

Side wall registers

Type: Double deflection type with horizontal front louvre blades and vertical rear blades at 19 mm nominal centres, capable of field adjustment of air throw over the range ±45°.

Construction: Extruded aluminium with mitred corners and aerofoil section blades that rotate in non-metallic bearings in the support frame. Hold blades firmly so they do not rattle or flutter.

Core: Removable core (support frame and blades).

Blades > 600 mm long: Support at mid-point on a notched support bar.

Dampers: Stream splitter or opposed blade type damper behind each register, to provide even air flow across the register face.

Thermally powered VAV diffusers

Type: Proprietary VAV diffuser with integral actuator and dampers to adjust air volume in response to temperature sensed at the diffuser. Provide uniform air distribution pattern to maximise Coanda effect over the operating range from full open to the minimum air flow.

Diffuser blades: Louvre or swirl type.

Construction: Appearance panel mounted within a pressed diffuser frame.

Material: Powder coated metallic-coated steel sheet.

Frame style: To suit the type of ceiling, and ceiling grid mounting requirements.

Operation: Integral hinged dampers to vary the outlet supply air volume under the control of a built-in room temperature sensing element.

Control: Provide one of the following:

- Self-powered type with expanding wax or similar temperature sensitive elements.
- Line powered with integral 24 V transformer.

Heating operation: If the system operates in both heating and cooling modes, provide a factory preset supply duct temperature sensor that reverses the control action between heating and cooling. Operate

in cooling mode when the air supply is below 20°C and in heating mode when supply air is above 27°C.

Room temperature set point: Adjustable from below the face of the diffuser over the 21°C to 26°C range.

Return or exhaust air grilles – indoor

Type: Extruded aluminium with fixed horizontal blades set into a fixed support frame with mitred corners. Fit blades tightly into the frame to prevent rattling or movement. Brace and stiffen to produce a rigid assembly.

Pressure drop: ≤ 10 Pa at the documented air flow.

Blades:

- Half chevron type: Blades at nominal 45° angle on a nominal 25 mm pitch.
- Chevron type: Blades at nominal 25 mm pitch. Provide a telescopic frame with clip-on pattern surround frames on both sides.
- Light proof grilles: Double chevron blades, blade pitch and edge detail designed to stop light penetration.

Air volume control: If the air grille is connected to a duct, provide an opposed blade damper behind the grille core, key operated without removing the core.

Egg crate return or exhaust air grilles

Type: Nominal 12 x 12 mm square, 12 mm deep egg crate type aluminium core fixed in an extruded aluminium frame with mitred corners. Fit core tightly into the frame to prevent rattling or movement.

Free area: ≥ 90% of nominal face area.

Air volume control: If the air grille is connected to a duct, provide an opposed blade damper behind the grille core, key operated without removing the core.

7.5 WEATHERPROOF LOUVRE GRILLES

Fixed louvres

Louvre blades: Provide blades fixed at nominal 45° angle and incorporating at least one hooked edge to prevent ingress of water under all operating conditions. Brace and stiffen to prevent rattling or movement.

Construction

Louvre blades: Brace and stiffen to prevent rattling or movement.

Frame: Flanged or channel to suit the installation profile.

Pressure drop: ≤ 15 Pa at the documented air flow including the resistance of screen, if fitted.

Screens: Provide screens behind louvres or integral perforations in the louvres.

7.6 INSTALLATION OF AIR GRILLES

Mounting

General: 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.

Tiled ceilings: Locate air grilles to minimise cut tiles. Otherwise, locate the air grille symmetrically in the tile.

Appearance: Install square.

Fixing

Accessibility: Provide fixings that 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

General: Provide side entry plenum or cushion head boxes to air grilles connected to flexible ductwork.

7.7 VOLUME CONTROL DAMPERS

Dampers controlling a single air grille attached to flexible duct

General: Provide damper as follows:

- Duct spigot located above tiled or accessible ceiling: Provide a butterfly damper in the rigid duct spigot.
- Duct spigot in other locations: Provide an opposed blade damper behind the face of the air grille.

8 AUTOMATIC CONTROLS

8.1 DESIGN

General

Requirement: Design automatic control systems.

Performance: Within the documented plant capacities, maintain the documented conditions. Provide control systems that are safe and stable in operation under all anticipated operating conditions including start up, shut down and fault condition.

Safety: Provide control devices and software to protect personnel from injury and equipment from damage by either normal or abnormal operation of the control system, including the removal and reapplication of power whether expected or unexpected.

Operating environment: Provide components that function correctly in their local environment.

8.2 CONTROL COMPONENTS

Performance

Sensors and control components: Provide sensors and control components as follows:

- Have performance that is not affected by corrosion or other environmental degradation for the documented design life.
- Not affected by the accumulation of dust or moisture, extraneous influences or the documented design life.
- That are not affected by variation of ±30% in supply voltage.
- Protected against the entry of vermin.
- Selected for a response time appropriate to the application.
- Provided with proprietary connections suitable for the size and type of cable used.

8.3 INPUT DEVICES – GENERAL

General

Requirement: Provide input devices with the following characteristics:

- With range, accuracy and response time appropriate to the required control function including the effects of transducer accuracy and signal transmission errors.
- Maintain documented performance over time.
- Protected by location or otherwise from extraneous influences including sunlight, heat sources and non-representative locations.
- Requiring maintenance or re-calibration to maintain performance at not more often than 12 month intervals.
- Designed for the type of location and application in which they are installed.
- Readily accessible for inspection, calibration, cleaning and maintenance.
- Tamperproof if located in occupied areas.
- Not affected by induced voltages or electromagnetic interference.

8.4 INSTALLATION

Sensors in occupied areas

Installation: Conform to the following:

- Securely attach to walls, ceilings or columns.
- Mount on concealed junction boxes and seal cable entries to prevent air from the cavity or conduit entering the junction box.
- Conceal all wiring from view inside wall, column or ceiling space.

Wall or column mounted sensors: Locate 1500 mm above floor level.

Sensors in unoccupied areas
Installation: Conform to **Sensors in occupied areas** except that sensors may be mounted on surface mounted junction boxes with wiring in exposed conduit.

9 MECHANICAL ELECTRICAL

9.1 LOW VOLTAGE POWER SYSTEMS

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

9.2 MOTORS

General
Requirement: Provide motors selected in conformance with AS 60034.1 (2023), the application load characteristics, motor manufacturers' recommendations and the following:

- Motors ≥ 0.75 kW: Three phase.

Rating
Standard: To AS 60034.1 (2023).

Maximum power rating: The greater of the documented minimum motor size and next preferred standard frame size above the maximum load of the driven equipment.

Duty: ≥ S1.

Class of rating: Continuous running duty.

Speed: ≤ 1500 r/min.

9.3 STARTERS

Standards
General: To AS/NZS 60947.1 (2021) and AS IEC 60034.12 (2023).

Electromechanical motor starters: To AS/NZS IEC 60947.4.1 (2015).

Selection
Motor starters: Provide with the following characteristics:

- Electricity distribution network limitations for starting currents and voltage flicker.
- Torque requirements for the motor load.
- Heating effects on the motor.
- Voltage drop during start due to starting currents.
- Time required to accelerate from rest to full speed.
- Number of starts per hour.

Motors with a limited number of starts per hour: Provide lockout timers in the motor control circuit to prevent motor restart within the designated non-restart time and which cannot be set by any manual resetting of the motor protection system.

9.4 MOTOR PROTECTION

General
Requirement: Provide over-current protection with manual reset giving overload protection in each phase of supply as part of the equipment assembly for each motor starter.

Standard: To AS 60034.11 (2023).

Single phase motor protection
Requirement: Overload units matching the motor heating curve characteristics.

3-phase motor protection - thermal overload protection
Requirement: Thermal overload protection relays for each motor.

Triple pole relays: Provide differential trip bar operation for single phase protection, and ambient temperature compensation.

Thermal overloads: Connect directly to contactor by means of proprietary links, except where operated separately by current transformers.

Star-delta starters: Provide triple pole thermal overload relay connected into motor phase winding circuits. Provide a name plate fixed to starter, stating full load current of motor phase winding.

Placement of sensors: If the configuration of the starter contactors is unsuitable for the placement of thermal overload sensors in each motor phase winding, fit to the line contactor.

10 MECHANICAL COMMISSIONING

10.1 COMMISSIONING

General

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.

Failure to meet documented performance: Identify and correct the cause of failure and repeat the commissioning procedure.

Reports

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

10.2 AIR BALANCING

General

Requirement: Balance each air handling system.

Completion: Balancing is complete when all the following conditions are met:

- Outdoor air quantities are within 100% and 110% of design.
- Other air quantities are within the tolerances in the **Air quantity tolerance table**.
- For the same component, each measured air quantity deviates by less than the instrument accuracy from the previous measured air quantity.
- Resistance across the cooling coil bank (if present) is equal to the wetted coil resistance. If necessary to achieve this, simulate wet coil resistance by blanking or other means.
- Resistance of the filter bank (if present) is equal to the average of its clean resistance and resistance of the filter when fully loaded with dirt. If necessary to achieve this, simulate filter resistance by blanking.
- For fans with variable speed drives, the frequency to the motor is between 45 and 50 Hz.
- At least one outlet on each branch has its damper at the minimum pressure drop position.
- At least one sub-branch damper is at the minimum pressure drop position.
- At least one branch damper is at the minimum pressure drop position.
- The fan speed or pitch angle is at the lowest value consistent with the above.

Air quantity tolerance table

System type	Terminal air quantity	Branch air quantity	Total air quantity
Supply, return or exhaust system where all terminals on any one sub-branch serve the same space	Within 100% and 120% of design	Within 100% and 110% of design	Within 100% and 110% of design
Supply, return or exhaust system where the terminals on any one sub-branch serve more than one space	Within 100% and 115% of design	Within 100% and 110% of design	Within 100% and 110% of design
Supply or return system in which temperature tolerance is closer than ±1.0 K.	Within 100% and 110% of design	Within 100% and 105% of design	Within 100% and 105% of design

10.3 AUTOMATIC CONTROLS

General

Requirement: Test controls hardware and software for correct operation.

Sensors

Calibration: Calibrate sensors to within the documented accuracy of the sensor.

Set points: Adjust sensors to documented values.

10.4 SAFETY CONTROLS

Testing

General: Test each safety control and facility by simulating the unsafe condition that the control is intended to protect against.

Monitoring: 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.

10.5 PLUMBING AND DRAINAGE

General

Requirement: Conform to AS/NZS 3500.1 (2021) Section 17.

11 MECHANICAL MAINTENANCE

11.1 GENERAL

Objectives

Requirement: Maintain the mechanical systems for the documented maintenance period so that the performance and service delivery including indoor conditions and indoor air quality, reliability, service life, compliance with statutory requirements, energy efficiency and safety of the system is equal to or better than that at the beginning of the maintenance period in parallel with and including:

- Periodic and statutory maintenance, cleaning and replacement of consumables.
- Emergency repairs.
- Condition reporting.

Maintenance period: To *0171 General requirements*.

Maximum call out response time: 3 hours.

Maximum time between programmed service visits: To AS 1851 (2012) and AS/NZS 3666.1 (2011) but not less than three-monthly.

Frequency of periodic maintenance and performance reports: After each programmed service visit.

11.2 STANDARDS

General

Air handling system maintenance: To AS 1851 (2012).

Microbial control: To AS/NZS 3666.2 (2011).

Statutory certification

Annual and other certification: Inspect and submit certification for all items required to be inspected annually or more frequently under statutory requirements including but not limited to air handling systems required for fire and smoke control, boilers, pressure vessels, cooling towers and warm water systems.

11.3 MAINTENANCE REQUIREMENTS

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 required

Minimum level: To the operation and maintenance manual and the manufacturer’s recommendations.

Frequency: Carry out the actions, at no lower frequency than the intervals recommended in AIRAH DA19 (2019) for Maintenance Level A.

11.4 EMERGENCY REPAIRS

General

Requirement: Respond to call outs for breakdowns or other faults requiring emergency repairs. Rectify faults and replace faulty materials and equipment.

11.5 PERIODIC MAINTENANCE

General

Routine visits: Make routine service visits at the frequency documented. Service items of equipment in conformance with the maintenance schedules in the operation and maintenance manuals and the manufacturer's recommendations.

Notification of defects: When defects in the mechanical services systems are identified, give notice.

11.6 COMPLETION

Maintenance records

Service records: Record maintenance undertaken in the schedules in the operation and maintenance manuals.

12 SELECTIONS

12.1 SYSTEMS

Air conditioning system schedule

	A	B	C
Spaces served			
One-piece unit or split system			
Ducted or non-ducted system			
Plant location			

Ventilation system schedule

	A	B	C
Spaces served			
Ventilation type			
Ducted or non-ducted			
Special requirements			

0802 HYDRAULIC DESIGN AND INSTALL

1 HYDRAULIC SYSTEMS

1.1 RESPONSIBILITIES

General

Requirement: Design systems and provide hydraulic services, as documented.

1.2 DESIGN

General

Requirement: To DESIGN in *0171 General requirements*.

Design criteria: Not less than the PCA (2022).

Designer qualifications

Designer qualification: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience. Conform to **DESIGNER** in *0171 General requirements*.

Design for durability and maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

Access for maintenance: Develop the design so the systems conform to **ACCESS FOR MAINTENANCE** in *0171 General requirements*.

Operating environment

Requirement: Provide equipment suitable for the environment in which it operates.

Hydraulic system design

Requirement: Provide engineering design that:

- Maximises the functionality, performance, safety, flexibility and reliability of the hydraulic services.
- Is technically sound.
- Can be constructed using methods that are good practice and in common use.
- That provide the lowest combined owning and operating cost over the design life of the systems.

Water heaters: Size water heaters to adequately and efficiently serve the functions documented.

Authority submissions: Make submissions, including notices, to authorities relating to the works.

Design life

General: To *0171 General requirements*.

Design life:

- Hot water heaters: 10 years.
- Rainwater tanks: 20 years:
- All other components and systems: 25 years.

Energy efficiency

Minimum: To the PCA (2022).

Water efficiency

Minimum: To the PCA (2022).

Noise levels

Ambient noise emitted: Lower than the level that can be heard within a habitable room in any neighbouring premises, regardless of whether any door or window to that room is open.

Noise levels in occupied spaces: To **NOISE LEVELS** in *0171 General requirements*.

Acoustic treatment of services: Provide acoustic treatment to achieve the documented space and ambient noise levels and acoustic separation.

Seismic restraint

Requirement: To **SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS** in *0171 General requirements*.

Fire separation
Requirement: As documented.

1.3 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.
- *0201 Demolition*.
- *0223 Service trenching*.

1.4 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).

Copper pipe and fittings-installation and commissioning: To AS 4809 (2017).

Gas: To AS/NZS 5601.1 (2022).

Microbial control: To AS/NZS 3666.1 (2011), AS/NZS 3666.2 (2011) and the recommendations of SA/SNZ HB 32 (1995).

1.5 INTERPRETATION

Abbreviations
General: For the purposes of this worksection, the following abbreviations apply:
- LPG: Liquefied petroleum gas.

1.6 SUBMISSIONS

General
Requirement: Conform to *0171 General requirements*.

Authority approvals
Authority submissions: Submit evidence of approval from authorities relating to the works.

Certification
Completion: Submit certificate as verification that the design and installation conforms to all contractual and statutory requirements.

Existing systems
Shutdowns: Submit detailed shutdowns schedule, including the date and time of shutdowns, details of proposed work and affected systems and locations, to **WORK ON EXISTING SYSTEMS**.

Existing condition: Submit proposals to rectify deficiencies If the existing condition does not conform to the documented requirements.

Operation and maintenance manuals
Requirement: Conform to **OPERATION AND MAINTENANCE MANUALS** in *0171 General 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 conformance to 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.

Drawings

Requirement: Submit drawings showing the following:

- Pipework and equipment layout and sections showing the work to be installed on the level that the services are installed.
- Long sections of below ground drainage.
- Riser layouts and sections.
- Downpipes.
- Rainwater harvesting.
- Stormwater connection.
- Stormwater drainage stacks.
- Stormwater overflow path.
- Evidence of compliance with special planning conditions.
- If not obvious from other drawings, provide single line diagrams for rainwater and stormwater infrastructure mains plans and building servicing.
- Piping and other schematic drawings including numbering of each valve to correspond to valve tags notation.
- Access openings, cover plates, valve boxes and access pits.
- Details of control panels including control and power diagrams.
- Insulation of piping, fittings and tanks.
- Penetrations and associated building work. If penetrations are through external walls, detail flashing and weatherproofing at 1:10 scale.
- Location, capacity, type and other relevant details of water heaters, including supports and safe trays.
- Location, type, grade and finish of piping, fittings, valves, meters and pipe supports.
- On-site detention pondage areas.
- Provision of blue metal backfill to seepage drain system.
- Provision of erosion control measures.
- Provision of road barriers and lighting.
- Provision of temporary sanitary accommodation for construction workers.
- Provision of trafficable cover plates in the public domain.
- Relevant survey levels.
- Site and floor set out points.
- Tank stands and supporting structures.

Subcontractors

General: Submit names, contact details, licence numbers and type of licence of proposed suppliers and installers.

1.7 WORK ON EXISTING SYSTEMS

Equipment removal

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

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

Recovered items

Requirement: To *0201 Demolition*.

Recovered materials: Recover all components associated with the items documented for recovery. Minimise damage during removal and deliver to the locations documented.

Existing systems

Condition of existing systems:

- If the existing condition does not conform to the documented requirements in the contract documents, provide proposals to rectify the deficiencies with related costing, time and other impacts.
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

Work on live electrical installations: Conform to WHS regulations.

Shutdowns

Requirement: Carry out shutdowns at scheduled times. Keep shutdown times to a minimum. In no case exceed documented or scheduled times.

Completion of shutdowns: Return systems to normal operation at the end of shutdowns.

1.8 INSPECTION

Notice

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

- Excavated surfaces.
- Concealed or underground services.

1.9 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).

Labelling

Water efficiency labelling: Provide products conforming to and labelled to the Water Efficiency Labelling Scheme (WELS).

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).

1.10 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 that 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.

Pipe support

Requirement: To **SERVICES INSTALLATION**, **Pipe support systems** in *0171 General requirements*.

1.11 PIPING

Finishes

Exposed piping: Finish exposed piping, including fittings and supports, as follows:

- In internal locations such as toilet and kitchen areas: Chrome-plated 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.

1.12 COMMISSIONING

General

Requirement: Provide commissioning as documented. Conform to *0171 General requirements* and SA TS 5342 (2021).

2 SANITARY FIXTURES

2.1 STANDARDS

General

Design for access and mobility: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

Installation: Install to manufacturer's recommendations.

3 TAPWARE

3.1 STANDARDS

General

Design for access and mobility: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

3.2 TAPS

General

Material: Brass or bronze.

Taps other than hose taps: Provide anti-splash aerator nozzles.

Construction: Provide the following:

- Ceramic disk valve.
- O-ring seals.
- Vandal resistant handle.
- Vandal resistant aerator nozzles.

Hose taps

Construction: Provide hose taps as follows:

- Type: DN 20 diameter brass finish hose tap.
- Riser: DN 20 diameter copper riser with a backplated elbow.
- Heads: Provide anti-vandal heads if documented.

Backflow prevention: Provide vacuum breaker backflow prevention device and isolation valve.

Installation: Conform to the following:

- Fix hose tap 450 mm above the floor.
- Install against a masonry or concrete wall. Fix the backplated elbow to the wall with 3, 20 mm brass screws, screwed into 20 x 6 mm expanding plastic plugs.

Taps and valve heads

Metal heads and handles: Provide brass fittings or a suitable bush to prevent electrolysis and growth.

Plastic heads and handles: Provide compact fittings designed to prevent fracture and exposure of jagged or rough edges.

Vandal-proof heads: Provide vandal-proof or anti-tampering devices for the designated types.

4 WATER HEATERS

4.1 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.

4.2 GAS STORAGE WATER HEATERS

Description

General: Proprietary automatic gas-fired water heater including connections, controls and fittings.

Standards

General: To AS/NZS 5601.1 (2022) and AS/NZS 5263.1.2 (2020).

Energy performance: To AS/NZS 4552.2 (2010).

4.3 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).

4.4 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 (2023).

Performance evaluation: To AS/NZS 5125.1 (2014).

4.5 INSTANTANEOUS WATER HEATERS

Gas instantaneous heaters

Standard: To AS/NZS 5601.1 (2022).

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).

4.6 INSTALLATION

General

Standard: Install to AS/NZS 3500.4 (2021).

Gas water heaters

Standard: Install to AS/NZS 5601.1 (2022).

Solar water heaters

Collectors: Install collectors:

- Facing ±20° 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 thorough each heater in the bank.

4.7 COMMISSIONING

General

Requirement: Commission to the manufacturer's recommendations.

5 TANKS

5.1 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).

5.2 SUBMISSIONS

Warranties

Manufacturer's warranty: Submit the tank manufacturer's warranty.

5.3 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.

5.4 BLADDER TANKS

General

Type: Proprietary plastic bladder type.

Material: Reinforced polymer conforming to AS/NZS 4020 (2018), resistant to puncture and microbial attack.

Bedding: Provide adequate bedding to support the weight of the bladder when full.

5.5 METALLIC-COATED STEEL TANKS

Construction

Materials: Conform to the following:

- Top and sides: Metallic-coated steel with polymer film to AS/NZS 4020 (2018) on the inside and prepainted on the outside.
- Base: Metallic-coated steel with polymer film to AS/NZS 4020 (2018) 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.

5.6 ROTATIONALLY MOULDED TANKS

General
Standard: To AS/NZS 4766 (2020).

5.7 ABOVE GROUND TANK INSTALLATION

General
Restraint: Restrain the tank to prevent movement, caused by wind and other loads when empty.

Base: Provide a level base with gaps not exceeding 10 mm, free of sharp projections and extending 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.

5.8 COMPLETION

Cleaning
Cleaning: Wash and flush tanks to remove manufacturing and other contaminants.

6 STORMWATER – BUILDINGS

6.1 DESIGN

General
Requirement: Design the roof drainage system, including sumps, rainwater outlets, overflow outlets and downpipes.

Roof drainage system design, application and calculations
Standards: Conform to the following:

- AS/NZS 3500.3 (2021).
- National Construction Code Series Volume 3: Plumbing Code of Australia (PCA (2022)).

Handbooks: Conform to the recommendations of SA HB 39 (2015).

Rainfall intensity for design:

- Eaves gutters: Annual exceedance probability of 5%.
- Box gutters: Annual exceedance probability of 1%.

Box gutter overflow
Overflow: Design for 100% overflow.

Methods of calculation
Requirement: Manual or software that employs the data and methods in the applicable standard.

Design documentation
Drawings: Show the following on the drawings:

- General layout of the system.
- Calculated capacities.
- Details of components including internal and external metal gutters, downpipes, sumps and rainheads.
- Spatial relationship to other services and building structure.
- Means of accommodating thermal and building movement.
- Details of penetrations.
- Coordination and interfaces with other trades.
- Connection points to site stormwater system.

6.2 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.

Access openings: Provide cast iron inspection openings to AS 1631 (1994) for ductile iron pipe, PVC-U to AS/NZS 1260 (2017) for PVC-U pipe or copper to AS 1589 (2001) for copper pipe.

Building in: If pipes are built into masonry or concrete, spiral wrap the pipe (and insulation, if any) with building paper.

6.3 STORMWATER DRAINS

Location
General: Provide stormwater drains to connect downpipes, surface drains, subsoil drains and drainage pits to the outlet point or point of connection. Make sure location of piping will not interfere with other services and building elements not yet installed or built. Subject to the preceding and documented layouts, follow the most direct route with the least number of changes in direction.

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.

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.

Pipe underlay
General: Bed piping on a continuous underlay of bedding material, minimum 75 mm and maximum 150 mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

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, maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Anchor blocks

Restraint: If required to restrain lateral and axial movement of the stormwater pipes, provide reinforced concrete anchor blocks at junctions and changes of grade or direction conforming to AS/NZS 3500.3 (2021) clause 7.9.

Thermal movement

General: Arrange piping to accommodate thermal expansion. Provide proprietary expansion joints in copper and plastic pipes if pipe flexibility does not allow movement. Make sure movement does not strain branch connections.

6.4 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.

Jointing

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 that 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.

6.5 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.

6.6 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.

6.7 COMPLETION

Cleaning
General: Clean and flush the whole installation.

7 WASTEWATER

7.1 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.

7.2 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 chrome-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).

7.3 SANITARY PLUMBING

Location
General: Verify location and invert level of piping before commencing installation.

Layout: Arrange piping in conformance with the following:

- Avoid interference with other services and building elements.
- Follow the most direct route with the least number of changes of direction.

Ducts: If installed in ducts, locate and fix stacks, wastes and pipes independently of other services. Arrange so they are accessible and removable throughout their entire length.

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.

Discharge from air handling systems
Trays, sumps and plumbing: To AS/NZS 3666.1 (2011).

Expansion joints

Location: Provide expansion joints if 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.

Thermal movement

General: Arrange piping to accommodate thermal expansion. Provide proprietary expansion joints in copper and plastic pipes if pipe flexibility does not allow for movement. Make sure that movement does not strain branch connections.

Tundishes

Location: Provide suitably sized, trapped tundishes to collect condensate wastes from mechanical equipment. Connect tundishes to nearest waste or floor drain. Connect tundish waste to floor wastes, wastes or drains and provide traps and vents if 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: If drainage connections pass through wet area floors, terminate 4 mm below the substrate surface.

7.4 SANITARY DRAINAGE

Laying

General: 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.

7.5 PIPING

Supports

Adverse soil conditions under structures: If soil under structures is unable to support piping without movement, suspend piping from the structure above on type 316 stainless steel hangers, fasteners and saddles at 600 mm maximum centres. Backfill with non-compacted lightweight material and size supports to carry the load of the piping and backfill and conform to the **Pipeline tolerances table**. Cover metal components with petroleum based mastic then wrap with petroleum based tape to provide a continuous barrier to prevent ingress of water. Provide 50% minimum overlap of tape.

Differential movement: If the geotechnical site investigation report predicts differential movements between buildings and the ground, conform to **SERVICES INSTALLATION**, **Differential movement** in *0171 General requirements*.

Pipeline tolerances table

	Permissible angular deviation from alignment	**Permissible displacement from alignment**

	Permissible angular deviation from alignment	Permissible displacement from alignment
Horizontal	1:300	15 mm
Vertical	1:500	5 mm

7.6 PITS

Installation

General: Prepare foundation, install pit and connect pipes, to manufacturer's recommendations.

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.

7.7 TESTING

Pre-completion tests

Requirement: Test to AS/NZS 3500.2 (2021) Section 15, before backfilling or concealing.

Leaks: If leaks are found, rectify and re-test.

7.8 COMPLETION

Cleaning

General: On completion clean and flush the whole installation.

8 COLD AND HEATED WATER

8.1 DESIGN

General

Requirement: Design the cold water and heated water systems.

Design parameters

Standards: Conform to the following:

- AS/NZS 3500.1 (2021).
- National Construction Code Series Volume 3: Plumbing Code of Australia (PCA).
- Pressure and velocity: Design drinking water and recycled water systems to achieve the following:
  - Minimum outlet pressure at any point: 250 kPa.
  - Maximum outlet pressure at any point: 500 kPa.
  - Maximum velocity at any point: 1.6 m/s.

8.2 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.

8.3 PIPING

Mains connection

Requirement: Connect the cold water supply system to the Network Utility Operator's main through a stop valve and meter.

Cold water system: Provide the cold water supply system, installed from the meter to the draw-off points or connections to other services.

Heated water system: Provide the heated water system, installed from the cold water connection points to the draw-off points or connections to other services.

Fittings and accessories

General: Provide the fittings required for the proper functioning of the water supply system, including taps, valves, backflow prevention devices, pressure and temperature control devices, strainers, gauges and automatic controls and alarms.

Provision for dismantling: Arrange piping by the provision of unions or similar so that valves, taps and other maintainable components can be removed for maintenance without disturbing or cutting adjacent piping.

Press-fit fittings

Type: Permanent and inseparable after pressing.

Fitting material: Copper, stainless steel or gunmetal.

Leak path: Incorporate a positive leak path in the form of a channel in the metallic body of the fitting that indicates leakage when dry pressure tested is over the range 2.2 kPa to 300 kPa or wet pressure tested is over the range 100 kPa to 650 kPa.

Seals: EPDM suitable for solar applications and incorporating a cylindrical pipe guide in the front of the seal.

Pipes under pressure embedded in concrete

Prohibition: Do not embed or cast water service pipes into concrete structures.

Sleeves

Requirement: Provide sleeves at penetrations to *0171 General requirements*.

Provision for expansion

Requirement: Provide for thermal expansion of piping to AS/NZS 3500.4 (2021) clause 4.13.3 using either:

- Inherent flexibility of the piping.
- Proprietary expansion compensators consisting of a corrugated stainless flexible hose inside a reinforced metallic braid and fitted with stainless steel flanges. Install in bending mode and provide guides and anchors to manufacturer’s recommendations.

Expansion loops: If expansion loops are used, install isolation valves either side of the expansion loops within ceiling spaces and riser ducts.

Venting

Location: Provide 15 mm minimum size air release vents at the following locations:

- High points of the system.
- Sections of the piping in which air may collect.
- Upstream from each item of heat exchange equipment.

Risers: Provide a 150 mm high riser set vertically from the pipe and fabricated from the same diameter and material as the pipe. Provide an automatic air vent at the top of the riser.

8.4 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 removed.

External valve locations: Protect from damage and vandalism.

Arrangement: Provide each backflow prevention device with the following:

- Provide unions if ≤ DN 50, 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.

In-wall mounted backflow prevention valves

Arrangement: Provide pre-plumbed proprietary high hazard valve assemblies as follows:

- Dual hot and cold valve trains.
- Flush mount, lockable, recessed Type 304 stainless steel cabinet.
- Slide-in front panel.
- DN 50 waste connection.

Vacuum breaker valves

Requirement: Provide vacuum breaker valves if required to prevent cross-connection of the cold water service.

8.5 PIPING INSULATION

General

Requirement: Insulate the following:

- Heated water piping, fittings and valves that are not chrome-plated.
- Cold water piping that is not chrome-plated and is located in a space subject to condensation.
- Cold water piping subject to freezing.

Minimum insulation R-Value: ≥ Total R-Value in AS/NZS 3500.4 (2021) for the type and location of the pipe.

Application: Fit insulation tightly to piping surfaces without gaps. Close butt ends of insulation sections. Minimise number of joints. If the insulation is in half-sections, make only half-circumferential joints at any one place. Seal longitudinal seams in foil laminate and fix insulation at maximum 500 mm centres with polypropylene, zinc-coated steel or aluminium straps.

Unions and other items requiring service: Install the insulation so that it is readily removable.

Fittings: Provide insulation with insulation R-Value at least equal to that of the adjacent piping insulation.

8.6 MARKING

Notice plate

General: Provide a notice plate containing condensed emergency instructions, legibly printed or engraved on durable material resistant to defacement, at least 3 mm thick or mounted on board at least 3 mm thick, permanently fixed in a convenient position at the control valves.

Buried services

Requirement: Provide a detectable marker tape with trace wire to identify the route of buried piping.

Marker tape: Provide a minimum 100 mm durable plastic in colour to AS 1345 (1995) continuously printed with the words DANGER – BURIED DRINKING WATER SERVICE BELOW.

Location: Lay in backfill 150 mm above the pipe.

Trace wire: Terminate with 1000 mm coil in a readily accessible location. Tag to match the record drawings.

8.7 PLANTER IRRIGATION

General

Location: If documented, provide a DN 20 hose tap within each planter area. Also provide a capped DN 20 diameter point for future connection of irrigation system adjacent to each hose tap.

Backflow prevention: Provide backflow prevention devices to the PCA and AS/NZS 3500.1 (2021).

8.8 TESTING

Pre-completion tests

Pressure tests: Before insulation is applied to joints, pressure test piping to AS/NZS 3500.1 (2021) and AS/NZS 3500.4 (2021) as appropriate.

Equipment: Before testing, disconnect any equipment not rated for the test pressure.

Leaks: If found, rectify and re-test.

Cross connections: Isolate systems individually and check for cross connections.

Backflow prevention: To AS/NZS 3500.1 (2021).

Tapware: Check for leaks.

Completion test

General: Provide a full operational test to verify conformance.

8.9 COMMISSIONING

General

Strainers: Remove, clean and replace strainer baskets.

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.

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.

8.10 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).

9 FUEL GAS

9.1 STANDARDS

Reticulated gas systems

General: To AS/NZS 5601.1 (2022).

Gas equipment

Standard: To AS 3645 (2017) and AS/NZS 5263.0 (2023).

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).

9.2 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.

9.3 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 that 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.

9.4 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.

9.5 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 (2022) Appendix D.

Appliances: Commission appliances. Conform to the recommendations of AS/NZS 5601.1 (2022) Appendix N.

9.6 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.

10 RAINWATER STORAGE SYSTEMS

10.1 STANDARDS

General
Metal rainwater goods: To AS/NZS 2179.1 (2014).

Design, installation, maintenance and repairs: To the recommendations of SA HB 230 (2008).

10.2 RAINWATER TANKS

General
Requirement: Provide structurally sound and watertight tanks.

Standard: If the tank is to contain drinking water or water for laundry or toilet flushing, provide materials to AS/NZS 4020 (2018).

Tank capacity: To statutory requirements but not less than the recommendations of SA HB 230 (2008).

Accessories: Provide the accessories needed to complete the installation. Include the following:

- Inlet and outlet connections to meet the intended flows to the NCC (2022) and AS/NZS 3500.3 (2021).
- Floating outlet to draw water from the upper part of the tank.
- Tight fitting lids or screens with maximum 1 mm mesh at all openings.
- Flap valves at every opening to the tank.
- Calmed inlet to the tank to prevent stirring sediment.
- Overflow siphon to skim surface contaminants.

Accessory materials: Select from:

- Ultraviolet light resistant plastic.
- Corrosion-resistant metal. Do not use copper or copper alloys with metallic-coated steel tanks.
- The same material as the tank.

Access opening: Provide a vermin-proof, childproof access opening above the high water level and cover with either a strainer or a lid fixed securely to the tank.

10.3 FIRST FLUSH DIVERTER

General

Requirement: Provide dry systems with a first flush diverter. Arrange to drain completely.

Sizing: Select for minimum 20 L/100 m^2 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.

10.4 RAINWATER FILTRATION

Tank inlet

General: Provide dry and charged (wet) systems with an easily cleanable filter to treat rainwater before the entry to the tank.

Mesh size: Maximum 1 mm.

Tank outlet

Water filters for drinking water: To AS 3497 (2021) and the requirements of the statutory authorities having jurisdiction.

10.5 PUMPS

General

Requirement: Provide pumps to fulfill the functions of the system.

Selection: To the recommendations of SA HB 230 (2008).

10.6 INSTALLATION

General

Connecting piping: Support independently of the tank. Provide a 300 mm long section of reinforced flexible hose to prevent piping exerting a load on the tank.

Overflow: Pipe to discharge away from the tank.

10.7 CLEANING

General

Requirement: Flush the rainwater system. Wash and flush tanks to remove manufacturing and other contaminants.

10.8 COMMISSIONING

General

Testing and commissioning: To AS/NZS 3500.1 (2021) Section 9.

11 HYDRAULIC MAINTENANCE

11.1 GENERAL

Objective

Requirement: Maintain the hydraulic systems for the documented maintenance period so that the performance, reliability, service life, energy efficiency and safety of the system is equal to or better than that at the beginning of the maintenance period, in parallel with and including:

- Periodic and statutory maintenance, cleaning and replacement of consumables.
- Emergency repairs.

Maintenance period: To *0171 General requirements*.

11.2 MAINTENANCE

Cold and heated water

Maintenance of tanks and piping for drinking water: To AS/NZS 3500.1 (2021) and AS/NZS 3500.4 (2021).

Ball float valves: Check and adjust for no overflow.

Heated water systems:

- Conform to the recommendations of AS/NZS 3500.4 (2021) Appendix M.
- Inspection and maintenance: To AS/NZS 3666.2 (2011).
- Provide service tags recording inspections and tests.

Leaks: Inspect cold and heated water systems at least annually for the following:

- Leaks, including leaks from cisterns.
- Other defects.
- Safe condition.
- Conformance to the PCA (2022) and Network Utility Operator requirements.

Leaks and defects: Report if found and rectify.

Strainers: Inspect and clean at least annually.

Rainwater storage systems

Requirement: Provide annual maintenance to SA HB 230 (2008) Table 10.1 at the following times:

- Maintenance period shorter than 12 months: Within a month of the end of the defects liability period.
- Maintenance period 12 months or longer: Annually.

Service tags: Record inspections and tests.

12 SELECTIONS

Refer to drawings and schedules for locations and extents

0811S SANITARY FIXTURES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide sanitary fixtures, as documented.

1.2 STANDARDS

General
Design for access and mobility: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

2 PRODUCTS

2.1 GENERAL

Authorised products
Requirement: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

Labelling
Water efficiency labelling: Provide products conforming to and labelled to the Water Efficiency Labelling Scheme (WELS).

3 EXECUTION

3.1 SANITARY FIXTURES

General
Requirement: Install to manufacturer's recommendations.

4 SELECTIONS

Refer to drawings and schedules for locations and extents.

0812S TAPWARE

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide tapware, as documented.

1.2 STANDARDS

General
Design for access and mobility: To the NCC cited AS 1428.1 (2009) and AS 1428.2 (1992).

2 PRODUCTS

2.1 GENERAL

Authorised products
Requirement: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

Labelling
Water efficiency labelling: Provide products conforming to and labelled to the Water Efficiency Labelling Scheme (WELS).

3 EXECUTION

3.1 TAPWARE

General
Requirement: Install to manufacturer's recommendations.

4 SELECTIONS

Refer to drawings and schedules for locations and extents.

0902 ELECTRICAL DESIGN AND INSTALL

1 ELECTRICAL SYSTEMS

1.1 RESPONSIBILITIES

General
Requirement: Design systems and provide electrical services, as documented.

1.2 DESIGN

General
Requirement: To DESIGN in *0171 General requirements*.

Designer qualifications
Designer qualifications: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience. Conform to **DESIGNER** in *0171 General requirements*.

Design for durability and maintainability
Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

Access for maintenance: Develop the design so the systems conform to **ACCESS FOR MAINTENANCE** in *0171 General requirements*.

Operating environment
Requirement: Provide equipment suitable for the environment in which it operates.

Energy efficiency
Requirement: To BCA (2022) J7 and BCA (2022) J9.

Seismic restraint
Requirement: To **SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS** in *0171 General requirements*.

Electrical system design
Requirement: Provide engineering design that:

- Maximises the functionality, performance, safety, flexibility and reliability of the electrical services.
- Is technically sound.
- Can be constructed using currently accepted methods.
- That provide the lowest combined owning and operating cost over the design life of the systems.

Design parameters: Provide facilities to meet the functional requirements of the works.

Fault protection: Automatic disconnection to AS/NZS 3000 (2018) clause 2.4.

Fire-resisting protection: Provide for switchboards and associated electrical conductors to BCA (2022) C3D14.

Maximum demand: Calculation method to AS/NZS 3000 (2018) Appendix C.

Authority submissions: Make submissions, including notices, to authorities relating to the works.

Design life
General: To *0171 General requirements*.

Design life: All components and systems: 25 years.

Fire separation
Requirement: As documented.

1.3 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.
- *0201 Demolition*.
- *0223 Service trenching*.

1.4 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 11801.1 (2019) and AS/NZS 14763.2 (2020).

1.5 INTERPRETATION

Abbreviations

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

- CCT: Correlated colour temperature.
- CFL: Compact fluorescent lamps.
- CRI: Colour rendering index.
- EEI: Energy efficiency index.
- EMI: Electromagnetic interference.
- EMR: Electromagnetic radiation.
- FD: Fluorescent lamp ballast code set out in AS/NZS 4783.2 (2002).
- LED: Light-emitting diode.
- RCD: Residual current device.
- SPD: Surge protection devices.

1.6 SUBMISSIONS

General

Requirement: Conform to *0171 General requirements*.

Authority approvals

Authority submissions: Submit evidence of approval from authorities relating to the works.

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.

Existing systems

Shutdowns: Submit detailed shutdowns schedule, including the date and time of shutdowns, details of proposed work and affected systems and locations, to **WORK ON EXISTING SYSTEMS**.

Existing condition: Submit proposals to rectify deficiencies If the existing condition does not conform to the documented requirements.

Operation and maintenance manuals

Requirement: Conform to **OPERATION AND MAINTENANCE MANUALS** in *0171 General 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.

ICT 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.

Type test: Submit test results for the following:

- Emergency evacuation lighting equipment: To AS/NZS 2293.3 (2018).
- Light-emitting diode luminaries: Photometric test results as evidence of luminous efficacy for the applicable CCT.
- Light-emitting diode lamp replacement modules: Photometric test results as evidence of luminous efficacy for the applicable CCT.

Quality plan

Information and communications technology (ICT) systems: Submit a quality plan prior to the commencement of the installation to AS/NZS 14763.2 (2020) Section 6. Within the quality plan, include installation methodology, engineering calculations of pathway and remote powering, maximum cable lengths and the records management system.

Records

Cable management: Before the date for practical completion, submit logbooks for each distribution frame with details of cable terminations and provisions for recording cable, line and jumper information.

Samples

Requirement: Submit samples, as follows:

- Lighting: To LIGHTING, **GENERAL**, **Samples**.
- Emergency evacuation lighting: To EMERGENCY EVACUATION LIGHTING, **GENERAL**, **Samples**.

Shop drawings

Requirement: Submit drawings showing the following:

- Cable ladder and tray routes.
- Cable riser layouts, take-offs and sections
- Concealed conduit locations with interconnections.
- Connections to other services.
- Control cable routes, cable sizes and types of cable, cable identification labelling.
- Control sensor and control device layouts.
- Control system schematics with wire/ terminal identification.
- External services layouts including underground cable routes and pit locations, underground communications cable routes and pit locations.
- Fire detection system layout.
- Layouts of control panels including control functions logic diagram, wiring diagram, proposed terminology and labelling.
- Lighting:
  . Lighting columns.
  . Lighting column mounting bases.
  . Non-proprietary luminaires.
  . Non-standard fixing brackets.
- Lightning protection system layout.
- Power and communication system layout.
- Reflected ceiling plan layouts showing lighting, emergency lighting, emergency warning system equipment, fire detection equipment and HVAC outlets.
- Security system layout.
- Switchboard layout, equipment details and labelling.
- Telecommunications cabling:
  . Layouts of equipment racks.
  . Cross-connect layout.
  . Cabling diagram for complete system.
  . Cable management system.
- Wiring diagrams.

Subcontractors

General: Submit names, contact details, licence numbers and type of licence of proposed suppliers and installers.

1.7 WORK ON EXISTING SYSTEMS

Equipment removal

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

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

Recovered items

Requirement: To *0201 Demolition*.

Recovered materials: Recover all components associated with the items documented for recovery. Minimise damage during removal and deliver to the locations documented.

Existing electrical systems

Condition of existing systems:

- If the existing condition does not conform to the requirements in the contract documents, provide proposals to rectify the deficiencies with related costing, time and other impacts.
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

Work on live electrical installations: Conform to WHS regulations.

Shutdowns

Requirement: Carry out shutdowns at scheduled times. Keep shutdown times to a minimum. In no case exceed documented or scheduled times.

Completion of shutdowns: Return systems to normal operation at the end of shutdowns.

1.8 SERVICE TRENCHING

General

Requirement: To *0223 Service trenching*.

1.9 COMMISSIONING

General

Requirement: Provide commissioning as documented. Conform to *0171 General requirements* and SA TS 5342 (2021).

2 LOW VOLTAGE POWER SYSTEMS

2.1 GENERAL

Network supply

General: Liaise with the electricity distributor and provide network connection.

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 required for the works.

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), AS 4262.2 (1999) and AS 1768 (2021).

Operating voltage (U_o): 230 V at 50 Hz.

Surge rating (I_{max}): 40 kA (8/20 µs) phase to neutral and 100 kA neutral to earth.

Voltage protection level (U_p): < 600 V at 3 kA.

Visual indicator: Provide visual indication of SPD status.

Maximum continuous operating voltage (U_c): 275 V a.c.

Enclosure and installation: House SPD in an electrical switchboard or panel and protect with a suitably rated circuit breaker or HRC fuse equal to or less than the load current rating of the SPD.

Enclosure mounting: DIN rail mounted.

2.3 SITE ELECTRICITY SUPPLY

General

Responsibilities: Provide site electricity supplies required for the works. Connect project electrical facilities to the network distributors external site electricity supply.

Consumers mains

Requirement: Provide consumers mains, associated services and all necessary fault and overload current protection equipment to AS/NZS 3000 (2018) Section 3, the electricity distributor's standards and the Service and Installation Rules.

Protected consumers mains: Provide short-circuit and overload protection, where required by the electricity distributor.

Alternative power supplies

General: Provide alternative power supplies, if required.

Metering

Retail: To the requirements of the electricity retailer and the electricity distributor.

Private: Provide energy measurement to BCA (2022) J9D3, if required.

Photovoltaic metering: Provide energy measurement to BCA (2022) J9D3, if required.

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 mm^2.
- Power subcircuits: 2.5 mm^2.
- Submains: 6 mm^2.

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.

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 continuous pathways provided in the brick.
- Stud framed walls with bulk insulation: Install cables in PVC-U conduit.
- Stud framed walls without bulk insulation: Install 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 cable 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 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).
- Patient treatment areas: 10 mA Type I 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.

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: 300 mm.
- Switches and controls: 1100 mm.

Accessories: Flush mounted, except in plant rooms.

Common faceplates: 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.

3 POWER GENERATION – PHOTOVOLTAIC

3.1 GENERAL

System components

Requirement: Incorporate the following:

- Photovoltaic modules.
- Roof mounted array support structure.
- Ground mounted array structure for modules including any solar tracking systems.
- Inverter/s.
- Weather station.
- Data logger with SIM/modem for off-site monitoring.
- d.c. wiring and protection.
- Regulator.
- Battery energy storage system.
- Connection to low voltage power system.

3.2 STANDARDS

General

Requirement: For the purpose of this worksection, the following standards relating to photovoltaic stand-alone systems are also applicable to photovoltaic grid 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 TS 61836 (2016).

3.3 PHOTOVOLTAIC MODULE

General

Selection: To AS/NZS 4509.2 (2010) and AS/NZS 5033 (2021).

Modules

Numbers: Provide sufficient number of photovoltaic modules using standard test conditions nominal rating to attain the minimum kW_{peak} capacity documented for the array system.

Encapsulation: Required.

Toughened glass: Required.

Hail resistance: Required.

UV resistance: Required.

Protection rating: ≥ IP66.

Integral bypass diode protection: Required.

Operating module temperature: -20°C to +80°C.

Cells

Type: Crystalline.

Standard: To IEC 61215-1-1 (2021).

Efficiency: ≥ 15%.

3.4 REGULATOR

General

Selection: To AS/NZS 4509.2 (2010).

Function: Charge cycle control including:

- Low battery voltage disconnect.
- Pulse width modulation.
- ≥ 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: ≥ 10 years.

Standards

General: To the AS 2676 series, AS 4086.1 (1993), AS/NZS 5139 (2019) and AS 5374 (2023).

3.6 INVERTER

General

Selection: To meet the documented performance.

Type: String inverter.

Waveform: True Sine wave.

Waveform quality: To the AS/NZS 4777 series.

Voltage regulation: ±8%.

Maximum d.c. voltage: Exceed open circuit voltage (V_{oc}) of PV strings at +5°C cell temperature.

Maximum power point tracking range: Between maximum power voltage (V_{mp}) of PV strings at +25°C and +70°C cell temperature.

Harmonic distortion of output current: < 4%.

Frequency regulation: ±1%.

Efficiency: ≥ 90% at 10% load.

Protection: Overload, short-circuit and transient required.

Automatic no-load shutdown: Required.

LED display:

- Output power for normal operation and historical records.
- Grid stability.
- Fault events.

Standards

General: To AS/NZS 4777.2 (2020).

Earth faults and alarms

Earth fault detection: Required.

System installation: To AS/NZS 5033 (2021).

System action: Create email and/or SMS alarm, and local audible alarm.

Operational instructions: Advise actions to solve fault.

Load balancing

Multiple inverter system: Balanced across 3-phases and to the network operator’s requirements.

Synchronisation

Requirement: Self-commutation modules that 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 power system control panels, switchgear and controlgear assemblies.

3.8 PHOTOVOLTAIC METERING

General

Requirement: Provide bidirectional 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 DATA LOGGER

General

Requirement: Provide data logger conforming to the following:

- Of same manufacturer as the inverter/s.
- Able to monitor multiple inverters at once.
- Able to record individual inverter performance and operational parameters, including the following:
  - . Energy total (kWh).
  - . Calculation of CO_2 saved (kg).
  - . Power now (W, kW).
  - . Energy generated today (kWh).
  - . Time period/date for energy generated.
  - . Instantaneous voltage of PV power system (V).
  - . Instantaneous current of PV power system (A).
  - . d.c. voltage and current.
  - . a.c. voltage, current and frequency.

Data logger and interface capabilities:

- Storage data capacity: ≥ 1 gigabyte.
- Save cycles: ≤ 30 minutes.
- Connection interfaces: USB interface, USB port, 8-pin data cable (RS485), network plug (RJ45 sockets) and RS232.
- Integrate and transfer data to a local computer or an off-site computer.

Installation

General: To manufacturer's recommendations.

Interface equipment:

- Data logger with inverter/s.
- Data logger with local computer and/or an off-site computer.

SIM card: Test functionality.

Client IT network: Obtain static IP address. Review firewall settings. Test functionality.

3.10 WEATHER STATION

General

Requirement: Provide weather station and sensors, compatible with inverter/s and data logger, as documented. Include the following weather information:

- Solar radiation.
- Module temperature.
- Ambient temperature.
- Wind speed.

Anemometer: Make sure anemometer is mounted with wind cups operating in the horizontal plane.

3.11 WEB SERVICE

General

Requirement: Provide free proprietary web service and internet platform for monitoring and visualisation of the PV system. Include the following:

- System information via email, including energy yield, maximum output, CO_2 reduction and system fault messages.
- Presentation of system data in diagrams and tables.

- Ability to publish web data on other websites
- Ability to customise individual web pages through HTML and insert own images.
- Ability to export the data in raw format, including web service APIs such as JSON or XML and flat CSV or text files.
- Access to be platform agnostic and adhere to modern web standards including HTML 4 and HTML 5.
- System capable of providing access to the raw data. Alternatively, capable of using custom or other off-the-shelf web service providers.

Data flow diagram: Provide details of transmission protocols and ports.

SIM card and modem: Provide and register web service product. Test functionality.

Update interval for broadcast data: Daily.

Licence fees: Prepare applications and pay licence fees in relation to registering web service for 25 years operation.

Training: Provide training for a minimum of 4 nominated staff in the web service product use and functionality.

Information: Provide information to maintain the system including necessary licences, usernames and passwords.

3.12 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.

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, if required.

Photovoltaic metering: Provide energy measurement to BCA (2022) J9D3, 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 ≥ 18 kA/second, whichever is the greater.

Spare capacity

Default spare poles: ≥ 20%.

Main switchboard incoming busbar: ≥ 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 that 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: Orange X15 or the manufacturer's standard colour.

- Installed in cupboards, switchrooms and plant rooms: Orange X15 or the manufacturer's standard powder coated finish.
- Installed elsewhere: Orange X15, the manufacturer's standard powder coated finish or to the documented non-standard powder coated colour.

Supporting structure

Assemblies:

- Wall mounted: ≤ 2 m^2.
- Floor mounted: > 2 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 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 support

Requirement: Support or tie mains and submains cables within 200 mm of terminations. Provide cable support 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): ≥ 2.1 x 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 (2023).

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 (2023) Table 4.

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 (2023) Table 4 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.

Cascade protection: Provided by either fault current limiting fuses or fault current limiting circuit breakers.

5.5 FUSE SWITCH UNITS

Fuse links

Requirement: Isolate when switch contacts are open. Provide 3-phase sets of high rupturing capacity (HRC) fuse links.

5.6 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.

5.7 ELECTRICITY DISTRIBUTOR'S SERVICE PROTECTIVE DEVICES

General

Low voltage service protective devices: To AS/NZS 3000 (2018), the electricity distributor's requirements and the Service and Installation Rules.

Service protective devices > 100 A: Provide fault current limiting circuit breakers with adjustable overload and short-circuit current facilities with full discrimination and cascade protection between the incoming supply protection systems and the downstream protection systems.

5.8 RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS (RCBO)

General

Standard: To AS/NZS 3190 (2016).

Integral non-overload protection type: To AS/NZS 61008.1 (2015).

Integral overload protection type: To AS/NZS 61009.1 (2015).

Modular type: To AS/NZS IEC 60947.2 (2015).

- Type I for patient treatment areas.
  - . Default tripping current: 10 mA.
  - . Switched neutral: Required.
- Type II.
  - . Default tripping current: 30 mA.

5.9 FUSES WITH ENCLOSED FUSE LINKS

General

Standards: To IEC 60269-1 (2006) and IEC 60269-2 (2013).

Fuses with fuse links for the protection of semiconductor devices: To IEC 60269-4 (2009).

Fuses with fuse links used as fault current limiters: Coordinate fuse type and rating with the protection switchgear manufacturer's recommendation if used downstream of the fault current limiters. Provide labels adjacent to the fuse holder stating FAULT CURRENT LIMITER and fuse size.

Fuse links: Enclosed, high rupturing capacity type mounted in a fuse carrier.

Breaking range and utilization category:

- Distribution/general purpose: gG.
- Motors: gM.

5.10 CONTACTORS

General

Standard: To AS/NZS IEC 60947.4.1 (2015).

Type: Enclosed, block type, air break, electromagnetic.

Poles: 3.

Rated operational current: The greater of:

- Full load current of the load controlled.

- ≥ 16 A.

Mechanical durability: 10 million cycles to AS/NZS IEC 60947.4.1 (2015).

Electric durability: ≥ 1 million operations at AC-22 to AS/NZS IEC 60947.4.1 (2015).

Mounting: Mount with sufficient clearance to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment.

Auxiliary contacts: Provide auxiliary contacts with at least one normally-open and one normally-closed separate contacts with rating of 6 A at 230 V a.c., utilization category AC-1.

6 LIGHTING

6.1 GENERAL

Samples

Requirement: Provide samples of luminaires and accessories complete with lamp control gear and three core flex and plug.

6.2 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).

6.3 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).

6.4 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), triphosphor, TL84, as documented.

Compact fluorescent lamp types: Four-pin, non-integrated type.

6.5 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.

6.6 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 microprocessor-based system to control lighting under automatic and user interface control, if required.

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 that 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 GENERAL

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.
- IT components.
- Active computer hardware.

System performance – general

Remote powering category: Category RP1 to AS/NZS 14763.2 (2020) Table 1 for a remote powering cable installation, also known as Power over Ethernet (PoE).

System performance - commercial buildings, small offices and home offices

Application class: To AS 11801.1 (2019) clause 6.3.1 Class E_A (500 MHz).

Balanced cabling system: To AS 11801.1 (2019) clause 8.2 Category 6_A, clauses 6.3, 7.2 and 9.3, AS 11801.2 (2019) and AS 11801.4 (2019).

Balanced cabling system components: To AS 11801.1 (2019) clause 8.2.1 (data/voice) Category 6_A AS 11801.2 (2019) and AS 11801.4 (2019).

Optical fibre cabling system: To AS 11801.1 (2019) clauses 6.5, 7.4, 8.3 and 9.5, AS 11801.2 (2019) and AS 11801.4 (2019).

System warranty: 15 years minimum.

System performance - distributed building services

Application class: To AS 11801.1 (2019) clause 6.3.1 Class E_A (500 MHz).

Balanced cabling system: To AS 11801.1 (2019) clause 8.2 Category 6_A, clause 9.3 and AS 11801.6 (2019).

Balanced cabling system components: To AS 11801.1 (2019) clause 8.2.1 Category 6_A and AS 11801.6 (2019).

Optical fibre cabling system: To AS 11801.1 (2019) clauses 8.3 and 9.5, and AS 11801.6 (2019).

System warranty: 15 years minimum.

System performance – data centres

Application class: Main distribution, intermediate distribution and zone distribution cabling systems to AS 11801.1 (2019) clause 6.3.1 Class E_A (500 MHz), and AS 11801.5 (2019) clause 6.3.2.

Balanced cabling system: To AS 11801.1 (2019) clause 8.2 Category 6_A, clause 9.3 and AS 11801.5 (2019).

Balanced cabling system components: To AS 11801.1 (2019) clause 8.2.1 Category 6_A and AS 11801.5 (2019) clauses 8.2, 9.2, 10 and 11.

Optical fibre cabling system: To AS 11801.5 (2019) clauses 6.3.3, 9.5, 10 and 11.3.

System warranty: 15 years minimum.

System performance – industrial premises

Application class: Main distribution, intermediate distribution and zone distribution cabling systems to AS 11801.1 (2019) clause 6.3.1 Class E_A (500 MHz), and AS 11801.3 (2019) clause 6.3.2.

Balanced cabling system: To AS 11801.1 (2019) clause 8.2 Category 6_A, clause 9.3 and AS 11801.3 (2019).

Balanced cabling system components: To AS 11801.1 (2019) clause 8.2.1 Category 6_A and AS 11801.3 (2019) clauses 8.2, 9.2, 10 and 11.

Optical fibre cabling system: To AS 11801.3 (2019) clauses 6.3.3, 8.3, 9.3, 10 and 11.3.

System warranty: 15 years minimum.

Surge protection devices (SPD)

General: Provide surge protection devices to protect equipment in racks and cabinets to LOW VOLTAGE POWER 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) and the AS 11801 series.

Communications cable systems: To AS/CA S009 (2020), the AS 11801 series, AS/NZS 3084 (2017) and AS/NZS 14763.2 (2020).

Communications cable systems for small office/home office: To AS/CA S009 (2020), the AS 11801 series and AS/NZS 14763.2 (2020).

Cable management and documentation: To AS/NZS 14763.2 (2020) and AS 3085.1 (2022).

7.3 NETWORK CONNECTION

External network

Requirement: Liaise with each external communications carrier and determine the services and site access requirements for each network carrier’s connection.

7.4 BUILDING ENTRANCE FACILITIES

Campus distributor (CD)

Standard: To AS/NZS 3084 (2017), AS 11801.1 (2019), AS 11801.2 (2019) and AS/NZS 14763.2 (2020).

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 11801.1 (2019), AS/NZS 14763.2 (2020) 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.

Copper cable termination distributors

General: Provide termination frames for the termination of copper horizontal cable services to the manufacturer's recommendations.

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 6_A 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. Document any required alternative in the quality plan.

Doors: Provide lockable doors with infill material suitable to provide airflow capability to suit environmental and security considerations.

Power provision: Minimum 1 socket-outlet for every 3 rack units on vertical rail. Make sure socket numbers suit the required power rating. Fit socket-outlets with captive rings to retain captive plugs.

Cable management: Provide as follows:

- 1 module for every 2 patch panels.
- 1 module for each fibre termination panel.
- Locate 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: To manufacturer's recommendations.

- 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 for both single and multicore optical fibre cables.

Cable management

Record book: To AS/NZS 14763.2 (2020) Section 9.

Location: Document in the quality plan.

Identification, labelling, and record documentation: To AS/NZS 14763.2 (2020) Section 9 and AS 3085.1 (2022).

7.6 CABLES

Copper

Standard: To AS/CA S008 (2020), AS/CA S009 (2020), the AS 11801 series and AS/NZS 14763.2 (2020).

Campus and building voice backbone cables: 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 6_A F/UTP cabling to each floor outlet.

Balanced system cables: Unshielded or shielded twisted pairs, as documented.

Cable end length: Sufficient cable slack to move within the rack.

Optical fibre

Standard: To AS 11801.1 (2019).

Campus and building backbone cables:

- Default multimode type: 6 core multi-mode OM4 50/125 µm.
- Default single mode type: Single core OS1 internal and OS2 external and underground.

Length: Provide not less than 1000 mm spare at each end.

Component type: LC.

Safe practices: To AS/NZS 2967 (2014).

External and underground

Standard: Water penetration resistance and UV stabilisation to AS/CA S008 (2020).

7.7 TELECOMMUNICATIONS OUTLETS

General

Outlets: Provide RJ45 8 way modular jacks, mounted on faceplate. Provide for up to three modular voice or data outlets on the each faceplate. Make sure unused socket positions are filled with blank inserts. Arrange the modular sockets with the locking latch in the bottom position, i.e. pins at the top.

Colour: Electric white.

Standard: To AS/CA S008 (2020).

Horizontal cabling termination: Terminate cabling to the rear of the outlet modular jack to manufacturers' instructions. Arrange cable pairs at each jack conforming to AS 11801.1 (2019) Figure 9.

Pinouts: T568A to AS 11801.1 (2019) and AS 11801.2 (2019).

7.8 FLY LEADS

General

Type: Flexible. Minimum 26 AWG.

Length: 1500 mm.

Quantity: Provide fly leads to 50% of outlets installed.

7.9 PATCH CORDS

General

Type: Flexible. CAT 6_A U/FTP. Minimum 26 AWG.

Length: 1000 mm.

Quantity: 100% of outlets installed.

Termination: Registered jacks.

7.10 WIRELESS ACCESS POINT (WAP)

General

Requirement: Provide WAPs as required, cabled to patch panels in the nearest FD.

Compatibility: ISO/IEC/IEEE 8802-11 (2022), IEEE 802.3 (2022) and IEEE 802.11 (2020).

LAN port: Minimum 2.5 GB.

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. 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 required.

7.12 ACTIVE COMPUTER HARDWARE

Computer hardware

General: Provide the computer hardware required for the operation and management of the building IT systems and as documented.

Network hub/switch

Type: Managed Gigabit ethernet Layer 2.

Interface: Web.

RS232 port: Required.

Quality of service: Implementation required to IEEE 802.1Q (2022).

Power over ethernet: Required.

VLAN: IEEE 802.19.1 (2018).

Security: IEEE 802.1X (2020) RADIUS protocol.

Mounting: Rack mounting.

Network router

Type: Gigabit ethernet.

Functions: Static IP, dynamic IP, integrated DHCP, PPPoE, and device name support.

Mounting: Rack mounting.

Backup/archive facilities

Type: Tape.

Mounting: Rack mounting.

Printers

General: As documented.

Voice telecommunication equipment

General: As documented.

Voice telecommunications equipment includes:

- Voice over Internet Protocol (VoIP) systems.
- Telephone handsets.

WAN interfaces

General: Provide WAN interface equipment for the operation and management of the WAN site and Building IT system interface as documented.

7.13 SOFTWARE

General

Requirement: Provide the software required for the operation and management of the building IT systems and equipment including the following:

- All passwords, access codes and other means used to limit or control access to, or modification (including extension) of, the software.
- All software and manuals necessary to modify or extend the software.
- Backup copies of software in electronic format.
- Installation of all software updates issued before the end of the defects liability period.

Compatibility: Provide software systems that are planned to have upgrades backward compatible, so that each upgrade does not require user input or changes to base data or to the site specific installation.

Licence: Provide fully licensed versions of all software and licenses for all users defined in the documents.

OSI model: Provide software that operates on the OSI model.

System software

General: Provide system software.

Application software

General: Provide the software required for the operation and management of building services systems and equipment including the following:

- Absolute right, and all necessary facilities, for the principal to modify extend or reduce any or all functions, hardware and software that form part of the system.
- Full listings of all software supplied that has been developed, modified or adapted to meet the requirements of this project.

Function: Provide software that delivers accurate and reliable results.

Modular construction: Provide software constructed in modules to assist maintenance and to reduce the delays in execution.

Pre-delivery tests

General: Verify that the software has been assembled and tested for operational performance before installation on site.

High level interface test: If a high level interface to other systems is required, test and verify software performance with the documented systems before installation on site.

7.14 INSTALLATION - GENERAL

Installation

Standard: To the AS 11801 series, AS/NZS 3084 (2017), AS/CA S008 (2020), AS/CA S009 (2020) and AS/NZS 14763.2 (2020).

Precedence: AS/NZS 14763.2 (2020) takes precedence over AS/NZS 3084 (2017).

Issues can include space requirements and remote powering demands for cable power loadings, bundle temperature rise and heat dissipation methods.

7.15 CABLE INSTALLATION

Installation

Requirement: To the manufacturers' recommendations.

Crossover: Install cables neatly.

Loom size: Loom cables into groups not exceeding 24 cables, as documented and to the quality plan. 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).

Separation for performance: To AS/NZS 14763.2 (2020).

Fluorescent luminaires: Maintain a clearance of more than 300 mm.

External cabling

Requirement: To CA C524 (2013).

7.16 TELECOMMUNICATIONS OUTLET INSTALLATION

Installation

Horizontal cabling termination: Terminate cabling to the rear of the outlet modular jack to manufacturer's recommendations. Arrange cable pairs at each jack conforming to AS 11801.1 (2019) Figure 9.

7.17 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 communications room electrical switchboard. Connect the CET to the local protective earth (PE) system at the local switchboard.

Distributor: Provide an earth bar within each distributor or rack and connect to the local CET.

Interconnections: Verify that there are no interconnections between the lightning protective earthing system and the telecommunications earthing system.

7.18 TESTING

General

Requirement: Carry out 100% permanent link tests to AS/NZS 14763.2 (2020).

Cable testing

Telecommunications cabling installation copper cables: To IEC 61935-1 (2019), IEC 61935-2 (2022) and AS/NZS 14763.2 (2020).

Telecommunications cabling installation fibre optic cables: To AS/NZS 14763.3 (2017).

Balanced cabling

Standard: To AS/NZS 14763.2 (2020) clause 6.3.1 and Table 2. Include the following for permanent link testing:

- Basic verification:
  - . Wire map.
  - . Length.
  - . Continuity.
- Internal transmission:
  - . Return loss.
  - . Insertion loss.
  - . Pair to pair NEXT.
  - . PS NEXT.
  - . Pair to pair ACR-N.
  - . PS ACR-N.
  - . Pair to pair ACR-F.
  - . PS ACR-F.
  - . DC loop resistance.
  - . DC resistance unbalance within a pair.
  - . DC resistance unbalance between pairs.

. Propagation delay.
. Delay skew.

Optical fibre cabling
Standard: To AS/NZS 14763.2 (2020) clause 6.3.2 and Table 4. Include the following for permanent link testing:

- Basic verification:
  . Polarity.
- Basic test group:
  . Attenuation.
  . Propagation delay.
  . Length.

7.19 COMMISSIONING

Software
Requirement: Commission to the manufacturer's recommendations.

Completion: Verify the functional and operational performance of the software before the date for practical completion.

Disaster recovery: Verify that the software recovers from disaster events without loss of data and without loss of reliability.

Reliability: Verify that the software system provides reliable reporting and results through alternative measurement methods.

8 TELEVISION DISTRIBUTION SYSTEMS

8.1 GENERAL

System components
Requirement: Provide a system suitable for the reception and distribution of analog and digital television, video, radio and sound signals.

Network connection: Arrange with the network operator(s) for the connection of their 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.

8.2 STANDARDS

General
Electromagnetic compatibility: To AS 1367 (2023) Section 3.

8.3 SYSTEM DESCRIPTION

System type
Type: As documented.

Performance requirements
General: To AS 1367 (2023).

Capacity: Provide the distribution system with the installed capacity to accommodate 30% additional outlets.

Signal sources
Free-to-air (FTA) antennae system: Provide FTA antennae system terminating at the premises cabling interface.

Satellite (SAT) antennae system: Provide SAT antennae system terminating at the premises cabling interface.

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 headend for the distribution of in-house television channels on separate channels of the network.

Service entry

General: Provide service entry facilities to suit signal sources, headend equipment and distribution systems.

Headend equipment

General: Provide headend 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 cabling distribution network from the headend equipment to each network distribution tap.

FTA distribution taps: Provide FTA distribution taps.

Satellite distribution taps: Where satellite system signals cannot connect to the FTA distribution system, provide individual distribution taps. Co-locate the taps with the FTA taps in groups to facilitate selected connection or changes to outlet feeders.

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 required.

Outlets

General: Provide outlets and feeders from distribution tap(s).

Quantity: Provide separate sockets for each source and service.

8.4 COMMISSIONING

General

Standard: To AS 1367 (2023) Section 9.

Requirement: Commission to the manufacturer's recommendations. Record the results of all tests.

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 GENERAL

Samples

Requirement: Provide samples of luminaires and exit signs.

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 that 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 GENERAL

System components
Requirement: Provide the following components:

- Access control system.
- Intruder detection system.
- Closed circuit television system.
- Intercom system.
- Remote monitoring system.

Security classification: As documented.

System communications: As documented.

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/NZS 62676.4 (2020).

Remote monitored systems: To AS/NZS 62676.1.2 (2020).

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 entry/exit time delay 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.

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.

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.

Entry access equipment: Provide direct wall-mounted 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, where documented.

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 that allow cameras to perform to manufacturer’s recommendations.

Fixing: Provide mounting brackets and hardware that 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 that 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.

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.

11 SELECTIONS

Refer to drawings and schedules for locations and extents